

Savitribai Phule Pune University

Faculty of Science & Technology



Curriculum

For

First Year

Bachelor of Engineering

(Choice Based Credit System)

(2019 Course)

(With Effect from Academic Year 2019-20)

TABLE -1 First Engineering Structure for Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107001	Engineering Mathematics-I	03	--	01	30	70	25	--	--	125	03	--	01	04
107002/ 107009	Engineering Physics / Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
102003	Systems in Mechanical Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
111006	Workshop [@]	--	02	--	--	--	--	25	--	25	--	01	--	01
Total		16	10	01	150	350	25	125	--	650	16	05	01	22
101007	Audit Course 1 ^{&}	02	Environmental Studies-I											

Induction Program : 2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II

TABLE -2 First Engineering Structure for Semester-II

[illegible]

Instructions:

- PR/Tutorial must be conducted in three batches per division.
 - Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective subjects.
 - Every Student should appear for Engineering Physics, Engineering Chemistry, Engineering Mechanics, Basic Electrical Engineering, Basic Electronics Engineering, Programming and Problem solving during the year.
 - College is allowed to distribute Teaching workload of subjects Engineering Physics, Engineering Chemistry, Basic Electrical Engineering, Basic Electronics Engineering, Engineering Mechanics, Programming and Problem solving in semester I and II dividing number of FE divisions into two appropriate groups.
 - Assessment of tutorial work has to be carried out as term-work examination. Term-work Examination and Practical Examination at first year of engineering course **shall be internal continuous assessment only.**
- Ω 1 Credit for Engineering Graphics theory has to be awarded on the basis of End semester examination of 50 marks while 1 credit of tutorial and practical **shall be awarded on internal continuous assessment only.**
- @ Credit for the course of workshop practical is to be awarded on the basis of continuous assessment / submission of job work.
- § Project based learning (PBL) requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload a load of 2 Hrs/week/batch needs to be considered for the faculty involved. The Batch needs to be divided into sub-groups of 5 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester.
- & Audit course for Environmental Studies and II (As per D.O.No.F.13-1/2000 (EA/ENV/COS-I) dated 14 May, 2019) is mandatory but non-credit course. Examination has to be conducted at the end of Sem I & II respectively for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point &CGPA.
- Audit course for Physical education is mandatory non-credit course. Examination has to be conducted at the end of Semester for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point &CGPA.
-

Guidelines for Induction Program

Induction programme for first year students is introduced to familiarize them to the new environment and encourage them to look beyond classrooms. Objective is to help new students adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self exploration. Induction Program should be preferably of 3 weeks (**2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II**).

In order to implement the (SIP) in the College the following activities can be taken at College.

- Physical Activity-This would involve a daily routine of physical activity with games and sports.
- Creative Arts: - Every student would choose one skill related to the arts whether visual arts or performing arts.
- Mentoring and Universal Human values:-Mentoring and connecting the students with faculty members and other students is the most important part of student induction. This can be effectively done by forming a group of 20-22 students with a faculty mentor each. This can be implemented through group discussion and real life activities rather than lecturing.
- Familiarization with College, Department, Branch :-The incoming student should be told about the credit, grading system and scheme of the examination. They should be explained how the study in College differs from the study in school. They should be taken on College tour and shown important points such as library, canteen, gymkhana etc. They should be shown their department.
- Literary Activity :-Literary Activity would encompass reading book, writing a summary, debating, checking play etc.
- Proficiency modules :- The modules can be designed to overcome some critical lacunas that students might have like English Speaking, Computer familiarity etc.
- Lectures by Eminent People:- The lectures of Eminent people to be organized to expose the student to social activity public life.
- Visit to local Area:-A couple of visits to the landmark of the city or a hospital or orphanage could be organized.
- Extracurricular activities in College:-The new students should be introduced to the extracurricular activities at the College.
- Feedback and Report on the program:-Students should be asked to give their mid program Feedback and each group of 20-22 students should be asked to prepare a single report on their experience of the program.

To Summarize the above activity the sequence of activities can be planned as given below :

- Address by Principal, HOD's and other functionaries and welcome the new students along with their parents.
- The branch wise allocation of students to be done and a group of 20-22 students is to be formed along with one faculty as mentor.
- A detail time table of various activities is to be prepared and displayed for all students. The timetable should give details of location and details of faculty in charge of the activity.
- The visit to local areas can be arranged on Saturdays.

The various activities to be carried out can be divided into three phases :-

1. Initial phase:- Which may include Address by Principal, HOD's and other functionaries College and Dept Visit, interaction with parents Forming of students group and assigning of mentor mentee.
2. Regular Phase:- This phase may include the activities such as creative arts / universal

Human values Games & Sports in the morning session and in the afternoon session. Literary activities, Proficiency module, Lectures & workshop, Extra curricular Activities can be scheduled.

3. Closing Phase:- This phase may include taking feed back of students, preparation of Report by each group, Test of creative Arts, Human Values can be taken.

These are summarized guidelines given to the student inducing induction programme (SIP) Please refer SIP Manual published by AICTE for detail guidelines [2].

Savitribai Phule Pune University		
First Year Engineering (2019 Course)		
107001 – Engineering Mathematics – I		
Teaching Scheme: TH : 3 Hrs./Week TUT : 1 Hr/Week	Credits 04	Examination Scheme: In-Semester Exam :30 Marks End-Semester Exam :70 Marks TW :25 Marks
Prerequisites: Differentiation, Integration, Maxima and Minima, Determinants and Matrices.		
Course Objectives: To make the students familiarize with concepts and techniques in Calculus, Fourier series and Matrices. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.		
Course Outcomes (COs): The students will be able to learn CO1: Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems. CO2: the Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems. CO3: to deal with derivative of functions of several variables that are essential in various branches of Engineering. CO4: to apply the concept of Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function. CO5: the essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems		
Course Contents		
Unit I: Differential Calculus: (08 Hrs.) Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits and Applications.		
Unit II: Fourier Series (08 Hrs.) Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Parseval's identity and Applications to problems in Engineering.		
Unit III: Partial Differentiation (08Hrs.) Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative, Change of Independent variables		
Unit IV: Applications of Partial Differentiation (08 Hrs.) Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.		
Unit V: Linear Algebra-Matrices, System of Linear Equations (08 Hrs.) Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in Engineering.		
Unit VI: Linear Algebra-Eigen Values and Eigen Vectors, Diagonalization (08 Hrs.) Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonalization of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations.		
Text Books:		

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill) 2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)		
Reference Books: 1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.) 2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education) 3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning) 4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson) 5. Applied Mathematics (Vol. I & Vol. II) by P.N.Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune. 6. Linear Algebra –An Introduction, Ron Larson, David C. Falvo (Cenage Learning, Indian edition)		
Tutorial and Term Work: i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division. ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on performance and continuous internal assessment.		
107002: Engineering Physics		
Teaching Scheme: TH: 04 Hr/week PR: 02 Hr/Week	Credits 05	Examination Scheme: In-Semester :30 Marks End-Semester :70 Marks PR :25 Marks
Prerequisite Courses, if any: Fundamentals of: optics, interference, diffraction polarization, wave-particle duality, semiconductors and magnetism		
Companion Course, if any: Laboratory Practical		
Course Objectives: To teach students basic concepts and principles of physics, relate them to laboratory experiments and their applications		
Course Outcomes: On completion of the course, learner will be able to– CO1: Develop understanding of interference, diffraction and polarization; connect it to few engineering applications. CO2: Learn basics of lasers and optical fibers and their use in some applications. CO3: Understand concepts and principles in quantum mechanics. Relate them to some applications. CO4: Understand theory of semiconductors and their applications in some semiconductor devices. CO5: Summarize basics of magnetism and superconductivity. Explore few of their technological applications. CO6: Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application.		
Course Contents		
Unit I	Wave Optics	(08 Hrs)
Interference <ul style="list-style-type: none"> - Introduction to electromagnetic waves and electromagnetic spectrum - Interference in thin film of uniform thickness (with derivation) - Interference in thin film wedge shape (qualitative) - Applications of interference: testing optical flatness, anti-reflection coating 		
Diffraction		

<ul style="list-style-type: none"> - Diffraction of light - Diffraction at a single slit, conditions for principal maxima and minima, diffraction pattern - Diffraction grating, conditions for principal maxima and minima starting from resultant amplitude equations, diffraction pattern - Rayleigh's criterion for resolution, resolving power of telescope and grating 		
Polarization		
<ul style="list-style-type: none"> - Polarization of light, Malus law - Double refraction, Huygen's theory of double refraction 		
Applications of polarization: LCD		
Unit II	Laser and Optic Fibre	(08 Hrs)
Laser		
<ul style="list-style-type: none"> - Basics of laser and its mechanism, characteristics of laser - Semiconductor laser: Single Hetro-junction laser - Gas laser: CO₂ laser - Applications of lasers: Holography, IT, industrial, medical 		
Optic Fiber		
<ul style="list-style-type: none"> - Introduction, parameters: Acceptance Angle, Acceptance Cone, Numerical Aperture - Types of optical fiber- step index and graded index - Attenuation and reasons for losses in optic fibers (qualitative) - Communication system: basic building blocks 		
Advantages of optical fiber communication over conventional methods.		
Unit III	Quantum Mechanics	(08 Hrs)
<ul style="list-style-type: none"> - De-Broglie hypothesis - Concept of phase velocity and group velocity (qualitative) - Heisenberg Uncertainty Principle - Wave-function and its physical significance - Schrodinger's equations: time independent and time dependent - Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in RigidBox) - Particle in Finite potential well (Particle in Non Rigid box) (qualitative) - Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode - Introduction to quantum computing 		
Unit IV	Semiconductor Physics	(08 Hrs)
<ul style="list-style-type: none"> - Free electron theory (Qualitative) - Opening of band gap due to internal electron diffraction due to lattice Band theory of solids - Effective mass of electron Density of states - Fermi Dirac distribution function - Conductivity of conductors and semiconductors - Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration) - Working of PN junction on the basis of band diagram - Expression for barrier potential (derivation) - Ideal diode equation - Applications of PN junction diode: Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell - Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect 		

Unit V	Magnetism and Superconductivity	(8Hrs.)
Magnetism		
<ul style="list-style-type: none"> - Origin of magnetism - Classification of magnetism on the basis of permeability (qualitative) - Applications of magnetic devices: transformer cores, magnetic storage, magneto-optical recording 		
Superconductivity		
<ul style="list-style-type: none"> - Introduction to superconductivity; Properties of superconductors: zero electrical resistance, critical magnetic field, persistent current, Meissner effect - Type I and Type II superconductors - Low and high temperature superconductors (introduction and qualitative) - AC/DC Josephson effect; SQUID: basic construction and principle of working; Applications of SQUID - Applications of superconductors 		
Unit VI	Non Destructive Testing and Nanotechnology	(8 Hrs.)
Non Destructive Testing		
<ul style="list-style-type: none"> - Classification of Non-destructive testing methods - Principles of physics in Non-destructive Testing - Advantages of Non-destructive testing methods - Acoustic Emission Testing - Ultrasonic (thickness measurement, flaw detection) - Radiography testing 		
Nanotechnology		
<ul style="list-style-type: none"> - Introduction to nanotechnology - Quantum confinement and surface to volume ratio - Properties of nanoparticles: optical, electrical, mechanical 		
Applications of nanoparticles: Medical (targeted drug delivery), electronics, space and defense, automobile		
Books & Other Resources:		
Text Books:		
<ol style="list-style-type: none"> 1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications 2. A textbook of optics – N Subrahmanyam and BriLal , S. Chand Publications 3. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications 		
Reference Books:		
<ol style="list-style-type: none"> 1. Fundamentals of Physics, Resnick and Halliday (John Wiley and Sons) 2. Optics, Jenkins and White (Tata Mcgraw Hill) 3. Principles of Physics, Serway and Jewett (Saunders college publishing) 4. Introduction to Solid State Physics, C. Kittel (Wiley and Sons) 5. Principles of Solid State Physics, H. V. Keer, New Age International 6. Laser and Non-Linear Optics, B. B. Laud (Oscar publication) 7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni (Capital Publishing Company) 		
Guidelines for Instructor's Manual		
Lab manual is expected to cover following points:		
<ol style="list-style-type: none"> 1. Engineering Program Outcome (Graduate Attribute) and which attributes will be covered during practical 2. List of experiments to be performed with mention of objectives and outcome of the experiment 		

Guidelines for Student's Lab Journal

Student's lab journal is expected to cover:

1. List of experiments to be performed with mention of objectives and outcome of the experiment.
2. Instructions to students for performing the experiments
3. Precautions for each experiment
4. Write up of experiment (Preferably mentioning significance of experiment).

Guidelines for Lab /TW Assessment

1. The distribution of weightage of term work marks should be informed to students before start of the semester.
2. Term work assessment should be on continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction

1. DO's and DONT'S, along with precautions, are need to be displayed at prominent location in laboratory
2. Students should be informed about DO'S and DON'T and precautions before performing the experiment

Suggested List of Laboratory Experiments (Any eight)

Sr.	Experiment
1	Experiment based on Newton's rings (determination of wavelength of monochromatic light, determine radius of curvature of plano-convex lens)
2	To determine position of diffraction minima by studying diffraction at a single slit
3	To determine unknown wavelength by using plane diffraction grating
4	To find out Resolving power of Diffraction Grating/Telescope
5	To verify Malus Law
6	Any experiment based on Double Refraction (Determination of refractive indices, identification of types of crystal)
7	Any Experiment based on Laser (Thickness of wire, determination of number of lines on grating surface)
8	An experiment based on optic fibers
9	To study IV characteristics of Solar Cell and determine parameters (fill factor and efficiency)
10	To determine band gap of given semiconductor
11	To determine Hall coefficient and charge carrier density
12	Temperature dependence characteristics of semiconductor laser
13	To find out Magnetic susceptibility of given material
14	Ultrasonic Interferometer: Determination of velocity of ultrasonic waves in given liquid and find its compressibility
Suggested Demonstration Experiments	
1	Michelson interferometer
2	Half shade Polarimeter
3	Determination of absorption coefficient of sound of given material
4	Temperature dependence
5	Brewster's law
6	Measurement of sound pressure level

102003 - Systems in Mechanical Engineering		
Teaching Scheme: TH : 3 Hrs./week PR : 2 Hrs./Week	Credits 04	Examination Scheme: In-Semester :30 Marks End-Semester :70 Marks PR :25 Marks
Course Objectives: <ol style="list-style-type: none"> 1. To identify the sources of energy and their conversions 2. To explain the basic concept of engineering thermodynamics and its application 3. To understanding the specifications of vehicles 4. To get acquainted with vehicle systems 5. To introduce manufacturing processes applying proper method to produce components 6. To be able to select and compare domestic appliances 		
Course Outcomes On completion of the course, learner will be able to CO1: Describe and compare the conversion of energy from renewable and non-renewable energy sources CO2: Explain basic laws of thermodynamics, heat transfer and their applications CO3: List down the types of road vehicles and their specifications CO4: Illustrate various basic parts and transmission system of a road vehicle CO5: Discuss several manufacturing processes and identify the suitable process CO6: Explain various types of mechanism and its application		
Course Contents		
Unit I Introduction of energy sources & its conversion (06 Hrs) Energy sources: Thermal energy, Hydropower energy, Nuclear energy, Solar energy, Geothermal energy, Wind energy, Hydrogen energy, Biomass energy and Tidal energy. Grades of Energy. (<i>Numerical on efficiency calculation of thermal power plant</i>) Energy conversion devices: Introduction of pump, compressor, turbines, wind mills etc (<i>Simple numerical on power and efficiency calculations</i>)		
Unit II Introduction to Thermal Engineering (06Hrs) Laws of thermodynamics, heat engine, heat pump, refrigerator (<i>simple numerical</i>) Modes of heat transfer: conduction, convection and radiation, Fourier's law, Newton's law of cooling, Stefan Boltzmann's law. (<i>Simple numerical</i>) Two stroke and Four stroke engines (Petrol, Diesel and CNG engines). Steam generators.		
Unit III Vehicles and their Specifications (04 Hrs) Classification of automobile. Vehicle specifications of two/three wheeler, light motor vehicles, trucks, buses and multi-axle vehicles. Engine components (Introduction). Study of engine specifications, comparison of specifications of vehicles. Introduction of Electric and Hybrid Vehicles. Cost analysis of the Vehicle.		
Unit IV Vehicle systems (08 Hrs) Introduction of chassis layouts, steering system, suspension system, braking system, cooling system and fuel injection system and fuel supply system. Study of Electric and Hybrid Vehicle systems. Study of power transmission system, clutch, gear box (Simple Numerical), propeller shaft, universal joint, differential gearbox and axles. Vehicle active and passive safety arrangements: seat, seat belts, airbags and antilock brake system.		

Unit V	Introduction to Manufacturing	(06 Hrs)
Conventional Manufacturing Processes: Casting, Forging, Metal forming (Drawing, Extrusion, etc.), Sheet metal working, Metal joining, etc. Metal cutting processes and machining operations- Turning, Milling and Drilling, etc.		
Micromachining. Additive manufacturing and 3D Printing. Reconfigurable manufacturing system and IOT, Basic CNC programming: Concept of Computer Numerical Controlled machines.		
Unit VI	Engineering Mechanisms and their application in Domestic Appliances	(6Hrs.)
Introduction to Basic mechanisms and equipment: Pumps, blowers, compressors, springs, gears, Belt-Pulley, Chain-Sprocket, valves, levers, etc. Introduction to terms: Specifications, Input, output, efficiency, etc.		
Applications of: Compressors - Refrigerator, Water cooler, Split AC unit; Pumps - Water pump for overhead tanks, Water filter/Purifier units; Blower - Vacuum cleaner, Kitchen Chimney; Motor - Fans, Exhaust fans, Washing machines; Springs - Door closure, door locks, etc.; Gears - Wall clocks, watches, Printers, etc.; Application of Belt-Pulley/Chain-Sprocket - Photocopier, bicycle, etc.; Valves - Water tap, etc.; Application of levers - Door latch, Brake pedals, etc.; Electric/Solar energy - Geyser, Water heater, Electric iron, etc. (simple numerical on efficiency calculation)		
Books & Other Resources		
Text Books		
<ol style="list-style-type: none"> 1. Nag, P. K., "Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd. 2. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai 3. Agrawal, Basant and Agrawal, C. M., (2008), "Basics of Mechanical Engineering", John Wiley and Sons, USA 4. Rajput, R.K., (2007), "Basic Mechanical Engineering", Laxmi Publications Pvt. Ltd. 5. Pravin Kumar, (2018), " Basic Mechanical Engineering, 2nd Ed.", Pearson (India) Ltd. 6. Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. "Fundamentals of Engineering Thermodynamics", Wiley 7. Surinder Kumar, (2011), "Basic of Mechanical Engineering", Ane Books Pvt. Ltd. New Delhi 		
Reference Books		
<ol style="list-style-type: none"> 1. Khan, B. H., "Non Conventional Energy Sources, Tata McGraw-Hill Publisher Co. Ltd. 2. Boyle, Godfrey, "Renewable Energy", 2nd Ed., Oxford University Press 3. Khurmi, R.S. ,and Gupta, J. K., "A Textbook of Thermal Engineering", S. Chand & Sons 4. Incropera, F. P. and Dewitt, D.P., (2007), "Fundamentals of Heat and Mass Transfer, 6th Ed., John Wiley and Sons, USA 5. Groover, Mikell P., (1996), "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Prentice Hall, USA 6. Norton, Robert L., (2009), "Kinematics and Dynamics of Machinery", Tata McGrawHill 7. Cleghorn, W. L., (2005), "Mechanisms of Machines", Oxford University Press 8. Juvinal, R. C., (1994), "Fundamentals of Machine Component Design", John Wiley and Sons, USA 9. Ganeshan, V., (2018), "Internal Combustion Engines", McGraw Hill 10. Anderson, Curtis Darrel and Anderson, Judy, (2010), "Electric and Hybrid Cars: A History", 2nd Ed., McFarland 		
Guidelines for Instructor's Manual		
The Instructor's Manual should contain following related to every experiment:		
<ul style="list-style-type: none"> • Brief theory related to the experiment. • Apparatus with their detailed specifications. 		

- Schematic, Layout /diagram.
- Observation table/ simulation plots/graphs.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few questions related to the experiment.
- Relevance of practical in real life /industry

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment:

- Theory related to the experiment.
- Apparatus with their detailed specifications.
- Schematic, Layout /diagram.
- Observation table/ simulation plots/graphs.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical, and understanding.
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

The student shall complete the following activity as a term work.

Sr. No.	Activity
1.	Group A: Industry / Workshop / Showroom Visit: The visit of students is mandatory, to provide awareness and understanding of the course.
2.	Group B: Assignments: The student shall complete the following assignments on: <ul style="list-style-type: none"> i. Energy sources (Minimum one assignment on Conventional and one on Non-conventional sources) ii. Vehicle specifications and systems in passenger car iii. Electric vehicle specifications and its systems iv. Domestic appliances viz. refrigerator, air-conditioner, washing machine, cold storage
3.	Group C: Experiments: The student shall complete the following (any four) experiments: <ul style="list-style-type: none"> i. Demonstration of power train system in the vehicle ii. Demonstration of vehicle systems (automobile chassis, steering system, suspension system, braking system - Any Two) iii. Demonstration of energy conversion devices iv. Demonstration of additive manufacturing / rapid prototyping techniques v. Demonstration of CNC

103004: Basic Electrical Engineering		
Teaching Scheme: TH : 03 Hr/week PR : 02 Hr/Week	Credits 04	Examination Scheme: In-Semester : 30 Marks End-Semester : 70 Marks PR : 25 Marks
Prerequisite Courses, if any: Engineering physics, electron theory, electricity, potential and kinetic energy		
Course Overview: This course aims at enabling students of all Engineering Branches to understand the basic concepts of electrical engineering. This course is designed to provide knowledge of fundamentals and various laws in electromagnetic and magnetic circuits, electrostatics. The steady state analysis of AC and DC circuits, and its applications transformer, batteries and different energy conversion techniques are also included in this course.		
Course Objectives: <ol style="list-style-type: none"> 1. To introduce fundamental concepts, various laws-principles and theorems associated with electrical systems. 2. To impart basic knowledge of all electrical quantities such as current, voltage, power, energy, frequency along with different types of fields. 3. To provide knowledge about fundamental parameters such as resistance, inductance and capacitance and magnetic circuits, AC and DC circuits. 4. To provide knowledge of the concepts of transformer, different energy conversions techniques. 		
Course Outcomes: At the end of course students will be able to CO1: Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect. CO2: Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic CO3: Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram. CO4: Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions CO5: Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply. CO6: Evaluate work, power, energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge.		
Course Contents		
Unit I	Electromagnetism:	(6Hrs)
Review: resistance, emf, current, potential, potential difference and Ohm's law Electromagnetism: Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of mmf, flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series magnetic circuit, Introduction to parallel magnetic circuit(Only theoretical treatment), comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left hand rule. Faradays laws of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of couplings. Energy stored in magnetic field.		

Unit II	Electrostatics and AC Fundamentals	(6 Hrs)
<p>A) Electrostatics: Electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance. Capacitor, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors (no derivation) and time constant. (2Hrs)</p> <p>B) AC Fundamentals: Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, Period, frequency, instantaneous, peak(maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor. (4Hrs)</p>		
Unit III	Single Phase AC Circuits	(06 Hrs)
Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance, series R-L, R-C and R-L-C circuits, phasor diagrams, voltage, current and power waveforms, resonance in series RLC circuits, concept of impedance, concept of active, reactive, apparent, complex power and power factor, Parallel AC circuits (No numericals), concept of admittance		
Unit IV	Polyphase A.C. Circuits and Single phase Transformers	(06 Hrs)
<p>A) Polyphase A.C. Circuits: Concept of three-phase supply and phase sequence. Balanced and unbalanced load, Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. (3Hrs)</p> <p>B) Single phase transformers: principle of working, construction and types, emf equation, voltage and current ratios. Losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformers. (3Hrs)</p>		
Unit V	DC Circuits:	(06 Hrs)
Classification of electrical networks, Energy sources – ideal and practical voltage and current sources, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoff's laws and their applications for network solutions using loop analysis, Superposition theorem, Thevenin's theorem.		
Unit VI	Work, Power, Energy and Batteries	(06 Hrs)
<p>A) Work, Power, Energy: Effect of temperature on resistance, resistance temperature coefficient, insulation resistance, conversion of energy from one form to another in electrical, mechanical and thermal systems. (4Hrs)</p> <p>B) Batteries : Different types of batteries (Lead Acid and Lithium Ion), construction, working principle, applications, ratings, charging and discharging, concept of depth of charging, maintenance of batteries, series -parallel connection of batteries (2Hrs)</p>		
Books & Other Resources:		
<p>Text Books:</p> <ol style="list-style-type: none"> 1. V.D. Toro, Principles of Electrical Engineering, Prentice Hall India, 1989 2. D. P. Kothari, I.J. Nagrath, Theory and Problems of Basic Electrical Engineering, PHI Publication 3. V.K. Mehta, Rohit Mehata Basic Electrical Engineering, S Chand Publications 4. B.L. Theraja, A text book on electrical technology Vol-I 		
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. H Cotton, Electrical technology, CBS Publications 2. L. S. Bobrow, —Fundamentals of Electrical Engineering, Oxford University Press, 2011. 3. E. Hughes, —Electrical and Electronics Technology, Pearson, 2010. 4. D. C. Kulshreshtha, —Basic Electrical Engineering, McGraw Hill, 2009. 		
Guidelines for Instructor's Manual		
<p>The Instructor's Manual should contain following related to every experiment –</p> <ul style="list-style-type: none"> • Brief theory related to the experiment. • Apparatus with their detailed specifications. 		

<ul style="list-style-type: none"> • Connection diagram /circuit diagram. • Observation table/ simulation waveforms. • Sample calculations for one/two reading. • Result table. • Graph and Conclusions. • Few questions related to the experiment. • Relevance of practical in real life /industry
<p style="text-align: center;">Guidelines for Student's Lab Journal</p> <p>The Student's Lab Journal should contain following related to every experiment –</p> <ul style="list-style-type: none"> • Theory related to the experiment. • Apparatus with their detailed specifications. • Connection diagram /circuit diagram. • Observation table/ simulation waveforms. • Sample calculations for one/two reading. • Result table. • Graph and Conclusions. • Few short questions related to the experiment.
<p style="text-align: center;">Guidelines for Lab /TW Assessment</p> <ul style="list-style-type: none"> • There should be continuous assessment for the TW. • Assessment must be based on understanding of theory, attentiveness during practical, understanding . • Session, how efficiently the student is able to do connections and get the results. • Timely submission of journal.
<p style="text-align: center;">Suggested List of Laboratory Experiments/Assignments</p>
<p style="text-align: center;">Group A</p> <p>Following eight practical are compulsory</p> <ol style="list-style-type: none"> 1. To study safety precautions while working on electrical systems, handling of various equipment's such as multimeter, ammeters, voltmeters, wattmeter's, real life resistors, inductors and capacitors 2. To calculate and measure of charging and discharging of capacitor and observe the response on storage oscilloscope. 3. To measure steady state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms on storage oscilloscope. 4. To derive resonance frequency and analyze resonance in series RLC circuit. 5. To verify the relation between phase and line quantities in three phase balanced star delta connections of load. 6. To determine efficiency and regulation of transformer by direct loading test of a single phase transformer. 7. To verify KVL and Superposition theorem. 8. To verify Thevenin's theorem in a DC network
<p style="text-align: center;">Group B</p> <p>From following minimum two practical are compulsory</p> <ol style="list-style-type: none"> 1. To measure insulation resistance of electrical equipment's/cable using Megger 2. To demonstrate different types of electrical protection equipments such as fuses, MCB, MCCB, ELCB. 3. To measure of earth resistance at substation earthing using fall of potential method with IS 3043 standard. 4. To study of LT and HT electricity bills.

110005: Programming and Problem Solving		
Teaching Scheme: TH: 03 Hrs/Week PR : 02 Hrs/Week	Credits 04	Examination Scheme: In-Semester : 30 Marks End-Semester : 70 Marks PR : 25 Marks
Prerequisite Courses, if any: students are expected to have a good understanding of basic computer principles.		
Companion Course, if any: Programming and Problem Solving Laboratory (110005)		
Course Objectives: Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation. <ol style="list-style-type: none"> 1. To understand problem solving, problem solving aspects, programming and to know about various program design tools. 2. To learn problem solving with computers 3. To learn basics, features and future of Python programming. 4. To acquaint with data types, input output statements, decision making, looping and functions in Python 5. To learn features of Object Oriented Programming using Python 6. To acquaint with the use and benefits of files handling in Python 		
Following Fields are applicable for courses with companion Laboratory course		
Course Outcomes: On completion of the course, learner will be able to– CO1: Inculcate and apply various skills in problem solving. CO2: Choose most appropriate programming constructs and features to solve the problems in diversified domains. CO3: Exhibit the programming skills for the problems those require the writing of well-documented programs including use of the logical constructs of language, Python. CO4: Demonstrate significant experience with the Python program development environment.		
Course Contents		
Unit I Problem Solving, Programming and Python Programming (07 Hrs) General Problem Solving Concepts- Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies, Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms. Basics of Python Programming: Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.		
Unit II Decision Control Statements (08 Hrs) Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The <i>break</i> , <i>continue</i> , <i>pass</i> , <i>else</i> statement used with loops. Other data types- Tuples, Lists and Dictionary.		

Unit III	Functions and Modules	(08 Hrs)
Need for functions, Function : definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.		
Unit IV	Strings	(07 Hrs)
Strings and Operations - concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.		
Unit V	Object Oriented Programming	(08 Hrs)
Programming Paradigms-monolithic, procedural, structured and object oriented, Features of Object oriented programming -classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation. Classes and Objects : classes and objects, class method and self object, class variables and object variables, public and private members, class methods.		
Unit VI	File Handling and Dictionaries	(07 Hrs)
Files : Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. Dictionary method. Dictionaries - creating, assessing, adding and updating values. Case Study : Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination).		
Text Books:		
<ol style="list-style-type: none"> 1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6 2. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; Second edition ISBN-10: 938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL 		
Reference Books:		
<ol style="list-style-type: none"> 1. R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st edition, ISBN-10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978-0132492645 2. Romano Fabrizio, “Learning Python”, Packt Publishing Limited, ISBN: 9781783551712, 1783551712 3. Paul Barry, “Head First Python- A Brain Friendly Guide”, SPD O’Reilly, 2nd Edition, ISBN:978-93-5213-482-3 4. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN-10: 9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943 5. Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978-9382609810 		
Programming and Problem Solving Laboratory		
Guidelines for Instructor's Manual		
The instructor’s manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), copy of curriculum, conduction & Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.		
Guidelines for Student's Lab Journal		
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of		

tool/framework/language used, Design, test cases, conclusion. Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

List of laboratory assignments is provided below for reference. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of coding style, proper indentation and comments.

Use of open source software and recent version is to be encouraged.

In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Suggested List of Laboratory Experiments/Assignments (Any 6 to 8 laboratory assignments)

Sr. No.	Problem Statement Write Program in Python (with function/class/file, as applicable)
1.	To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions.
2.	To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as $e=mc^2$ where m is the mass of the object and c is its velocity.
3.	To accept N numbers from user. Compute and display maximum in list, minimum in list, sum and average of numbers.
4.	To accept student's five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is $60 \geq$ and <75 then the grade is first division. If aggregate is $50 \geq$ and <60 , then the grade is second division. If aggregate is $40 \geq$ and <50 , then the grade is third division.
5.	To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself. Ex. 371.
6.	To simulate simple calculator that performs basic tasks such as addition, subtraction, multiplication and division with special operations like computing x^y and $x!$.

7.	To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors
8.	To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
9.	To accept a number from user and print digits of number in a reverse order.
10.	To input binary number from user and convert it into decimal number.
11.	To generate pseudo random numbers.
12.	To accept list of N integers and partition list into two sub lists even and odd numbers.
13.	To accept the number of terms a finds the sum of <i>sine</i> series.
14.	To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series.
15.	Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring
16.	To copy contents of one file to other. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.
17.	To count total characters in file, total words in file, total lines in file and frequency of given word in file.
18.	Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation “Asst Manager”
19.	Create class STORE to keep track of Products (Product Code, Name and price). Display menu of all products to user. Generate bill as per order.
Mini-Projects	
20.	Calculator with basic functions. Add more functionality such as graphic user interface and complex calculations.
21.	Program that simulates rolling dice. When the program runs, it will randomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.
22.	Use raspberry pi/or similar kit and python for- <ul style="list-style-type: none"> • Room Temperature Monitoring System • Motion Detection System • Soil Moisture Sensor • Home Automation System • A robot • Smart mirror or a smart clock. • Smile Detection using Raspberry Pi Camera
23.	Guess Number: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user’s guess is wrong, the program should return some sort of indication as to how wrong (e.g. the number is too high or too low). If the user guesses correctly, a positive indication should appear. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.

111006 -Workshop Practice		
Teaching Scheme: PR : 2 Hrs/Week	Credits 01	Examination Scheme: PR : 25 Marks
Course Objectives: <ol style="list-style-type: none"> 1. To understand the construction and working of machine tools and functions of its parts. 2. To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop leading to understanding of a production processes. 3. To understand workshop layout and safety norms. 		
Course Outcomes: CO1: Familiar with safety norms to prevent any mishap in workshop. CO2: Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job. CO3: Able to understand the construction, working and functions of machine tools and their parts. CO4: Able to know simple operations (Turning and Facing) on a centre lathe.		
Note <ol style="list-style-type: none"> 1. The demonstration of machine tools to be conducted by <u>teaching</u> faculty. 2. Minimum eight experiments to be conducted out of 10. 		
Guidelines for Instructor's Manual Instructor manual shall contain: <ul style="list-style-type: none"> • The production drawing of a job with all linear and geometric dimensions, Raw material, size and shape, allowances provided. • List of tooling required. • Process plan to complete the job. • General safety instructions. 		
Guidelines for Student's Lab Journal <ol style="list-style-type: none"> i. Student has to maintain a workshop diary consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job and time schedule. ii. Student has to maintain one file for write ups based on demonstration of machine tools and safety norms 		
Guidelines for LAB/TW Assessment Term work assessment shall be based on the timely completion of jobs, quality of job, skill acquired, and maintain of workshop diary and brief write-ups on illustrations/sketches of demonstrated parts/mechanisms/machine tools etc.		
Guidelines for Laboratory Conduction <ol style="list-style-type: none"> i. 1st on importance of workshop practical and shop floor safety norms ii. 2nd to 6th Sessions are about demonstration of machine tools (Any 4) iii. 7th to 9th on making utility job (Any 2) iv. 10th & 11th session on preparation of workshop layout and safety norms. 		
Suggested List of Laboratory Experiments/Assignments		
Sr. No.	List of Experiments	
1.	Mandatory briefing on shop-floor safety	
2.	Demonstration and working of centre lathe Demonstration on various functions of lathe parts: Headstock, Tailstock, Carriage, Lead screw, All geared Mechanism, Apron mechanism etc.	
3.	Demonstration of Lathe operations: Step turning and facing, drilling operation on a Mild Steel cylindrical job on centre lathe. Understanding the concept of speed, feed and depth of cut.	

4.	Demonstration of Drilling machine Demonstration on construction of Radial drilling machine, Tool holding devices, Concept of speed, feed and depth of cut.
5.	Demonstration on Milling machine Demonstration on construction, table movements, indexing and tooling of milling machine.
6.	Demonstration of Shaper/Grinding machine (Any one) Shaper: Crank and slotted link mechanism, Work feed mechanism Grinding: Surface grinder/Cylindrical grinding machine, Mounting of grinding wheel
7.	Term work includes one job of Carpentry Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns and its allowances.
8.	Term work to include one job involving fitting to size, male-female fitting with drilling and tapping operation on Mild Steel plate; Introduction to marking, cutting and sawing, sizing of metal, shearing, Concept of fits and interchangeability, selection of datum and measurements.
9.	Term work to include one utility job preferably using sheet metal (e.g. Tray, Funnel etc.) with riveting/welding/brazing/soldering (at least one temporary and one Permanent joint either using resistance welding/Arc welding); Introduction to sheet metal operations: punching, blanking, bending, drawing.
10.	Prepare a Layout of Workshop To prepare a work shop layout.
11.	Collection of information about safety norms in any one of the following type of industry: Metalworking/Chemical/Cement/Pharmaceuticals/Defense/Atomic energy/Aerospace /Marine/Construction/Railway etc.

Reference/Text Books

1. John, K. C., (2010), "Mechanical Workshop Practice, Prentice Hall Publication, New Delhi
2. Hazra and Chaudhary, Workshop Technology-I & II, Media promoters & Publisher Pvt. Ltd.

TH:02 Hrs./week **101007: Environmental Studies-I**
(Mandatory Non-Credit Course)

Course Objectives:

1. To explain the concepts and strategies related to sustainable development and various components of environment.
2. To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships.
3. To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources.
4. To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity on national and local scale.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO2: Explain and identify the role of the organism in energy transfers in different ecosystems.

CO3: Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources.

CO4: Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings.

Course Contents

Unit I Introduction to environmental studies (02 Hrs)		
Multidisciplinary nature of environmental studies; components of environment – atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.		
Unit II Ecosystems (06 Hrs)		
What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:		
a) Forest ecosystem		
b) Grassland ecosystem		
c) Desert ecosystem		
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)		
Unit III Natural Resources: Renewable and Non-renewable Resources (08 Hrs)		
Land Resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.		
Water: Use and over-exploitation of surface and ground water, floods droughts, conflicts over water (international & inter-state).		
Heating of earth and circulation of air; air mass formation and precipitation.		
Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.		
Unit IV Biodiversity and Conservation (08 Hrs)		
Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity; In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.		
Suggested Readings:		
1. Carson, R. 2002. Silent spring. Houghton Mifflin Harcourt.		
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.		
3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.		
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.		
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principals of Conservation Biology. Sunderland: Sinauer Associates, 2006.		
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.		
7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp.29-64). Zed Books.		
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.		
107008 – Engineering Mathematics – II		
Teaching Scheme:	Credits	Examination Scheme:
TH : 4 Hrs./Week	05	In-Semester : 30 Marks
TUT : 1 Hr./Week		End-Semester : 70 Marks
		TW : 25 Marks
Prerequisites:		
Integration, Differential Equation, Three-dimensional coordinate systems		

Course Objectives: To make the students familiarize with Mathematical Modeling of physical systems using differential equations advanced techniques of integration, tracing of curve, multiple integrals and their applications. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.		
Course Outcomes (COs): The students will be able to learn CO1: the effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc. CO2: advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications. CO3: to trace the curve for a given equation and measure arc length of various curves. CO4: the concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner. CO5: evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.		
Course Contents		
Unit I:	First Order Ordinary differential Equations	(09 Hrs.)
Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form, Bernoulli's equation.		
Unit II:	Applications of Differential Equations	(09 Hrs.)
Applications of Differential Equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, Rectilinear Motion, Simple Harmonic Motion, One dimensional Conduction of Heat.		
Unit III:	Integral Calculus	(09 Hrs.)
Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions.		
Unit IV:	Curve Tracing	(09 Hrs.)
Tracing of Curves – Cartesian, Polar and Parametric curves, Rectification of curves.		
Unit V:	Solid Geometry	(09 Hrs.)
Cartesian, Spherical polar and Cylindrical coordinate systems, Sphere, Cone and Cylinder.		
Unit VI:	Multiple Integrals and their Applications	(09 Hrs.)
Double and Triple integrations, Change of order of integration, Applications to find Area, Volume, Mass, Centre of Gravity and Moment of Inertia.		
Text Books: 1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill) 2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)		
Reference Books: 1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.) 2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education) 3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning) 4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson) 5. Applied Mathematics (Vol. I and II) by P.N. Wartikar and J.N. Wartikar Vidyarthi Griha Prakashan, Pune. 6. Differential Equations by S. L. Ross (John Wiley and Sons)		
Tutorial and Term Work: i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students) per division. ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on		

performance and continuous internal assessment.		
107009: Engineering Chemistry		
Teaching Scheme: TH : 04 Hrs/week PR : 02 Hrs/Week	Credits 05	Examination Scheme: In Semester : 30 Marks End Semester: 70 Marks PR : 25 Marks
Prerequisite Courses, if any: Types of titrations, volumetric analysis, structure property relationship, types of crystals, periodic table, classification and properties of polymers, electromagnetic radiation, electrochemical series		
Companion Course, if any: Laboratory Practical		
Course Objectives: <ol style="list-style-type: none"> 1. To understand technology involved in analysis and improving quality of water as commodity. 2. To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials. 3. To understand structure, properties and applications of speciality polymers and nano material. 4. To study conventional and alternative fuels with respect to their properties and applications. 5. To study spectroscopic techniques for chemical analysis. 6. To understand corrosion mechanisms and preventive methods for corrosion control. 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Apply the different methodologies for analysis of water and techniques involved in softening of water as commodity. CO2: Select appropriate electro-technique and method of material analysis. CO3: Demonstrate the knowledge of advanced engineering materials for various engineering applications. CO4: Analyze fuel and suggest use of alternative fuels. CO5: Identify chemical compounds based on their structure. CO6: Explain causes of corrosion and methods for minimizing corrosion.		
Course Contents		
Unit I	Water Technology	(08Hrs)
Impurities in water, hardness of water: Types, Units and Numericals. Determination of hardness (by EDTA method using molarity concept) and alkalinity, numericals. Ill effects of hard water in boiler - priming and foaming, boiler corrosion, caustic embrittlement, scale and sludge. Water treatment: i) Zeolite method and numericals ii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis.		
Unit II	Instrumental Methods of Analysis	(08Hrs)
Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), ion selective electrode: ion selective membranes such as solid membrane, enzyme based membrane and gas sensing membrane. [A] Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve. [B] pHmetry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve.		

Unit III	Engineering Materials	(08Hrs)
<p>A] Speciality polymers: Introduction, preparation, properties and applications of the following polymers:</p> <ol style="list-style-type: none"> 1. Engineering Thermoplastic: Polycarbonate, 2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalanate), 3. Conducting Polymer: Polyacetylene, 4. Electroluminescent polymer: Polyphenylenevinylene, 5. Polymer composites: Fiber reinforced plastic (FRP)- Glass reinforced and Carbon reinforced polymer composite <p>[B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).</p>		
Unit IV	Fuels	(08Hrs)
<p>Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel),</p> <p>Calorific value (CV): Higher calorific value (HCV) and Lower calorific value (LCV), Determination of Calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numericals,</p> <p>Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, numericals,</p> <p>Liquid fuel: Petroleum: Refining of petroleum /crude oil and composition, boiling range and uses of various fractions,</p> <p>Gaseous fuel: Composition, properties and applications of CNG. Hydrogen gas as a future fuel</p> <p>Alternative fuels: Power alcohol and biodiesel.</p>		
Unit V	Spectroscopic Techniques	(08Hrs)
<p>[A]UV-Visible Spectroscopy:</p> <p>Introduction, interaction of electromagnetic radiation with matter, statement of Beer's law and Lambert's law, absorption of UV radiation by organic molecule leading to different electronic transitions, terms involved in UV-visible Spectroscopy- chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift, Instrumentation and basic principle of single beam spectrophotometer, applications of UV-visible spectroscopy.</p> <p>[B] Infra red Spectroscopy:</p> <p>Introduction, Principle of IR Spectroscopy, types of vibrations: Stretching (symmetric and asymmetric) and bending (scissoring, rocking, wagging and twisting), conditions of absorption of IR radiations, vibration of diatomic and polyatomic molecules. Instrumentation with block diagram. Parts of IR spectrum, fundamental group region, fingerprint region, applications of IR spectroscopy.</p>		
Unit VI	Corrosion Science	(08Hrs)
<p>Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, galvanic cell corrosion, concentration cell corrosion, Factors influencing rate of corrosion. Methods of corrosion control and prevention: cathodic and anodic protection, metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, cladding, electroplating, cementation.</p>		
Books & Other Resources:		
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Engineering Chemistry by O .G. Palanna, Tata Magraw Hill Education Pvt. Ltd. 2. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd. 3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher 		

Reference Books:

1. Engineering Chemistry, Wiley India Pvt. Ltd.
2. Inorganic Chemistry, 5 ed by Shriver and Atkins, Oxford University Press
3. Basic Concept of Analytical Chemistry, 2ed , S. M. Khopkar, New Age-International Publisher
4. Instrumental Methods of Chemical Analysis, G. R. Chatwal& S. K. Anand, Himalaya Publishing House
5. Spectroscopy of organic compounds, 2 ed, P. S. Kalsi, New Age-International Ltd., Publisher
6. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, Wiley Eastern Limited

1. To determine hardness of water by EDTA method
2. To determine alkalinity of water
3. To determine strength of strong acid using pH meter
4. To determine maximum wavelength of absorption of $\text{CuSO}_4/\text{FeSO}_4/\text{KMnO}_4$, verify Beer's law and find unknown concentration of given sample.
5. Titration of a mixture of weak acid and strong acid with strong base using conductometer
6. Preparation of polystyrene/phenol-formaldehyde/urea-formaldehyde resin
7. To determine molecular weight/radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
8. Proximate analysis of coal.
9. To coat copper and zinc on iron plate using electroplating.
10. Preparation of biodiesel from oil.
11. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nanoparticles

104010:Basic Electronics Engineering**Teaching Scheme:**

TH : 03 Hrs./week
PR : 02 Hrs./week

Credits**04****Examination Scheme**

In - Semester : 30 Marks
End - Semester : 70 Marks
PR : 25 Marks

Course Objectives:

1. The principle of electronics and working principle of PN junction diode and special purpose diodes.
2. The functioning of transistors like BJT, MOSFETs and OPAMP.
3. Basics of various logic gates, digital circuits and their applications.
4. Working and functions of various electronic instruments.
5. The operating principles and applications of various active and passive sensors.
6. Basic principles of communication systems.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Explain the working of P-N junction diode and its circuits.

CO2: Identify types of diodes and plot their characteristics and also can compare BJT with MOSFET.

CO3: Build and test analog circuits using OPAMP and digital circuits using universal/basic gates and flip flops.

CO4: Use different electronics measuring instruments to measure various electrical parameters.

CO5: Select sensors for specific applications.

CO6: Describe basic principles of communication systems.		
Course Contents		
Unit I	Introduction to Electronics	(08Hrs)
Evolution of Electronics, Impact of Electronics in industry and in society. Introduction to active and passive components, P-type Semiconductor, N-type Semiconductor. Current in semiconductors(Diffusion and Drift Current) P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias condition, V-I characteristics of P-N junction Diode, Diode as a switch, Half Wave Rectifier, Full wave and Bridge Rectifier. Special purpose diodes: Zener diode, Light Emitting Diode (LED) and photo diode along with V-I characteristics and their applications.		
Unit II	Transistor and OPAMP	(07Hrs)
Bipolar Junction Transistor : Construction, type, Operation, V-I Characteristics, region of operation, BJT as switch and CE amplifier Metal Oxide Semiconductor Field Effect Transistors (MOSFET): Construction, Types, Operation, V-I characteristics, Regions of operation, MOSFET as switch & amplifier. Operational amplifier: Functional block diagram of operational amplifier, ideal operational amplifier, Op-amp as Inverting and Non inverting amplifier		
Unit III	Number System and Logic Gates	(07Hrs)
Number System:- Binary, BCD, Octal, Decimal, Hexadecimal their conversion and arithmetic, De-Morgan's theorem. Basic Gates:- AND, OR, NOT, Universal Gate- XOR, XNOR, Half adder, Full adder Flip Flop's SR, JK, T and D Introduction to Microprocessor and Microcontroller (Only block diagram and explanation)		
Unit IV	Electronic Instrumentation	(06Hrs)
Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO) Power scope, AC/DC power supply, Auto transformer, Analog ammeter and voltmeter.		
Unit V	Sensors	(07Hrs)
Classification of a sensors, Active /Passive Sensors, Analog/Digital Sensors, Motion Sensors (LVDT, Accelerometer), Temperature Sensors (Thermocouple, Thermistor, RTD), Semiconductor Sensors(Gas Sensors), Optical Sensors (LDR), Mechanical Sensors (Strain Guage, Load Cell, Pressure sensors), Biosensors. (Working Principle and one application).		
Unit VI	Communication Systems	(07Hrs)
Basic Communication System: Block Diagram, Modes of Transmission, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Allotment of frequency band for different applications, Block Diagram of AM and FM Transmitter and receiver, Mobile Communication System: Cellular concept, Simple block diagram of GSM system.		
Books & Other Resources:		
Text Books:		
<ol style="list-style-type: none"> 1. "Electronics Devices" by Thomas. L. Floyd, 9th Edition, Pearson (Unit I, II) 2. "Modern Digital Electronics" by R.P. Jain, 4th Edition, Tata McGraw Hill (Unit III) 3. "Electronic Instrumentation" by H.S. Kalsi, 3rd Edition, Tata McGraw Hill (Unit IV) 4. "Sensors and Transducers" by D. Patrnabis, 2nd Edition, PHI (Unit V) 5. "Electronic Communication Systems" by Kennedy & Davis, 4th Edition, Tata McGraw Hill (Unit VI) 6. "Mobile Wireless communication" by M. Schwartz, Cambridge University Press (Unit VI) 		
Reference Books:		
<ol style="list-style-type: none"> 1. "Digital Fundamentals" by Thomas. L. Floyd, 11th Edition, Pearson 		

2. “Mobile Communication” by J. Schiller, 2 nd Edition, Pearson	
3. “Sensors Handbook”, by S. Soloman, 2 nd Edition.	
List of Laboratory Experiments/Assignments	
1.	Electronic Components: Study of Active and Passive components a) Resistors (Fixed & Variable), Calculation of resistor value using color code. b) Capacitors (Fixed & Variable) c) Inductors, Calculation of inductor value using color code. d) Devices such Diode, BJT, MOSFETs, various IC packages e) Switches & Relays
2.	Measurements using various measuring equipments: a) Set up CRO and function generator for measurement of voltage, frequency b) Obtain the phase shift between to signals using CRO with the help of Lissagous pattern. c) Measure voltage, resistance using digital multimeter. Also use multimeter to check diode, BJT
3.	V-I characteristics of: a) P-N Junction Diode (Study the datasheet of typical PN junction diode 1N 400X) b) Zener Diode (Study the datasheet of typical Zener diode 1N 4148)
4.	Rectifier circuits: a) Implement half wave, full wave and bridge rectifier using diodes b) Observe the effect of capacitor filter on rectifier output
5.	Frequency response of MOSFET: a) To plot frequency response of BJT amplifier.(Simulation) b) To plot frequency response of MOSFET amplifier.(Simulation)
6.	Linear applications of Op-amp: Build inverting and non-inverting amplifier using op-amp (Study the datasheet of typical Op-Amp 741)
7.	Test and verify the truth tables of: a) Basic and Universal Gates (Study the data sheet of respective IC's) b) Half / Full Adder c) RS/JK/T/D flip flop
8.	Study of transducers : (Any 3)
9.	Build and test any circuit using BJT/MOSFET/Op-Amp/Logic Gates using any one sensor.
10.	Case Study of any one electronics appliances with block diagram, specification etc.
<u>Guidelines for Instructor's Manual</u>	
<ul style="list-style-type: none"> The instructor's manual is to be developed as a hands-on resource and reference. Copy of Curriculum, Conduction & Assessment guidelines, List of Experiments to be attached. 	
<u>Guidelines for Student's Lab Journal</u>	
<ul style="list-style-type: none"> The laboratory assignments/experiments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each experiment. Each experiment should consist of : <ul style="list-style-type: none"> ✓ Title. ✓ Objectives. ✓ Problem Statement, Outcomes ✓ Hardware / Software (If any) requirements. ✓ Concept. ✓ Experimental procedure / Setup. 	

<ul style="list-style-type: none"> ✓ Observation table ✓ Conclusion. 		
<p align="center"><u>Guidelines for Laboratory Conduction</u></p> <ul style="list-style-type: none"> All the experiments mentioned in the syllabus are compulsory. Use of open source software and recent version is to be encouraged. 		
<p align="center"><u>Guidelines for Lab /TW Assessment</u></p> <ul style="list-style-type: none"> Continuous assessment of laboratory work is done based on overall performance. Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include: <ul style="list-style-type: none"> ✓ Timely completion. ✓ Performance. ✓ Punctuality and neatness. The parameters for assessment is to be known to the students at the beginning of the course. 		
101011: Engineering Mechanics		
Teaching Scheme: TH : 3 Hrs./week PR : 2 Hrs./Week	Credits 04	Examination Scheme: In-Semester : 30 Marks End-Semester : 70 Marks PR : 25 Marks
Prerequisite Courses, if any: 12th Physics, Maths		
Course Objectives: <ol style="list-style-type: none"> To impart knowledge about force systems and methods to determine resultant centroid and moment of inertia To teach methods to calculate force of friction To impart knowledge to determine reaction of beams, calculate member forces in trusses, cables and frames using principles of equilibrium To teach space force systems To train students to solve problems related to particle mechanics using principles of kinematics, kinetics and work power energy 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Determine resultant of various force systems CO2: Determine centroid, moment of inertia and solve problems related to friction CO3: Determine reactions of beams, calculate forces in cables using principles of equilibrium CO4: Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space CO5: Calculate position, velocity and acceleration of particle using principles of kinematics CO6: Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy		
Course Contents		
Unit I	Resolution and Composition of Forces	(07Hrs)
Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent forces. Moment of a force, Varignon's theorem, resultant of parallel force system, Couple, Equivalent force couple system, Resultant of parallel general force system		
Unit II	Distributed Forces and Friction	(06Hrs)
Moment of area, Centroid of plane lamina and wire bends, Moment of Inertia. Friction- Laws of friction, application of friction on inclined planes Wedges and ladders friction Application to flat belt		

Unit III	Equilibrium	(06Hrs)
Free body diagram Equilibrium of concurrent, parallel forces in a plane Equilibrium of general forces in a plane Equilibrium of three forces in a plane, Types of beams, simple and compound beams, Type of supports and reaction, Forces in space, Resultant of concurrent and parallel forces in a space, Equilibrium of concurrent and parallel forces in a space.		
Unit IV	Analysis of Structures	(06 Hrs)
Two force member, Analysis of plane trusses by Method of joints Analysis of plane trusses by method of section, Analysis of plane frames, Cables subjected to point load multi force member.		
Unit V	Kinematics of Particle	(06 Hrs)
Kinematics of linear motion- Basic concepts Equation of motion for constant acceleration Motion under gravity, Variable acceleration motion curves. Kinematics of curvilinear motion- Basic Concepts Equation of motion in Cartesian coordinates Equation of motion in path coordinates Equation of motion in polar coordinates Motion of projectile.		
Unit VI	Kinetics of Particle	(06Hrs)
Kinetics- Newton's Second Law of motion Application of Newton's Second Law. Work, power, energy, conservative and non-conservative forces Conservation of energy for motion of particle, Impulse, Momentum, Direct central impact. Coefficient of restitution, Impulse Momentum principle of particle.		
Books & Other Resources:		
Text Books:		
1. Vector Mechanics for Engineers, by F. P. Beer and E. R. Johnson, McGraw-Hill Publication 2. Engineering Mechanics by R. C. Hibbeler, Pearson Education		
Reference Books:		
1. Engineering Mechanics by S. P. Timoshenko and D. H. Young, McGraw- Hill publication 2. Engineering Mechanics by J. L. Meriam and Craige, John Willey 3. Engineering Mechanics by F L Singer, Harper and Rowe publication 4. Engineering Mechanics by A. P. Boresi and R. J. Schmidt, Brooks/Cole Publication		
Laboratory Course		
Guidelines for Instructor's Manual		
An instruction manual with aim, objective, apparatus, procedure and calculations to be performed for each experiment to be provided for students called as Lab Manual. Every year problems for assignment should be changed. It is advisable to give different data to different batches		
Guidelines for Student's Lab Journal		
Journal should be hand written		
Guidelines for Lab /TW Assessment		
Each and every experiment should be assessed and given mark out of 10. Finally the marks can be converted as per given in the structure.		
Guidelines for Laboratory Conduction		
Divide the students of a batch in groups of not more than 4 students and ask each group to take readings separately followed by calculations for each experiment. After every experiment faculty should sign the lab manual of readings of every student in the batch		
Suggested List of Laboratory Experiments/Assignments		

Sr. No.	Group A	
	1. Verification of law of parallelogram of forces/polygon of forces. 2. To determine support reaction of simple/compound beams. 3. Determination of coefficient friction of belt/inclined plane. 4. To determine forces in the members of space force system. 5. To study the curvilinear motion. 6. Determination of coefficient of restitution.	
	Group B	
	Assignment of five problems on every unit to be solved during practical	
	Group C	
	Any two assignments of the following by graphical method using any drawing software. a) To determine the resultant of general force system. b) To determine unknown forces of concurrent force system c) To determine the forces in the member of the plane truss d) To determine velocity and acceleration of particle from given s-t diagram.	
102012: Engineering Graphics		
Teaching Scheme: TH : 01 Hr/week PR : 02 Hrs/Week TUT : 01 Hr/Week		Credits 02 Examination Scheme: End-Semester : 50 Marks TW : 25 Marks
Course Objectives		
1. To acquire basic knowledge about engineering drawing language, line types, dimension methods, and simple geometrical construction. 2. To draw conic sections by various methods, involutes, cycloid and spiral. 3. To acquire basic knowledge about physical realization of engineering objects and shall be able to draw its different views. 4. To visualize three dimensional engineering objects and shall be able to draw their isometric views. 5. To imagine visualization of lateral development of solids. 6. To acquire basic knowledge about the various CAD drafting software's and its basic commands required to construct the simple engineering objects.		

Course Outcomes		
On completion of the course, learner will be able to		
CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.		
CO2: Construct the various engineering curves using the drawing instruments.		
CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.		
CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.		
CO5: Draw the development of lateral surfaces for cut section of geometrical solids.		
CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools.		
Course Contents		
Unit I	Fundamentals of Engineering Drawing	(01 Hrs)
Need of Engineering Drawing and design, Sheet layout, Line types and dimensioning and simple geometrical constructions		
Unit II	Introduction to 2D and 3D computer aided drafting packages	(02 Hrs)
Evolution of CAD, Importance of CAD, Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D and 3D drawings		
Unit III	Engineering Curves	(01 Hr)
Introduction to conic sections and its significance, various methods to construct the conic sections. Helix for cone and cylinder , rolling curves (Involute , Cycloid) and Spiral		
Unit IV	Orthographic Projection	(02 Hrs)
Principle of projections, Introduction to First and Third angle Projection methods, Orthographic projection of point, line, plane, solid and machine elements/parts		
Unit V	Isometric Projection	(03 Hrs)
Introduction to isometric projection, oblique projection and perspective projection. Draw the isometric projection from the given orthographic views		
Unit VI	Development of Lateral Surfaces	(03 Hrs)
Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfaces for cut section of cone, pyramid, prism etc.		
Books & Other Resources		
Text Books		
<ol style="list-style-type: none"> 1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India 2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi 3. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi 4. Rathnam, K., (2018), " A First Course in Engineering Drawing", Springer Nature Singapore Pte. Ltd., Singapore 		
Reference Books		
<ol style="list-style-type: none"> 1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA 2. Bhatt, N. D., (2018), "Machine Drawing", Chartor Publishing house, Anand, India 3. Dhawan, R. K., (2000), "A Textbook Of Engineering Drawing", S. Chand, New Delhi 4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA 5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), "Principles of engineering graphics", McMillan Publishing, USA 		

6. Jensen, C., Helsel, J. D., Short, D. R., (2008), "Engineering Drawing and Design", McGraw-Hill International, Singapore

Guidelines for Laboratory Conduction

Tutorial Session

Can be utilized to teach the basic commands of any drafting package, by using this knowledge students shall be able to complete the five assignments on the CAD software. (Minimum 2 problems in each assignment)

Assignment 1: Construct any Engineering Curve using any method

Assignment 2: Orthographic view of any machine element along with sectional view.

Assignment 3: Draw Isometric view for given orthographic views.

Assignment 4 :Draw the isometric or Orthographic view of a product/object (For example Workshop Job prepared during the workshop practice or any product developed during the first year session).

Assignment 5: Draw the development of lateral surface of a solid/ truncated solid.

Practical Session

Draw minimum two problems on each assignment on the A3 size drawing sheet.

Suggested List of Laboratory Experiments/Assignments

Assignment 1: Construct any Engineering Curve by any method

Assignment 2: Orthographic view of any machine element along with sectional view.

Assignment 3: Draw Isometric view for given orthographic views.

Assignment 4: Draw the development of lateral surface of a solid/ truncated solid

Assignment 5: Draw the isometric or Orthographic view of a product/object (For example Workshop Job prepared during the workshop practice or any product developed during the first year session.)

110013: Project Based Learning

Teaching Scheme:

PR: 04 Hrs/Week

Credits

02

Examination Scheme:

PR : 50 Marks

Preamble:

For better learning experience, along with traditional classroom teaching and laboratory learning; project based learning has been introduced with an objective to motivate students to learn by working in group cooperatively to solve a problem.

Project-based learning (PBL) is a student-centric pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems. Students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge, or problem. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Problem based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development.

Course Objectives:

1. To emphasizes learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engages students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes:

CO1: Project based learning will increase their capacity and learning through shared cognition.

CO2: Students able to draw on lessons from several disciplines and apply them in practical way.

CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning.

Group Structure:

Working in supervisor/mentor –monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem.

- There should be team/group of 5 -6 students
- A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or “wondering”. This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame.

A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students’ wondering within different disciplines and professional environments. A chosen problem has to be **exemplary**. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize and present their learning.
- Activities may include- Solving real life problem, investigation /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment AND evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

- Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
- Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
- Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that all activities are to be recorded and regularly, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor (you may call it PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment, evaluation and weightage:

- Idea Inception (5%)
- Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (50%) (Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) (25%)
- Demonstration (Presentation, User Interface, Usability etc) (10%)
- Contest Participation/ publication (5%)
- Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (5%)

PBL workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

References:

- Project-Based Learning, Edutopia, March 14, 2016.
- What is PBL? Buck Institute for Education.
- www.schoology.com
- www.wikipedia.org
- www.howstuffworks.com

101014: Environmental Studies-II**TH: 02 Hr/week****Mandatory Non-Credit Course****Course Objectives:**

1. To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.
2. To understand the evolution of environmental policies and laws.
3. To explain the concepts behind the interrelations between environment and the development.
4. To examine a range of environmental issues in the field, and relate these to scientific theory.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Have an understanding of environmental pollution and the science behind those problems and potential solutions.

CO2: Have knowledge of various acts and laws and will be able to identify the industries that are violating these rules.

CO3: Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources.

CO4: Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.

Course Contents**Unit V****Environmental Pollution****(08 Hrs)**

Environmental pollution : types, causes, effects and controls; Air, water, soil, chemical and noise pollution

Nuclear hazards and human health risks

Solid waste management: Control measures of urban and industrial waste

Pollution case studies.		
Unit VI	Environmental Pollution	(07 Hrs)
Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities & agriculture. Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto Protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC). Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context		
Unit VII	Human Communities and the Environment	(06 Hrs)
Human population and growth; Impacts on environment, human health and welfare. Carbon foot-print. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods earthquakes, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).		
Unit VIII	Field work	(05 Hrs)
<ul style="list-style-type: none"> • Visit to an area to document environmental assets; river/forest/flora/fauna, etc. • Visit to a local polluted site – Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds and basic principles of identification. • Study of simple ecosystems-pond, river Delhi Ridge, etc 		
Suggested Readings: <ol style="list-style-type: none"> 1. Carson, R. 2002. Silent spring. Houghton Mifflin Harcourt. 2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press. 3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge. 4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principals of Conservation Biology, Sunderland: Sinauer Associates, 2006 6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37. 7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp.29-64). Zed Books. 8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century. 		

**Faculty of Science and Technology
Savitribai Phule Pune University
Maharashtra, India**



<http://unipune.ac.in>

**Curriculum
for
Second Year of Computer Engineering
(2019 Course)
(With effect from 2020-21)**

Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) (With effect from Academic Year 2020-21)		
Table of Contents		
Sr. No.	Title	Page Number
1.	Program Outcomes	3
2.	Program Specific Outcomes	3
3.	Course Structure (Course titles, scheme for teaching, credit, examination and marking)	4
4.	General Guidelines	5
5.	Course Contents (Semester III)	8 To 48
	210241: Discrete Mathematics	8
	210242: Fundamentals of Data Structures	11
	210243: Object Oriented Programming (OOP)	14
	210244: Computer Graphics	17
	210245: Digital Electronics and Logic Design	20
	210246: Data Structures Laboratory	23
	210247: OOP and Computer Graphics Laboratory	28
	210248: Digital Electronics Laboratory	32
	210249: Business Communication Skills	34
	210250: Humanity and Social Science	37
	210251: Audit Course 3	43
6.	Course Contents (Semester IV)	50 To 80
	207003: Engineering Mathematics III	50
	210252: Data Structures and Algorithms	52
	210253: Software Engineering	55
	210254: Microprocessor	58
	210255: Principles of Programming Languages	61
	210256: Data Structures and Algorithms Laboratory	64
	210257: Microprocessor Laboratory	68
	210258: Project Based Learning II	70
	210259: Code of Conduct	75
	210260: Audit Course 4	80
7.	Acknowledgement	86
8.	Task Force at Curriculum Design	87

Savitribai Phule Pune University
Bachelor of Computer Engineering

Program Outcomes (POs)

Learners are expected to know and be able to–

PO1	Engineering knowledge	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.
PO3	Design / Development of Solutions	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
PO4	Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices.
PO7	Environment and Sustainability	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of Engineering practice.
PO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication Skills	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project Management and Finance	Demonstrate knowledge and understanding of Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.
PO12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

A graduate of the Computer Engineering Program will demonstrate-

PSO1	Professional Skills- The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities.
PSO2	Problem-Solving Skills- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
PSO3	Successful Career and Entrepreneurship- The ability to employ modern computer languages, environments and platforms in creating innovative career paths to be an entrepreneur and to have a zest for higher studies.

Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2020-21)

Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
210241	Discrete Mathematics	03	-	-	30	70	-	-	-	100	03	--	-	03
210242	Fundamentals of Data Structures	03	-	-	30	70	-	-	-	100	03	-	-	03
210243	Object Oriented Programming (OOP)	03	-	-	30	70	-	-	-	100	03	-	-	03
210244	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
210245	Digital Electronics and Logic Design	03	-	-	30	70	-	-	-	100	03	-	-	03
210246	Data Structures Laboratory	-	04	-	-	-	25	50	-	75	-	02	-	02
210247	OOP and Computer Graphics Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210248	Digital Electronics Laboratory	-	02	-	-	-	25	-	-	25	-	01	-	01
210249	Business Communication Skills	-	02	-	-	-	25	-	-	25	-	01	-	01
210250	Humanity and Social Science	-	-	01	-	-	25	-	-	25	-	-	01	01
210251	Audit Course 3													
Total Credit											15	06	01	22
Total		15	12	01	150	350	125	75	-	700	-	-	-	-

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
207003	Engineering Mathematics III	03	-	01	30	70	25	-	-	125	03	--	01	04
210252	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
210253	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
210254	Microprocessor	03	-	-	30	70	-	-	-	100	03	-	-	03
210255	Principles of Programming Languages	03	-	-	30	70	-	-	-	100	03	-	-	03
210256	Data Structures and Algorithms Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210257	Microprocessor Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
210258	Project Based Learning II	-	04	-	-	-	50	-	-	50	-	02	-	02
210259	Code of Conduct	-	-	01	-	-	25	-	-	25	-	-	01	01
210260	Audit Course 4													
Total Credit											15	05	02	22
Total		15	10	02	150	350	150	25	25	700	-	-	-	-

General Guidelines

1. Every undergraduate program has its own objectives and educational outcomes. These objectives and outcomes are furnished by considering various aspects and impacts of the curriculum. These **Program Outcomes (POs)** are categorically mentioned at the beginning of the curriculum (ref: NBA Manual). There should always be a rationale and a goal behind the inclusion of a course in the curriculum. Course Outcomes though highly rely on the contents of the course; many-a-times are generic and bundled. The **Course Objectives, Course Outcomes** and **CO-PO mappings matrix** justifies the motives, accomplishment and prospect behind learning the course. The Course Objectives, Course Outcomes and CO-PO Mapping Matrix are provided for reference and these are indicative only. The course instructor may modify them as per his or her perspective.
2. **@:CO and PO Mapping Matrix** (Course Outcomes and Program Outcomes)- The **expected** attainment mapping matrix at end of course contents, indicates the correlation levels of 3, 2, 1 and '-'. The notation of 3, 2 and 1 denotes substantially (high), moderately (medium) and slightly (low). The mark '-' indicates that there is no correlation between the respective CO and PO.
3. **#:Elaborated examples/Case Studies**- For each course, contents are divided into six units-I, II, III, IV, V and VI. Elaborated examples/Case Studies are included at the end of each unit to explore how the learned topics apply to real world situations and need to be explored so as to assist students to increase their competencies, inculcating the specific skills, building the knowledge to be applicable in any given situation along with an articulation. One or two sample exemplars or case studies are included for each unit; instructor may extend the same with more. **Exemplar/Case Studies may be assigned as self-study by students and to be excluded from theory examinations.**
4. *:For each unit contents, the desired content attainment mapping is indicated with Course Outcome(s). Instructor may revise the same as per their viewpoint.
5. For laboratory courses, set of suggested assignments is provided for reference. Laboratory Instructors may design suitable set of assignments for respective course at their level. **Beyond curriculum assignments and mini-project may be included as a part of laboratory work.** The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners.
6. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorial may be as per guidelines of authority.
7. For each course, irrespective of the examination head, the instructor should motivate students to read and publish articles, research papers related to recent development and invention in the field.
8. For laboratory, instructions have been included about the conduction and assessment of laboratory work. **These guidelines are to be strictly followed. Use of open source software is appreciated.**
9. **Term Work^[1]**—Term work is continuous assessment that evaluates a student's progress throughout the semester^[1]. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous

standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. **It is recommended to conduct internal monthly practical examination as part of continuous assessment.**

Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

10. **Laboratory Journal**- Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.

11. **Tutorial**^[1] - Tutorials can never be an individual course but an additional aid to the learners. Tutorials help the learners to inculcate the contents of the course with focused efforts on small group of the learners. Tutorial conduction should concentrate more on simplifying the intricacies converging to clear understanding and application. **Assessment of tutorial work is to be done in a manner similar to assessment of term-work; do follow same guidelines.**

12. **Audit Course**^[1]: The student registered for audit course shall be awarded the grade AP/PP (Audit Course Pass) and the grade 'AP'/'PP' shall be included in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP'/'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

13. **\$**:For courses 210249: Business Communication Skills, 210250: Humanity and Social Science and 210260: Code of Conduct, one credit can be earned by student if student successfully completes the Swayam course as listed in curriculum of respective course in this document.

UGC has issued the UGC (Credit Framework for online learning courses through SWAYAM) Regulation 2016 advising the Universities to identify courses where credits can be transferred on to the academic record of the students for courses done on SWAYAM. AICTE has also put out gazette notification in 2016 and subsequently for adoption of these courses for credit transfer ^[2].

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. This is done through a platform that facilitates hosting of the courses to be accessed by anyone, anywhere at any time. Courses delivered through SWAYAM are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However, learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated center on specified dates. Eligibility for the certificate is generally announced on the course page. Universities/colleges approving credit transfer for these courses can use the marks/certificate obtained in these courses for the same.^[2]

Note: For Examination rules, pattern and assessment please refer ^[1]

[1]http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/Rules%20and%20Regulations%20F.E.%202019%20Patt_10.012020.pdf

[2] <https://swayam.gov.in/about>

Abbreviations		
TW: Term Work	TH: Theory	PR: Practical
OR: Oral	TUT: Tutorial	Sem: Semester

Semester III



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210241: Discrete Mathematics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks

Prerequisites: Basic Mathematics

Companion Course : ---

Course Objectives:

To introduce several Discrete Mathematical Structures found to be serving as tools even today in the development of theoretical computer science.

- To introduce students to understand, explain, and apply the foundational mathematical concepts at the core of computer science.
- To understand use of set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.
- To acquire knowledge of logic and proof techniques to expand mathematical maturity.
- To learn the fundamental counting principle, permutations, and combinations.
- To study how to model problem using graph and tree.
- To learn how abstract algebra is used in coding theory.

Course Outcomes:

On completion of the course, learner will be able to–

- CO1: Formulate** problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.
- CO2: Apply** appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.
- CO3: Design and analyze** real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.
- CO4: Specify, manipulate and apply** equivalence relations; construct and use functions and apply these concepts to solve new problems.
- CO5: Calculate** numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics.
- CO6: Model and solve** computing problem using tree and graph and solve problems using appropriate algorithms.
- CO7: Analyze** the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures.

Course Contents

Unit I	Set Theory and Logic	(07 Hours)
Introduction and significance of Discrete Mathematics, Sets – Naïve Set Theory (Cantorian Set Theory), Axiomatic Set Theory, Set Operations, Cardinality of set, Principle of inclusion and exclusion. Types of Sets – Bounded and Unbounded Sets, Diagonalization Argument, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Power set, Propositional Logic - logic, Propositional Equivalences, Application of Propositional Logic- Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.		
#Exemplar/Case Studies	Know about the great philosophers- Georg Cantor, Richard Dedekind and Aristotle	
*Mapping of Course Outcomes for Unit I	CO1, CO2, CO3	
Unit II	Relations and Functions	(07 Hours)

Relations and their Properties, n-ary relations and their applications, Representing relations, Closures of relations, Equivalence relations, Partial orderings, Partitions, Hasse diagram, Lattices, Chains and Anti-Chains, Transitive closure and Warshall's algorithm. **Functions**- Surjective, Injective and Bijective functions, Identity function, Partial function, Invertible function, Constant function, Inverse functions and Compositions of functions, The Pigeonhole Principle.

[#Exemplar/Case Studies](#) Know about the great philosophers-Dirichlet

[*Mapping of Course Outcomes for Unit II](#) CO2,CO4

Unit III

Counting Principles

(07 Hours)

The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Algorithms for generating Permutations and Combinations.

[#Exemplar/Case Studies](#) Study Sudoku solving algorithms and algorithm for generation of new SUDOKU. Study Hank-shake Puzzle and algorithm to solve it.

[*Mapping of Course Outcomes for Unit III](#) CO2,CO5

Unit IV

Graph Theory

(07 Hours)

Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, the handshaking lemma, Single source shortest path- Dijkstra's Algorithm, Planar Graphs, Graph Colouring.

[#Exemplar/Case Studies](#) Three utility problem, Web Graph, Google map

[*Mapping of Course Outcomes for Unit IV](#) CO1,CO2,CO6

Unit V

Trees

(07 Hours)

Introduction, properties of trees, Binary search tree, tree traversal, decision tree, prefix codes and Huffman coding, cut sets, Spanning Trees and Minimum Spanning Tree, Kruskal's and Prim's algorithms, The Max flow- Min Cut Theorem (Transport network).

[#Exemplar/Case Studies](#) Algebraic Expression Tree, Tic-Tac-Toe Game Tree

[*Mapping of Course Outcomes for Unit V](#) CO1,CO2,CO6

Unit VI

Algebraic Structures and Coding Theory

(07 Hours)

The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, and Congruence relations, Rings, Integral Domains and Fields, Coding theory, Polynomial Rings and polynomial Codes, Galois Theory –Field Theory and Group Theory.

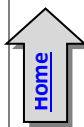
[#Exemplar/Case Studies](#) Cryptography used in world war II

[*Mapping of Course Outcomes for Unit VI](#) CO1, CO2, CO7

Learning Resources

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics", TMH, ISBN 10:0-07-066913-9.
2. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8.



Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978-0-07-288008-3
2. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India / Pearson, ISBN: 0132078457, 9780132078450.
3. Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.
4. Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd, ISBN:978-81-265-2758-8.
5. Sriram P. and Steven S., "Computational Discrete Mathematics", Cambridge University Press, ISBN 13: 978-0-521-73311-3.

e-Books:

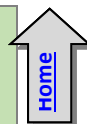
- <https://www.ebookphp.com/discrete-mathematical-structures-6th-edition-epub-pdf/>
- <http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf>
- <http://home.iitk.ac.in/~aral/book/mth202.pdf>
- <https://web.stanford.edu/class/cs103x/cs103x-notes.pdf>
- <http://home.iitk.ac.in/~aral/book/mth202.pdf>

MOOC/ Video Lectures available at:

- <https://www.nptel.ac.in/courses/106/106/106106094/>
- <https://nptel.ac.in/courses/106/106/106106183/>
- <https://nptel.ac.in/courses/106/103/106103205/>
- <https://nptel.ac.in/courses/106/105/106105192/>
- <https://nptel.ac.in/courses/111/106/111106050/>
- <https://nptel.ac.in/courses/111/106/111106102/>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210242: Fundamentals of Data Structures		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses : 110005: Programming and Problem Solving		
Companion Course : 210247: Data Structures Laboratory		
Course Objectives: The course is intended to provide the foundations of the practical implementation and usage of Data Structures and Algorithms to ensure that the learner evolves into a competent programmer capable of designing and analyzing implementations of data structures and algorithms for different kinds of problems. <ul style="list-style-type: none"> To understand the standard and abstract data representation methods. To acquaint with the structural constraints and advantages in usage of the data. To understand various data structures, operations on it and the memory requirements To understand various data searching and sorting methods. To understand various algorithmic strategies to approach the problem solution. 		
Course Outcomes: On completion of the course, learner will be able to– <p>CO1: Design the algorithms to solve the programming problems, identify appropriate algorithmic strategy for specific application, and analyze the time and space complexity.</p> <p>CO2: Discriminate the usage of various structures, Design/Program/Implement the appropriate data structures; use them in implementations of abstract data types and Identity the appropriate data structure in approaching the problem solution.</p> <p>CO3: Demonstrate use of sequential data structures- Array and Linked lists to store and process data.</p> <p>CO4: Understand the computational efficiency of the principal algorithms for searching and sorting and choose the most efficient one for the application.</p> <p>CO5: Compare and contrast different implementations of data structures (dynamic and static).</p> <p>CO6: Understand, Implement and apply principles of data structures-stack and queue to solve computational problems.</p>		
Course Contents		
Unit I	Introduction to Algorithm and Data Structures	(07 Hours)
Introduction: From Problem to Program (Problem, Solution, Algorithm, Data Structure and Program). Data Structures: Data, Information, Knowledge, and Data structure, Abstract Data Types (ADT), Data Structure Classification (Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral data structures). Algorithms: Problem Solving, Introduction to algorithm, Characteristics of algorithm, Algorithm design tools: Pseudo-code and flowchart. Complexity of algorithm: Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, finding complexity using step count method, Analysis of programming constructs-Linear, Quadratic, Cubic, Logarithmic. Algorithmic Strategies: Introduction to algorithm design strategies- Divide and Conquer, and Greedy strategy.		
#Exemplar/Case Studies	Multiplication technique by the mathematician Carl Friedrich Gauss and Karatsuba algorithm for fast multiplication.	
*Mapping of Course Outcomes for Unit I	CO1, CO2	

Unit II	Linear Data Structure Using Sequential Organization	(07 Hours)
<p>Concept of Sequential Organization, Overview of Array, Array as an Abstract Data Type, Operations on Array, Merging of two arrays, Storage Representation and their Address Calculation: Row major and Column Major, Multidimensional Arrays: Two-dimensional arrays, n-dimensional arrays. Concept of Ordered List, Single Variable Polynomial: Representation using arrays, Polynomial as array of structure, Polynomial addition, Polynomial multiplication. Sparse Matrix: Sparse matrix representation using array, Sparse matrix addition, Transpose of sparse matrix- Simple and Fast Transpose, Time and Space tradeoff.</p>		
#Exemplar/Case Studies	<p>Study use of sparse matrix in Social Networks and Maps.</p> <p>Study how Economists use polynomials to model economic growth patterns, how medical researchers use them to describe the behaviour of Covid-19 virus.</p>	
*Mapping of Course Outcomes for Unit II	CO1, CO2, CO3	
Unit III	Searching and Sorting	(07 Hours)
<p>Searching: Search Techniques-Sequential Search/Linear Search, Variant of Sequential Search- Sentinel Search, Binary Search, Fibonacci Search, and Indexed Sequential Search.</p> <p>Sorting: Types of Sorting-Internal and External Sorting, General Sort Concepts-Sort Order, Stability, Efficiency, and Number of Passes, Comparison Based Sorting Methods-Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Shell Sort, Non-comparison Based Sorting Methods-Radix Sort, Counting Sort, and Bucket Sort, Comparison of All Sorting Methods and their complexities.</p>		
#Exemplar/Case Studies	<p>Use of Fibonacci search in non-uniform access memory storage and in Optimization of Unimodal Functions. Timsort as a hybrid stable sorting algorithm</p>	
*Mapping of Course Outcomes for Unit III	CO1, CO2, CO4	
Unit IV	Linked List	(07 Hours)
<p>Introduction to Static and Dynamic Memory Allocation,</p> <p>Linked List: Introduction, of Linked Lists, Realization of linked list using dynamic memory management, operations, Linked List as ADT, Types of Linked List: singly linked, linear and Circular Linked Lists, Doubly Linked List, Doubly Circular Linked List, Primitive Operations on Linked List- Create, Traverse, Search, Insert, Delete, Sort, Concatenate. Polynomial Manipulations-Polynomial addition. Generalized Linked List (GLL) concept, Representation of Polynomial using GLL.</p>		
#Exemplar/Case Studies	Garbage Collection	
*Mapping of Course Outcomes for Unit IV	CO1, CO2, CO3, CO5	
Unit V	Stack	(07 Hours)
<p>Basic concept, stack Abstract Data Type, Representation of Stacks Using Sequential Organization, stack operations, Multiple Stacks, Applications of Stack- Expression Evaluation and Conversion, Polish notation and expression conversion, Need for prefix and postfix expressions, Postfix expression evaluation, Linked Stack and Operations.</p> <p>Recursion- concept, variants of recursion- direct, indirect, tail and tree, backtracking algorithmic strategy, use of stack in backtracking.</p>		
#Exemplar/Case Studies	Android- multiple tasks/multiple activities and back-stack, Tower of Hanoi, 4 Queens problem.	
*Mapping of Course Outcomes for Unit V	CO1, CO2, CO3, CO5, CO6	

Unit VI	Queue	(07 Hours)
Basic concept , Queue as Abstract Data Type, Representation of Queue using Sequential organization, Queue Operations, Circular Queue and its advantages, Multi-queues, Linked Queue and Operations. Deque -Basic concept, types (Input restricted and Output restricted), Priority Queue-Basic concept, types (Ascending and Descending).		
#Exemplar/Case Studies	Priority queue in bandwidth management	
*Mapping of Course Outcomes for Unit VI	CO1, CO2, CO3, CO5, CO6	

Learning Resources

Text Books:

1. Horowitz and Sahani, "Fundamentals of Data Structures in C++", University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley Publication, ISBN: 978-1-118-29027-9

Reference Books:

1. Steven S S. Skiena, "The Algorithm Design Manual", Springer, 2nd ed. 2008 Edition, ISBN-13: 978-1849967204, ISBN-10: 1849967202.
2. Allen Downey, Jeffery Elkner, Chris Meyers, "How to think like a Computer Scientist: Learning with Python", Dreamtech Press, ISBN: 9789351198147.
3. M. Weiss, "Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
4. Brassard and Bratley, "Fundamentals of Algorithmic", Prentice Hall India/Pearson Education, ISBN 13-9788120311312.
5. Yashwant Kanetkar & A. Kanetkar, "Let us Python", BPB Publisher, ISBN: 9789389845006

e-Books:

- <https://www.ebooks.com/en-us/book/95777110/Python-data-structures-and-algorithms/benjamin-baka/>
- <https://www.ebookphp.com/advanced-data-structures-epub-pdf/>
- <https://www.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epub-pdf/>

MOOC Links/Video Lectures available at:

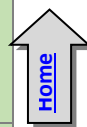
- <https://nptel.ac.in/courses/106/102/106102064/>
- <https://nptel.ac.in/courses/106/105/106105085>
- <https://nptel.ac.in/courses/106/106/106106127>

Other:

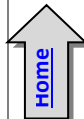
3. Know Thy Complexities! (<https://www.bigocheatsheet.com/>)
(<https://github.com/RehanSaeed/.NET-Big-O-Algorithm-Complexity-Cheat-Sheet>)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	-	-	-	-	-	-	-	-
CO2	1	2	2	1	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-
CO4	1	-	1	-	-	-	-	-	-	-	-	-
CO5	1	1	-	1	-	-	-	-	-	-	-	-
CO6	1	1	1	1	1	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210243: Object Oriented Programming(OOP)		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses : 110005: Programming and Problem Solving		
Companion Course : 210247: OOP and Computer Graphics Laboratory		
Course Objectives: The course is intended to provide the foundations and in-depth understanding of a modern object-oriented language and develop skills in software development, through an algorithmic approach and the application of principles of objected oriented programming. <ul style="list-style-type: none"> To learn the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. To learn the syntax and semantics of the C++ programming language. To understand the concept of data abstraction and encapsulation, how to design C++ classes for code reuse, how to implement copy constructors and class member functions, to overload functions and operators in C++. To learn how inheritance and virtual functions implement dynamic binding with polymorphism. To learn how to design and implement generic classes with C++ templates and how to use exception handling in C++ programs. 		
Course Outcomes: On completion of the course, learner will be able to– <p>CO1: Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software.</p> <p>CO2: Design object-oriented solutions for small systems involving multiple objects.</p> <p>CO3: Use virtual and pure virtual function and complex programming situations.</p> <p>CO4: Apply object-oriented software principles in problem solving.</p> <p>CO5: Analyze the strengths of object-oriented programming.</p> <p>CO6: Develop the application using object oriented programming language(C++).</p>		
Course Contents		
Unit I	Fundamentals of Object Oriented Programming	(07 Hours)
Introduction to object-oriented programming , Need of object-oriented programming, Fundamentals of object-oriented programming: Namespaces, objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. Benefits of OOP, C++ as object oriented programming language. C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, Access specifiers, separating interface from implementation. Functions- Function, function prototype, accessing function and utility function, Constructors and destructor, Types of constructor, Objects and Memory requirements, Static members: variable and functions, inline function, friend function.		
#Exemplar/Case Studies	Story of C++ invention by Bjarne Stroustrup	
*Mapping of Course Outcomes for Unit I	CO1, CO5	
Unit II	Inheritance and Pointers	(07 Hours)
Inheritance- Base Class and derived Class, protected members, relationship between base Class and		



derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Public and Private Inheritance, Types of Inheritance, Ambiguity in Multiple Inheritance, Virtual Base Class, Abstract class, Friend Class, Nested Class.

Pointers: declaring and initializing pointers, indirection Operators, Memory Management: new and delete, Pointers to Objects, this pointer, Pointers Vs Arrays, accessing Arrays using pointers, Arrays of Pointers, Function pointers, Pointers to Pointers, Pointers to Derived classes, Passing pointers to functions, Return pointers from functions, Null pointer, void pointer.

#Exemplar/Case Studies	Know about Firefox and Thunderbird as one of the popular softwares developed using C++
--	--

*Mapping of Course Outcomes for Unit II	CO2, CO4
---	----------

Unit III	Polymorphism	(07 Hours)
----------	--------------	------------

Polymorphism- Introduction to Polymorphism, Types of Polymorphism, Operator Overloading- concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable.

Function overloading, **Run Time Polymorphism-** Pointers to Base class, virtual function and its significance in C++, pure virtual function and virtual table, virtual destructor, abstract base class.

#Exemplar/Case Studies	Study about use of C++ SDKs wrappers for Java and .Net.
--	---

*Mapping of Course Outcomes for Unit III	CO2, CO3, CO4
--	---------------

Unit IV	Files and Streams	(07 Hours)
---------	-------------------	------------

Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output.

#Exemplar/Case Studies	Study features used for Microsoft Office, Internet Explorer and Visual Studio that are written in Visual C++
--	--

*Mapping of Course Outcomes for Unit IV	CO2, CO4
---	----------

Unit V	Exception Handling and Templates	(07 Hours)
--------	----------------------------------	------------

Exception Handling- Fundamentals, other error handling techniques, simple exception handling- Divide by Zero, Multiple catching, re-throwing an exception, exception specifications, user defined exceptions, processing unexpected exceptions, constructor, destructor and exception handling, exception and inheritance. **Templates-** The Power of Templates, Function template, overloading Function templates, and class template, class template and Nontype parameters, template and friends Generic Functions, The type name and export keywords.

#Exemplar/Case Studies	Study about use of exception handling in Symbian Operating System (discontinued mobile operating system) that was developed using C++.
--	--

*Mapping of Course Outcomes for Unit V	CO2, CO4, CO6
--	---------------

Unit VI	Standard Template Library (STL)	(07 Hours)
---------	---------------------------------	------------

Introduction to STL, STL Components, Containers- Sequence container and associative containers, container adapters, Application of Container classes: vector, list,

Algorithms- basic searching and sorting algorithms, min-max algorithm, set operations, heap sort,

Iterators- input, output, forward, bidirectional and random access. Object Oriented Programming – a road map to future

#Exemplar/Case Studies	Study MySQL open source C++ code available at GitHub.
--	---

*Mapping of Course Outcomes for Unit VI	CO2, CO4, CO6
---	---------------

Learning Resources



Text Books:

1. Deitel, "C++ How to Program", 4th Edition, Pearson Education, ISBN:81-297-0276-2
2. Robert Lafore, "Object-Oriented Programming in C++", fourth edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089)

Reference Books:

1. Herbert Schildt, "C++-The complete reference", Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805
2. Matt Weisfeld, "The Object-Oriented Thought Process", Third Edition Pearson ISBN-13:075-2063330166
3. E.Balagurusamy, "Object-Oriented Programming with C++", 7th edition, Graw-Hill Publication, ISBN 10: 9352607996 ISBN 13: 9789352607990
4. Cox Brad, Andrew J. Novobilski, "Object –Oriented Programming: An Evolutionary Approach", Second Edition, Addison–Wesley, ISBN:13:978-020-1548341

e-Books:

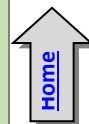
- <https://www.springer.com/gp/book/9781852334505>
- <https://www.ebookphp.com/object-oriented-programming-in-c-epub-pdf/>
- <https://www.springer.com/gp/book/9781447133780>

MOOC/ Video Lectures available at:

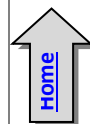
- <https://nptel.ac.in/courses/106/105/106105151/>
- https://swayam.gov.in/nd1_noc20_cs07/preview
- <https://www.classcentral.com/course/swayam-programming-in-c-6704>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	-	-	-	-	-	-	-	-
CO2	1	2	1	1	-	-	-	-	-	-	-	1
CO3	2	1	2	2	-	-	-	-	-	-	-	-
CO4	2	1	2	1	-	-	-	-	-	-	-	1
CO5	-	1	-	1	-	-	-	-	-	-	-	-
CO6	-	-	1	-	-	-	-	-	-	-	-	1



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210244: Computer Graphics		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite : Basic Mathematics		
Companion Course : 210247: OOP and Computer Graphics Laboratory		
Course Objectives: The Computer Graphics course prepares students for activities involving the design, development, and testing of modeling, rendering, and animation solutions to a broad variety of problems found in entertainment, sciences, and engineering. <ul style="list-style-type: none"> • Remembering: To acquaint the learner with the basic concepts of Computer Graphics. • Understanding: To learn the various algorithms for generating and rendering graphical figures. • Applying: To get familiar with mathematics behind the graphical transformations. • Understanding: To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting. • Creating: To generate Interactive graphics using OpenGL. 		
Course Outcomes: On completion of the course, learner will be able to– <p>CO1: Identify the basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of computer graphics.</p> <p>CO2: Apply mathematics to develop Computer programs for elementary graphic operations.</p> <p>CO3: Illustrate the concepts of windowing and clipping and apply various algorithms to fill and clip polygons.</p> <p>CO4: Understand and apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection.</p> <p>CO5: Understand the concepts of color models, lighting, shading models and hidden surface elimination.</p> <p>CO6: Create effective programs using concepts of curves, fractals, animation and gaming.</p>		
Course Contents		
Unit I	Graphics Primitives and Scan Conversion Algorithms	(07 Hours)
Introduction, graphics primitives - pixel, resolution, aspect ratio, frame buffer. Display devices, applications of computer graphics. Introduction to OpenGL - OpenGL architecture, primitives and attributes, simple modelling and rendering of two- and three-dimensional geometric objects, GLUT, interaction, events and call-backs picking. (Simple Interaction with the Mouse and Keyboard) Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: DDA, Bresenham, and Midpoint.		
#Exemplar/Case Studies	Study about OpenGL Architecture Review Board (ARB)	
*Mapping of Course Outcomes for Unit I	CO1, CO2	
Unit II	Polygon, Windowing and Clipping	(07 Hours)



Polygons: Introduction to polygon, types: convex, concave and complex. Inside test. Polygon Filling: flood fill, seed fill, scan line fill. Windowing and clipping: viewing transformations, 2-D clipping: Cohen – Sutherland algorithm line Clipping algorithm, Sutherland Hodgeman Polygon clipping algorithm, Weiler Atherton Polygon Clipping algorithm.		
#Exemplar/Case Studies	Study Guard-band clipping Technique and it's use in various rendering softwares, Use of 3D pipeline/ polygonal modelling and applications.	
*Mapping of Course Outcomes for Unit II	CO2, CO3	
Unit III	2D, 3D Transformations and Projections	(07 Hours)
2-D transformations: introduction, homogeneous coordinates, 2-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary point. 3-D transformations: introduction, 3-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary axis. Projections : Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and Perspective (Vanishing Points – 1 point, 2 point and 3 point)		
#Exemplar/Case Studies	Study use of transformations and projections in education and training software.	
*Mapping of Course Outcomes for Unit III	CO2, CO4	
Unit IV	Light, Colour, Shading and Hidden Surfaces	(07 Hours)
Colour models: Properties of Light, CIE chromaticity Diagram, RGB, HSV, CMY. Illumination Models: Ambient Light, Diffuse reflection, Specular Reflection, and the Phong model, Combined diffuse and Specular reflections with multiple light sources, warn model, Shading Algorithms: Halftone, Gauraud and Phong Shading. Hidden Surfaces Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock)		
#Exemplar/Case Studies	Study any popular graphics designing software	
*Mapping of Course Outcomes for Unit IV	CO5	
Unit V	Curves and Fractals	(07 Hours)
Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, Fractals: Introduction, Classification, Fractal generation: snowflake, Triadic curve, Hilbert curve, Applications.		
#Exemplar/Case Studies	Case study on measuring the length of coastline using fractals	
*Mapping of Course Outcomes for Unit V	CO2, CO6	
Unit VI	Introduction to Animation and Gaming	(07 Hours)
Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility. Animation: Introduction, Conventional and computer based animation, Design of animation sequences, Animation languages, Key- frame, Morphing, Motion specification. Gaming: Introduction, Gaming platform (NVIDIA, i8060), Advances in Gaming.		
#Exemplar/Case Studies	Study of any open source tools- Unity/Maya/Blender	
*Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources


 Home

Text Books:

1. S. Harrington, "Computer Graphics"||, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.
2. Donald D. Hearn and Baker, "Computer Graphics with OpenGL", 4th Edition, ISBN-13: 9780136053583.
3. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

Reference Books:

1. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice"||, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics"||, 2nd Edition, Tata McGraw Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.

e-Books:

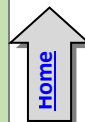
- <https://open.umn.edu/opentextbooks/textbooks/introduction-to-computer-graphics>
- <http://www2.cs.uidaho.edu/~jeffery/courses/324/lecture.html>

MOOC/ Video Lectures available at:

- <https://nptel.ac.in/courses/106/106/106106090/>
- <https://nptel.ac.in/courses/106/102/106102065/>

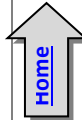
@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	-	-	-	-	-
CO2	3	-	1	1	-	-	-	-	-	-	-	-
CO3	1	2	-	1	-	-	-	-	-	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-
CO5	1	-	1	-	-	-	-	-	-	-	-	-
CO6	-	2	2	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210245: Digital Electronics and Logic Design		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses : 104010: Basic Electronics Engineering		
Companion Course : 210249: Digital Electronics Lab		
Course Objectives: The goal of this course is to impart the fundamentals of digital logic design; starting from learning the basic concepts of the different base number systems, to basic logic elements and deriving logical expressions to further optimize a circuit diagram. Objective is to see that learners are not only able to evaluate different combinational logic designs, but also design their own digital circuits given different parameters. <ul style="list-style-type: none"> To study number systems and develop skills for design and implementation of combinational logic circuits and sequential circuits To understand the functionalities, properties and applicability of Logic Families. To introduce programmable logic devices and ASM chart and synchronous state machines. To introduce students to basics of microprocessor. 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Simplify Boolean Expressions using K Map. CO2: Design and implement combinational circuits. CO3: Design and implement sequential circuits. CO4: Develop simple real-world application using ASM and PLD. CO5: Differentiate and Choose appropriate logic families IC packages as per the given design specifications. CO6: Explain organization and architecture of computer system		
Course Contents		
Unit I	Minimization Technique	(07 Hours)
Logic Design Minimization Technique: Minimization of Boolean function using K-map(up to 4 variables) and Quine Mc-Clusky Method, Representation of signed number- sign magnitude representation ,1's complement and 2's complement form (red marked can be removed), Sum of product and Product of sum form, Minimization of SOP and POS using K-map.		
#Exemplar/Case Studies	Digital locks using logic gates	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Combinational Logic Design	(07 Hours)
Code converter -: BCD, Excess-3, Gray code, Binary Code. Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Look ahead carry generator, Multiplexers (MUX): MUX (IC 74153, 74151), Cascading multiplexers, Demultiplexers (DEMUX)- Decoder (IC 74138, IC 74154), Implementation of SOP and POS using MUX, DMUX, Comparators (2 bit), Parity generators and Checker.		
#Exemplar/Case Studies	Combinational Logic Design of BCD to 7-segment display Controller	
*Mapping of Course Outcomes for Unit II	CO2	

Unit III	Sequential Logic Design	(07 Hours)
Flip-Flop: SR, JK,D,T, Preset and Clear, Master Slave JK Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flop-Flop. Registers: SISO, SIPO, PISO, PIPO, Shift Registers, Bidirectional Shift Register, Ring Counter , Universal Shift Register Counters: Asynchronous Counter, Synchronous Counter, BCD Counter, Johnson Counter, Modulus of the counter (IC 7490),Synchronous Sequential Circuit Design :Models- Moore and Mealy, State diagram and State Table ,Design Procedure, Sequence Generator and detector.		
#Exemplar/Case Studies	Electronic Voting Machine (EVM)	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Algorithmic State Machines and Programmable Logic Devices	(07 Hours)
Algorithmic State Machines: Finite State Machines (FSM) and ASM, ASM charts, notations, construction of ASM chart and realization for sequential circuits. PLDS:PLD, ROM as PLD, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Designing combinational circuits using PLDs.		
#Exemplar/Case Studies	Wave form generator using MUX controller method	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Logic Families	(07 Hours)
Classification of logic families: Unipolar and Bipolar Logic Families, Characteristics of Digital ICs: Fan-in, Fan-out, Current and voltage parameters, Noise immunity, Propagation Delay, Power Dissipation, Figure of Merits, Operating Temperature Range, power supply requirements. Transistor -Transistor Logic: Operation of TTL NAND Gate (Two input), TTL with active pull up, TTL with open collector output, Wired AND Connection, Tristate TTL Devices, TTL characteristics. CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations- Wired Logic, Open drain outputs.		
#Exemplar/Case Studies	To study the various basic gate design using TTL/CMOS logic family	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Introduction to Computer Architecture	(07 Hours)
Introduction to Ideal Microprocessor – Data Bus, Address Bus, Control Bus. Microprocessor based Systems – Basic Operation, Microprocessor operation, Block Diagram of Microprocessor. Functional Units of Microprocessor – ALU using IC 74181, Basic Arithmetic operations using ALU IC 74181, 4-bit Multiplier circuit using ALU and shift registers. Memory Organization and Operations, digital circuit using decoder and registers for memory operations.		
#Exemplar/Case Studies	Microprocessor based system in Communication /Instrumentation Control	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		
Text Books: 1. R.P.Jain, “ Modern Digital Electronics”, Tata McGraw Hill 4 th Edition, ISBN 978-0-07-06691-16 2. Moris Mano, “Digital Logic and Computer Design”, Pearson , ISBN 978-93-325-4252-5 3. G. K. Kharate, “Digital Electronics”, Oxford Press, ISBN-10: 0198061838		
Reference Books: 1. John Yarbrough, “Digital Logic applications and Design”, Cengage Learning, ISBN – 13: 978-81-315-0058-3		



2. D. Leach, Malvino, Saha, "Digital Principles and Applications", Tata McGraw Hill, ISBN – 13:978-0-07-014170-4.
3. Anil Maini, "Digital Electronics: Principles and Integrated Circuits", Wiley India Ltd, ISBN:978-81-265-1466-3.
4. Norman B and Bradley, "Digital Logic Design Principles", Wiley, ISBN:978-81-265-1258

eBooks:

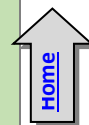
- <https://www.springer.com/gp/book/9783030361952>
- <https://www.mheducation.co.uk/ebook-fundamentals-of-digital-logic-9780077144227-emea>

MOOC/ Video Lectures available at:

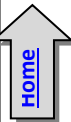
- Digital Circuits, by Prof. Santanu Chattopadhyay, https://swayam.gov.in/nd1_noc19_ee51/preview (Unit I, II, III, IV)
- Digital Circuits and Systems, Prof. S. Srinivasan <https://nptel.ac.in/courses/117/106/117106086/> (Unit I, II, III, IV)
- Microprocessors and Interfacing By Prof. Shaik Rafi Ahamed | IIT Guwahati https://swayam.gov.in/nd1_noc20_ee11/preview (Unit VI)
- Switching Circuits And Logic Design By Prof. Indranil Sengupta w https://swayam.gov.in/nd1_noc20_cs67/preview (Unit V)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	-	-	-	-	-	-	-	-
CO2	2	1	2	-	-	-	-	-	-	-	-	-
CO3	2	1	2	-	-	-	-	-	-	-	-	-
CO4	2	-	2	1	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	-	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210246: Data Structures Laboratory		
Teaching Scheme Practical: 04 Hours/Week	Credit Scheme 02	Examination Scheme and Marks Term Work: 25 Marks Practical: 50 Marks
Companion Course : 210242: Fundamentals of Data Structures		
Course Objectives: To understand basic techniques and strategies of algorithm analysis, the memory requirement for various data structures like array, linked list, stack, queue etc using concepts of python and C++ programming language.		
Course Outcomes: On completion of the course, learner will be able to– CO1: Use algorithms on various linear data structure using sequential organization to solve real life problems. CO2: Analyze problems to apply suitable searching and sorting algorithm to various applications. CO3: Analyze problems to use variants of linked list and solve various real life problems. CO4: Designing and implement data structures and algorithms for solving different kinds of problems.		
Guidelines for Instructor's Manual The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface), University syllabus, conduction and Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.		
Guidelines for Student's Laboratory Journal The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.		
Guidelines for Laboratory /Term Work Assessment Continuous assessment of laboratory work is done based on overall performance and Laboratory assignments performance of student. Each Laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.		
Guidelines for Laboratory Conduction The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts		



learned. Instructor may also set one assignment or mini-project that is suitable to respective branch **beyond the scope of syllabus**.

Set of suggested assignment list is provided in groups- A, B, C, D, and E. Each student must perform at least 13 assignments (at least 3 from group A, 3 from group B, 2 from group C, 2 from group D and 3 from group E.)

Group A and B assignments should be implemented in Python without using built-in methods for major functionality of assignment. Use List data structure of Python as array. Group C, D and E assignments should be implemented in C++ language.

Operating System recommended:- 64-bit Open source Linux or its derivative

Programming tools recommended:- Open Source Python, Programming tool like Jupyter Notebook, Pycharm, Spyder, G++/GCC.

Guidelines for Practical Examination

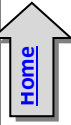
Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Virtual Laboratory:

- <http://cse01-iiith.vlabs.ac.in/Courses%20Aligned.html?domain=Computer%20Science>

Suggested List of Laboratory Experiments/Assignments

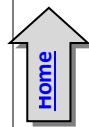
Sr. No.	Group A
1	<p>In second year computer engineering class, group A student's play cricket, group B students play badminton and group C students play football.</p> <p>Write a Python program using functions to compute following: -</p> <ol style="list-style-type: none"> List of students who play both cricket and badminton List of students who play either cricket or badminton but not both Number of students who play neither cricket nor badminton Number of students who play cricket and football but not badminton. <p>(Note- While realizing the group, duplicate entries should be avoided, Do not use SET built-in functions)</p>
2	<p>Write a Python program to store marks scored in subject "Fundamental of Data Structure" by N students in the class. Write functions to compute following:</p> <ol style="list-style-type: none"> The average score of class Highest score and lowest score of class Count of students who were absent for the test Display mark with highest frequency
3	<p>Write a Python program for department library which has N books, write functions for following:</p> <ol style="list-style-type: none"> Delete the duplicate entries Display books in ascending order based on cost of books Count number of books with cost more than 500. Copy books in a new list which has cost less than 500.
4	<p>Write a Python program that computes the net amount of a bank account based a transaction log from console input. The transaction log format is shown as following: D 100 W 200 (Withdrawal is not allowed if balance is going negative. Write functions for withdraw and deposit) D means deposit while W means withdrawal.</p> <p>Suppose the following input is supplied to the program:</p> <p>D 300, D 300 , W 200, D 100 Then, the output should be: 500</p>



5	<p>Write a Python program to compute following operations on String:</p> <ul style="list-style-type: none">a) To display word with the longest lengthb) To determines the frequency of occurrence of particular character in the stringc) To check whether given string is palindrome or notd) To display index of first appearance of the substringe) To count the occurrences of each word in a given string																									
6	<p>It is decided that weekly greetings are to be furnished to wish the students having their birthdays in that week. The consolidated sorted list with desired categorical information is to be provided to the authority. Write a Python program to store students PRNs with date and month of birth. Let List_A and List_B be the two list for two SE Computer divisions. Lists are sorted on date and month. Merge these two lists into third list "List_SE_Comp_DOB" resulting in sorted information about Date of Birth of SE Computer students</p>																									
7	<p>Write a Python Program for magic square. A magic square is an $n * n$ matrix of the integers 1 to n^2 such that the sum of each row, column, and diagonal is the same. The figure given below is an example of magic square for case $n=5$. In this example, the common sum is 65.</p> <table><tr><td>15</td><td>8</td><td>1</td><td>24</td><td>17</td></tr><tr><td>16</td><td>14</td><td>7</td><td>5</td><td>23</td></tr><tr><td>22</td><td>20</td><td>13</td><td>6</td><td>4</td></tr><tr><td>3</td><td>21</td><td>19</td><td>12</td><td>10</td></tr><tr><td>9</td><td>2</td><td>25</td><td>18</td><td>11</td></tr></table>	15	8	1	24	17	16	14	7	5	23	22	20	13	6	4	3	21	19	12	10	9	2	25	18	11
15	8	1	24	17																						
16	14	7	5	23																						
22	20	13	6	4																						
3	21	19	12	10																						
9	2	25	18	11																						
8	<p>Write a Python program that determines the location of a saddle point of matrix if one exists. An $m \times n$ matrix is said to have a saddle point if some entry $a[i][j]$ is the smallest value in row i and the largest value in j.</p>																									
9	<p>Write a Python program to compute following computation on matrix:</p> <ul style="list-style-type: none">a) Addition of two matrices b) Subtraction of two matricesc) Multiplication of two matrices d) Transpose of a matrix																									
10	<p>Write a Python program for sparse matrix realization and operations on it- Transpose, Fast Transpose and addition of two matrices</p>																									
Group B																										
11	<ul style="list-style-type: none">a) Write a Python program to store roll numbers of student in array who attended training program in random order. Write function for searching whether particular student attended training program or not, using Linear search and Sentinel search.b) Write a Python program to store roll numbers of student array who attended training program in sorted order. Write function for searching whether particular student attended training program or not, using Binary search and Fibonacci search																									
12	<ul style="list-style-type: none">a) Write a Python program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using binary search (recursive and non-recursive). Insert friend if not present in phonebookb) Write a Python program to store names and mobile numbers of your friends in sorted order on names. Search your friend from list using Fibonacci search. Insert friend if not present in phonebook.																									
13	<p>Write a Python program to maintain club members, sort on roll numbers in ascending order. Write function "Ternary_Search" to search whether particular student is member of club or not. Ternary search is modified binary search that divides array into 3 halves instead of two.</p>																									
14	<p>Write a Python program to store first year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using</p> <ul style="list-style-type: none">a) Selection Sortb) Bubble sort and display top five scores.																									



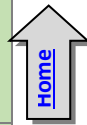
15	Write a Python program to store second year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using a) Insertion sort b) Shell Sort and display top five scores
16	Write a Python program to store first year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using quick sort and display top five scores.
17	Write a Python program to store 12 th class percentage of students in array. Write function for sorting array of floating point numbers in ascending order using bucket sort and display top five scores.
18	Write Python program to store 10 th class percentage of students in array. Write function for sorting array of floating point numbers in ascending order using radix sort and display top five scores
Group C	
19	Department of Computer Engineering has student's club named 'Pinnacle Club'. Students of second, third and final year of department can be granted membership on request. Similarly one may cancel the membership of club. First node is reserved for president of club and last node is reserved for secretary of club. Write C++ program to maintain club member's information using singly linked list. Store student PRN and Name. Write functions to: a) Add and delete the members as well as president or even secretary. b) Compute total number of members of club c) Display members d) Two linked lists exists for two divisions. Concatenate two lists.
20	The ticket booking system of Cinemax theater has to be implemented using C++ program. There are 10 rows and 7 seats in each row. Doubly circular linked list has to be maintained to keep track of free seats at rows. Assume some random booking to start with. Use array to store pointers (Head pointer) to each row. On demand a) The list of available seats is to be displayed b) The seats are to be booked c) The booking can be cancelled.
21	Write C++ program for storing appointment schedule for day. Appointments are booked randomly using linked list. Set start and end time and min and max duration for visit slot. Write functions for- A) Display free slots B) Book appointment C) Sort list based on time D) Cancel appointment (check validity, time bounds, availability) E) Sort list based on time using pointer manipulation
22	Second year Computer Engineering class, set A of students like Vanilla Ice-cream and set B of students like butterscotch ice-cream. Write C++ program to store two sets using linked list. compute and display- a) Set of students who like both vanilla and butterscotch b) Set of students who like either vanilla or butterscotch or not both c) Number of students who like neither vanilla nor butterscotch
23	Write C++ program for storing binary number using doubly linked lists. Write functions- a) To compute 1's and 2's complement b) Add two binary numbers
24	Write C++ program to realize Set using Generalized Liked List (GLL) e.g. A = { a, b, {c, d,e, {}}, {f,g}, h, l, {j,k}, l, m}. Store and print as set notation.
Group D	



25	<p>A palindrome is a string of character that's the same forward and backward. Typically, punctuation, capitalization, and spaces are ignored. For example, "Poor Dan is in a droop" is a palindrome, as can be seen by examining the characters "poor danisina droop" and observing that they are the same forward and backward. One way to check for a palindrome is to reverse the characters in the string and then compare with them the original-in a palindrome, the sequence will be identical. Write C++ program with functions-</p> <ol style="list-style-type: none"> To print original string followed by reversed string using stack To check whether given string is palindrome or not
26	In any language program mostly syntax error occurs due to unbalancing delimiter such as {}, [], (). Write C++ program using stack to check whether given expression is well parenthesized or not.
27	<p>Implement C++ program for expression conversion as infix to postfix and its evaluation using stack based on given conditions:</p> <ol style="list-style-type: none"> Operands and operator, both must be single character. Input Postfix expression must be in a desired format. Only '+', '-', '*', and '/' operators are expected.
28	A classic problem that can be solved by backtracking is called the Eight Queens problem, which comes from the game of chess. The chess board consists of 64 square arranged in an 8 by 8 grid. The board normally alternates between black and white square, but this is not relevant for the present problem. The queen can move as far as she wants in any direction, as long as she follows a straight line, Vertically, horizontally, or diagonally. Write C++ program with recursive function for generating all possible configurations for 4-queen's problem.
Group E	
29	Queues are frequently used in computer programming, and a typical example is the creation of a job queue by an operating system. If the operating system does not use priorities, then the jobs are processed in the order they enter the system. Write C++ program for simulating job queue. Write functions to add job and delete job from queue.
30	Write program to implement a priority queue in C++ using an inorder list to store the items in the queue. Create a class that includes the data items (which should be template) and the priority (which should be int). The inorder list should contain these objects, with operator <= overloaded so that the items with highest priority appear at the start of the list (which will make it relatively easy to retrieve the highest item.)
31	A double-ended queue (deque) is a linear list in which additions and deletions may be made at either end. Obtain a data representation mapping a deque into a one-dimensional array. Write C++ program to simulate deque with functions to add and delete elements from either end of the deque.
32	Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write C++ program to simulate the system using circular queue using array.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-
CO3	-	2	1	1	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210247: OOP and Computer Graphics Laboratory

Teaching Scheme Practical: 04 Hours/Week	Credit Scheme 02	Examination Scheme and Marks Term Work: 25 Marks Practical: 25Marks
---	-----------------------------------	--

Companion Course : 210243: Object Oriented Programming(OOP), 210244: Computer Graphics

Course Objectives:

To understand basics of Computer Graphics, apply various methods and techniques for implementing line-circle drawing, projections, animation, shading, illumination and lighting using concepts of Object Oriented Programming.

Course Outcomes:

On completion of the course, learner will be able to–

- CO1: Understand** and **apply** the concepts like inheritance, polymorphism, exception handling and generic structures for implementing reusable programming codes.
- CO2: Analyze** the concept of file and **apply** it while storing and retrieving the data from secondary storages.
- CO3: Analyze** and **apply** computer graphics algorithms for line-circle drawing, scan conversion and filling with the help of object oriented programming concepts.
- CO4: Understand** the concept of windowing and clipping and **apply** various algorithms to fill and clip polygons.
- CO5: Apply** logic to implement, curves, fractals, animation and gaming programs.

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - Open Source C++ Programming tool like G++/GCC, OPENGL.

Virtual Laboratory:

- <http://cse18-iiith.vlabs.ac.in/Introduction.html?domain=Computer%20Science>
- <http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php>

Part I : Object Oriented Programming

Suggested List of Laboratory Experiments/Assignments (All assignments are compulsory)

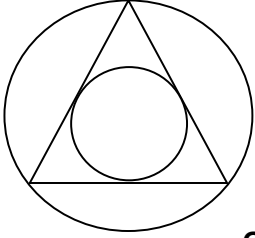
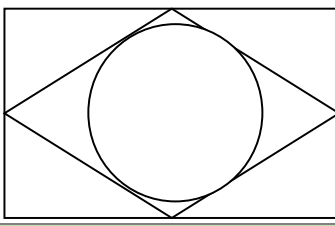
Sr. No.	Group A
1.	Implement a class Complex which represents the Complex Number data type. Implement the following <ol style="list-style-type: none"> 1. Constructor (including a default constructor which creates the complex number 0+0i). 2. Overload operator+ to add two complex numbers. 3. Overload operator* to multiply two complex numbers. 4. Overload operators << and >> to print and read Complex Numbers.
2.	Develop a program in C++ to create a database of student's information system containing the following information: Name, Roll number, Class, Division, Date of Birth, Blood group, Contact address, Telephone number, Driving license no. and other. Construct the database with suitable member functions. Make use of constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete as well as exception handling.
3.	Imagine a publishing company which does marketing for book and audio cassette versions. Create a class publication that stores the title (a string) and price (type float) of publications. From this class derive two classes: book which adds a page count (type int) and tape which adds a playing time in minutes (type float). Write a program that instantiates the book and tape class, allows user to enter data and displays the data members. If an exception is caught, replace all the data member values with zero values.
	Group B
4.	Write a C++ program that creates an output file, writes information to it, closes the file, open it again as an input file and read the information from the file.
5.	Write a function template for selection sort that inputs, sorts and outputs an integer array and a float array.
	Group C
6.	Write C++ program using STL for sorting and searching user defined records such as personal records (Name, DOB, Telephone number etc) using vector container. OR Write C++ program using STL for sorting and searching user defined records such as Item records (Item code, name, cost, quantity etc) using vector container.

7. Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks in the map, using the state name as an index and returns the population of the state.

Part II : Computer Graphics

Suggested List of Laboratory Experiments/Assignments

(All assignments are compulsory)

Sr. No.	Group A
1.	Write C++ program to draw a concave polygon and fill it with desired color using scan fill algorithm. Apply the concept of inheritance.
2.	Write C++ program to implement Cohen Southerland line clipping algorithm.
3.	<p>a) Write C++ program to draw the following pattern. Use DDA line and Bresenham's circle drawing algorithm. Apply the concept of encapsulation.</p>  <p>OR</p> <p>b) Write C++ program to draw the following pattern. Use DDA line and Bresenham's circle drawing algorithm. Apply the concept of encapsulation.</p> 
	Group B
4.	<p>a) Write C++ program to draw 2-D object and perform following basic transformations, Scaling b) Translation c) Rotation. Apply the concept of operator overloading.</p> <p>OR</p> <p>b) Write C++ program to implement translation, rotation and scaling transformations on equilateral triangle and rhombus. Apply the concept of operator overloading.</p>
5.	<p>a) Write C++ program to generate snowflake using concept of fractals.</p> <p>OR</p> <p>b) Write C++ program to generate Hilbert curve using concept of fractals.</p> <p>OR</p> <p>c) Write C++ program to generate fractal patterns by using Koch curves.</p>
	Group C
6.	<p>a) Design and simulate any data structure like stack or queue visualization using graphics. Simulation should include all operations performed on designed data structure. Implement the same using OpenGL.</p> <p>OR</p> <p>b) Write C++ program to draw 3-D cube and perform following transformations on it using OpenGL i) Scaling ii) Translation iii) Rotation about an axis (X/Y/Z).</p> <p>OR</p> <p>c) Write OpenGL program to draw Sun Rise and Sunset.</p>

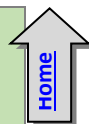
7. a) Write a C++ program to control a ball using arrow keys. Apply the concept of polymorphism.
OR
 b) Write a C++ program to implement bouncing ball using sine wave form. Apply the concept of polymorphism.
OR
 c) Write C++ program to draw man walking in the rain with an umbrella. Apply the concept of polymorphism.
OR
 Write a C++ program to implement the game of 8 puzzle. Apply the concept of polymorphism.
OR
 d) Write a C++ program to implement the game Tic Tac Toe. Apply the concept of polymorphism.

Mini-Projects/ Case Study

8. Design and implement game / animation clip / Graphics Editor using open source graphics library. Make use of maximum features of Object Oriented Programming.

[@The CO-PO Mapping Matrix](#)

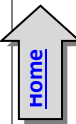
PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	-
CO2	-	1	2	1	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-
CO5	-	2	2	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210248: Digital Electronics Laboratory		
Teaching Scheme Practical: 02 Hours/Week	Credit Scheme 01	Examination Scheme and Marks Term Work: 25 Marks
Companion Course : 210245: Digital Electronics and Logic Design		
Course Objectives: To understand fundamentals and functionality of electronic circuits, design and implement combinational circuits like MUX, comparator, adder/subtractor, design and implement sequential circuits like flip-flop, registers, and counters using different integrated circuits.		
Course Outcomes: On completion of the course, learner will be able to– CO1: Understand the working of digital electronic circuits. CO2: Apply the knowledge to appropriate IC as per the design specifications. CO3: Design and implement Sequential and Combinational digital circuits as per the specifications.		
Guidelines for Instructor's Manual The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of course, conduction and Assessment guidelines, topics under consideration- concept, objectives, outcomes, data sheets of various ICs.		
Guidelines for Student's Laboratory Journal The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, circuit diagram, pin configuration, conclusion/analysis).		
As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.		
Guidelines for Laboratory /Term Work Assessment Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of student. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality and neatness.		
Guidelines for Laboratory Conduction The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Student should perform at least 12 experiments with all experiments from group A and any 5 assignments from group Band one from group C assignments.		

Virtual Laboratory:

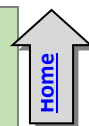
- <http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/index.html>
- <http://vlabs.iitb.ac.in/vlabs-dev/labs/dldesignlab/index.html>

**Suggested List of Laboratory Experiments/Assignments**

Sr. No.	Group A
1	To Realize Full Adder/ Subtractor using a) Basic Gates and b) Universal Gates
2	Design and implement Code Converters-Binary to Gray and BCD to Excess-3
3	Design and Realization of BCD Adder using 4-bit Binary Adder (IC 7483).
4	Realization of Boolean Expression for suitable combination logic using MUX 74151 /74153, DMUX 74154/74138
5	To Verify the truth table of two bit comparators using logic gates.
6	Design and Implement Parity Generator and checker using EX-OR.
	Group B
7	Design and Realization: Flip Flop conversion
8	Design of 2 bit and 3 bit Ripple Counter using MS JK flip-flop.
9	Design of Synchronous 3 bit Up and Down Counter using MSJK Flip Flop / D Flip Flop
10	Realization of Mod -N counter using (Decade Counter IC 7490) .
11	Design and implement Sequence generator (for Prime Number/odd and even) using MS JK flip-flop.
12	Design and implement Sequence detector using MS JK flip-flop.
	Group C
13	Study of Shift Registers (SISO,SIPO, PISO, PIPO)
14	Design of ASM chart using MUX controller Method.

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210249: Business Communication Skills

Teaching Scheme Practical: 02 Hours/Week	Credit Scheme 01[§]	Examination Scheme and Marks Term Work[§]: 25 Marks
---	---	---

Course Objectives:

- To facilitate Holistic growth ;
- To make the engineering students aware, about the importance, the role and the content of business communication skills ;
- To develop the ability of effective communication through individual and group activities;
- To expose students to right attitudinal and behavioural aspects and to build the same through various activities;

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Express effectively through verbal/oral communication and improve listening skills

CO2: Write precise briefs or reports and technical documents.

CO3: Prepare for group discussion / meetings / interviews and presentations.

CO4: Explore goal/target setting, self-motivation and practicing creative thinking.

CO5: Operate effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership qualities.

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about University/program/ institute/ department/foreword/preface), curriculum of course, conduction and Assessment guidelines, topics under consideration concept objectives, outcomes, guidelines, references.

Guidelines for Student's Laboratory Journal and Term Work Assessment

The student must prepare the journal in the form of report elaborating the activities performed. Continuous assessment of laboratory work is to be done based on overall performance and performance of student at each assignments. Each Laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage.

Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion of assignment, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities- SWOT analysis, presentations, team activity, event management, group discussion, Group exercises and interpersonal skills and similar other activities/assignments and Well presented, timely and complete report.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/activities-Active participation and proactive learning 50% and report 20%)

Students must submit the report of all conducted activities conducted. The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;

Guidelines for Laboratory Conduction

The instructor may frame assignments to enhance skills supporting career aspects. Multiple set of activity based assignments can be prepared and distributed among batches.

Every student must be given adequate opportunity to participate actively in each activity. An exercise can be designed to allow multiple skills exposure for example a group task encouraging discussions, team building, value sharing, leadership and role play all at the same time.

MOOC at Swayam:§

https://swayam.gov.in/nd2_imb19_mg14/preview

Virtual Laboratory:

- <https://ve-iitg.vlabs.ac.in/>

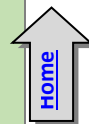
Sr. No.	Suggested List of Laboratory Experiments/Assignments
1	SWOT analysis The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements. through this activity. SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self-esteem. The concern teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects
2	Personal and Career Goal setting – Short term and Long term The teacher should explain to them on how to set goals and provide template to write their short term and long term goals.
3	Public Speaking Any one of the following activities may be conducted : 1. Prepared speech (Topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.) 2. Extempore speech (Students deliver speeches spontaneously for 5 minutes each on a given topic) 3. Story telling (Each student narrates a fictional or real life story for 5 minutes each) 4. Oral review (Each student orally presents a review on a story or a book read by them)
4	Reading and Listening skills The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills. The teacher should also give passages asked questions on the article by the readers. Students will get marks on various topics to students for evaluating their reading comprehension.
5	Group discussion Group discussions could be done for groups of 5-8 students at a time Two rounds of a GD for each group should be conducted and teacher should give them feedback.
6	Letter/Application writing Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.
7	Report writing The teacher should teach the students how to write report .The teacher should give proper format and layouts. Each student will write one report based on visit / project / business proposal.
8	Resume writing- Guide students and instruct them to write resume



9	Presentation Skill Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical. The teacher should guide them on effective presentation skills. Each student should make a presentation for at least 10 minutes.
10	Team games for team building - Students should make to participate in team activity.
11	Situational games for role playing as leaders
12	Faculty may arrange one or more sessions from following: Yoga and meditation. Stress management, relaxation exercises, and fitness exercises. Time management and personal planning sessions.
13	Mock interviews- guide students and conduct mock interviews
14	Telephonic etiquettes -To teach students the skills to communicate effectively over the phone. Students will be divided into pairs. Each pair will be given different situations, such as phone call to enquire about job vacancy, scheduling a meeting with team members, phone call for requesting of urgent leave from higher authorities. Students will be given 10 min to prepare. Assessment will be done on the basis of performance during the telephone call.
15	Email etiquettes -To provide students with an in-depth understanding of email skills. Students will be made to send e-mails for different situations such as sending an e-mail to the principal for a leave, inviting a friend for a party, e-mail to enquire about room tariff of a hotel. Students will be assessed on the basis of e-mail such as clarity, purpose and proof reading of e-mail.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	2	1	-
CO3	-	-	-	-	-	-	-	-	2	-	-	1
CO4	-	-	-	-	-	-	-	-	-	2	-	2
CO5	-	-	-	-	-	-	-	-	3	-	-	2



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210250: Humanity and Social Science

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Tutorial: 01 Hours/Week	01^s	Term work^s: 25 Marks

Course Objectives:

To enable the students to explore aspects of human society and to acquire the intellectual, communication skills and develop characteristics that encourages personal fulfilment, meaningful professional life and responsible citizenship.

- To facilitate Holistic growth;
- To Educate about Contemporary, National and International affairs;
- To bring awareness about the responsibility towards society.
- To give an insight about the emergence of Indian society and the relevance of Economics.

Course Outcomes:

On completion of the course, learner will be–

- CO1: Aware** of the various issues concerning humans and society.
- CO2: Aware** about their responsibilities towards society.
- CO3:** Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.
- CO4: Able** to understand the nature of the individual and the relationship between self and the community.
- CO5: Able** to understand major ideas, values, beliefs, and experiences that have shaped human history and cultures.

Course Contents**Preamble:**

As applied sciences, Engineering and Technology are meant to come up with effective solutions to social problems making it imperative that the present generation of engineers and technologists understand the society they live in. Studying the social sciences can provide individuals with crucial answers and observations that could certainly help in understanding of one's life which can alleviate social relations. A broad perspective of nationalistic thinking will provide the students with the ability to be socially conscientious, more resilient and open to building an inclusive society.

Experiencing real-life situations and complex scenarios that arise in each situation will help the budding professions to contribute their skills and knowledge to helping people improve and understand their behaviour or psychological processes. Understanding how the world works begins with an understanding of oneself and gaining hands-on experience and/or thinking about human values and ethics will help trigger a sense of responsibility among the students and lead them to finding effective solutions.

Course Structure: The tutorial sessions to be divided into 2 groups

1. Interactive Sessions to be conducted in classroom
2. Interactive Activities to be conducted Outside Classroom

MOOC/ Video Lectures available at^s:

- <https://nptel.ac.in/courses/109/103/109103023/>
- <https://nptel.ac.in/courses/109/107/109107131/>

- Teachers will play the role of interventionists and instigating students to apply their thinking abilities on social concepts
- As facilitators and mentors teachers will coax the students to thinking out-of-the-box to come up with creative solutions
- Teachers should focus on instilling a sense of social consciousness through the activities conducted indoors and outdoors.

Change of Mindset

- Since the course deviates from technical subjects, students will have to be counseled into the importance of social sciences
- A background understanding of the importance of this course in their professional and personal life will have to be enumerated to the students
- Teachers will have to rationalize the course outcomes to get the students invested in the activities being conducted

Designing of Course

- Since students lack prior knowledge, it is imperative that the tutorials conducted be engaging in its activities
- Focus of the sessions should be the learning outcome of each activity conducted either in the class or outside the class
- All activities designed should be as close to real-life making them relatable and applicable
- Student-engagement should be a priority so that the knowledge internalized will be higher
- The activities chosen can be modified to cater to the college location and social context
- The learning should be focused on application of ethics and values during each activity
- The chosen sessions should cater to giving the students the opportunity to be involved and engaged in their role as contributors to society and the nation at large

Basic function of the tutor

- To present a holistic view of the curriculum and the role of this course in it and emphasizing the benefit of the sessions towards developing communications skills, critical thinking and problems solving

Grouping

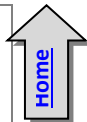
- The class will be divided into groups of 20 students
- The blend of cultural and social diversity will enhance the learning at the end of each activity
- Teachers will have to be mentored to handle sensitive issues diplomatically while encouraging students to stand up for their beliefs
- The groups will have to have inter-personal sessions so that they get to understand their team members better and work cohesively
- Management support and encouragement to engage students in life-enriching experiences is important

Assessment of Learning

- It is important for tutors to make sure that assessment is consistent with learning objectives of each activity
- Assessment of students should be focused on the students' ability to internalize the learning
- Tutors need to understand meaningful ways of assessing students' work to motivate learning

Tutorial Conduction and Term Work guidelines**Interactive Sessions to be conducted during Tutorial (in classroom)**

1. PREPARED SPEECH ON CURRENT AFFAIRS
 - a. Purpose – Get students to stay abreast and invested in national current affairs
 - b. Method – Each student has to read an editorial from any national paper (English), find out more information on the topic and present it to the class; ending the session with his/her opinion on the matter
 - c. Outcome – Awareness of national state of affairs. Improve on oratory skills. Instil the thinking and contemplative skills and form non-judgmental opinions about an issue
2. UNDERSTANDING INDIA'S CULTURAL DIVERSITY
 - a. Purpose – Expose students to the intricacies of Indian cultural across various states
 - b. Method – Each student (or a small group of students in case the number of students is large) has to pick a state and come to the tutorial session prepared with a PPT that will showcase the demographic, sociographic and cultural information of that state
 - c. Outcome – Information about the beauty of Indian cultural diversity. Enhance exploratory skill, communication skills and learn to present using technological tools.

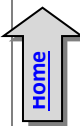


3. WRITING AN ARTICLE ON ANY SOCIAL ISSUE
 - a. Purpose – Highlight various social and cultural evil malevolence existing in our country and express one's opinion on how it can be changed
 - b. Method – Each student will have to write a 200 word essay on any of existing social malice that is prevalent in society. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate
 - c. Outcome – Learn to raise one's voice against the wrong doings in communities. Build writing skills, improve language and gain knowledge about how to write an impactful essay
4. GROUP DISCUSSION ON COMMUNAL TOPIC
 - a. Purpose – Make students aware of the issues that are pertinent in a society and express a learned opinion about it
 - b. Method – Students in groups of 20 each will discuss a relevant and grave issue that is dogging the nation. Alternatively, topics from current affairs (National budget, democratic process, economical strengthening of the country).
 - c. Outcome – Develop group communication skills. Learn to speak up one's opinion in a forum. Cultivate the habit of presenting solution-driven arguments making them contributors in any team
5. QUIZ ON SOCIAL BEHAVIOR
 - a. Purpose – Augment proper social etiquette among students and make them responsible citizens
 - b. Method – Conduct a quiz on traffic rules using audio-visual aids or using dumb charades where one student has to enact the traffic rule and the others have to guess that rule
 - c. Outcome – Grasp of various traffic rules and driving etiquette. Build verbal and non-verbal communication skills
6. SCREEN A MOVIE (FOCUS ON POSITIVITY AND POWER OF THE MIND)
 - a. Purpose – Expose students to introspective skills and try to develop a positive thinking in life
 - b. Method – Screen a movie / a documentary / a video that focuses on the power of the mind and how to create affirmations in one's life. At the end of the movie, students can be asked to express their opinions and write down what changes / improvements they plan to take in their choices thereafter. This can be followed by a guest lecture by expert/s or workshop
 - c. Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations
7. QUIZ ON SOCIAL BEHAVIOR
 - a. Purpose – Augment proper social etiquette among students and make them responsible citizens
 - b. Method – Conduct a quiz on traffic rules using audio-visual aids or using dumb charades where one student has to enact the traffic rule and the others have to guess that rule
 - c. Outcome – Grasp of various traffic rules and driving etiquette. Build verbal and non-verbal communication skills
8. SCREEN A MOVIE (FOCUS ON POSITIVITY AND POWER OF THE MIND)
 - a. Purpose – Expose students to introspective skills and try to develop a positive thinking in life
 - b. Method – Screen a movie / a documentary / a video that focuses on the power of the mind and how to create affirmations in one's life. At the end of the movie, students can be asked to express their opinions and write down what changes / improvements they plan to take in their choices thereafter. This can be followed by a guest lecture by expert/s or workshop

- c. Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations
- 9. DEBATE ON A TOPIC FROM SOCIAL SCIENCES
 - a. Purpose – Educate students about various domains in social sciences and develop an interest towards gaining knowledge about these topics
 - b. Method – Various topics from various domains of social sciences can be chosen and students in pairs can pick a topic and present their arguments for or against the topic. Time for each debate will be 10 minutes maximum
 - c. Outcome – Recognize the significance of social sciences in our lives. Cultivate the habit to present forceful arguments while respecting the opponents perspective and enhance verbal skills.

Interactive Activities to be conducted during Tutorial (Outside Classroom)

1. WASTE MANAGEMENT and CLEAN CAMPUS
 - a. Purpose: Create awareness among students about the significance of a clean environment and social responsibility to deter littering and segregate waste
 - b. Method: Students (in groups) will be given charge of areas of campus and will be expected to clean that segment. Also, they will be entrusted with the responsibility to collect, separate waste and hand over to the housekeeping authority
 - c. Outcome: Develop the habit to maintain cleanliness at home as well as learn to respect community areas at college or workplace. It will also encourage them become ambassadors among their peers to advocate protection of the environment
2. MAKING A VIDEO ON SOCIAL WASTAGES.
 - a. Purpose: Instil among students a sense of responsibility towards judiciously using natural resources like water and electricity
 - b. Method: Using their phones / hand-held devices, groups of students will make a 3 – 4 minute short film that will highlight irresponsible behavior in terms of wastage of water, leaving lights, fans and other electrical appliances on when not in use, defacing public and campus property by scribbling on walls and common areas. They will make awareness for the same among students. The creative videos will be posted on the college website and social media as an encouragement
 - c. Outcome: Conscientious behavior towards saving public utility resources. Explore the use of audio-visual tools to create more meaningful messages that can effect a change in society
3. RELAY MARATHON (3 – 5 kms)
 - a. Purpose: Propagate a social message by way of a sport activity
 - b. Method: A group of students will begin the race with banner / placard in hand that contains a social message. The group runs for 500 meters and hands over the banner / placard to the next group of students. This chain of exchange will continue for 3 – 5 kms.
 - c. Outcome: Become aware of the need for fitness and encouragement towards healthier lifestyle. Students will also be able to express their creativity in terms of meaningful messages and gain attention towards worthy social causes from the community in and around the campus.
4. TREE PLANTATION ON CAMPUS
 - a. Purpose: Involve students to actively participate in environment protection and develop greener surroundings
 - b. Method: Each student will plant a sapling and take care of that plant until it is able to sustain itself. Alternatively, students can organize a tree plantation drive in a public area and nurture it
 - c. Outcome: Besides increase in plants in the locality, students will feel a sense of empowerment and become social contributors towards protecting the environment.
5. VISIT TO AN OLD AGE HOME / ORPHANAGE
 - a. Purpose: Build a sense of responsibility towards the less fortunate in our society and feel privileged to be able to effect real change in the world around us



- b. Method: Students have to visit an old age home or orphanage in the vicinity of the college. They can interact with the inmates, probably donate utilities to the charity organization and/or probably stage a few inclusive activities with the residents of the place. After the visit, students can submit a brief report about their experience
 - c. Outcome: Learn first-hand about the conditions and social situations that the no-so-privileged members of our society have to endure to survive and go beyond their embarrassment to interact with the destitute which will help students appreciate the importance of Indian family values
6. STREET PLAY ACTIVITY
 - a. Purpose: Create awareness in themselves as well as people in the community on various social evils that need to be eradicated
 - b. Method: Students will prepare and enact a street play on any pertinent issues in society. The topics suggested can be perils of mobile phones / online fraud / safety for girls / mental and physical health of the youth.
 - c. Outcome: Allow students to deliberate and think deeply about the looming issues that is dogging our society and the future of the youth. This will also bring out the creative skills among the students and allow them to showcase their talent.
7. BUDDY / BIG BROTHER SYSTEM
 - a. Purpose: Include and involve the less fortunate children making them feel wanted and cared for as well as use the opportunity to share knowledge among school students.
 - b. Method: Students have to go to nearby schools after procuring appropriate permissions to teach a particular topic on either technical or non technical domains. Each student can choose to adopt 5 students from the class to be their mentor over a period of 1 year by staying in touch with them and helping them resolve their issues on academic or other matters.
 - c. Outcome: Appreciation and respect towards the responsibility of teaching. They will learn to be accountable as social contributors and bring about some change in the lives of the young students they mentor as Buddies or Big Brother.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

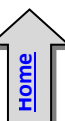
The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;
 - Add photos of the activity;(optional)
 - Add a title page to the beginning of your report;
 - Write in clear and objective language; and
 - Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/Activities-Active participation and proactive learning 50% and report 20%)

Learning Resources



Books:

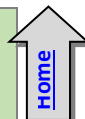
1. A. Alavudeen, M. Jayakumaran, and R Kalil Rahman, "Professional Ethics and Human Values"
2. Ram Ahuja, "Social Problems in India" (third edition)
3. Shastry, T. S. N., "India and Human rights: Reflections", Concept Publishing Company India Pvt. Ltd., 2005.
4. Nirmal, C.J., "Human Rights in India: Historical, Social and Political Perspectives (Law in India)", Oxford India
5. Rangarajan, "Environmental Issues in India", Pearson Education.
6. University of Delhi, The Individual and Society, Pearson Education.
7. Wikipedia.org / wiki /social studies.
8. M. N. Srinivas, "Social change in modern India", 1991, Orient Longman.
9. David Mandelbaum, Society in India, 1990, Popular.
10. Dr. Abha Singh, "Behavioral Science: Achieving Behavioral Excellence for Success", Wiley.

e-Books:

- <https://www.moteoo.org/en/products/social-science-and-humanities-student-book-english>
- <https://www.springeropen.com/books>
(SpringerOpen open access books; download them free of charge from SpringerLink)
- <https://muse.jhu.edu/article/541846/pdf>
(This content has been declared *free* to read by the publisher during the COVID-19)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	2	2	-	-	-
CO2	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	2	2	-	-	1
CO4	-	-	-	-	-	-	2	2	2	-	-	-
CO5	-	-	-	-	-	-	-	2	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-



Savitribai Phule Pune University
Second Year of Engineering (2019 Course)
210251: Audit Course 3

In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself [1]

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

- | | |
|---|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations | <ul style="list-style-type: none"> Surveys Mini-Project Hands on experience on focused topic |
|---|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 3 Options

Audit Course Code	Audit Course Title
AC3-I	Green Construction and Design
AC3-II	Social Awareness and Governance Program
AC3-III	Environmental Studies
AC3-IV	Smart Cities
AC3-V	Foreign Language (one of Japanese/Spanish/French/German). Course contents for Japanese(Module 1) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.

<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>

http://www.unipune.ac.in/university_files/syllabi.htm

AC3-I: Green Construction and Design

Prerequisites: General awareness of environment and eco system.

Course Objectives:

1. To motivate students for undertaking green construction projects, technical aspects of their design, obstacles to getting them done, and future directions of the field.
2. To increase awareness of green construction issues, so that students will know the range of existing knowledge and issues.
3. Proper use of energy, water and other resources without harming environment.
4. To reduce waste pollution and Environment Degradation.

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the importance of environment friendly society.

CO2: Apply primary measures to reduce carbon emissions from their surroundings.

CO3: Learn role of IT solutions in design of green buildings.

CO4: Understand the use of software systems to complete statutory compliances involved in the design of a new home or office building through green construction.

Course Contents

1. Introduction to Green Construction, need of green construction, Importance, Government Initiatives, your role in the Green Environment.
2. How to do Green Construction, Project Definition, Team Building, Education and Goal Setting, Documents and Specification.
3. Elements of Green Construction, Materials Construction Waste Management, Indoor Air Quality, Energy Efficiency.
4. Indian Green Building Council (IGBC), Introduction to IGBC, IGBC rating system, Green building projects in India, Benefits of green building, effects on natural resources.

Team Projects:

Students will be formed into groups to research green construction and design in a particular construction context and report their results to the class. What are the particular obstacles and opportunities to integrating green construction techniques into the following sectors? Be sure to consider technical, social, political and economic issues:

Hotels (economy, luxury, resorts), Hospitals, Retail(big box, malls, small scale downtown retail), Office, Government, ,Schools, Universities, Housing, Transportation Stations (Airport Terminals, Train Stations).

References :

1. Kibert, C. (2008) Sustainable Construction: Green Building Design and Delivery, 2nd edition(Hoboken, NJ: John Wiley and Sons.
2. Handbook of Green Building Design and Construction 1st Edition, by Sam Kubba, eBook ISBN:9780123851291.

IGBC Green New Buildings Rating System, Version 3.0, Abridged Reference Guide September 2014. Available:[https://igbc.in/igbc/html_pdfs/abridged/IGBC%20Green%20New%20Buildings%20Rating%20System%20\(Versio%203.0\).pdf](https://igbc.in/igbc/html_pdfs/abridged/IGBC%20Green%20New%20Buildings%20Rating%20System%20(Versio%203.0).pdf)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	2	-	-	3	3	-	-	-	-	-
CO2	-	-	2	-	-	3	3	-	-	-	-	-
CO3	-	-	-	-	3	-	2	-	-	-	-	-
CO4	-	-	1	-	3	-	2	-	-	-	-	-

AC3-II: Social Awareness and Governance Program**Prerequisites:**

Awareness about basic terms in Social Science and Governance

Course Objectives:

1. To Increase community awareness about social issues and to promote the practice of good governance in both private and public institutions, through policy advocacy and awareness creation in order to ensure proper utilization of public resources and good service delivery.
2. Increase community awareness on health, education, and human rights.
3. Transferring costs of social activities to other various segments of society.
4. To enhance youth participation in decision-making, democracy and economic development.

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand social issues and responsibilities as member of society.

CO2: Apply social values and ethics in decision making at social or organizational level

CO3: Promote obstacles in national integration and role of youth for National Integration

CO4: Demonstrate basic features of Indian Constitution.

Course Contents

1. Indian Society as Pluralistic, Fundamentals of unity in diversity, diversity and disparity in Indian society, women in mass media, disparities due to disability.
2. The Indian constitution as unifying factor, Introduction Making of Indian Constitution, Basic features of Indian Constitution, Strengths of Indian Constitution, and Fundamental Duties.
3. National Integration: Introduction, The Value of Tolerance, Minority Classes And Constitution, Pre-Requisites of National Integration, Obstacles To National Integration, Promotion of National Integration, Role of Youth In Promoting Communal Harmony.
4. Socialization, Ethics, Values and Prejudices, Meaning of Socialization, Functions of Socialization, Agents of Socialization, Importance of Socialization, Role of Ethics In Individual Development, Role of Basic Human Values In Individual Development, Relative Value System.

Activities:

1. Conducting training/workshops/debates on HIV/AIDS prevention and stigma reduction.
2. Public shows on girls' education and empowerment.
3. Conducting campaigns on adult/disabled education.
4. To support the government to develop policy that encourages youth participation in decision-making through government agencies.

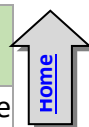
References:

1. Devidas M. Muley , S Chand, " Social Awareness and Personality Development", ISBN: 812193074X.
2. Bhagabati Prosad Banerjee, Durga Das Basu, Shakeel Ahmad Khan, V. R. Manohar, "Introduction to the Constitution of India", ISBN : 9788180385599.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	2	-	-	-	-
CO2	-	-	-	-	-	-	-	3	2	-	-	-
CO3	-	-	-	-	-	-	-	2	2	-	-	-
CO4	-	-	-	-	-	-	-	1	1	-	-	-

AC3-III: Environmental Studies



Environmental studies are the field that examines this relationship between people and the environment. An environmental study is an interdisciplinary subject examining the interplay between the social, legal, management, and scientific aspects of environmental issues.

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understand and realize the multi-disciplinary nature of the environment, its components, and inter-relationship between man and environment
4. Understand the relevance and importance of the natural resources in the sustenance of life on earth and living standard

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Comprehend the importance of ecosystem and biodiversity

CO2: Correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and prevention

CO3: Identify different types of environmental pollution and control measures

CO4: Correlate the exploitation and utilization of conventional and non-conventional resources

Course Contents

1. **Natural Resources:** Introduction, Renewable and non-renewable, Forest, water, mineral, food, energy and land resources, Individual and conservation of resources, Equitable use of resources.
2. **Ecosystems:** Concept, Structure, Function, Energy flow, Ecological succession, Forest, grassland, desert and aquatic ecosystems - Introduction, characteristic features, structure and function.
3. **Biodiversity:** Genetic, Species and ecological diversity, Bio Geographical classification of India, Value and hot spots, Biodiversity at global, national and local levels, India as mega-biodiversity nation, Threats to biodiversity, Endangered and endemic species of India, Conservation of Biodiversity, Endangered and endemic species, Conservation of biodiversity.
4. **Pollution:** Definition, Causes, effects and control measures of the pollution – Air, soil, Noise, Water, Marine and Thermal and Nuclear Pollution, Solid waste management, Role of Individual in Prevention of Pollution, Pollution #Exemplar/Case Studies, Disaster management

Reference:

1. Bharucha, E.,-Textbook of "Environmental Studies", Universities Press(2005),ISBN-10:8173715408
2. Mahua Basu, "Environmental Studies", Cambridge University Press, ISBN-978-1-107-5317-3

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	3	3	-	-	-	-	1
CO3	-	2	-	-	-	2	3	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	-

AC3-IV: Smart Cities



We breathe in a world defined by urbanization and digital ubiquity, where mobile broadband connections outnumber fixed ones, machines dominate a new "internet of things," and more people live in cities than in the countryside. This course enables us to take a broad historical look at the forces that have shaped the planning and design of cities and information technologies from the rise of the great industrial cities of the nineteenth century to the present. This course considers the motivations, aspirations, and shortcomings of them all while offering a new civics to guide our efforts as we build the future together, one click at a time.

Course Objectives

- To identify urban problems
- To study Effective and feasible ways to coordinate urban technologies.
- To study models and methods for effective implementation of Smart Cities.
- To study new technologies for Communication and Dissemination.
- To study new forms of Urban Governance and Organization.

Course Outcomes

On completion of the course, learner will be able to–

CO1: Understand the dynamic behavior of the urban system by going beyond the physical appearance and by focusing on representations, properties and impact factors

CO2: Explore the city as the most complex human-made organism with a metabolism that can be modeled in terms of stocks and flows

CO3: Knowledge about data-informed approaches for the development of the future city, based on crowd sourcing and sensing

CO4: Knowledge about the latest research results in for the development and management of future cities

CO5: Understand how citizens can benefit from data-informed design to develop smart and responsive cities

Course Contents

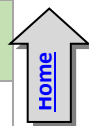
Urbanization and Ubiquity - The slow emergence of learning cities in an urbanizing world. Cities as collective learners, what do we know?- Framing a view -A gamut of learning types - Secrets of knowing and accelerating change - Why some cities learn and others do not.

References:

1. Anthony M. Townsend, W. W. Norton and Company "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", ISBN: 0393082873, 9780393082876.
2. Tim Campbell, Routledge, "Beyond Smart Cities: How Cities Network, Learn and Innovate", Routledge, ISBN: 9781849714266.
3. Stan Geertman, Joseph Ferreira, Jr. Robert Goodspeed, John Stillwell, "Planning Support Systems and Smart Cities", Lecture notes in Geo information and Cartography, Springer.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	-	-	2	2	1	-	-	-	-
CO2	1	2	1	-	-	1	1	-	-	-	-	-
CO3	2	1	3	3	2	-	1	-	1	1	1	
CO4	-	3	2	-	-	-	-	-	-	-	1	2

AC3-V: Foreign Language- Japanese (Module 1)**About course:**

With changing times, the competitiveness has gotten into the nerves and “Being the Best” at all times is only the proof of it. Nonetheless, ‘being the best’ differs significantly from ‘Communicating the best’! The best can merely be communicated whilst using the best... suited Language!!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer’s companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market and find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the ‘resume’ since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course learner will be able to-

CO1: Will have ability of basic communication.

CO2: Will have the knowledge of Japanese script.

CO3: Will get introduced to reading, writing and listening skills

CO4: Will develop interest to pursue professional Japanese Language course.

Course Contents

1. Introduction to Japanese Language. Hiragana basic Script, colors, Days of the week
2. Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo Long vowels, Greetings and expressions
3. Self Introduction, Introducing other person, Numbers, Months, Dates, Telephone numbers, Stating one's age.

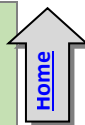
Reference:

1. Minna No Nihongo, “Japanese for Everyone”, Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers and Distributors Pvt.Ltd.
2. <http://www.tcs.com> (http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japan-centric-Delivery-Center-Pune.aspx)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1

Semester IV



Savitribai Phule Pune University
Second Year of Engineering (2019 Course)
207003: Engineering Mathematics III

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week Tutorial: 01 Hour/ Week	Theory: 03 Tutorial: 01	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks Term Work: 25 Marks

Prerequisites: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification and Representation of data.

Companion Course : ---

Course Objectives:

To make the students familiar with concepts and techniques in Linear differential equations, Fourier transform and Z-transform, Statistical methods, Probability theory and Numerical methods. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

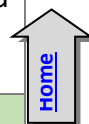
Course Outcomes:

On completion of the course learner will able to-

- CO1: Solve Linear differential equations, essential in modelling and design of computer-based systems.
- CO2: Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.
- CO3: Apply Statistical methods like correlation and regression analysis and probability theory for data analysis and predictions in machine learning.
- CO4: Solve Algebraic and Transcendental equations and System of linear equations using numerical techniques.
- CO5: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

Course Contents

Unit I	Linear Differential Equations (LDE)	(08 Hours)
LDE of n^{th} order with constant coefficients, Complementary function, Particular integral, General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE, Simultaneous and Symmetric simultaneous DE.		
Unit II	Transforms	(08 Hours)
Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine and Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses, Discrete Fourier Transform.		
Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.		
Unit III	Statistics	(07 Hours)
Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates.		
Unit IV	Probability and Probability Distributions	(07 Hours)



Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hypergeometric, Sampling distributions, Test of Hypothesis: Chi-Square test, t-test.

Unit V	Numerical Methods	(08 Hours)
--------	-------------------	------------

Numerical Solution of Algebraic and Transcendental equations: Bisection, Secant, Regula-Falsi, Newton–Raphson and Successive Approximation Methods, Convergence and Stability.

Numerical Solutions of System of linear equations: Gauss elimination, LU Decomposition, Cholesky, Jacobi and Gauss-Seidel Methods.

Unit VI	Numerical Methods	(08 Hours)
---------	-------------------	------------

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4th order methods and Predictor-Corrector methods.

Learning Resources

Text Books:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).

Reference Books:

1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
4. Differential Equations, 3e by S. L. Ross (Wiley India).
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press).
6. Numerical Methods for Scientific and Engineering Computation, by M. K. Jain, S. R. K. Iyengar And R. K. Jain, 5e, (New Age International Publication)

MOOC Link:

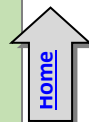
1. NPTEL Course "Transform Calculus And its applications in differential equations"
<https://nptel.ac.in/courses/111/105/111105123/>
2. NPTEL Course on "Numerical Methods" <https://nptel.ac.in/courses/111/107/111107105/>

Virtual LAB Link:

1. Numerical Methods: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/index.php

Guidelines for Tutorial and Term Work:

- i) Tutorial shall be engaged in batches (batch size as per norms) per division.
- ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.



Savitribai Phule Pune University Second Year of Engineering (2019 Course) 210252: Data Structures and Algorithms		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses: 110005: Programming and Problem Solving 210242: Fundamentals of Data Structures		
Companion Course: 210257: Data Structures and Algorithms Laboratory		
Course Objectives: The course is intended to provide the foundations of the practical implementation and usage of Data Structures and Algorithms to ensure that the learner evolves into a competent programmer capable of designing and analyzing implementations of data structures and algorithms for different kinds of problems. <ul style="list-style-type: none"> • To develop a logic for graphical modeling of the real life problems. • To suggest appropriate data structure and algorithm for graphical solutions of the problems. • To understand advanced data structures to solve complex problems in various domains. • To operate on the various structured data • To build the logic to use appropriate data structure in logical and computational solutions. • To understand various algorithmic strategies to approach the problem solution. 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Identify and articulate the complexity goals and benefits of a good hashing scheme for real-world applications. CO2: Apply non-linear data structures for solving problems of various domain. CO3: Design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language. CO4: Analyze the algorithmic solutions for resource requirements and optimization CO5: Use efficient indexing methods and multiway search techniques to store and maintain data. CO6: Use appropriate modern tools to understand and analyze the functionalities confined to the secondary storage.		
Course Contents		
Unit I	Hashing	(07 Hours)
Hash Table- Concepts-hash table, hash function, basic operations, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing, closed addressing and separate chaining. Skip List- representation, searching and operations- insertion, removal		
#Exemplar/Case Studies	Book Call Number and Dictionary	
*Mapping of Course Outcomes for Unit I	CO1, CO4	
Unit II	Trees	(08 Hours)

Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals(recursive and non-recursive)- inorder, preorder, post order, depth first and breadth first, Operations on binary tree. Huffman Tree (Concept and Use), Binary Search Tree (BST), BST operations, Threaded binary search tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary search tree, in order traversal of in-order threaded binary search tree.

#Exemplar/Case Studies Use of binary tree in expression tree-evaluation and Huffman's coding

***Mapping of Course Outcomes for Unit II** CO2, CO3, CO4

Unit III	Graphs	(07 Hours)
----------	--------	------------

Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. **Traversals**-depth first and breadth first, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prim's and Kruskal Algorithms, Dijkstra's Single source shortest path, All pairs shortest paths- Floyd-Warshall Algorithm Topological ordering.

#Exemplar/Case Studies Data structure used in Webgraph and Google map

***Mapping of Course Outcomes for Unit III** CO2, CO3, CO4

Unit IV	Search Trees	(08 Hours)
---------	--------------	------------

Symbol Table-Representation of Symbol Tables- Static tree table and Dynamic tree table, Weight balanced tree - Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming, Height Balanced Tree- AVL tree. Red-Black Tree, AA tree, K-dimensional tree, Splay Tree

#Exemplar/Case Studies Keyword search in a document using OBST

***Mapping of Course Outcomes for Unit IV** CO2, CO3, CO5

Unit V	Indexing and Multiway Trees	(07 Hours)
--------	-----------------------------	------------

Indexing and Multiway Trees- Indexing, indexing techniques-primary, secondary, dense, sparse, Multiway search trees, B-Tree- insertion, deletion, B+Tree - insertion, deletion, use of B+ tree in Indexing, Trie Tree.

#Exemplar/Case Studies Heap as a Priority Queue

***Mapping of Course Outcomes for Unit V** CO2, CO3, CO5

Unit VI	File Organization	(07 Hours)
---------	-------------------	------------

Files: concept, need, primitive operations. **Sequential file organization-** concept and primitive operations, **Direct Access File-** Concepts and Primitive operations, **Indexed sequential file organization-**concept, types of indices, structure of index sequential file, **Linked Organization-** multi list files, coral rings, inverted files and cellular partitions.

#Exemplar/Case Studies **External Sort-** Consequential processing and merging two lists, multiway merging- a k way merge algorithm

***Mapping of Course Outcomes for Unit VI** CO4, CO6

Learning Resources

Text Books:

1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786.
2. M Folk, B Zoellick, G. Riccardi, "File Structures", Pearson Education", ISBN:81-7758-37-5
3. Peter Brass, "Advanced Data Structures", Cambridge University Press, ISBN: 978-1-107-43982-5

Reference Books:

1. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0.
2. Michael J Folk, "File Structures an Object Oriented Approach with C++", Pearson Education, ISBN: 81-7758-373-5.
3. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++", Second Edition, University Press, ISBN:81-7371522 X.
4. G A V Pai, "Data Structures and Algorithms", McGraw-Hill Companies, ISBN -9780070667266.
5. Goodrich, Tamassia, Goldwasser, "Data Structures and Algorithms in Java", Wiley Publication, ISBN: 9788126551903

e-Books:

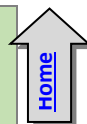
- <https://www.ebooks.com/en-us/book/95777110/Python-data-structures-and-algorithms/benjamin-baka/>
- <https://www.ebookphp.com/advanced-data-structures-epub-pdf/>
- <https://www.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epub-pdf/>

MOOC/ Video Lectures available at:

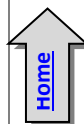
- <https://nptel.ac.in/courses/106/102/106102064/>
- <https://nptel.ac.in/courses/106/105/106105085>
- <https://nptel.ac.in/courses/106/106/106106127>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	1	-	-	-	-	-	-	-	-
CO5	1	-	1	1	-	-	-	-	-	-	-	-
CO6	2	1	1	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Engineering (2019 Course) 210253: Software Engineering		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses : 110005: Programming and Problem Solving		
Companion Course : ---		
Course Objectives: <p>The main objective of this course is to introduce the students to software engineering- the fundamentals of software engineering principles and practices, including project management, configurations management, requirements definition, system analysis, design, testing, and deployment with hands-on experience in a group software development project.</p> <ul style="list-style-type: none"> To learn and understand the principles of Software Engineering. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements. To apply design and testing principles to software project development. To understand project management through life cycle of the project. 		
Course Outcomes: <p>On completion of the course, learner will be able to-</p> <p>CO1: Analyze software requirements and formulate design solution for a software.</p> <p>CO2: Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.</p> <p>CO3: Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.</p> <p>CO4: Model and design User interface and component-level.</p> <p>CO5: Identify and handle risk management and software configuration management.</p> <p>CO6: Utilize knowledge of software testing approaches, approaches to verification and validation.</p> <p>CO7: Construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain efficient, reliable, robust and cost-effective software solutions.</p>		
Course Contents		
Unit I	Introduction to Software Engineering and Software Process Models	(06Hours)
Software Engineering Fundamentals: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice. Software Process: A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, A Final Word on Evolutionary Processes. Unified Process, Agile software development: Agile methods, plan driven and agile development.		
#Exemplar/Case Studies	Agile Tools- JIRA	
*Mapping of Course Outcomes for Unit I	CO1, CO3, CO7	
Unit II	Software Requirements Engineering and Analysis	(07 Hours)



Modeling: Requirements Engineering, Establishing the Groundwork, Identifying Stakeholders, Recognizing Multiple Viewpoints, working toward Collaboration, Asking the First Questions, Eliciting Requirements, Collaborative Requirements Gathering, Usage Scenarios, Elicitation Work Products, Developing Use Cases, Building the Requirements Model, Elements of the Requirements Model, Negotiating Requirements, Validating Requirements.

Suggested Free Open Source tools: StarUML, Modelio, SmartDraw.

#Exemplar/Case Studies	Write SRS in IEEE format for selected Project Statement/ case study Study SRS of Online Voting system (http://dos.iitm.ac.in/OOSD_Material/CaseStudies/CaseStudy2/eVote-srs.pdf), Library management System, Develop use case model for any software applications.
------------------------	---

*Mapping of Course Outcomes for Unit II	CO1, CO3, CO7
---	---------------

Unit III	Estimation and Scheduling	(07 Hours)
----------	---------------------------	------------

Estimation for Software Projects: The Project Planning Process, Defining Software Scope and Checking Feasibility, Resources management, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition Techniques, Software Sizing, Problem-Based Estimation, LOC-Based Estimation, FP-Based Estimation, Object Point (OP)-based estimation, Process-Based Estimation, Process-Based Estimation, Estimation with Use Cases, Use-Case–Based Estimation, Reconciling Estimates, Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Mode, Preparing Requirement Traceability Matrix

Project Scheduling: Project Scheduling, Defining a Task for the Software Project, Scheduling.

Suggested Free Open Source Tools: Gantt Project, Agantty, Project Libre.

#Exemplar/Case Studies	Write SRS in IEEE format for selected Project Statement/ case study, Study SRS of Online Voting system, Library management System (http://dos.iitm.ac.in/OOSD_Material/CaseStudies/CaseStudy2/eVote-srs.pdf),
------------------------	--

*Mapping of Course Outcomes for Unit III	CO1, CO3, CO7
--	---------------

Unit IV	Design Engineering	(07 Hours)
---------	--------------------	------------

Design Concepts: Design within the Context of Software Engineering, The Design Process, Software Quality Guidelines and Attributes, Design Concepts - Abstraction, Architecture, design Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object-Oriented Design Concept, Design Classes, The Design Model, Data Design Elements, Architectural Design Elements, Interface Design Elements, Component-Level Design Elements, Component Level Design for Web Apps, Content Design at the Component Level, Functional Design at the Component Level, Deployment-Level Design Elements.

Architectural Design: Software Architecture, What is Architecture, Why is Architecture Important, Architectural Styles, A brief Taxonomy of Architectural Styles.

Suggested Free Open Source Tool: Smart Draw

#Exemplar/Case Studies	Study design of Biometric Authentication software
------------------------	---

*Mapping of Course Outcomes for Unit IV	CO1, CO2 CO3, CO7
---	-------------------

Unit V	Risks and Configuration Management	(07 Hours)
--------	------------------------------------	------------

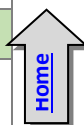
Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

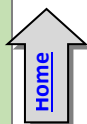
Software Configuration Management: Software Configuration Management, The SCM Repository The SCM Process, Configuration Management for any suitable software system.

Suggested Free Open Source Tools: CF Engine Configuration Tool, Puppet Configuration Tool.

#Exemplar/Case Studies	Risk management in Food delivery software
------------------------	---

*Mapping of Course Outcomes for Unit V	CO1,CO2 CO3, CO7											
Unit VI	Software Testing										(07 Hours)	
A Strategic Approach to Software Testing, Verification and Validation, Organizing for Software Testing, Software Testing Strategy—The Big Picture, Criteria for Completion of Testing, Strategic Issues, Test Strategies for Conventional Software, Unit Testing, Integration Testing, Test Strategies for Object-Oriented Software, Unit Testing in the OO Context, Integration Testing in the OO Context, Test Strategies forWebApps, Validation Testing, Validation-Test Criteria, Configuration Review.												
Suggested Free Open Source Tools: Selenium, JUnit.												
#Exemplar/Case Studies	Selemium Testing with any online application											
*Mapping of Course Outcomes for Unit VI	CO1,CO2 CO3, CO6											
Learning Resources												
Text Books:												
1. Roger Pressman, “Software Engineering: A Practitioner’s Approach” , McGraw Hill, ISBN 0–07–337597–7												
2. Ian Sommerville, “Software Engineering” , Addison and Wesley, ISBN 0-13-703515-2												
Reference Books:												
1. Carlo Ghezzi, “Fundamentals of Software Engineering", PHI, ISBN-10: 0133056996												
2. Rajib Mall, “Fundamentals of Software Engineering” , PHI, ISBN-13: 978-8120348981												
3. Pankaj Jalote, “An Integrated Approach to Software Engineering” , Springer, ISBN 13: 9788173192715.												
4. S K Chang, “Handbook of Software Engineering and Knowledge Engineering” , World Scientific, Vol I, II, ISBN: 978-981-02-4973-1												
5. Tom Halt, “Handbook of Software Engineering”, Clanye International ISBN-10: 1632402939												
e-books:												
• https://ebookpdf.com/roger-s-pressman-software-engineering												
MOOC/ Video Lectures available at:												
• https://swayam.gov.in/nd1_noc19_cs69/preview												
• https://swayam.gov.in/nd2_cec20_cs07/preview												
@The CO-PO Mapping Matrix												
CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	2	2	2	-	-	-	-
CO3	-	-	2	-	-	2	-	-	-	-	-	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-
CO5	-	2	2	-	-	-	-	-	-	-	-	-
CO6	-	2	2	-	-	-	-	-	-	-	-	-
CO7	1	-	1	1	-	-	-	-	-	-	-	-





Savitribai Phule Pune University Second Year of Engineering (2019 Course) 210254: Microprocessor		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses : 210248: Digital Electronics and Logic Design		
Companion Course : 210258: Microprocessor Laboratory		
Course Objectives: The course is intended to provide practical exposure to the students on microprocessors, design and coding knowledge on 80386 and introduction to microcontrollers. <ul style="list-style-type: none"> To learn and distinguish the architecture and programmer's model of advanced processor. To identify the system level features and processes of advanced processors. To acquaint the learner with application instruction set and logic to build assembly language programs. 		
Course Outcomes: After successful completion of the course, the learner will be able to- CO1: Exhibit skill of assembly language programming for the application. CO2: Classify Processor architectures. CO3: Illustrate advanced features of 80386 Microprocessor. CO4: Compare and contrast different processor modes. CO5: Use interrupts mechanism in applications CO6: Differentiate between Microprocessors and Microcontrollers. CO7: Identify and analyze the tools and techniques used to design, implement, and debug microprocessor-based systems.		
Course Contents		
Unit I	Introduction to 80386	(07 Hours)
Brief History of Intel Processors, 80386 DX Features and Architecture, Programmers Model, Operating modes, Addressing modes and data types. Applications Instruction Set: Data Movement Instructions, Binary Arithmetic Instructions, Decimal Arithmetic Instructions, Logical Instructions, Control Transfer Instructions, String and Character Transfer Instructions, Instructions for Block Structured Language, Flag Control Instructions, Coprocessor Interface Instructions, Segment Register Instructions, Miscellaneous Instructions.		
#Exemplar/Case Studies	Study-Evolution of Microprocessor	
*Mapping of Course Outcomes for Unit I	CO1,CO2	
Unit II	Bus Cycles and System Architecture	(07 Hours)
Initialization- Processor State after Reset. Functional pin Diagram, functionality of various pins, I/O Organization, Memory Organization (Memory banks), Basic memory read and writes cycles with timing diagram. Systems Architecture- Systems Registers (Systems flags, Memory Management registers, Control registers, Debug registers, Test registers), System Instructions.		
#Exemplar/Case Studies	Study-Motherboard of Computer and it's components.	
*Mapping of Course Outcomes for Unit II	CO3	
Unit III	Memory Management	(08 Hours)

Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, GDTR, LDTR, IDTR. Formats of Descriptors and Selector, Segment Translation, Page Translation, Combining Segment and Page Translation.

#Exemplar/Case Studies Try creating an animation by using any of /Study of the tools to create and access all the type of possible segments in 80386DX.

***Mapping of Course Outcomes for Unit III** CO1,CO2

Unit IV	Protection	(08 Hours)
---------	------------	------------

Need of Protection, Overview of 80386DX Protection Mechanisms: Protection rings and levels, Privileged Instructions, Concept of DPL, CPL, RPL, EPL.

Inter privilege level transfers using Call gates, Conforming code segment, Privilege levels and stacks. Page Level Protection, Combining Segment and Page Level Protection.

#Exemplar/Case Studies Study about- can the security of the system be compromised using CALL gates?

***Mapping of Course Outcomes for Unit IV** CO4, , CO6

Unit V	Multitasking and Virtual 8086 Mode	(08Hours)
--------	------------------------------------	-----------

Multitasking- Task State Segment, TSS Descriptor, Task Register, Task Gate Descriptor, Task Switching, Task Linking, Task Address Space.

Virtual Mode – Features, Memory management in Virtual Mode , Entering and leaving Virtual mode.

#Exemplar/Case Studies Study about multitasking implemented by using timing interrupt generated by internal clock of the system. Consider three different tasks: One displaying a string at first row accessing VRAM directly; Second Blinking the string with certain time interval and; Third clearing the screen.

***Mapping of Course Outcomes for Unit V** CO4, CO5, CO6

Unit VI	Interrupts, Exceptions, and Introduction to Microcontrollers	(07 Hours)
---------	--	------------

Interrupts and Exceptions: Identifying Interrupts, Enabling and Disabling Interrupts, Priority among Simultaneous Interrupts and Exceptions, Interrupt Descriptor Table (IDT), IDT Descriptors, Interrupt Tasks and Interrupt Procedures, Error Code, and Exception Conditions.

Introduction to Microcontrollers: Architecture of typical Microcontroller, Difference between Microprocessor and Microcontroller, Characteristics of microcontrollers, Application of Microcontrollers.

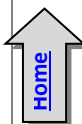
#Exemplar/Case Studies Try building a Minimum System using 8051 microcontroller (Provide complete architecture and component selection with rationale). Indicate Memory Map explicitly.

***Mapping of Course Outcomes for Unit VI** CO4,CO6, CO7

Learning Resources

Text Books:

1. Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 2 Edition, 2006 ISBN 0-07-100462-9
2. A.Ray, K.Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill,2004 ISBN 0-07-463841-6
3. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995.
4. Intel 80386 Hardware Reference Manual 1986, Intel Corporation, Order no.: 231732-001, 1986.
5. James Turley- "Advanced 80386 Programming Techniques", McGraw-Hill, ISBN: 10:0078813425, 13: 978-0078813429.



Reference Books:

1. Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422.
2. Walter A. Triebel, "The 80386Dx Microprocessor: Hardware", Software, and Interfacing, Pearson Education, ISBN: 0137877307, 9780137877300.
3. Brey, Barry B, "8086/8088, 80286, 80386 and 80486 Assembly Language Programming", Prentice Hall, ISBN: 13: 9780023142475.
4. Mohammad Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", Prentice Hall, ISBN:-10:0966498011, 13:978:0966498011.
5. Introduction to 64 bit Intel Assembly Language Programming for Linux, 2nd Edition, Ray Seyfarth, ISBN10: 1478119209, ISBN-13: 9781478119203, 2012.
6. Assembly Language Step-by-step: Programming with Linux, 3rd Edition, Jeff Duntemann, Wiley ISBN:-10 0470497025, ISBN-13: 978-0470497029, 2009.

Intel 80386 Programmer's Reference Manual:

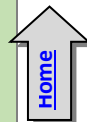
- <http://intel80386.com/386htm/toc.htm>
- <https://css.csail.mit.edu/6.858/2014/readings/i386.pdf>

MOOC/ Video Lectures available at:

- <https://nptel.ac.in/courses/106/108/106108100/>
- <https://nptel.ac.in/courses/108/107/108107029/>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-
CO4	2	-	2	-	-	-	-	-	-	-	-	-
CO5	2	-	2	-	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-
CO7	2	1	1	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Engineering (2019 Course) 210255: Principles of Programming Languages		
Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks
Prerequisite Courses : 110005: Programming and Problem Solving, 210253: Object Oriented Programming		
Companion Course : 210257: Data Structures and Algorithms Laboratory		
Course Objectives: <ul style="list-style-type: none"> To learn basic principles of programming languages and programming paradigms. To learn structuring the data and manipulation of data, computation and program structure. To learn Object Oriented Programming (OOP) principles using Java Programming Language. To learn basic concepts of logical and functional programming language. 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Make use of basic principles of programming languages. CO2: Develop a program with Data representation and Computations. CO3: Develop programs using Object Oriented Programming language : Java. CO4: Develop application using inheritance, encapsulation, and polymorphism. CO5: Demonstrate Multithreading for robust application development. CO6: Develop a simple program using basic concepts of Functional and Logical programming paradigm.		
Course Contents		
Unit I	Fundamentals of Programming	(06Hours)
Importance of Studying Programming Languages, History of Programming Languages, Impact of Programming Paradigms, Role of Programming Languages, Programming Environments. Impact of Machine Architectures: The operation of a computer, Virtual Computers and Binding Times. Programming paradigms- Introduction to programming paradigms, Introduction to four main Programming paradigms- procedural, object oriented, functional, and logic and rule based.		
#Exemplar/Case Studies	A case study: Retail Sales application	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Structuring the Data, Computations and Program	(07 Hours)
Elementary Data Types : Primitive data Types, Character String types, User Defined Ordinal Types, Array types, Associative Arrays, Record Types, Union Types, Pointer and reference Type. Expression and Assignment Statements: Arithmetic expression, Overloaded Operators, Type conversions, Relational and Boolean Expressions, Short Circuit Evaluation, Assignment Statements, Mixed mode Assignment. Statement level Control Statements: Selection Statements, Iterative Statements, Unconditional Branching. Subprograms: Fundamentals of Sub Programs, Design Issues for Subprograms, Local referencing Environments, Parameter passing methods. Abstract Data Types and Encapsulation Construct: Design issues for Abstraction, Parameterized Abstract Data types, Encapsulation Constructs, Naming Encapsulations.		
#Exemplar/Case Studies	Data representation and computations in Retail Sales	
*Mapping of Course Outcomes for Unit II	CO2	

Unit III	Java as Object Oriented Programming Language- Overview	(07 Hours)
<p>Fundamentals of JAVA, Arrays: one dimensional array, multi-dimensional array, alternative array declaration statements,</p> <p>String Handling: String class methods, Classes and Methods: class fundamentals, declaring objects, assigning object reference variables, adding methods to a class, returning a value, constructors, this keyword, garbage collection, finalize() method, overloading methods, argument passing, object as parameter, returning objects, access control, static, final, nested and inner classes, command line arguments, variable - length arguments.</p>		
#Exemplar/Case Studies	Demonstrate classes , objects, data, methods for Online Banking System using Java.	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Inheritance, Packages and Exception Handling using Java	(07 Hours)
<p>Inheritances: member access and inheritance, super class references, Using super, multilevel hierarchy, constructor call sequence, method overriding, dynamic method dispatch, abstract classes, Object class.</p> <p>Packages and Interfaces: defining a package, finding packages and CLASSPATH, access protection, importing packages, interfaces (defining, implementation, nesting, applying), variables in interfaces, extending interfaces, instance of operator. fundamental, exception types, uncaught exceptions, try, catch, throw, throws, finally, multiple catch clauses, nested try statements, built-in exceptions, custom exceptions (creating your own exception sub classes).</p> <p>Managing I/O: Streams, Byte Streams and Character Streams, Predefined Streams, Reading console Input, Writing Console Output, Print Writer class.</p>		
#Exemplar/Case Studies	Demonstrate inheritance, Packages and interface for Online Banking System using Java.	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Multithreading in Java	(07 Hours)
<p>Concurrency and Synchronization, Java Thread Model: Thread priorities, Synchronization, Messaging, Main Thread, Creating thread: Implementing Thread using thread class and Runnable interface. Creating multiple threads using is Alive() and join().</p> <p>Web Based Application in Java: Use of JavaScript for creating web based applications in Java, Introduction to Java script frameworks- ReactJS, VueJS, AngularJS (open source).</p>		
#Exemplar/Case Studies	Demonstrate Multithreading for Gaming.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Logical and Functional Programming	(07 Hours)
<p>Functional Programming Paradigm: Understanding symbol manipulation, Basic LISP functions, definitions, predicates, conditionals and scoping, Recursion and iteration, Properties List array and access functions, Using lambda definitions, printing, reading and atom manipulation.</p> <p>Logic Programming Paradigm: An Overview of Prolog, Syntax and Meaning of Prolog Programs, Lists, Operators, Arithmetic, Using Structures.</p>		
#Exemplar/Case Studies	Demonstrate Functional and Logic Programming for Software Project Management.	
*Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources


 Home

Text Books:

1. T. W. Pratt, M. V. Zelkowitz, "Programming Languages Design and Implementation", 4th Ed, PHI, ISBN 81-203-2035-2.
2. Sebesta R., "Concepts of Programming Languages", 4th Edition, Pearson Education, ISBN-81-7808-161-X.
3. Herbert Schildt, "The Complete Reference Java", 9th Ed, TMH, ISBN: 978-0-07-180856-9.

Reference Books:

1. Deugo, —Java Gems, Cambridge University Press, ISBN 10: 0521648246 ISBN 13: 9780521648240
2. Carl Townsend, "Programming in turbo PROLOG", Tata-McGraw Hill
3. Ivan Bratko, "Prolog Programming for Artificial Intelligence", Wesley Publishers Limited
4. Winston P., Klaus B., Horn P., "LISP", 3rd Edition, Pearson Education, 81 - 7808 -155-5
5. Carlo Ghezzi, Mehdi Jazayeri, —Programming Language Concepts, 3rd Ed, Wiley Publication ISBN : 978-81-265-1861-6.

eBooks:

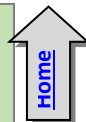
- <https://www.springer.com/gp/book/9781848820319>
- <https://www.springer.com/gp/book/9781848829138>

eBooks:

- <https://nptel.ac.in/courses/106/102/106102067/>
- https://swayam.gov.in/nd1_noc20_cs08/preview
- https://swayam.gov.in/nd2_aic20_sp13/preview
- https://swayam.gov.in/nd1_noc19_cs84/preview

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-
CO4	2	-	2	-	-	-	-	-	-	-	-	-
CO5	2	-	2	-	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210256: Data Structures and Algorithms Laboratory		
Teaching Scheme Practical: 04 Hours/Week	Credit Scheme 02	Examination Scheme and Marks Term Work: 25 Marks Practical: 25 Marks
Companion Course : 210252: Data Structures and Algorithms, 210255: Principles of Programming Languages		
Course Objectives: <ul style="list-style-type: none"> To understand practical implementation and usage of non linear data structures for solving problems of different domain. To strengthen the ability to identify and apply the suitable data structure for the given real world problems. To analyze advanced data structures including hash table, dictionary, trees, graphs, sorting algorithms and file organization. 		
Course Outcomes: On completion of the course, learner will be able to– CO1: Understand the ADT/libraries, hash tables and dictionary to design algorithms for a specific problem. CO2: Choose most appropriate data structures and apply algorithms for graphical solutions of the problems. CO3: Apply and analyze non linear data structures to solve real world complex problems. CO4: Apply and analyze algorithm design techniques for indexing, sorting, multi-way searching, file organization and compression. CO5: Analyze the efficiency of most appropriate data structure for creating efficient solutions for engineering design situations.		
Guidelines for Instructor's Manual The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of course, conduction and Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.		
Guidelines for Student's Laboratory Journal The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, <u>Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis.</u> Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.		
Guidelines for Laboratory / Term Work Assessment Continuous assessment of laboratory work should be done based on overall performance and Laboratory assignments performance of student. Each Laboratory assignment assessment should be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.		
Guidelines for Laboratory Conduction The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the		

average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged.

In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Set of suggested assignment list is provided in groups- A, B, C, D, E, F and G. Each student must perform at least 12 assignments(at least 02 from group A, 03 from group B, 02 from group C, 2 from group D, 01 from group E, 02 from group F.)

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - Open Source Python - Group A assignments, C++ Programming tool like G++/GCC

Guidelines for Practical Examination

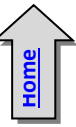
Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. Consequently encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. Therefore adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Virtual Laboratory:

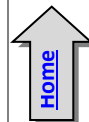
- <http://cse01-iiith.vlabs.ac.in/Courses%20Aligned.html?domain=Computer%20Science>

Suggested List of Laboratory Experiments/Assignments

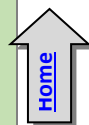
Sr. No	Group A
1	Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client's telephone number. Make use of two collision handling techniques and compare them using number of comparisons required to find a set of telephone numbers
2	Implement all the functions of a dictionary (ADT) using hashing and handle collisions using chaining with / without replacement. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert(key, value), Find(key), Delete(key)
3	For given set of elements create skip list. Find the element in the set that is closest to some given value. (note: Decide the level of element in the list Randomly with some upper limit)
4	To create ADT that implement the "set" concept. a. Add (new Element) -Place a value into the set , b. Remove (element) Remove the value c. Contains (element) Return true if element is in collection, d. Size () Return number of values in collection Iterator () Return an iterator used to loop over collection, e. Intersection of two sets , f. Union of two sets, g. Difference between two sets, h. Subset
	Group B
5	A book consists of chapters, chapters consist of sections and sections consist of subsections. Construct a tree and print the nodes. Find the time and space requirements of your method.
6	Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree - i. Insert new node, ii. Find number of nodes in longest path from root, iii. Minimum data value found in the tree, iv. Change a tree so that the roles of the left and right pointers are swapped at every node, v. Search a value



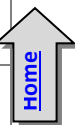
7	Construct an expression tree from the given prefix expression eg. $+-a*bc/def$ and traverse it using post order traversal (non recursive) and then delete the entire tree.
8	Read for the formulas in propositional calculus. Write a function that reads such a formula and creates its binary tree representation. What is the complexity of your function?
9	Convert given binary tree into threaded binary tree. Analyze time and space complexity of the algorithm.
10	Consider threading a binary tree using preorder threads rather than inorder threads. Design an algorithm for traversal without using stack and analyze its complexity. _
11	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.
12	Implement a file compression algorithm that uses binary tree. Your program should allow the user to compress and decompress messages containing alphabets using the standard Huffman algorithm for encoding and decoding.
Group C	
13	Represent a given graph using adjacency matrix/list to perform DFS and using adjacency list to perform BFS. Use the map of the area around the college as the graph. Identify the prominent land marks as nodes and perform DFS and BFS on that.
14	There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight take to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Check whether the graph is connected or not. Justify the storage representation used.
15	You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.
16	Tour operator organizes guided bus trips across the Maharashtra. Tourists may have different preferences. Tour operator offers a choice from many different routes. Every day the bus moves from starting city S to another city F as chosen by client. On this way, the tourists can see the sights alongside the route travelled from S to F. Client may have preference to choose route. There is a restriction on the routes that the tourists may choose from, the bus has to take a short route from S to F or a route having one distance unit longer than the minimal distance. Two routes from S to F are considered different if there is at least one road from a city A to a city B which is part of one route, but not of the other route.
17	Consider the scheduling problem. n tasks to be scheduled on single processor. Let t_1, \dots, t_n be durations required to execute on single processor is known. The tasks can be executed in any order but one task at a time. Design a greedy algorithm for this problem and find a schedule that minimizes the total time spent by all the tasks in the system. (The time spent by one is the sum of the waiting time of task and the time spent on its execution.)
Group D	
18	Given sequence $k = k_1 < k_2 < \dots < k_n$ of n sorted keys, with a search probability p_i for each key k_i . Build the Binary search tree that has the least search cost given the access probability for each key?



19	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword											
	Group E											
20	Consider a scenario for Hospital to cater services to different kinds of patients as Serious (top priority), b) non-serious (medium priority), c) General Checkup (Least priority) Implement the priority queue to cater services to the patients.											
21	Implement the Heap/Shell sort algorithm implemented in Java demonstrating heap/shell data structure with modularity of programming language											
22	Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure. Analyze the algorithm.											
	Group F											
23	Department maintains a student information. The file contains roll number, name, division and address. Allow user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If it is, then the system displays the student details. Use sequential file to main the data.											
24	Company maintains employee information as employee ID, name, designation and salary. Allow user to add, delete information of employee. Display information of particular employee. If employee does not exist an appropriate message is displayed. If it is, then the system displays the employee details. Use index sequential file to maintain the data.											
25	Implementation of a direct access file -Insertion and deletion of a record from a direct access file											
26	Assume we have two input and two output tapes to perform the sorting. The internal memory can hold and sort m records at a time. Write a program in java for external sorting. Find out time complexity.											
	Mini-Projects/ Case Study											
27	Design a mini project using JAVA which will use the different data structure with or without Java collection library and show the use of specific data structure on the efficiency (performance) of the code.											
28	Design a mini project to implement Snake and Ladders Game using Python.											
29	Design a mini project to implement a Smart text editor.											
30	Design a mini project for automated Term work assessment of student based on parameters like daily attendance, Unit Test / Prelim performance, Students achievements if any, Mock Practical.											
@The CO-PO Mapping Matrix												
PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-	-	-	-
CO3	-	2	2	1	-	-	-	-	-	-	-	-
CO4	1	2	1	1	-	-	-	-	-	-	-	-
CO5	1	1	2	2	-	-	-	-	-	-	-	-



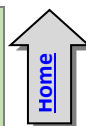
Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210257: Microprocessor Laboratory		
Teaching Scheme Practical: 02 Hours/Week	Credit Scheme 01	Examination Scheme and Marks Term Work: 25 Marks Practical: 25 Marks
Companion Course : 210254: Microprocessor		
Course Objectives: <ul style="list-style-type: none"> To understand assembly language programming instruction set To understand different assembler directives with example To apply instruction set for implementing X86/64 bit assembly language programs 		
Course Outcomes: On completion of the course, learner will be able to– CO1. Understand and apply various addressing modes and instruction set to implement assembly language programs CO2. Apply logic to implement code conversion CO3. Analyze and apply logic to demonstrate processor mode of operation		
Guidelines for Laboratory /Term Work Assessment Continuous assessment of laboratory work is based on overall performance and Laboratory assignments performance of student. Each Laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.		
Guidelines for Laboratory Conduction The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Use of open source software is encouraged. In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus. Operating System: 64-bit Open source Linux or its derivative. Programming Tools: Preferably using Linux equivalent or MASM/TASM/NASM/FASM.		
Guidelines for Practical Examination Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.		
Virtual Laboratory: <ul style="list-style-type: none"> http://209.211.220.205/vlabiitece/mi/MI3.php 		
Suggested List of Laboratory Experiments/Assignments(any 10)		
Sr. No.	Assignments	



1	Write an X86/64 ALP to accept five 64 bit Hexadecimal numbers from user and store them in an array and display the accepted numbers.
2	Write an X86/64 ALP to accept a string and to display its length.
3	Write an X86/64 ALP to find the largest of given Byte/Word/Dword/64-bit numbers.
4	Write a switch case driven X86/64 ALP to perform 64-bit hexadecimal arithmetic operations (+, -, *, /) using suitable macros. Define procedure for each operation.
5	Write an X86/64 ALP to count number of positive and negative numbers from the array.
6	Write X86/64 ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user for: (a) HEX to BCD b) BCD to HEX (c) EXIT. Display proper strings to prompt the user while accepting the input and displaying the result. (Wherever necessary, use 64-bit registers).
7	Write X86/64 ALP to detect protected mode and display the values of GDTR, LDTR, IDTR, TR and MSW Registers also identify CPU type using CPUID instruction.
8	Write X86/64 ALP to perform non-overlapped block transfer without string specific instructions. Block containing data can be defined in the data segment.
9	Write X86/64 ALP to perform overlapped block transfer with string specific instructions. Block containing data can be defined in the data segment.
10	Write X86/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition and add and shift method. (use of 64-bit registers is expected).
11	Write X86 Assembly Language Program (ALP) to implement following OS commands i) COPY, ii) TYPE Using file operations. User is supposed to provide command line arguments
12	Write X86 ALP to find, a) Number of Blank spaces b) Number of lines c) Occurrence of a particular character. Accept the data from the text file. The text file has to be accessed during Program_1 execution and write FAR PROCEDURES in Program_2 for the rest of the processing. Use of PUBLIC and EXTERN directives is mandatory.
13	Write x86 ALP to find the factorial of a given integer number on a command line by using recursion. Explicit stack manipulation is expected in the code.
14	Write an X86/64 ALP password program that operates as follows: a. Do not display what is actually typed instead display asterisk ("*"). If the password is correct display, "access is granted" else display "Access not Granted"
15	Study Assignment: Motherboards are complex. Break them down, component by component, and Understand how they work. Choosing a motherboard is a hugely important part of building a PC. Study- Block diagram, Processor Socket, Expansion Slots, SATA, RAM, Form Factor, BIOS, Internal Connectors, External Ports, Peripherals and Data Transfer, Display, Audio, Networking, Overclocking, and Cooling. 4. https://www.intel.in/content/www/in/en/support/articles/000006014/boards-and-kits/desktop-boards.html

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	-
CO2	2	1	-	1	-	-	-	-	-	-	-	-
CO3	-	1	-	1	-	-	-	-	-	-	-	-



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210258: Project Based Learning II

Teaching Scheme Practical: 04 Hours/Week	Credit Scheme 02	Examination Scheme and Marks Term Work: 50 Marks
---	-----------------------------------	---

Course Objectives:

- To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problem.
- To Evaluate alternative approaches, and justify the use of selected tools and methods.
- To emphasizes learning activities that are long-term, inter-disciplinary and student-centric.
- To engages students in rich and authentic learning experiences.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
- To develop an ecosystem that promotes entrepreneurship and research culture among the students.

Course Outcomes:

CO1: Identify the real life problem from societal need point of view

CO2: Choose and compare alternative approaches to select most feasible one

CO3: Analyze and synthesize the identified problem from technological perspective

CO4: Design the reliable and scalable solution to meet challenges

CO5: Evaluate the solution based on the criteria specified

CO6: Inculcate long life learning attitude towards the societal problems

Course Contents

Preamble:

Project-based learning is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world. PBL, is more than just projects. With PBL students "investigate and respond to an authentic, engaging, and complex problem, or challenge" with deep and sustained attention. PBL is "learning by doing." The truth is, many in education are recognizing we live in a modern world sustained and advanced through the successful completion of projects. In short, If students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Project based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development. The PBL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It Brings what students should academically know, understand, and be able to do and requires students to present their problems, research process, methods, and results.[\[1\]](#)

Project based learning (PBL) requires regular mentoring by faculty throughout the semester for successful completion of the idea/project tasks selected by the students per batch. For the faculty involved in PBL , teaching workload of 4 Hrs/week/batch needs to be considered. The Batch should be divided into sub-groups of 4 to 5 students. Idea implementation /Real life problem/Complex assignments / activities / projects. under project based learning is to be carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester

Group Structure:

Working in supervisor/mentor monitored groups; the students plan, manage, and complete a task/project/activity which addresses the stated problem.

1. There should be team/group of 4-5 students
2. A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or “wondering”. This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated interdisciplinary or subject frame.

A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students’ wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and structure of the activity.

A few hands-on activities that may or may not be multidisciplinary.

Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.

Activities may include- Solving real life problem, investigation, /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation of the individual and the team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
3. Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment/evaluation and weightage:

1. Idea Inception and Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (10%)
2. Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (Individual assessment and team assessment) (40%)
3. Documentation (Gathering requirements, design and modelling, implementation/execution, use of technology and final report, other documents) (15%)
4. Demonstration (Presentation, User Interface, Usability) (20%)

5. Contest Participation/ publication (15%)

PBL workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. It will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

Note :

- While planning for the assessment, choose a valid method based on your context. It should be able to understand by both the students as well as the faculty.
- The student group must follow the principles of Software Engineering (Scoping out the problem, the solution implementation and related documentation).
- Researching the problem and outlining various approaches is key here and should be emphasized by the tutor and the mentor.
- Aspects of design thinking (from the point of view of the person facing the problem) are very important. Students should not jump into the technology aspects first.
- The team can follow the principles of Agile Software Development. The weekly meetings could be used as a Scrum meeting.
- The tutor and mentor should actively help the students to scope the work and the approach. They must validate the technology choices.
- If the implementation code is well documented, the project can be continued by subsequent batch – which will help solve a bigger problem.

Text Books:

1. A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017
2. Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.
3. Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Capraro, Mary Margaret Capraro

Reference Books:

1. De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.
2. Gopalan, "Project management core text book", 2 Indian Edition
3. James Shore and Shane Warden, "The Art of Agile Development"

Tutors Role in Project Based Learning

- The fundamentals of problem based learning, lies with the Tutors role.
- Tutors are not the source of solutions rather they act as the facilitator and mentor.
- The facilitator skills of the Tutors / Teacher are central to the success of PBL.

Change of Mindset

- Students are not used to the constructivist approach to learning, it is important that they are carefully told what to expect in PBL.
- Tutors need to explain the differences between PBL and traditional learning.
- Tutors need to explain the principals involved and role of the students in PBL learning.

Designing Problem

- Considering the prior knowledge of the students, their ability and creativity, problem statement should be designed.
- For 2nd year PBL students the tutor should place more emphasis on getting the students to perform higher-level tasks.
- It is important for tutors to design problems that are anchored in authentic contexts only
- Students should take ownership of the problem.
- Problems should not be over simplified or well defined
- Learning should not be the sequencing of instructional events, but the application of principles for responding to the needs of the situation.
- The problems given to students in PBL should be realistic, complex, and should reflect, as

much as possible, the actual problems that students would encounter in real life.

Basic function of the tutor

- A good understanding of the overall curriculum the students have to study, the principles of problems solving, critical thinking and meta-cognitive skills.

Grouping

- Study the background and profile of each student.
- Make sure that students of different backgrounds and experience are assigned in a group
- It is useful to group students of different abilities, gender, and nationalities together.
- Tutors must have the commitment to devote the time to the tutorial process.
- A good tutor is always interested in helping students to learn better.
- Sufficient resources should be made available for students to take part the PBL tutorial.
- Time management is important.

Assessment of Learning

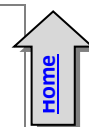
- It is important for tutors to make sure that assessment is consistent with learning objectives of the groups in PBL
- Assessment of students should not be focused only on the final leaning product.
- PBL tutors need to understand meaningful ways of assessing students' work to motivate learning.
- For assessment to be implemented properly there should be well designed and clearly defined goals and objectives and well thought out strategies, techniques, criteria, and marking schemes.

Student's Role in PBL

- Prepare students for PBL before starting the sessions.
- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PBL must be responsible for their own learning.
- Throughout the PBL process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for themselves and be free.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PBL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PBL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Inquiry Skills

- Students in PBL are expected to develop critical thinking abilities by constantly relating:
 - What they read to do?
 - What they want to do with that information?
 - They need to analyze information presented within the context of finding answers.
 - Modeling is required so that the students can observe and build a conceptual model of the required processes.
 - Formative and summative questions for evaluation:
 - How effective is?
 - How strong is the evidence for?
 - How clear is?
 - What are the justifications for thinking?
 - Why is the method chosen?
 - What is the evidence given to justify the solution?



Information Literacy

- Information literacy is an integral part of self- directed learning

Information literacy involves the ability to:

- Know when there is a need for information
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.
- Skills required by students in information literacy include:
- How to prepare the search , How to carry out the research,
- Sorting and assessing of information in general

Collaborative learning

- It is an educational approach to teaching and learning that involves
- groups of students working together to solve a problem or complete a project
- In collaborative learning, learners have the opportunity to talk with peers, exchange diverse beliefs present and defend ideas, as well as questioning other ideas.

Interpersonal Skills

- Interpersonal skills relating to group process are essential for effective problem solving and learning.
 - It is important that students are made aware of these inter personal skills.
 - Consensual decision making skills, Dialogue and discussion skills, Team maintenance skills
 - Conflict management skills and Team leadership skills.
- Students who have these skills have a better opportunity to learn than students who do not have these skills and Time Management

Resources

- Students need to have the ability to evaluate the resources used

Students have to evaluate the source of the resources used by asking the following questions:

- How current is it?, Is there any reason to suspect bias in the source?
- How credible and accurate is it?

Meta-cognitive Skills

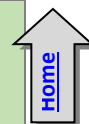
- Students need to reflect on the processes they are using during the learning process,
- Compare one strategy with another, and evaluate the effectiveness of the strategy used

Reflection Skills

- Reflection helps students refine and strengthen their high-level thinking skills and abilities through self-assessment.
- Reflection gives students opportunities to think about how they answered a question, made a decision, or solved a problem.
- What strategies were successful or unsuccessful? ,What issues need to be remembered for next time? , What could or should be done differently in the future?

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	2



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210259: Code of Conduct

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Tutorial: 01 Hours/Week	01[±]	Term work[±]: 25 Marks

Preamble:

Engineering is one of the important and cultured professions. With respect to any engineering profession, engineers are expected to exhibit the reasonable standards of integrity and honesty. Engineering is directly or indirectly responsible to create a vital impact on the quality of life for the society. Acceptably, the services provided by engineers require impartiality, honesty, equity and fairness and must give paramount importance to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the principles of ethical conduct.

Prime aim is to recognize and evaluate ethical challenges that they will face in their professional careers through knowledge and exercises that deeply challenge their decision making processes and ethics.

Course Objectives:

- To promote ethics, honesty and professionalism.
- To set standards that are expected to follow and to be aware that If one acts unethically what are the consequences.
- To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
- To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis
- To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the basic perception of profession, professional ethics, various moral and social issues, industrial standards, code of ethics and role of professional ethics in engineering field.

CO2: Aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.

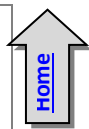
CO3: Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

CO4: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.

Course Contents

The following are the certain guidelines as far as ethics and code of conduct are concerned to be clearly and elaborately explained to the students,

Fundamental norms Engineers, in the fulfillment of their professional duties, should include paying utmost attention to the safety, health, and welfare of the society. Along with that engineers should execute the services only in their areas of competence. Whenever there is a need to issue public statements then such statements should be expressed in objective and truthful manner. Engineer should extend high sense of integrity by acting for each employer or client as faithful agents or trustees. Whatever may be the working scope engineer should conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.



As far as ethical practices are concerned engineers should not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or Code. Engineers should not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise moreover he/she should not aid or abet the unlawful practice of engineering by a person or firm.

Engineers having knowledge of any alleged violation of the Code should report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required. Engineers should disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services. Engineers should not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties. Engineers should not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.

Engineers should never falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

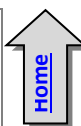
Engineers should not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They should not offer any gift or other valuable consideration in order to secure work. They should not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

There are certain obligations accompanied with engineering profession. Engineers should acknowledge their errors and should not distort or alter the facts. Candid advises in special cases are always welcome. Engineers should not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers.

Engineers should not promote their own interest at the expense of the dignity and integrity of the profession furthermore they should treat all persons with dignity, respect, fairness, and without discrimination. Engineers should at all times strive to serve the public interest. Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community. Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations. Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminar.

Engineers should not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice. They should not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action. "Sustainable development" is the challenge for the engineers meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

Following are contents to be covered in tutorial session-



1. **Introduction to Ethical Reasoning and Engineer Ethics:** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.
2. **Professional Practice in Engineering :** Global Issues -Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct
3. **Ethics as Design** - Doing Justice to Moral Problems : Engineer's Responsibility for Safety - Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk
4. **Workplace Responsibilities and Rights** - Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination
5. **Computers, Software, and Digital Information**
6. **Responsibility for the Environment**

#Exemplar/Case Studies :

General Motors ignition switch recalls (2014), Space Shuttle Columbia disaster (2003), Space Shuttle Challenger disaster (1986), Therac-25 accidents (1985 to 1987), Chernobyl disaster (1986), Bhopal disaster (1984), Kansas City Hyatt Regency walkway collapse (1981)

Guidelines for Conduction:

The course will exemplify the budding engineers the Code of Conduct and ethics pertaining to their area and scope of their work. The Instructor/Teacher shall explain the students the importance and impact of the ethics and code of conduct.

Confined to various courses and project/mini-project development the possible vulnerabilities and threats need to be elaborated and the students' participation need to be encouraged in designing such document explicitly mentioning Code of Conduct and Disclaimers.

Suggested set of Activities

1. **Purpose**-Introduce the concept of Professional Code of Conduct
Method – Using Group Discussion as a platform, ask students to share one practice in their family / home that everyone has to follow. For ex. not wearing footwear in the house, taking a bath first thing in the morning, seeking blessings from elders, etc. Connect this Code of Conduct in their family to one that exists in the professional world
Outcome – Awareness of profession-specific code of conduct and importance of adherence of that code specified. Ability to express opinions verbally and be empathetic to diverse backgrounds and values
2. **Purpose**-Impress upon the students, the significance of morality
Method – Role play a professional situation where an engineer is not competent and is trying to copy the work of a colleague and claim credit for that work. Ask observing students to react to that situation. Alternatively, a short video that clearly shows unethical behavior can be played and ask viewers their opinion about the situation. Note to teachers – read about Kohlber's theory and Gilligan's theory to understand levels of moral behavior
Outcome – Incite students to contemplate their own immoral behavior in public space or academic environment (like copying homework or assignment). Will coax students to introspect their own values and encourage them to choose the right path
3. **Purpose**-Highlight the importance of professional ideals like conflict management, ambition, ethical manners and accountability
Method – Each student will have to write a 200 word essay on any of above mentioned virtues of being a good professional. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate
Outcome – Learn to express one's ideas and identify and relate to good virtues. Build writing skills, improve language and gain knowledge about how to write an impactful essay



4. **Purpose**–Make students aware of proper and globally accepted ethical way to handle work, colleagues and clients
Method – Teacher can form groups of 6 – 7 students and assign them different cases (these can be accessed online from copyright free websites of B-school content)
Outcome – Develop group communication skills. Learn to speak up one’s opinion in a forum. Cultivate the habit of presenting solution-driven analytical arguments making them contributors in any team.
5. **Purpose** – Make students aware that technology can be harmful if not used wisely and ethically
Method – Conduct a quiz on various ethical dilemmas that are relevant in today’s world pertaining to privacy right, stalking, plagiarism, hacking, weaponizing technology, AI, electronic garbage creating environmental hazard etc
Outcome – Make students aware of various adverse consequences of technology development and allow them to introspect on how to use technology responsibly.
6. **Purpose** – Expose students to professional situations where engineers must use their skills ethically and for the betterment of society and nation
Method – Students in groups of 4 can be given an assignment in the earlier session to present in front of the class one specific case where they felt unethical treatment has been meted out to a person by an engineer – either as a witness, advisor, dishonesty, improper skills testimony etc. The group has to make a short presentation and also suggested plausible solutions to that situation. Q&A from other students must encouraged to allow healthy discussion
Outcome – Become aware of unethical code of conduct in the professional world and how to follow a moral compass especially when one reaches positions of power.
7. **Purpose** – Provide an insight into rights and ethical behavior.
Method – Movies like The Social Network can be played and students can be asked to discuss their opinion about collegiality, intellectual property, friendship and professional relationships
Outcome – help them look at success stories from an ethical point of view. Develop critical thinking and evaluation of circumstances.
8. **Purpose** – Make students contemplate about ideal and safe professional environment and decide on making right decisions based on codes of conduct
Method – Students can be asked to write down 5 most important codes of conduct that they feel that every computer engineer should follow. After evaluation by teacher / experts, the collection of codes can be converted into a handbook to be given to every student as a memoir to help them in their professional life.
Outcome – Introspection and think about how to shape the professional environment. Also, when they carry back with them their own codes of conduct, they could feel bound to adhere to these ethics.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities. The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;
 - Add photos of the activity;(optional)
 - Add a title page to the beginning of your report;
 - Write in clear and objective language; and
 - Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/Activities- Active participation and proactive learning 50% and report 20%)

Term Work Assessment Guidelines

Students must submit the report of all conducted activities conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;
 - Add photos of the activity;(optional)
 - Add a title page to the beginning of your report;
 - Write in clear and objective language; and
 - Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Active participation and proactive learning 50% and report 20%)

Web Links:

- <https://www.ieee.org/about/compliance.html>
- <https://www.cs.cmu.edu/~bmclaren/ethics/caseframes/91-7.html>
- <https://www.nspe.org/>
- http://www.ewh.ieee.org/soc/pes/switchgear/presentations/tp_files/2017-1_Thurs_Shiffbauer_Singer_Engineering_Ethics.pdf

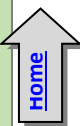
MOOC/ Video lectures available at:

- https://swayam.gov.in/nd1_noc20_mg44/preview

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	2	-	-	-	-
CO2	-	-	-	-	-	-	2	2	-	-	-	-
CO3	-	-	-	-	-	-	3	2	-	-	-	-
CO4	-	-	-	-	-	-	2	3	-	-	-	-

Savitribai Phule Pune University
Second Year of Engineering (2019 Course)
210260: Audit Course 4



In addition to credits, it is recommended that there should be audit course in preferably in each semester starting from second year in order to supplement student's knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credits [1] and clears all the audit courses specified in the syllabus. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself. [1]

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

- | | |
|---|---|
| <ul style="list-style-type: none"> • Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations | <ul style="list-style-type: none"> • Surveys • Mini-Project • Hands on experience on focused topic |
|---|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 4 Options

Audit Course Code	Audit Course Title
AC4-I	Water Management
AC4-II	Intellectual Property Rights and Patents
AC4-III	The Science of Happiness
AC4-IV	Stress Relief: Yoga and Meditation
AC4-V	Foreign Language (one of Japanese/Spanish/French/German) Course contents for Japanese(Module 2) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier. [1]
<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>
http://www.unipune.ac.in/university_files/syllabi.htm

AC4-I: Water Management

Water is a vital resource for all life on the planet. Only three percent of the water resources on Earth are fresh and two-thirds of the freshwater is locked up in ice caps and glaciers. One fifth of the remaining one percent is in remote, inaccessible areas. As time advances, water is becoming scarcer and having access to clean, safe, drinking water is limited among countries. Pure water supply and disinfected water treatment are prerequisites for the well-being of communities all over the world. One of the biggest concerns for our water-based resources in the future is the sustainability of the current and even future water resource allocation. This course will provide students a unique opportunity to study water management activities like planning, developing, distributing and optimum use of water resources. This course covers the topics that management of water treatment of drinking water, industrial water, sewage or Wastewater, management of water resources, management of flood protection.

Course Objectives

- To develop understanding of water resources.
- To study global water cycle and factors that affect this cycle.
- To analyze the process for water resources and management.
- To study the research and development areas necessary for efficient utilization and management of water resources.

Course Outcomes

On completion of the course, learner will be able to–

CO1: Understand the global water cycle and its various processes

CO2: Understand climate change and their effects on water systems

CO3: Understand Drinking treatment and quality of groundwater and surface water

CO4: Understand the Physical, chemical, and biological processes involved in water treatment and distribution.

Course Contents

1. Understanding 'water'-Climate change and the global water cycle, understanding global hydrology
2. Water resources planning and management-Water law and the search for sustainability: a comparative analysis, Risk and uncertainty in water resources planning and management
3. Agricultural water use -The role of research and development for agriculture water use
4. Urban water supply and management - The urban water challenge, Water sensitive urban design

References:

1. R. Quentin Graft, Karen Hussey, Quentin Graft, Karen Hussey, Publisher, "Water Resources Planning and Management", Cambridge University Press, ISBN: 9780511974304, 9780521762588.
2. P. C. Basil, "Water Management in India", ISBN: 8180690970, 2004.
3. C.A. Brebbia, "Water Resources Management", ISBN: 978-1-84564-960-9, 978-1-84564-961-6.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	1	-	-	-	-	-
CO2	-	-	-	-	-	-	2	-	-	-	-	1
CO3	-	-	-	-	-	-	1	-	-	-	-	
CO4	-	-	-	-	-	2	2	-	-	-	-	2

AC4-II: Intellectual Property Rights and Patents

Intellectual property is the area of law that deals with protecting the rights of those who create original works. It covers everything from original plays and novels to inventions and company identification marks. The purpose of intellectual property laws is to encourage new technologies, artistic expressions and inventions while promoting economic growth.

Innovation and originality have great potential value. Whatever line of activity you are engaged in, future success depends on them. The last few years have seen intellectual property rights become an issue of general interest: the smart phone “patent wars”, the introduction of Digital Rights management (DRM) and the rise of generic pharmaceuticals and open-source software are just some examples that have been in the public eye. Protecting your intellectual rights appropriately should be at a priority. Yet too many people embark on their chosen professions without even a basic awareness of intellectual property.

Course Objectives:

- To encourage research, scholarship, and a spirit of inquiry
- To encourage students at all levels to develop patentable technologies.
- To provide environment to the students of the Institute for creation, protection, and commercialization of intellectual property and to stimulate innovation.

Course Outcomes:

On completion of the course, learner will be able to–

- CO1: Understand** the fundamental legal principles related to confidential information, copyright, patents, designs, trademarks and unfair competition
- CO2: Identify, apply and assess** principles of law relating to each of these areas of intellectual property
- CO3: Apply** the appropriate ownership rules to intellectual property you have been involved in creating

Course Contents

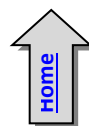
- 1. Introduction to Intellectual Property Law**–The Evolutionary Past–The IPRT Tool Kit–Para-Legal Tasks in Intellectual Property Law
- 2. Introduction to Trade mark** – Trade mark Registration Process – Post registration Procedures -Trade mark maintenance - Transfer of Rights – Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark
- 3. Introduction to Copyrights** – Principles of Copyright Principles -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer and duration – Right to prepare Derivative works
- 4. Introduction to Trade Secret**–Maintaining Trade Secret–Physical Security–Employee Limitation - Employee confidentiality agreement

Reference:

1. Debirag E. Bouchoux, “Intellectual Property” Cengage learning, New Delhi, ISBN-10:1111648573
2. Ferrera, Reder, Bird, Darrow, “Cyber Law. Texts and Cases”, South-Western’s Special Topics Collections, ISBN:0-324-39972-3
3. Prabhuddha Ganguli, “Intellectual Property Rights”, Tata Mc-Graw–Hill, New Delhi, ISBN-10:0070077177

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	1	-	-	-	1
CO2	-	-	-	-	-	-	-	2	-	-	-	1
CO3	-	-	-	-	-	-	-	1	-	-	-	1



AC4-III: The Science of Happiness

Everybody wants to be happy. One can explore innumerable ideas about what happiness is and how we can get some. But not many of those ideas are based on science. That's where this course comes in. The subject "Science of Happiness" aims to teach the pioneering science of positive psychology, which explores the ancestry of a happy and meaningful life. Clinical psychologists have been dealing with miserable feelings since their discipline was established. In the last 30 years, neuroscientists have made major headway in the understanding of the sources of anger, depression, and fear.

Today, whole industries profit from this knowledge—producing pills for every sort of pathological mood disturbance. But until recently, few neuroscientists focused on the subject of happiness. This course focuses on discovering how cutting-edge research can be applied to their lives. Students will learn about the Intra-disciplinary research supporting this view, spanning the fields of psychology, neuroscience, evolutionary biology, and beyond. The course offers students practical strategies for tapping into and nurturing their own happiness, including trying several research-backed activities that foster social and emotional well-being, and exploring how their own happiness changes along the way.

Course Objectives

- To understand the feeling of happiness
- To study the sources of positive feelings
- To analyze the anatomy of the happiness system
- To study the effect of thoughts and emotions on the happiness system

Course Outcomes

On completion of the course, learner will be able to—

CO1: Understand what happiness is and why it matters to you

CO2: Learn how to increase your own happiness

CO3: Understand of the power of social connections and the science of empathy

CO4: Understand what is mindfulness and its real world applications

Course Contents

1. Happiness: what is it? , 2. The secret of smiling
3. The autonomy of positive feelings
4. Positive feelings as a compass
5. The happiness system
6. Foundations: Emotions, Motivation and nature of Wellbeing
7. Subjective well being
8. Love and well being
9. Optimal well being
10. Religion, Spirituality and wellbeing

References:

1. Happier, Stefan Klein, "The Science of Happiness, How Our Brains Make Us Happy and what We Can Do to Get", Da Capo Press, ISBN 10: 156924328X, 13: 978-1569243282.
2. C. Compton, Edward Hoffman, "Positive Psychology: The Science of Happiness and Flourishing", William, Cengage Learning, 2012, ISBN10: 1111834121.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	1	-	-	-	-	-	-	-	1
CO2	-	-	-	1	-	-	-	-	-	-	-	2
CO3	-	-	-	-	-	-	1	-	1	-	-	2
CO4	-	-	-	-	-	-	-	-	-	-	-	2

AC4-IV: Yoga and Meditation

The concepts and practices of Yoga originated in India about several thousand years ago. Its founders were great Saints and Sages. The great Yogis presented rational interpretation of their experiences of Yoga and brought about a practical and scientifically sound method within every one's reach. Yoga today, is no longer restricted to hermits, saints, and sages; it has entered into our everyday lives and has aroused a worldwide awakening and acceptance in the last few decades. The science of Yoga and its techniques have now been reoriented to suit modern sociological needs and lifestyles.

Yoga is one of the six systems of Vedic philosophy. The Yoga advocates certain restraints and observances, physical discipline, breathe regulations, restraining the sense organs, contemplation, meditation and Samadhi. The practice of Yoga prevents psychosomatic disorders and improves an individual's resistance and ability to endure stressful situations.

Course Objectives:

- To impart knowledge about the basic technique and practice of yoga, including instruction in breath control, meditation, and physical postures
- To gain an intellectual and theoretical understanding of the principles embodied in the Yoga Sutras, the Bhagavad-Gita, and other important texts and doctrines
- Relaxation and stress reduction ,Personal insight and self understanding, Personal empowerment, Gaining wisdom and spiritual discernment
- Awakening the abilities or powers of the Super conscious mind

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand philosophy and religion as well as daily life issues will be challenged and enhanced.

CO2: Enhances the immune system.

CO3: Intellectual and philosophical understanding of the theory of yoga and basic related Hindu scriptures will be developed.

CO4: Powers of concentration, focus, and awareness will be heightened.

Course Contents

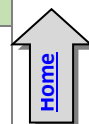
1. Meaning and definition of yoga – Scope of Yoga - Aims and Objectives of Yoga – Misconception about yoga.
2. Ayurveda: an introduction to this system of health care derived from the Vedic tradition Anatomy and Physiology as they relate to Yoga
3. Yoga Philosophy and Psychology

References:

1. B.K.S. Iyengar, "BKS Iyengar Yoga The Path to Holistic Health" , DK publisher, ISBN-13: 978-1409343479
2. Osho, "The Essence of Yoga", Osho International Foundation, ISBN: 9780918963093

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	2	-	-	2	-	-	-
CO2	-	-	-	-	-	2	1	-	-	-	-	-
CO3	-	2	-	-	-	2	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	2	-	-	-	-



AC4-V: Foreign Language (Japanese) Module 2

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best... suited Language!!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course learner will-

1. have ability of basic communication.
2. have the knowledge of Japanese script.
3. get introduced to reading , writing and listening skills
4. develop interest to pursue professional Japanese Language course

Course Contents

1. Katakana basic Script, Denoting things (nominal and pre nominal demonstratives), Purchasing at the Market / in a shop / mall (asking and stating price)
2. Katakana : Modified kana, double consonant, letters with ya, yu, yo, Long vowels, Describing time, describing starting and finishing time (kara ~ made), Point in time (denoting the time when any action or the movement occurs)
3. Means of transport (Vehicles), Places, Countries, Stating Birth date, Indicating movement to a certain place by a vehicle.

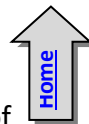
References:

1. Minna No Nihongo, "Japanese for Everyone", (Indian Edition), Goyal Publishers and Distributors Pvt. Ltd.
2. <http://www.tcs.com> (http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japan-centric-Delivery-Center-Pune.aspx)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1

Acknowledgement



It is with great pleasure and honor that I share the curriculum for Second Year of Computer Engineering (2019 Course) on behalf of Board of Studies (BoS), Computer Engineering. We, members of BoS are giving our best to streamline the processes and curricula design at both UG and PG programs.

It is always the strenuous task to balance the curriculum with the blend of core courses, current developments and courses to understand social and human values. By considering all the aspects with adequate prudence the contents are designed satisfying most of the necessities as per AICTE guidelines and to make the graduate competent enough as far as employability is concerned. I sincerely thank all the minds and hands who work adroitly to materialize these tasks. I really appreciate everyone's contribution and suggestions in finalizing the contents.

Success is sweet. But it's sweeter when it's achieved thorough co-ordination, cooperation and collaboration. I am overwhelmed and I feel very fortunate to be working with such a fabulous team- the Members of Board of Studies, Computer Engineering!

Even in these anxious situation, during the time of this unfortunate pandemic, each and every person, including the course coordinators and their team members, have worked seamlessly to come up with this all inclusive curriculum for Second Year of Computer Engineering.

Thank you to all of you for delivering such great teamwork. I don't think it would have been possible to achieve the goal without each and every one of your efforts! I would like to express my deep gratitude to Dr. Rajesh Prasad (SITS), member BoS, Computer Engineering, for coordinating the complete activity and getting it to completion in a smooth manner.

I deeply appreciate and thank the managements of various colleges affiliated to SPPU for helping us in this work. These colleges have helped us by arranging sessions for preliminary discussion in the initial stage and at the same time in conducting Faculty Development Programs for various courses of the revised curriculum. All your support is warmly appreciated.

I sincerely appreciate, the hard work put in by the [course coordinators and their team](#) members, without your intellectual work and creative mind, and it would have not been possible to complete this draft. You have been a valuable member of our team!

Special thanks are due to Dr. Parikshit Mahalle, Dr. Swati Bhavsar and Dr. Jayashri Prasad for helping with the formatting and crisp presentation of this draft. I would like to thank you from the core of my heart. Thank you for always being your best selves and contributing to the work.

I am thankful to Dr. Nuzhat Shaikh, for the time she has spent in critically reading the draft and giving the final touches. I appreciate her initiative and thank her for her time, patience and hard work!

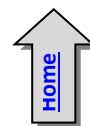
Thank you all, for not only your good work but also for all the support you have given each other throughout the drafting process, that's what makes the team stronger! You took the meaning of teamwork to a whole new level.

Thank you for all your efforts!

Professor (Mrs) Varsha H. Patil

Chairman, Board of Studies (BoS), Computer Engineering, Faculty of Science and Technology, Savitribai Phule Pune University.

BoS Members- Dr. Shirish Sane, Dr. Sunil Bhirud, Dr. Manik Dhore, Dr. Rajesh Prasad, Dr. Girish Khilari, Dr. Sachin Lodha, Dr. Parikshit Mahalle, Dr. Pramod Patil, Dr. Venkatesharan, Dr. Geetanjali Kale, Dr. Suhasini Itkar, Dr. R. V. Patil and Dr. P. M. Yawalkar.

Task Force at Curriculum Design**1. Advisors, the Team of Board of Studies-**

Dr. Varsha Patil (Chairman), Dr. Shirish Sane, Dr. Sunil Bhirud, Dr. Manik Dhore, Dr. Rajesh Prasad, Dr. Girish Khilari, Dr. Sachin Lodha, Dr. Parikshit Mahalle, Dr. Pramod Patil, Dr. Venkatesharan, Dr. Geetanjali Kale, Dr. Suhasini Itkar, Dr. R. V. Patil and Dr. P. M. Yawalkar.

2. Team Leader- Dr. Rajesh Prasad**3. Teams, Course Design-**

Name of Course	Team Leaders	Team Members	
Discrete Mathematics	Dr. Nihar Ranjan Dr. Mrs. Archana Chaugule	Dr. S. K. Pathan Dr. Mrs. Snehal Kamapur Dr. Mrs. Shital Sonawane	Dr. V. S. Pawar Dr. Kailash Shaw Prof. Ravindra Rathore
Fundamental of Data Structure & Lab	Dr. S R Dhore Dr. Prashant Dhotre	Dr. Mrs. Gitanjali Shinde Dr. Mrs. A. P. Kale Prof. Anupama Phakatkar	Dr. Vinayak Kottawar Prof. Ajitkumar Shitole Prof. Ms. Snehal Kulkarni
Object Oriented Programming	Dr. Amol Dhumane Dr. Mrs. S. K. Wagh	Prof. D. D. Sapkal Prof. Ms. Poojashree Vidap Prof. K. M. Sanghavi	Dr. Mrs. R. A. Satao Dr. Mrs. Swati Bhavsar Dr. Mrs. Chiwhane
Computer Graphics & Lab	Dr. Mrs. N. F. Shaikh	Prof. P. P. Vaidya Prof. Dr. Aparna Junnarkar	Dr. Shabnam Farook Sayyad Prof. Mrs. Laxmi Sisode
Digital Electronics and Logic Design & Lab	Dr. Mrs. C. R. Jadhav Dr. V. V. Kimbahune	Prof. M. B. Lonare Prof. Mrs. M.S. Pokale Dr A. R. Buchade	Dr. Nilesh Sabale Prof. Ms. Ila Sawant
Humanities and Social Studies & Code of Conduct	Dr. Mrs. R. A. Khan	Prof. Mrs. Vaidehi Banerjee Prof. N. L. Bhale	Prof. S. P. Pingat Mr. Ranjeet Gawande
Data Structures and Algorithms & Lab	Dr. Mrs. G. S. Navale Dr. S. D. Babar	Dr. K. C. Nalavade Dr Mrs. A. R. Deshpande Prof. Ms. Pallavi Baviskar	Prof. Mrs. S. M. Bhadkumbhe Prof. Ms. Neha Patil
Software Engineering	Dr. Mrs. J. R. Prasad	Dr. Mrs. Manjusha Joshi Prof. Ms. Deipali Gore	Dr. Hanchate D.B. Prof. Sachin Shinde Ms. Poonam Dholi
Microprocessor & Lab	Dr. Sunil M. Sangve Dr. Sable Nilesh P.	Prof. Mrs. S.A. Joshi Dr. K. N. Honwadkar Prof. Mahendra Salunke	Prof. Nitin M. Shahane Prof. N. L. Bhale Prof. Uday C. Patkar
Principles of Programming Languages	Dr. Mrs. Jyoti Rao	Dr. J. R. Pansare Prof. Mrs. P. P. Joshi Prof. Mrs. Sonali Lunavat Prof. Ms. Geeta R Gupta Prof. Mrs. Snehal Patil	Prof. Mrs. Vaishali Latke Prof. Santosh Nagargoje Prof. Vaibhav Muddebhalkar Prof. Phadtare Tushar T
Project Based Learning	Dr. Mrs. Manisha Bhende Dr. Chaudhari Manohar	Dr. Saumitra Das Dr. D. T. Mane Dr. Swati Bhavsar	Prof. Subhash Rathod Prof. Mrs. Swati Shinde Prof. Kushal P. Birla Mr. Pravin Andhale

[Back to Table of Contents](#)

Curriculum for Third Year of Computer Engineering (2019 Course)

(With effect from 2021-22)



<http://unipune.ac.in>

Faculty of Science and Technology

**Savitribai Phule Pune University
Maharashtra, India**

Third Year of Computer Engineering (2019 Course) (With effect from 2021-22)

Prologue

It is with great pleasure and honor that I share the syllabi for Third Year of Computer Engineering (2019 Course) on behalf of Board of Studies, Computer Engineering. We, members of BoS are giving our best to streamline the processes and curricula design.

While revising syllabus, honest and sincere efforts are put to tune Computer Engineering program syllabus in tandem with the objectives of Higher Education of India, AICTE, UGC and affiliated University (SPPU) by keeping an eye on the technological advancements and industrial requirements globally.

Syllabus revision is materialized with sincere efforts, active participation, expert opinions and suggestions from domain professionals. Sincere efforts have been put by members of BoS, teachers, alumni, industry experts in framing the draft with guidelines and recommendations.

Case Studies are included in almost all courses. Course Instructor is recommended to discuss appropriate related recent technology/upgrade/Case Studies to encourage students to study from course to the scenario and think through the largest issues/recent trends/ utility/ developing real world/ professional skills.

I am sincerely indebted to all the minds and hands who work adroitly to materialize these tasks. I really appreciate your contribution and suggestions in finalizing the contents.

Thanks,

Dr. Varsha H. Patil

Chairman, Board of Studies (Computer Engineering), SPPU, Pune

links for First and Second Year Computer Engineering Curriculum 2019:

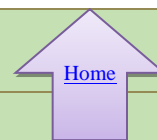
1. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/Rules%20and%20Regulations%20F.E.%202019%20Patt_10.012020.pdf
2. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/First%20Year%20Engineering%202019%20Patt.Syllabus_05.072019.pdf
3. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus2020/SE%20Computer%20Engg.%202019%20%20Patt_03.072020.pdf

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2021-22)

Table of Contents

Sr. No.	Title	Page Number
1.	Program Outcomes	04
2.	Program Specific Outcomes	04
3.	Course Structure (Course titles, scheme for teaching, credit, examination and marking)	05
4.	General Guidelines	07
5.	Course Contents (Semester V)	
	310241: Database Management Systems	10
	310242: Theory of Computation	13
	310243: Systems Programming and Operating System	16
	310244: Computer Networks and Security	19
	310245A: Elective I- Internet of Things and Embedded Systems	22
	310245B: Elective I- Human Computer Interface	25
	310245C: Elective I- Distributed Systems	28
	310245D: Elective I- Software Project Management	31
	310246: Database Management Systems Laboratory	33
	310247: Computer Networks and Security Laboratory	37
	310248: Laboratory Practice I	40
	310249: Seminar and Technical Communication	44
	310250: Audit Course 5	46
6.	Course Contents (Semester VI)	
	310251: Data Science and Big Data Analytics	53
	310252: Web Technology	56
	310253: Artificial Intelligence	59
	310254A: Elective II- Information Security	62
	310254B: Elective II- Augmented and Virtual Reality	65
	310254C: Elective II- Cloud Computing	68
	310254D: Elective II- Software Modeling and Architectures	71
	310255: Internship	74
	310256: Data Science and Big Data Analytics Laboratory	77
	310257: Web Technology Laboratory	82
	310258: Laboratory Practice II	85
	310259: Audit Course 6	91
7.	Acknowledgement	97
8.	Task Force at Curriculum Design	98

Savitribai Phule Pune University
Bachelor of Computer Engineering



Program Outcomes (POs)

Learners are expected to know and be able to

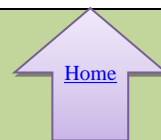
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.
PO3	Design / Development of Solutions	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
PO4	Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and Sustainability	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of Engineering practice.
PO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication Skills	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project Management and Finance	Demonstrate knowledge and understanding of Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.
PO12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

A graduate of the Computer Engineering Program will demonstrate-

PSO1	Professional Skills- The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities.
PSO2	Problem-Solving Skills- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
PSO3	Successful Career and Entrepreneurship- The ability to employ modern computer languages, environments and platforms in creating innovative career paths to be an entrepreneur and to have a zest for higher studies.

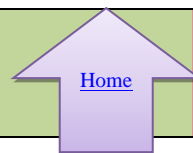
Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2021-22)



Semester V

Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
310241	Database Management Systems	03	-	-	30	70	-	-	-	100	03	-	-	03
310242	Theory of Computation	03	-	-	30	70	-	-	-	100	03	-	-	03
310243	Systems Programming and Operating System	03	-	-	30	70	-	-	-	100	03	-	-	03
310244	Computer Networks and Security	03	-	-	30	70	-	-	-	100	03	-	-	03
310245	Elective I	03	-	-	30	70	-	-	-	100	03	-	-	03
310246	Database Management Systems Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
310247	Computer Networks and Security Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
310248	Laboratory Practice I	-	04	-	-	-	25	25	-	50	-	02	-	02
310249	Seminar and Technical Communication	-	-	01	-	-	50	-	-	50	-	-	01	01
Total		15	10	01	150	350	125	50	25	700	15	05	01	21
310250	Audit Course 5												Grade	
Total Credit											15	05	01	21
310245 Elective I Options:						310250 Audit Course 5 Options:								
310245(A) Internet of Things and Embedded Systems						310250 (A) Cyber Security								
310245(B) Human Computer Interface						310250 (B) Professional Ethics and Etiquettes								
310245(C) Distributed Systems						310250 (C) Learn New Skills								
310245(D) Software Project Management						310250 (D) Engineering Economics								
						310250 (E) Foreign Language								
Laboratory Practice I														
Assignments from Systems Programming and Operating System and Elective I														

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2021-22)



Semester VI

Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		\$\$\$ Lecture	\$\$\$ Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
310251	Data Science and Big Data Analytics	04	-	-	30	70	-	-	-	100	03	-	-	03
310252	Web Technology	04	-	-	30	70	-	-	-	100	03	-	-	03
310253	Artificial Intelligence	04	-	-	30	70	-	-	-	100	03	-	-	03
310254	Elective II	04	-	-	30	70	-	-	-	100	03	-	-	03
310255	Internship**	-	-	-	-	-	100 **	-	-	100	-	-	-	04 **
310256	Data Science and Big Data Analytics Laboratory	-	04	-	-	-	50	25	-	75	-	02	-	02
310257	Web Technology Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
310258	Laboratory Practice II	-	04	-	-	-	50	25	-	75	-	02	-	02
Total		12	10	-	120	280	225	50	25	700	12	09	-	21
310259	Audit Course 6											Grade		
Total											12	09	-	21

310254 Elective II Options:

- 310254(A) [Information Security](#)
 310254(B) [Augmented and Virtual Reality](#)
 310254(C) [Cloud Computing](#)
 310254(D) [Software Modeling and Architectures](#)

310259 Audit Course 6 Options:

- 310259(A) [Digital and Social Media Marketing](#)
 310259(B) [Sustainable Energy Systems](#)
 310259(C) [Leadership and Personality Development](#)
 310259(D) [Foreign Language](#)
 310259(E) [Learn New Skills](#)

Laboratory Practice II:

Assignments from **Artificial Intelligence** and **Elective II**.

**** Internship:**

Internship guidelines are provided in course curriculum sheet.

\$\$\$ Hours/Week for Theory Course in Third Year of Engineering, Semester VI:

As per the apex bodies' recommendations and guidelines, it is need of the day to train the pre-final year students for the industrial readiness through internship. As per the guidelines of AICTE, the duration of internship is 4-6 weeks after completion of semester V and before commencement of semester VI, so it is apparent that the contact hours of the TE students need to be managed meticulously. It becomes mandatory as per the structure that 4 credits for internship must be earned by the students. **Per semester, 15 weeks duration that is suggested ideally by the affiliated university will eventually reduce to fruitful 12 weeks after the implementation of the revised curriculum (2019 Course). With the evaluatory introduction of internship in the structure, we are left with the choice of 4 theory courses in the sixth semester with 12 weeks instead of traditional 15 weeks.** To balance the credits and to achieve the minimum required contact hours, it is the reasonable choice to allot 4 hours / week for each theory course of the sixth semester of Third year of Engineering. The additional one lecture/ week will definitely be instrumental in achieving the largest of minimum contact hours. As such there is no correspondence of weekly load and credits earned, the credit allotted per course remain intact despite of the change. **So it is almost imperative that the commencement of VI Semester need to be approx. 3 weeks beyond the schedule.**

1. Every undergraduate program has its own objectives and educational outcomes. These objectives and outcomes are furnished by considering various aspects and impacts of the curriculum. The **Program Outcomes (POs)** for Engineering are categorically mentioned at the beginning of the curriculum (ref: NBA Manual). There should always be a rationale and a goal behind the inclusion of a course in the curriculum. Course Outcomes though highly rely on the contents of the course; many-a-times are generic and bundled. The **Course Objectives, Course Outcomes and CO-PO mappings matrix** justifies the motives, accomplishment and prospect behind learning the course. The Course Objectives, Course Outcomes and CO-PO Mapping Matrix are provided for reference and these are indicative only. The course instructor may modify them as per his or her perspective.
2. @: **CO and PO Mapping Matrix**(Course Outcomes and Program Outcomes)- The **expected** attainment mapping matrix at end of course contents, indicates the correlation levels of 3, 2, 1 and '-'. The notation of 3, 2 and 1 denotes substantially (high), moderately (medium) and slightly (low). The mark '-' indicates that there is no correlation between the respective CO and PO.
3. #: **Elaborated examples/Case Studies**- For each course, contents are divided into six units-I, II, III, IV, V and VI. Elaborated examples/Case Studies are included at the end of each unit to explore how the learned topics apply to real world situations and need to be explored to assist students to increase their competencies, inculcating the specific skills, building the knowledge to be applicable in any given situation along with an articulation. One or two sample exemplars or case studies are included for each unit; instructor may extend the same with more. **Exemplar/Case Studies may be assigned as self-study by students and to be excluded from theory examinations.**
4. *: For each unit contents, the desired content attainment mapping is indicated with Course Outcome(s). Instructor may revise the same as per their viewpoint.
5. For laboratory courses, set of suggested assignments is provided for reference. Laboratory Instructors may design suitable set of assignments for respective course at their level. **Beyond curriculum assignments and mini-project may be included as a part of laboratory work.** The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners.
6. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorial may be as per guidelines of authority.
7. For each course, irrespective of the examination head, the instructor should motivate students to read and publish articles, research papers related to recent development and invention in the field.
8. For laboratory, instructions have been included about the conduction and assessment of laboratory work. **These guidelines are to be strictly followed. Use of open source software is appreciated.**
9. **Term Work** ^[1]-Term work is continuous assessment that evaluates a student's progress throughout the semester ^[1]. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been

achieved. It is recommended to conduct internal monthly mock practical test as part of continuous assessment.

Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.


[Home](#)

10. Laboratory Journal- Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.

11. Tutorial ^[1] - Tutorials can never be an individual course but an additional aid to the learners. Tutorials help the learners to inculcate the contents of the course with focused efforts on small group of the learners. Tutorial conduction should concentrate more on simplifying the intricacies converging to clear understanding and application. **Assessment of tutorial work is to be done in a manner similar to assessment of term-work; do follow same guidelines.**

12. Audit Course ^[1] - The student registered for audit course shall be awarded the grade AP/PP (Audit Course Pass) and the grade 'AP'/'PP' shall be included in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP'/'PP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

13. UGC has issued the UGC (Credit Framework for online learning courses through SWAYAM) Regulation 2016 advising the Universities to identify courses where credits can be transferred on to the academic record of the students for courses done on SWAYAM. AICTE has also put out gazette notification in 2016 and subsequently for adoption of these courses for credit transfer^[2].

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity, and quality. This is done through a platform that facilitates hosting of the courses to be accessed by anyone, anywhere at any time. Courses delivered through SWAYAM are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However, learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated center on specified dates. Eligibility for the certificate is generally announced on the course page. Universities/colleges approving credit transfer for these courses can use the marks/certificate obtained in these courses for the same.^[2]

For more rules, pattern and assessment of semester examination refer^[1]

14. **Internship:

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

[1][http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/Rules%20and%20Regulations%20F.E.%202019%20Part 10.012020.pdf](http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/Rules%20and%20Regulations%20F.E.%202019%20Part%2010.012020.pdf)

[2] <https://swayam.gov.in/about>

Abbreviations		
TW: Term Work	TH: Theory	PR: Practical
OR: Oral	TUT: Tutorial	Sem: Semester

Semester V

Savitribai Phule Pune University

Third Year of Computer Engineering (2019 Course)

310241: Database Management Systems


[Home](#)
Teaching Scheme:**Theory: 03 Hours/Week****Credit: 03****Examination Scheme:****Mid-Sem (TH) : 30 Marks****End-Sem (TH): 70 Marks****Prerequisites Courses:** Discrete Mathematics (210241), Data Structures and Algorithms (210252)**Companion Course:** Database Management Systems Laboratory (310246)**Course Objectives:**

- To understand the fundamental concepts of Database Management Systems
- To acquire the knowledge of database query languages and transaction processing
- To understand systematic database design approaches
- To acquire the skills to use a powerful, flexible, and scalable general-purpose databases to handle Big Data
- To be familiar with advances in databases and applications

Course Outcomes:

On completion of the course, learners should be able to

CO1: Analyze and design Database Management System using ER model**CO2:** Implement database queries using database languages**CO3:** Normalize the database design using normal forms**CO4:** Apply Transaction Management concepts in real-time situations**CO5:** Use NoSQL databases for processing unstructured data**CO6:** Differentiate between Complex Data Types and analyze the use of appropriate data types**Course Contents****Unit I****Introduction to Database Management Systems and ER Model****06 Hours**

Introduction, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models. **Database Design and ER Model:** Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity-Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting ER and EER diagram into tables.

#Exemplar/Case Studies

Analyze and design database using ER Model for any real-time application and convert the same into tables.

***Mapping of Course Outcomes for Unit I**

CO1

Unit II**SQL and PL/SQL****07 Hours**

SQL: Characteristics and Advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators. **Tables:** Creating, Modifying, Deleting, Updating. **SQL DML Queries:** SELECT Query and clauses, Index and Sequence in SQL. **Views:** Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries. **PL/SQL:** Concept of Stored Procedures and Functions, Cursors, Triggers, Assertions, Roles and Privileges.

#Exemplar/Case Studies

Implementation of Unit 1 case study using SQL and PL/SQL.

*Mapping of Course Outcomes for Unit II	CO1, CO2	
Unit III	Relational Database Design	06 Hours
Relational Model: Basic concepts, Attributes and Domains, CODD's Rules. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF.		
#Exemplar/Case Studies	Normalize relational database designed in Unit I.	
*Mapping of Course Outcomes for Unit III	CO1, CO3	
Unit IV	Database Transaction Management	07 Hours
Introduction to Database Transaction, Transaction states, ACID properties, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Lock-based, Time-stamp based Deadlock handling. Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints. Log-Based Recovery: Deferred Database Modifications and Immediate Database Modifications.		
#Exemplar/Case Studies	Study of Transaction Management in Postgre SQL	
*Mapping of Course Outcomes for Unit IV	CO3, CO4	
Unit V	NoSQL Databases	07 Hours
Introduction to Distributed Database System, Advantages, Disadvantages, CAP Theorem. Types of Data: Structured, Unstructured Data and Semi-Structured Data. NoSQL Database: Introduction, Need, Features. Types of NoSQL Databases: Key-value store, document store, graph, wide column stores, BASE Properties, Data Consistency model, ACID Vs BASE, Comparative study of RDBMS and NoSQL. MongoDB (with syntax and usage): CRUD Operations, Indexing, Aggregation, MapReduce, Replication, Sharding.		
#Exemplar/Case Studies	Use of NoSQL databases for processing unstructured data from social media.	
*Mapping of Course Outcomes for Unit V	CO5, CO6	
Unit VI	Advances in Databases	07 Hours
Emerging Databases: Active and Deductive Databases, Main Memory Databases, Semantic Databases. Complex Data Types: Semi-Structured Data, Features of Semi-Structured Data Models. Nested Data Types: JSON, XML. Object Orientation: Object-Relational Database System, Table Inheritance, Object-Relational Mapping. Spatial Data: Geographic Data, Geometric Data.		
#Exemplar/Case Studies	Applications of advanced databases in real time environment.	

***Mapping of Course Outcomes for Unit VI**

CO5, CO6

Learning Resources**Text Books :**

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626

Reference Books :

1. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
2. S.K.Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9
4. Adam Fowler, "NoSQL For Dummies", John Wiley & Sons, ISBN-1118905628
5. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emerepty Limited, ISBN: 1743045743, 9781743045749
6. Joy A. Kreibich, "Using SQLite", O'REILLY, ISBN: 13:978-93-5110-934-1
7. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications ISBN: 9788176569644, 9788176569644
8. Seema Acharya, "Demystifying NoSQL", Wiley Publications, ISBN: 9788126579969

e-Books :

1. SQL and Relational Theory
 - a. (How to Write Accurate SQL code), C.J. Date, O'REILLY Publication
2. SQL A Beginner's Guide, Andy Oppel, Robert Sheldon, McGraw Hill Publication

MOOCs Courses Links:

- <http://www.nptelvideos.com/lecture.php?id=6518>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	2	3	1	-	-	-	1	-	-	-	3
CO2	-	2	3	-	-	2	-	-	-	-	-	3
CO3	-	2	3	-	1	-	-	-	-	-	-	3
CO4	2	2	2	2	-	-	-	-	-	1	-	3
CO5	-	2	3	-	-	-	-	-	-	-	1	3
CO6	2	2	-	-	-	-	1	-	2	-	1	1

Savitribai Phule Pune University Third Year of Computer Engineering (2019 Course) 310242: Theory of Computation		
Teaching Scheme: Theory: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
Prerequisites Courses: Discrete Mathematics (210241)		
Companion Course: --		
Course Objectives: <ul style="list-style-type: none"> To introduce the students to basics of Theory of Computation To study abstract computing models to provide a formal connection between algorithmic problem solving and the theory of languages To understand Grammar, Pushdown Automata and Turing Machine for language processing and algorithm design To learn about the theory of computability and complexity for algorithm design 		
Course Outcomes: After completion of the course, learners should be able to CO1: Understand formal language, translation logic, essentials of translation, alphabets, language representation and apply it to design Finite Automata and its variants CO2: Construct regular expression to present regular language and understand pumping lemma for RE CO3: Design Context Free Grammars and learn to simplify the grammar CO4: Construct Pushdown Automaton model for the Context Free Language CO5: Devise Turing Machine for the different requirements outlined by theoretical computer science CO6: Analyze different classes of problems, and study concepts of NP completeness		
Course Contents		
Unit I	Formal Language Theory and Finite Automata	07 Hours
Finite Automata (FA): An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language. FA without output: Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion. Minimization of DFAs. FA with output: Moore and Mealy machines -Definition, models, inter-conversion.		
#Exemplar/Case Studies	FSM for vending machine, spell checker	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Regular Expressions (RE)	07 Hours
Introduction, Operators of RE, Precedence of operators, Algebraic laws for RE, Language to Regular Expressions, Equivalence of two REs. Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages. Myhill-Nerode theorem.		
#Exemplar/Case Studies	RE in text search and replace	

*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Context Free Grammar (CFG) and Context Free Language(CFL)	07 Hours
Basic Elements of Grammar, Formal Definition of Context Free Grammar, Sentential form, Derivation and Derivation Tree/ Parse Tree, Context Free Language (CFL), Ambiguous Grammar, writing grammar for language. Simplification of CFG: Eliminating ϵ -productions, unit productions, useless production, and useless symbols. Normal Forms: Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for CFG, Closure properties of CFL, Decision properties of CFL, Chomsky Hierarchy, Cock-Younger-Kasami Algorithm.		
#Exemplar/Case Studies	Parser, CFG for Palindromes, Parenthesis Match	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Pushdown Automata (PDA)	07 Hours
Introduction, Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs CFLs. Deterministic CFLs.		
#Exemplar/Case Studies	Parsing and PDA: Top-Down Parsing, Bottom-up Parsing simulation showing use of PDA	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Turing Machines (TM)	07 Hours
Turing Machine Model, Formal definition of Turing Machines, Language Acceptability by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction, Computing function with Turing Machine, Variants of Turing Machines, Halting Problem of TM, Halting vs Looping, A Turing-unrecognizable language, Reducibility, Recursion Theorem. The Model of Linear Bounded Automata.		
#Exemplar/Case Studies	Algorithms using Turing Machine	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Computability and Complexity Theory	07 Hours
Computability Theory: Decidable Problems and Un-decidable Problems, Church-Turing Thesis. Reducibility: Undecidable Problems that is recursively enumerable, A Simple Un-decidable problem. Complexity Classes: Time and Space Measures, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and NP-hard Problems.		
#Exemplar/Case Studies	Traveling salesman problem, Post Correspondence Problem (PCP)	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1
2. Daniel Cohen, "Introduction to Computer Theory", Wiley & Sons, ISBN 97881265133454

Reference Books:

1. Sanjeev Arora and Boaz Barak, "Computational Complexity: A Modern Approach", Cambridge University Press, ISBN: 0521424267 97805214242643
2. John Martin, "Introduction to Languages and The Theory of Computation", 2nd Edition, McGrawHill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5
3. J. Carroll & D Long, "Theory of Finite Automata", Prentice Hall, ISBN 0-13-913708-45
4. Kavi Mahesh, "Theory of Computation: A Problem-Solving Approach", Wiley India, ISBN 1081265331106
5. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, ISBN-13: 97811331878137
6. Vivek Kulkarni, "Theory of Computation", Oxford University Press, ISBN 0-19-808458

e-Books :

- <https://cglab.ca/~michiell/TheoryOfComputation/TheoryOfComputation.pdf>
- https://www.cs.virginia.edu/~robins/Sipser_2006_Second_Edition_Problems.pdf
- [http://ce.sharif.edu/courses/94-95/1/ce414-2/resources/root/Text%20Books/Automata/John%20E.%20Hopcroft,%20Rajeev%20Motwani,%20Jeffrey%20D.%20Ullman-Introduction%20to%20Automata%20Theory,%20Languages,%20and%20Computations-Prentice%20Hall%20\(2006\).pdf](http://ce.sharif.edu/courses/94-95/1/ce414-2/resources/root/Text%20Books/Automata/John%20E.%20Hopcroft,%20Rajeev%20Motwani,%20Jeffrey%20D.%20Ullman-Introduction%20to%20Automata%20Theory,%20Languages,%20and%20Computations-Prentice%20Hall%20(2006).pdf)

MOOCs Courses Links:

- <https://nptel.ac.in/courses/106/104/106104148/>
- <https://nptel.ac.in/courses/106/104/106104028/>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2	1	-	-	-	-	-	-	2
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	2	1	-	-	-	-	-	-	2
CO6	3	3	3	3	1	-	-	-	-	-	-	1

Savitribai Phule Pune University**Third Year of Computer Engineering (2019 Course)**
310243: Systems Programming and Operating System[Home](#)**Teaching Scheme:****Credit: 03****Examination Scheme:****Theory: 03****Mid-Sem (TH) : 30 Marks****Hours/Week****End-Sem (TH): 70 Marks****Prerequisites Courses:** Programming and Problem Solving (110005), Data Structures and Algorithms (210252), Principles of Programming Languages (210255), Microprocessor (210254)**Companion Course:** Laboratory Practice I (310248)**Course Objectives:**

- To get acquainted with the basics of System Programming
- To acquire knowledge of data structures used in the design of System Software
- To be familiar with the format of object modules, the functions of linking, relocation, and loading
- To comprehend the structures and functions of Operating Systems and process management.
- To deal with concurrency and deadlock in the Operating System
- To learn and understand memory management of Operating System

Course Outcomes:

On completion of the course, learners should be able to

CO1: Analyze and synthesize basic System Software and its functionality.**CO2:** Identify suitable data structures and Design & Implement various System Software**CO3:** Compare different loading schemes and analyze the performance of linker and loader**CO4:** Implement and Analyze the performance of process scheduling algorithms**CO5:** Identify the mechanism to deal with deadlock and concurrency issues**CO6:** Demonstrate memory organization and memory management policies**Course Contents**

Unit I	Introduction	08 Hours
<p>Introduction to Systems Programming, Need of Systems Programming, Software Hierarchy, Types of software: system software and application software, Machine structure.</p> <p>Evolution of components of Systems Programming: Text Editors, Assembler, Macros, Compiler, Interpreter, Loader, Linker, Debugger, Device Drivers, Operating System. Elements of Assembly Language Programming: Assembly Language statements, Benefits of Assembly Language, A simple Assembly scheme, Pass Structure of Assembler.</p> <p>Design of two pass Assembler: Processing of declaration statements, Assembler Directives and imperative statements, Advanced Assembler Directives, Intermediate code forms, Pass I and Pass II of two pass Assembler.</p>		
#Exemplar/Case Studies	Study of Debugging tools like GDB	
*Mapping of Course Outcomes for Unit I	CO1, CO2, CO3	
Unit II	Macro Processor and Compilers	06 Hours
<p>Introduction, Features of a Macro facility: Macro instruction arguments, Conditional Macro expansion, Macro calls within Macros, Macro instructions, Defining Macro, Design of two pass Macro processor, Concept of single pass Macro processor.</p> <p>Introduction to Compilers: Phases of Compiler with one example, Comparison of Compiler and Interpreter.</p>		

#Exemplar/Case Studies	GNU M4 Macro Processor	
*Mapping of Course Outcomes for Unit II	CO1, CO2, CO3	
Unit III	Linkers and Loaders	07 Hours
Introduction, Loader schemes: Compile and Go, General Loader Scheme, Absolute Loaders, Subroutine Linkages, Relocating Loaders, Direct linking Loaders, Overlay structure, Design of an Absolute Loader, Design of Direct linking Loader, Self-relocating programs, Static and Dynamic linking.		
#Exemplar/Case Studies	Study the concepts of Class loading in Java.	
*Mapping of Course Outcomes for Unit III	CO1, CO2, CO3	
Unit IV	Operating System (OS)	07 Hours
Introduction: Evolution of OS, Operating System Services, Functions of Operating System. Process Management: Process, Process States: 5 and 7 state model, Process control block, Threads, Thread lifecycle, Multithreading Model, Process control system calls. Process Scheduling: Uni-processor Scheduling, Scheduling: Preemptive, Non-preemptive, Long-term, Medium-term, Short term scheduling. Scheduling Algorithms: FCFS, SJF, RR, and Priority.		
#Exemplar/Case Studies	Process management in Linux /Windows/Android Readers-Writers problem	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Synchronization and Concurrency Control	07 Hours
Concurrency: Principle and issues with Concurrency, Mutual Exclusion, Hardware approach, Software approach, Semaphore, Mutex and monitor, Reader writer problem, Producer Consumer problem, Dining Philosopher problem. Deadlocks: Principle of Deadlock, Deadlock prevention, Deadlock avoidance, Deadlock detection, Deadlock recovery.		
#Exemplar/Case Studies	Concurrency Mechanism: Unix/Linux/Windows.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Memory Management	07 Hours
Introduction: Memory Management concepts, Memory Management requirements. Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy Systems Fragmentation, Paging, Segmentation, Address translation. Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit. Virtual Memory (VM): Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Look aside Buffer, Page Size, VM with Segmentation, VM with Combined paging and segmentation. Page Replacement Policies: First In First Out (FIFO), Last Recently Used(LRU), Optimal, Thrashing.		
#Exemplar/Case Studies	Memory management in Linux /Windows/Android	

***Mapping of Course Outcomes for Unit VI**

CO6

Learning Resources**Text Books:**

1. John Donovan, "Systems Programming", McGraw Hill, ISBN 978-0-07-460482-3
2. Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 - 4
3. Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN 978- 1-118-06333-0

Reference Books:

1. Leland Beck, "System Software: An Introduction to Systems Programming", Pearson
2. John R. Levine, Tony Mason, Doug Brown, "Lex & Yacc", 1st Edition, O'REILLY, ISBN 81-7366-062-X
3. Alfred V. Aho, Ravi Sethi, Reffrey D. Ullman, "Compilers Principles, Techniques, and Tools", Addison Wesley, ISBN 981-235-885-4

e-Books :

- <https://www.elsevier.com/books/systems-programming/anthony/978-0-12-800729-7>
- <https://www.kobo.com/us/en/ebook/linux-system-programming-1>
- <https://www.ebooks.com/en-us/subjects/computers-operating-systems-ebooks/279/>
- <https://www.e-booksdirectory.com/details.php?ebook=9907>

MOOCs Courses Links:

- <https://www.udacity.com/course/introduction-to-operating-systems--ud923>
- nptel video lecture link: <https://nptel.ac.in/courses/106/105/106105214/>
- <https://www.edx.org/course/computer-hardware-and-operating-systems>
- https://onlinecourses.nptel.ac.in/noc19_cs50/preview
- <https://www.udemy.com/course/system-programming/>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	-	-	-	-	-	-	-	-
CO2	2	2	1	2	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	-
CO4	2	1	2	1	-	-	-	-	-	-	-	1
CO5	2	2	1	2	-	-	-	-	-	-	-	1
CO6	2	1	2	1	-	-	-	-	-	-	-	1

Savitribai Phule Pune University		
Third Year of Computer Engineering (2019 Course)		
310244: Computer Networks and Security		
Teaching Scheme: Theory: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
Prerequisites Courses: Discrete Mathematics (210241)		
Companion Course: Computer Networks and Security Laboratory (310247)		
Course Objectives:		
<ul style="list-style-type: none">• To understand the fundamental concepts of networking standards, protocols and technologies• To learn different techniques for framing, error control, flow control and routing• To learn different layer protocols in the protocol stacks• To understand modern network architectures with respect to design and performance• To learn the fundamental concepts of Network Security		
Course Outcomes:		
On completion of the course, learners should be able to		
CO1: Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies		
CO2: Illustrate the working and functions of data link layer		
CO3: Analyze the working of different routing protocols and mechanisms		
CO4: Implement client-server applications using sockets		
CO5: Illustrate role of application layer with its protocols, client-server architectures		
CO6: Comprehend the basics of Network Security		
Course Contents		
Unit I	Introduction To Computer Networks	06 Hours
Definition, Types of Networks: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Wireless networks, Networks Software, Protocol, Design issues for the Network layers. Network Models: The OSI Reference Model, TCP/IP Model, Network Topologies, Types of Transmission Medium. Network Architectures: Client-Server, Peer To Peer, Hybrid. Network Devices: Bridge, Switch, Router, Gateway, Access Point. Line Coding Schemes: Manchester and Differential Manchester Encodings, Frequency Hopping (FHSS) and Direct Sequence Spread Spectrum (DSSS).		
#Exemplar/Case Studies	Study of Campus wide networking.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Data Link Layer	08 Hours
Introduction, functions. Design Issues: Services to Network Layer, Framing. ARQ strategies: Error detection and correction, Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol. WAN Connectivity: PPP and HDLC. MAC Sub layer: Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, CSMA/CD, CSMA/CA, Binary Exponential Back-off algorithm, Introduction to Ethernet IEEE 802.3, IEEE 802.11 a/b/g/n, IEEE 802.15 and IEEE 802.16 Standards.		
#Exemplar/Case Studies	Demonstration of DLL protocols on Simulator	

*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Network Layer	08 Hours
Introduction: Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: Classes of IP (Network addressing), IPv4, IPv6, Network Address Translation, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, MPLS. Routing in MANET: AODV, DSR, Mobile IP.		
#Exemplar/Case Studies	Demonstration of Routing Protocols on simulator.	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Transport Layer	07 Hours
Process to Process Delivery, Services, Socket Programming. Elements of Transport Layer Protocols: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Congestion Control. Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless networks.		
#Exemplar/Case Studies	Demonstration of Transport layer protocols on Simulator.	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Application Layer	06 Hours
Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, DHCP, SNMP.		
#Exemplar/Case Studies	Study of Application Layer protocols using network protocol analyzer. e.g. Wireshark	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Security	07 Hours
Introduction, Security services, Need of Security, Key Principles of Security, Threats and Vulnerabilities, Types of Attacks, ITU-T X.800 Security Architecture for OSI, Security Policy and mechanisms, Operational Model of Network Security, Symmetric and Asymmetric Key Cryptography. Security in Network, Transport and Application: Introduction of IPSec, SSL, HTTPS, S/MIME, Overview of IDS and Firewalls.		
#Exemplar/Case Studies	Study of security protocols in Network, Transport and Application Layer using network protocol analyzer. Wireshark	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		
Text Books : <ol style="list-style-type: none"> 1. Fourauzan B., "Data Communications and Networking", 5th Edition, TataMcGraw-Hill, Publications, ISBN:0-07-058408-7 2. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson India, 2012. 		

Reference Books :

1. Kurose, Ross, “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204
2. L. Peterson and B. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan-Kaufmann, 2012.
3. Douglas E. Comer & M.S Narayanan, “Computer Network & Internet”, Pearson Education
4. William Stallings, “Cryptography and Network Security: Principles and Practice”, 4th Edition
5. Pachghare V. K., “Cryptography and Information Security”, 3rd Edition, PHI,

e-Books :

- <https://people.cs.clemson.edu/~jmarty/courses/kurose/KuroseCh1-2.pdf>
- <http://eti2506.elimu.net/Introduction/Books/Data Communications and Networking By Behrouz A.Forouzan.pdf>
- <http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf>
- https://www.tutorialspoint.com/data_communication_computer_network/data_communication_on_computer_network_tutorial.pdf

Case Study:

- <https://slideplayer.com/slide/6106945>
- <http://www.worldcolleges.info/sites/default/files/Cisco - Ccie Fundamental - Network Design And Case Studies.PDF>
- http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

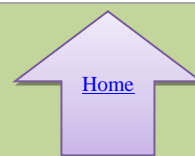
MOOCs Courses link:

- nptel.ac.in/courses/106/105/106105183
- nptel.ac.in/courses/106/105/106105080
- nptel.ac.in/courses/106/105/106105081
- nptel.ac.in/courses/106/106/106106091
- nptel.ac.in/courses/106/105/106105031
- <https://www.mooc-list.com/tags/computer-networking>
- <https://www.coursera.org/courses?query=computer%20network>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	2	2	1	-	-	-	-	1	1
CO2	1	1	1	1	1	-	1	-	-	1	-	-
CO3	3	1	2	1	2	-	-	-	-	-	-	1
CO4	1	2	1	2	2	-	-	-	1	-	1	1
CO5	1	3	-	-	1	-	1	1	-	-	-	-
CO6	1	-	2	1	-	1	-	-	-	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective I



310245(A): Internet of Things and Embedded Systems

Teaching Scheme: Theory: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
---	-------------------	---

Prerequisites Courses: Digital Electronics and Logic Design (210245)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To understand fundamentals of Internet of Things (IoT) and Embedded Systems
- To learn advances in Embedded Systems and IoT
- To learn methodologies for IoT application development
- To learn the IoT protocols, cloud platforms and security issues in IoT
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Understand the fundamentals and need of Embedded Systems for the Internet of Things
CO2: Apply IoT enabling technologies for developing IoT systems
CO3: Apply design methodology for designing and implementing IoT applications
CO4: Analyze IoT protocols for making IoT devices communication
CO5: Design cloud based IoT systems
CO6: Design and Develop secured IoT applications

Course Contents

Unit I	Introduction to Embedded Systems	07 Hours
Definition, Characteristics of Embedded System, Real time systems, Real time tasks. Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.		
#Exemplar/Case Studies	Installation of Real Time Operating System	
*Mapping of Course Outcomes for Unit I	CO1,CO2	
Unit II	Internet of Things : Concepts	07 Hours
Introduction to Internet of Things (IoT): Definition, Characteristics of IoT, Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks. Physical Design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion. Logical Design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT.		
#Exemplar/Case Studies	Exemplary device: Raspberry Pi / Arduino: Programming: Arduino IDE/ Python, Interfacing. Other IoT Devices.	
*Mapping of Course Outcomes for Unit II	CO1,CO2	
Unit III	IoT: Design Methodology	07 Hours
IoT Design Methodology: Steps, Basics of IoT Networking, Networking Components, Internet		

Structure, Connectivity Technologies, IoT Communication Models and IoT Communication APIs, Sensor Networks, Four pillars of IoT: M2M, SCADA, WSN, RFID.		
#Exemplar/Case Studies	Home Automation using IoT communication models and IoT Communication APIs.	
*Mapping of Course Outcomes for Unit III	CO3,CO4	
Unit IV	IoT Protocols	07 Hours
Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa.		
#Exemplar/Case Studies	LoRa based Smart Irrigation System.	
*Mapping of Course Outcomes for Unit IV	CO4,CO5	
Unit V	Cloud Platforms for IoT	07 Hours
Software Defined Networking, Introduction to Cloud Storage Models, Communication API. WAMP: Auto Bahn for IoT, Xively Cloud for IoT. Python Web Application Framework: Django Architecture and application development with Django, Amazon Web Services for IoT, Sky Net IoT Messaging Platform, RESTful Web Service, GRPC,SOAP.		
#Exemplar/Case Studies	Smart parking, Forest fire detection	
*Mapping of Course Outcomes for Unit V	CO4, CO5	
Unit VI	Security in IoT	07 Hours
Introduction, Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling. Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, Lightweight cryptography.		
#Exemplar/Case Studies	Home Intrusion Detection	
*Mapping of Course Outcomes for Unit VI	CO2, CO6	
Learning Resources		
Text Books:		
<div>1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on Approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515</div> <div>2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley Publication, ISBN: 978-1-119-99435-0</div>		
Reference Books:		
<div>1. Dawoud Shenouda Dawoud, Peter Dawoud, “Microcontroller and Smart Home Networks”, ISBN: 9788770221566, e-ISBN: 9788770221559</div> <div>2. Charles Crowell, “IoT-Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT”,ISBN-13 : 979-8613100194</div> <div>3. David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Press,ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5</div> <div>4. David Etter, “IoT Security: Practical guide book”, amazon kindle Page numbers, source ISBN: 1540335011.</div> <div>5. Brian Russell, Drew Van Duren, “Practical Internet of Things Security”, Second Edition,</div>		

Packt Publishing, ISBN: 9781788625821

6. Dr. Shiram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, "Internet of Things", Wiley publication, 2nd Edition, ISBN: 9789388991018

e-Books :

- <https://www.iotforall.com/ebooks/an-introduction-to-iot>
- <https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies>

MOOCs Courses link

- <https://nptel.ac.in/courses/106/105/106105166/>
- <https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-development/>
- <https://www.coursera.org/learn/iot>
- <https://nptel.ac.in/courses/108/108/108108098/>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	-	-	-	-	1	-	1	-
CO2	3	2	1	2	1	-	-	-	-	-	-	-
CO3	2	3	3	3	2	3	-	-	2	-	1	-
CO4	1	2	2	2	3	3	-	-	2	1	2	2
CO5	2	2	2	3	3	3	-	-	2	1	2	2
CO6	2	2	1	2	2	2	-	1	1	-	1	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective I



310245(B): Human Computer Interface

Teaching Scheme:
Theory: 03
Hours/Week

Credit: 03

Examination Scheme:

Mid-Sem (TH) : 30 Marks

End-Sem (TH): 70 Marks

Prerequisites Courses: Computer Graphics (210244), Software Engineering (210253)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To understand the importance of HCI design process in software development
- To learn fundamental aspects of designing and implementing user interfaces
- To study HCI with technical, cognitive and functional perspectives
- To acquire knowledge about variety of effective human-computer-interactions
- To co-evaluate the technology with respect to adapting changing user requirements in interacting with computer

Course Outcomes:

On completion of the course, learners should be able to

CO1: Design effective Human-Computer-Interfaces for all kinds of users

CO2: Apply and analyze the user-interface with respect to golden rules of interface

CO3: Analyze and evaluate the effectiveness of a user-interface design

CO4: Implement the interactive designs for feasible data search and retrieval

CO5: Analyze the scope of HCI in various paradigms like ubiquitous computing, virtual reality ,multi-media, World wide web related environments

CO6: Analyze and identify user models, user support, and stakeholder requirements of HCI systems

Course Contents

Unit I

Introduction and Foundation of HCI

07 Hours

Foundation: Human Memory. **Thinking:** Reasoning and Problem Solving, Emotion, Individual Difference, Psychology and design of Interactive systems, The Computer-Text Entry Device, Positioning, Pointing, Display devices, Devices for virtual reality and 3D Interaction, The Interactions-Models of Interaction, Frameworks and HCI, Ergonomics, Interaction styles, Ergonomics, Elements of WIMP Interface, Interactivity, Measurable Human Factors, The context of Interaction. **Importance of User Interface:** Defining user Interface, Brief History of Human-Computer Interface, Good and Poor Design- Importance of good design.

#Exemplar/Case Studies

Paper prototype – Design elements of GUI

***Mapping of Course Outcomes for Unit I**

CO1,CO6

Unit II

Human Perspective in Interaction Design Process

07 Hours

Know your user/client: Understanding how people interact with computers, Important human characteristics in Design, Human considerations in design of Business systems, Human Interaction speeds, Performance versus Preference, Methods of gaining an understanding of users, Miller's Law.

Design Guidelines: Navigating the interface, Organizing the display, Getting user's attention, Facilitating data entry. **Principles:** Determine user's skill level, Identify the tasks, Choose an

interaction style, Natural Language, Eight Golden rules of Interface design, Prevent errors, Ensuring Human control while increasing automation. Theories: Design-by-level, Stages of action, Consistency, Contextual Theories, Dynamic theories.		
#Exemplar/Case Studies	Registration form design.	
*Mapping of Course Outcomes for Unit II	CO1,CO2	
Unit III	Interaction Styles and HCI in Software Process	07 Hours
Design, Process of Interaction Design. Interaction styles: Command line, Menu Selection, Form fill-in, Direct Manipulation. Graphical User Interface: Popularity of Graphics, Concept of direct manipulation, Advantages, Disadvantages and characteristics of Graphical user interface. Web User Interface: Popularity and Characteristics, Merging of Graphical business systems and the Web- Characteristics of Intranet versus Internet, Web page versus application design, Principles for user interface design, Software life cycle, Usability Engineering, Iterative design and prototyping, Design Rationale.		
#Exemplar/Case Studies	Comparison - GUI and Web design with a real time example.	
*Mapping of Course Outcomes for Unit III	CO1,CO3,CO5	
Unit IV	Usability Evaluation and Universal Design	07 Hours
User interface design process: Designing for People: Seven commandments, Usability Assessment in the Design process, Common Usability problems, Practical and Objective measures of Usability, Formative and Summative evaluation, Usability specifications for evaluation, Analytic methods, Model based analysis, GOMS model, Empirical methods, Field studies, Usability testing in Laboratory, Controlled experiments, Heuristic Evaluation, Cognitive Walkthrough. Evaluation framework: Paradigms and techniques, DECIDE: a framework to guide evaluation, Universal design principles, Multi-modal interaction, Designing for diversity.		
#Exemplar/Case Studies	GOMS model - Adding items to a cart of e-shopping website.	
*Mapping of Course Outcomes for Unit IV	CO1,CO3	
Unit V	HCI Paradigms	07 Hours
Paradigms for Interaction: Time sharing, Video display units, Programming toolkits, Personal computing, The metaphor, Direct manipulation, Hypertext, Computer-supported cooperative work, Agent based interfaces. Ubiquitous Computing: Sensor-based and context-aware interaction, Data Integrity versus Data immunity, Handling missing data, Data entry and fudge ability, Auditing versus Editing, Retrieval in Physical World, Retrieval in Digital world, Constrained Natural Language output, Five stage search framework, Dynamic queries and faceted search, The social aspects of search. Pattern Recognition: Introduction, Examples, Role of Machine Learning, Pattern Recognition Process, Pattern Recognition in HCI.		
#Exemplar/Case Studies	Interface Design- Pattern gesture recognition	
*Mapping of Course Outcomes for Unit V	CO1,CO3,CO4	
Unit VI	HCI for Mobile and Handheld devices	07 Hours
Designing for Mobile and other devices: Anatomy of a Mobile app, Mobile form factors, Handheld format apps, Tablet format apps, Mini-tablet format apps, Mobile Navigation, Content, and control idioms- browse controls, Navigation and toolbars, Drawers, Tap-to-reveal and direct manipulation, Searching, Sorting and Filtering, Welcome and help screens, Multi-touch gestures,		

Inter-app integration, Android Accessibility Guidelines.

Other devices: Designing for kiosks, Designing for 10-foot interfaces, Designing for automotive interfaces, Designing for audible interfaces.

#Exemplar/Case Studies	GUI in Python Enlist and evaluate handled devices
*Mapping of Course Outcomes for Unit VI	CO3,CO5,CO6

Learning Resources

Text Books:

1. Alan J. Dix, Janet Finlay, Russell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004, ISBN 81-297-0409-9
2. Jenny Preece, Rogers, Sharp, "Interaction Design-beyond human-computer interaction", WILEY-INDIA, ISBN 81-265-0393-9
3. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, "Designing the User Interface: Strategies for Effective Human- Computer Interaction", 6th Edition, Pearson Education Limited, ISBN 987-1-292-03701-1.

Reference Books :

1. Alan Cooper, Robert Reiman, David Cronin, Christopher Noessel, "About Face: The Essentials of Interaction Design", 4th edition, WILEY, ISBN 978-1-118-76658-3
2. Mary Beth Rosson and John M. Carroll, "Usability Engineering: Scenario-Based Development of Human-Computer Interaction", Morgan Kaufmann Publishers, ISBN 978-1-558-60712-5
3. Wibert O. Galitz, "The Essential Guide to user Interface Design", WILEY India, ISBN: 978-1-265-0280-6
4. Jenifer Tidwell, "Designing Interfaces", O'REILLY, ISBN: 978-1-449-37970-4
5. Julie A. Jacko (Ed), "The Human-Computer Interaction Handbook", 3rd edition, CRC Press, 2012
6. Zou J., Nagy G. (2006) "Human-Computer Interaction for Complex Pattern Recognition Problems"
7. Basu M., Ho T.K. (eds) "Data Complexity in Pattern Recognition. Advanced Information and Knowledge Processing", Springer, London

e-Books :

- http://www.37steps.com/data/pdf/PRIntro_medium.pdf
- https://www.ecse.rpi.edu/~nagy/PDF_chrono/2005_Zou_Nagy_complexity_05.pdf
- <https://www.raywenderlich.com/240-android-accessibility-tutorial-getting-started>

MOOCs Courses link

- <https://www.edx.org/course/human-computer-interaction-i-fundamentals-design-p>
- <https://www.edx.org/course/human-computer-interaction-ii-cognition-context-cu>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	1	1	1	-	-	1	1	3	1
CO2	2	2	-	1	-	-	-	2	1	-	-	-
CO3	-	1	2	3	-	1	-	1	-	-	1	-
CO4	-	-	-	2	3	1	-	-	1	-	-	-
CO5	3	2	2	-	2	2	2	-	-	2	2	3
CO6	-	1	2	1	2	3	-	1	-	-	-	2

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective I
310245(C): Distributed Systems



Teaching Scheme: Theory: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
---	-------------------	---

Prerequisites Courses: Computer Networks and Security(310244)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To learn the fundamentals of Distributed Systems
- To learn types of communication and synchronization in Distributed Systems
- To acquaint with the Distributed File Systems
- To understand consistency and replication in Distributed Systems
- To understand the fault tolerance based Distributed Systems

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Analyze Distributed Systems types and architectural styles
CO2: Implement communication mechanism in Distributed Systems
CO3: Implement the synchronization algorithms in Distributed System applications
CO4: Develop the components of Distributed File System
CO5: Apply replication techniques and consistency model in Distributed Systems
CO6: Build fault tolerant Distributed Systems

Course Contents

Unit I	Introduction	07 Hours
Defining Distributed Systems, Characteristics, Middleware and Distributed Systems. Design goals: Supporting resource sharing, Making distribution transparent, Open, Scalable, Pitfalls. Types of Distributed Systems: High Performance Distributed Computing, Distributed Information Systems, Pervasive Systems. Architectural styles: Layered architectures, Object based architectures, Publish Subscribe architectures. Middleware organization: Wrappers, Interceptors, Modifiable middleware. System architecture: Centralized, Decentralized, Hybrid, Example architectures – Network File System, Web.		
#Exemplar/Case Studies	Case Study of Middleware System that includes Design, Architecture and Application.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Communication	07 Hours
Introduction: Layered Protocols, Types of Communication, Remote Procedural Call- Basic RPC Operation, Parameter Passing, RPC-based application support, Variations on RPC, Example: DCE RPC, Remote Method Invocation. Message Oriented Communication: Simple Transient Messaging with Sockets, Advanced Transient Messaging, Message Oriented Persistent Communication, Examples. Multicast Communication: Application Level Tree-Based Multicasting, Flooding-Based Multicasting, Gossip-Based Data Dissemination.		
#Exemplar/Case Studies	Apache Kafka Distributed Event Streaming Platform, gRPC Open Source RPC Framework	
*Mapping of Course	CO2	

Outcomes for Unit II		
Unit III	Synchronization	07 Hours
Clock Synchronization: Physical Clocks, Clock Synchronization Algorithms. Logical Clocks – Lamport’s Logical clocks, Vector Clocks. Mutual Exclusion: Overview, Centralized Algorithm, Distributed Algorithm, Token-Ring Algorithm, Decentralized Algorithm. Election Algorithms: Bully Algorithm, Ring Algorithm. Location Systems: GPS, Logical Positioning of nodes, Distributed Event Matching. Gossip-Based Contribution: Aggregation, A Peer-Sampling Service, Gossip-Based Overlay Construction.		
#Exemplar/Case Studies	Design Time Synchronization Mechanism in Distributed Gaming	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Naming and Distributed File Systems	07 Hours
Names, Identifiers, Addresses, Flat Naming, Structured Naming, Attributed Based Naming, Introduction to Distributed File Systems, File Service Architecture. Case study: Suns Network file System, Andrew File System.		
#Exemplar/Case Studies	Study of Google File System	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Consistency and Replication	07 Hours
Introduction: Reasons for Replication, Replication as Scaling Technique. Data-Centric Consistency Models: Continuous Consistency, Consistent Ordering of Operations. Client-Centric Consistency Models: Eventual Consistency, Monotonic Reads, Monotonic Writes, Read Your Writes, Writes Follow Reads. Replica Management: Finding the best server location, Content Replication and Placement, Content Distribution, Managing Replicated Objects. Consistency Protocols: Continuous Consistency, Sequential Consistency, Cache Coherence Protocols, Example: Caching, and Replication in the web.		
#Exemplar/Case Studies	Study of HDFS Architecture for Data Replication	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Fault Tolerance	07 Hours
Introduction to Fault Tolerance: Basic Concepts, Failure Models, Failure Masking by Redundancy. Process Resilience: Resilience by Process Groups, Failure Masking and Replication, Example: Paxos, Consensus in faulty systems with crash failures, some limitations on realizing Fault Tolerant tolerance, Failure Detection. Reliable Client Server Communication: Point to Point Communication, RPC Semantics in the Presence of Failures. Reliable Group Communication: Atomic multicast, Distributed commit. Recovery: Introduction, Check pointing, Message Logging, Recovery Oriented Computing.		
#Exemplar/Case Studies	Study of any Open Source Tool for Building Fault-Tolerant System such as Circuit Breaker/Nginx/HaProxy/Akka	
*Mapping of Course	CO6	

Outcomes for Unit VI												
Learning Resources												
Text Books:												
<div><div>1.</div><div>Maarten van Steen, Andrew S. Tanenbaum, “Distributed System”, Third edition, version 3</div></div> <div><div>2.</div><div>George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth edition</div></div>												
Reference Books:												
<div><div>1.</div><div>Christian Cachin, Rachid Guerraoui, Luís Rodrigues, “Introduction to Reliable and Secure Distributed Programming”, Springer; 2nd ed. 2011 edition</div></div> <div><div>2.</div><div>Vijay K. Garg, “Elements of Distributed Computing”, Wiley</div></div> <div><div>3.</div><div>Maarten Van Steen and Andrew S. Tanenbaum, “Distributed Systems”, Amazon Digital Services; 3rd edition</div></div>												
e-Books :												
<div><div>•</div><div>Martin Kleppmann, “Designing Data-Intensive Applications”, Oreilly</div></div>												
MOOC Courses links:												
<div><div>•</div><div>Prof. Rajiv Misra, Distributed System, https://nptel.ac.in/courses/106/106/106106168/#</div></div> <div><div>•</div><div>Prof. Rajiv Misra, Cloud computing and Distributed System</div></div> <div><div>•</div><div>Prof. Rajiv Misra, Distributed System, https://nptel.ac.in/courses/106/104/106104182/</div></div>												
@The CO-PO Mapping Matrix												
CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	1	-	-	-	-	-	1
CO2	3	2	2	2	1	-	-	-	-	1	-	1
CO3	3	2	2	2	1	-	-	-	-	1	-	1
CO4	3	1	2	2	1	-	-	-	-	1	-	1
CO5	3	1	1	1	-	-	-	-	-	-	-	1
CO6	1	1	1	1	1	-	-	-	-	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective I



310245(D): Software Project Management

Teaching Scheme: Theory: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (paper): 70 Marks
---	-------------------	--

Prerequisites Courses: Software Engineering(210253)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To understand the fundamentals of Software Project Management
- To investigate software project planning and management tools
- To learn software project scheduling and tracking
- To discuss about the agile project management
- To know people management in software project

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Comprehend Project Management Concepts
- CO2:** Use various tools of Software Project Management
- CO3:** Schedule various activities in software projects
- CO4:** Track a project and manage changes
- CO5:** Apply Agile Project Management
- CO6:** Analyse staffing process for team building and decision making in Software Projects and Management

Course Contents

Unit I	Introduction to Software Project Management	07 Hours
Project Definition, Project versus Flow type work, Project Lifecycle, Processes and Knowledge Areas in Project Management (PM), Build or Buy decision, Work Breakdown Structure (WBS) and its types, Introduction to PMBOK, Program and Portfolio Management.		
#Exemplar/Case Studies	Analysis of a project using PMBOK concepts	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Project Planning and Project Management Tools	07 Hours
Project Planning: Steps for Project Planning, PERT and Gantt Charts, Gantt Project, Microsoft Project and Primavera Project Management Software, Objectives of Activity planning, Project Schedules, Activities, Sequencing and Scheduling, Network Planning Models, Formulating Network Model.		
#Exemplar/Case Studies	Create software project plan using any tool.	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Activity based Scheduling	07 Hours
Introduction, Objectives of Activity Planning, Project Schedules. Activities: Sequencing and Scheduling, Network Planning Models, Formulating Network Model, Activity relationships (FS, SF, SS, FF), Forward Pass and Backward Pass techniques, Critical Path concept and remedies.		
#Exemplar/Case Studies	Apply the critical path technique to the project	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Project Tracking and Control	07 Hours

Introduction, Collection of Project data, Visualizing progress, Cost monitoring, Earned Value Analysis, Project tracking, Change Control, Software Configuration Management, Managing contracts, Contract Management.

#Exemplar/Case Studies	Analyze the effect of a major requirement change on the schedule
*Mapping of Course Outcomes for Unit IV	CO4

Unit V	Agile Project Management	07 Hours
---------------	---------------------------------	-----------------

Predictive versus Empirical Management, Comparison between Non-Agile and Agile Project, Three stages of Agile Project, Estimation, Scope Management, Roles and Responsibilities, Scheduling and Tracking.

#Exemplar/Case Studies	Analyse the same project using Agile. Create the three stages of the project.
*Mapping of Course Outcomes for Unit V	CO5

Unit VI	Staffing in Software Projects	07 Hours
----------------	--------------------------------------	-----------------

Managing People, Organizational behaviour, Best methods of Staff Selection, Motivation, The Oldham, Hackman job characteristic Model, Stress, Health and Safety, Ethical and Professional concerns, Working in Teams, Decision Making, Organizational structures, Dispersed and Virtual Teams, Communications Genres, Communication Plans.

#Exemplar/Case Studies	Analyse a case study for a distributed team and comment
*Mapping of Course Outcomes for Unit VI	CO6

Learning Resources

Text Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Sixth Edition, Tata McGraw Hill, New Delhi, 2017
2. Robert K. Wysocki, "Effective Software Project Management", Wiley Publication, 2011

Reference Books :

1. Ken Schwaber, "Agile Project Management", Microsoft Press, 2004
2. Walker Royce, "Software Project Management", Addison-Wesley, 1998
3. Jalote Pankaj, "Software Project Management in Practice", Addison-Wesley Professional, 2002
4. PMBOK Guide

e-Books :

- [https://www.kornev-online.net/ITIL/Mcgraw.Hill.Software Project Management 2nd Edition.pdf](https://www.kornev-online.net/ITIL/Mcgraw.Hill.Software%20Project%20Management%202nd%20Edition.pdf)
- <http://library.lol/main/B96E3B122326F8D2C6FBD35A5E978422>

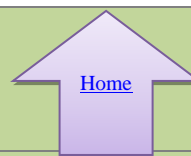
MOOCs Courses Links:

- https://onlinecourses.nptel.ac.in/noc19_cs70/preview
- [Software Project Management By Prof. Rajib Mall & Prof. Durga Prasad Mohapatra | IIT Kharagpur](#)
- Agilealliance.org, Scrum.org, Scrumalliance.org

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	-	-	-	1	-	3	-
CO2	-	-	-	2	2	-	-	-	1	-	3	-
CO3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	-	1	-	3	-
CO5	-	-	2	1	1	-	-	1	2	-	3	-
CO6	-	-	-	-	1	-	-	-	3	1	3	-

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310246:Database Management Systems Laboratory



Teaching Scheme
Practical: 04 Hours/Week

Credit:02

Examination Scheme and Marks
Term work: 25 Marks
Practical: 25 Marks

Companion Course: Database Management Systems(310241)

Course Objectives:

- To develop Database programming skills
- To develop basic Database administration skills
- To develop skills to handle NoSQL database
- To learn, understand and execute process of software application development

Course Outcomes:

On completion of the course, learners will be able to

CO1: Design E-R Model for given requirements and convert the same into database tables

CO2: Design schema in appropriate normal form considering actual requirements

CO3: Implement SQL queries for given requirements, using different SQL concepts

CO4: Implement PL/SQL Code block for given requirements

CO5: Implement NoSQL queries using MongoDB

CO6: Design and develop application considering actual requirements and using database concepts

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, and punctuality.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - MYSQL/Oracle, MongoDB, ERD plus, ER Win

Virtual Laboratory:

- <http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/labs/index.php>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A, B, C) are compulsory

Sr. No.	Group A: SQL and PL/SQL
1.	<p>ER Modeling and Normalization:</p> <p>Decide a case study related to real time application in group of 2-3 students and formulate a problem statement for application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize Relational data model.</p> <p>Note: Student groups are required to continue same problem statement throughout all the assignments in order to design and develop an application as a part Mini Project. Further assignments will be useful for students to develop a backend for system. To design front end interface students should use the different concepts learnt in the other subjects also.</p>
2.	<p>SQL Queries:</p> <p>a. Design and Develop SQLDDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc.</p> <p>b. Write at least 10 SQL queries on the suitable database application using SQL DML statements.</p> <p>Note: Instructor will design the queries which demonstrate the use of concepts like Insert, Select, Update, Delete with operators, functions, and set operator etc.</p>
3.	<p>SQL Queries – all types of Join, Sub-Query and View:</p> <p>Write at least 10 SQL queries for suitable database application using SQL DML statements.</p> <p>Note: Instructor will design the queries which demonstrate the use of concepts like all types of Join, Sub-Query and View</p>
4.	<p>Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory.</p> <p>Suggested Problem statement:</p> <p>Consider Tables:</p> <p>1. Borrower(Roll_no, Name, Date of Issue, Name of Book, Status)</p> <p>2. Fine(Roll_no, Date, Amt)</p> <ul style="list-style-type: none"> • Accept Roll_no and Name of Book from user. • Check the number of days (from date of issue). • If days are between 15 to 30 then fine amount will be Rs 5per day. • If no. of days>30, per day fine will be Rs 50 per day and for days less than 30, Rs. 5 per day.

5.	<ul style="list-style-type: none"> After submitting the book, status will change from I to R. If condition of fine is true, then details will be stored into fine table. Also handles the exception by named exception handler or user define exception handler. <p style="text-align: center;">OR</p> <p>Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 5 to 9. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns, radius and area.</p> <p>Note: Instructor will frame the problem statement for writing PL/SQL block in line with above statement.</p>
6.	<p>Named PL/SQL Block: PL/SQL Stored Procedure and Stored Function.</p> <p>Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is ≤ 1500 and marks ≥ 990 then student will be placed in distinction category if marks scored are between 989 and 900 category is first class, if marks 899 and 825 category is Higher Second Class.</p> <p>Write a PL/SQL block to use procedure created with above requirement.</p> <p>Stud_Marks(name, total_marks) Result(Roll, Name, Class)</p> <p>Note: Instructor will frame the problem statement for writing stored procedure and Function in line with above statement.</p>
7.	<p>Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor)</p> <p>Write a PL/SQL block of code using parameterized Cursor that will merge the data available in the newly created table N_Roll Call with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.</p> <p>Note: Instructor will frame the problem statement for writing PL/SQL block using all types of Cursors in line with above statement.</p>
8.	<p>Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers).</p> <p>Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library_Audit table.</p> <p>Note: Instructor will Frame the problem statement for writing PL/SQL block for all types of Triggers in line with above statement.</p>
9.	<p>Database Connectivity:</p> <p>Write a program to implement MySQL/Oracle database connectivity with any front end language to implement Database navigation operations (add, delete, edit etc.)</p>
Group B: NoSQL Databases	
1.	<p>MongoDB Queries:</p> <p>Design and Develop MongoDB Queries using CRUD Operations. (Use CRUD Operations, SAVE method, logical operators etc.).</p>
2.	<p>MongoDB – Aggregation and Indexing:</p> <p>Design and Develop MongoDB Queries using aggregation and indexing with suitable example using MongoDB.</p>
3.	<p>MongoDB – Map-reduces operations:</p> <p>Implement Map reduces operation with suitable example using MongoDB.</p>
4.	<p>Database Connectivity:</p> <p>Write a program to implement Mongo DB database connectivity with any front end language to implement Database navigation operations (add, delete, edit etc.)</p>

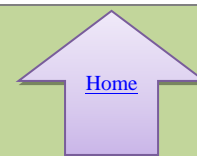
Group C: Mini Project

1. Using the **database concepts covered in Group A and Group B**, develop an application with following details:
 1. Follow the same problem statement decided in Assignment -1 of Group A.
 2. Follow the Software Development Life cycle and other concepts learnt in **Software Engineering Course** throughout the implementation.
 3. Develop application considering:
 - Front End: Java/Perl/PHP/Python/Ruby/.net/any other language
 - Backend : MongoDB/ MySQL/Oracle
 4. Test and validate application using Manual/Automation testing.
 5. Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle:
 - Title of the Project, Abstract, Introduction
 - Software Requirement Specification
 - Conceptual Design using ER features, Relational Model in appropriate Normalize form
 - Graphical User Interface, Source Code
 - Testing document
 - Conclusion.
- Note:**
- Instructor should maintain progress report of mini project through out the semester from project group.
 - Practical examination will be on assignments given above in Group A and Group B only
 - Mini Project in this course should facilitate the Project Based Learning among students

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	3	-	3	1	1	1	3	1	-	1
CO2	2	2	3	-	2	-	1	-	3	-	1	-
CO3	-	1	2	-	2	1	-	1	3	-	-	2
CO4	-	1	2	-	2	-	-	-	3	2	1	-
CO5	-	1	2	-	2	-	2	-	3	1	-	1
CO6	2	2	3	-	3	1	-	-	3	-	2	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310247:Computer Networks and Security Laboratory



Teaching Scheme Practical: 02 Hours/Week	Credit: 01	Examination Scheme and Marks Term work: 25 Marks Oral: 25 Marks
---	-------------------	--

Companion Course: Computer Network and Security(310244)

Course Objectives:

- To learn computer network hardware and software components
- To learn computer network topologies and types of network
- To develop an understanding of various protocols, modern technologies and applications
- To learn modern tools for network traffic analysis
- To learn network programming

Course Outcomes:

On completion of the course, learners will be able to

- CO1:** Analyze the requirements of network types, topology and transmission media
CO2: Demonstrate error control, flow control techniques and protocols and analyze them
CO3: Demonstrate the subnet formation with IP allocation mechanism and apply various routing algorithms
CO4: Develop Client-Server architectures and prototypes
CO5: Implement web applications and services using application layer protocols
CO6: Use network security services and mechanisms

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Oral Examination

Oral examination should be jointly conducted by the internal examiner and external examiner. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementations in term work. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended: -64-bit Open-source Linux or its derivative

Programming tools recommended: - Open-Source/C/C++/JAVA

Programming tool like G++/GCC, Wireshark/Ethereal and Packet Tracer

Virtual Laboratory:

- <http://vlabs.iitb.ac.in/vlab/>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A, B, C) are compulsory

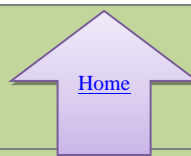
Sr. No.	Group A (Unit I and II): Attempt any two assignments from Sr.No. 1 to 3. Assignments 4 and 5 are compulsory.
1.	Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.
2.	Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.
3.	Setup a WAN which contains wired as well as wireless LAN by using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN2 (Wireless LAN).
4.	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC.
5.	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in Peer-to-Peer mode.
Group B (Unit III and IV)	
6.	Write a program to demonstrate Sub-netting and find subnet masks.
7.	Write a program to implement link state /Distance vector routing protocol to find suitable path for transmission.
8.	Use packet Tracer tool for configuration of 3 router network using one of the following protocol RIP/OSPF/BGP.
9.	Write a program using TCP socket for wired network for following <ol style="list-style-type: none"> Say Hello to Each other File transfer Calculator
10.	Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.
Group C (Unit V and VI): Assignment Sr. No. 11 is Compulsory and attempt any four from Assignments Sr. No 12 to 17.	
11.	Write a program for DNS lookup. Given an IP address as input, it should return URL and vice-versa.
12.	Installing and configure DHCP server and write a program to install the software on remote machine.

13.	Capture packets using Wireshark, write the exact packet capture filter expressions to accomplish the following and save the output in file: 1. Capture all TCP traffic to/from Facebook, during the time when you log in to your Facebook account 2. Capture all HTTP traffic to/from Facebook, when you log in to your Facebook account 3. Write a DISPLAY filter expression to count all TCP packets (captured under item #1) that have the flags SYN, PSF, and RST set. Show the fraction of packets that had each flag set. 4. Count how many TCP packets you received from / sent to Face book, and how many of each were also HTTP packets.
14.	Study and Analyze the performance of HTTP, HTTPS and FTP protocol using Packet tracer tool.
15.	To study the SSL protocol by capturing the packets using Wireshark tool while visiting any SSL secured website (banking, e-commerce etc.).
16.	Illustrate the steps for implementation of S/MIME email security through Microsoft® Office Outlook.
17.	To study the IPsec (ESP and AH) protocol by capturing the packets using Wireshark tool.

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	2	-	2	1	1	-	-	1	-	1
CO2	-	3	-	1	1	-	-	1	-	-	-	-
CO3	3	2	1	1	-	-	-	1	-	-	1	1
CO4	-	1	2	1	1	1	-	-	-	-	-	1
CO5	2	3	-	-	1	-	-	-	1	-	-	-
CO6	-	1	3	1	1	-	1	-	2	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310248: Laboratory Practice I



Teaching Scheme
Practical: 04 Hours/Week

Credit:02

Examination Scheme and Marks
Term work: 25 Marks
Practical: 25 Marks

Companion Course: Systems Programming and Operating System (310243), Elective I(310245)

Course Objectives:

- To learn system programming tools
- To learn modern operating system
- To learn various techniques, tools, applications in IoT and Embedded Systems /Human Computer Interface/Distributed Systems/ Software Project Management

Course Outcomes:

On completion of the course, learners will be able to

- **Systems Programming and Operating System**
 - CO1:** Implement language translators
 - CO2:** Use tools like LEX and YACC
 - CO3:** Implement internals and functionalities of Operating System
- **Internet of Things and Embedded Systems**
 - CO4:** Design IoT and Embedded Systems based application
 - CO5:** Develop smart applications using IoT
 - CO6:** Develop IoT applications based on cloud environment

OR
- **Human Computer Interface**
 - CO4:** Implement the interactive designs for feasible data search and retrieval
 - CO5:** Analyze the scope of HCI in various paradigms like ubiquitous computing, virtual Reality and ,multi-media, World wide web related environments
 - CO6:** Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems

OR
- **Distributed Systems**
 - CO4:** Demonstrate knowledge of the core concepts and techniques in Distributed Systems
 - CO5:** Apply the principles of state-of-the-Art Distributed Systems in real time applications
 - CO6:** Design, build and test application programs on Distributed Systems

OR
- **Software Project Management**
 - CO4:** Apply Software Project Management tools
 - CO5:** Implement software project planning and scheduling
 - CO6:** Analyse staffing in software project

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus. For the elective subjects students should form group of 3-4 students. The faculty coordinator will take care that all the assignment should be assigned to class and minimum two assignments are compulsory for each group.

Programming tools recommended: -

Human computer Interface-GUI in python

Internet of Things and Embedded System- Raspberry Pi/Arduino Programming; Arduino IDE/Python Interfacing. Other IoT devices

Software project management-MS project/Gantt Project/Primavera

Virtual Laboratory:

- <http://cse18-iiith.vlabs.ac.in/Introduction.html?domain=Computer%20Science>
- <http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A, B, C) are compulsory

Part I: Systems Programming and Operating System

Sr. No.	Group A (Any Two Assignments from Sr. No. 1 to 3)
1.	Design suitable Data structures and implement Pass-I and Pass-II of a two-pass assembler for pseudo-machine. Implementation should consist of a few instructions from each category and few assembler directives. The output of Pass-I (intermediate code file and symbol table) should be input for Pass-II.

2.	Design suitable data structures and implement Pass-I and Pass-II of a two-pass macro-processor. The output of Pass-I (MNT, MDT and intermediate code file without any macro definitions) should be input for Pass-II.
3.	Write a program to create a Dynamic Link Library for any mathematical operation and write an application program to test it. (Java Native Interface / Use VB or VC++)
Group B(Any Two Assignments from Sr. No. 4 to 7)	
4.	Write a program to solve Classical Problems of Synchronization using Mutex and Semaphore.
5.	Write a program to simulate CPU Scheduling Algorithms: FCFS, SJF (Preemptive), Priority (Non-Preemptive) and Round Robin (Preemptive).
6.	Write a program to simulate Memory placement strategies – best fit, first fit, next fit and worst fit.
7.	Write a program to simulate Page replacement algorithm.
Part II : Elective I	
Suggested List of Laboratory Experiments/Assignments (Any Two assignments from each elective subject are compulsory and Instructor will take care that all the assignments should be covered among different batch students)	
Internet of Things and Embedded Systems	
1.	Understanding the connectivity of Raspberry-Pi / Arduino with IR sensor. Write an application to detect obstacle and notify user using LEDs.
2.	Understanding the connectivity of Raspberry-Pi / Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, generate alerts using LEDs.
3.	Understanding and connectivity of Raspberry-Pi / Beagle board with camera. Write an application to capture and store the image.
4.	Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.
Human Computer Interface	
1.	Design a paper prototype for selected Graphical User Interface.
2.	Implement GOMS (Goals, Operators, Methods and Selection rules) modeling technique to model user's behavior in given scenario.
3.	Design a User Interface in Python.
4.	To redesign existing Graphical User Interface with screen complexity.
Distributed System	
1.	Implementation of Inter-process communication using socket programming: implementing multithreaded echo server.
2.	Implementation of RPC Mechanism.
3.	Simulation of election algorithms (Ring and Bully).
4.	Implementation of Clock Synchronization: a) NTP b) Lamports clock.
Software Project Management	
1.	Create Project Plan <ul style="list-style-type: none"> ▪ Specify project name and start (or finish) date. ▪ Identify and define project tasks. ▪ Define duration for each project task. ▪ Define milestones in the plan ▪ Define dependency between tasks ▪ Define project calendar. ▪ Define project resources and specify resource type ▪ Assign resources against each task and baseline the project plan

2.	Execute and Monitor Project Plan <ul style="list-style-type: none"> ▪ Update % Complete with current task status. ▪ Review the status of each task. ▪ Compare Planned vs Actual Status ▪ Review the status of Critical Path ▪ Review resources assignation status
3.	Generate Dashboard and Reports <ul style="list-style-type: none"> • Dashboard <ul style="list-style-type: none"> o Project Overview o Cost Overview o Upcoming Tasks • Resource Reports <ul style="list-style-type: none"> o Over-allocated Resources o Resource Overview • Cost Reports <ul style="list-style-type: none"> o Earned Value Report o Resource Cost Overview o Task Cost Overview • Progress Reports <ul style="list-style-type: none"> o Critical Tasks o Milestone Report o Slipping Tasks

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	-	-	-	-	-	-	1
CO2	1	2	2	2	2	-	-	-	-	-	-	1
CO3	1	2	2	2	2	-	-	-	-	-	-	1
CO4	1	2	3	2	-	2	-	-	2	1	2	-
CO5	1	2	2	1	-	2	-	-	3	2	1	-
CO6	2	2	2	1	-	2	-	-	2	-	2	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310249: Seminar and Technical Communication


[Home](#)
Teaching Scheme**Credit: 01****Examination Scheme and Marks****Tutorial: 01 Hour/Week****Term Work: 50 Marks****Course Objectives:**

- To explore the basic principles of communication (verbal and non-verbal) and active, empathetic listening, speaking and writing techniques
- To explore the latest technologies
- To enhance the communication skills
- To develop problem analysis skills

Course Outcomes:

On completion of the course, learners will be able to

CO1: Analyze a latest topic of professional interest**CO2:** Enhance technical writing skills**CO3:** Identify an engineering problem, analyze it and propose a work plan to solve it**CO4:** Communicate with professional technical presentation skills**Guidelines**

- Each student will select a topic in the area of Computer Engineering and Technology preferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years.
- The topic must be selected in consultation with the Institute guide.
- Each student will make a seminar presentation using audio/visual aids for a duration of 20-25 minutes and submit the seminar report prepared in Latex only.
- Active participation at classmate seminars is essential.
- BoS has circulated the Seminar Log book and it is recommended to use it.

Guidelines for Assessment

Panel of staff members along with a guide would be assessing the seminar work based on these parameters-Topic, Contents and Presentation, regularity, Punctuality and Timely Completion, Question and Answers, Report, Paper presentation/Publication, Attendance and Active Participation.

Recommended Format of the Seminar Report

- Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and Year and University
- Seminar Approval Sheet/Certificate,
- Abstract and Keywords
- Acknowledgements
- Table of Contents, List of Figures, List of Tables and Nomenclature
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any/,Discussions and Conclusions ,Bibliography/References
- Plagiarism Check report
- Report Documentation page

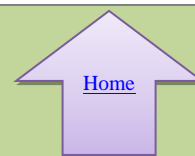
Reference Books :

1. Rebecca Stott, Cordelia Bryan, Tory Young, "Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)", Longman, ISBN-13: 978-0582382435
2. Johnson-Sheehan, Richard, "Technical Communication", Longman. ISBN 0-321-11764-6
3. Vikas Shirodka, "Fundamental skills for building Professionals", SPD, ISBN 978-93-5213-146-5

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	-
CO2	-	1	2	1	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
310250: Audit Course 5



In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at Institute level itself [1]

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

- | | |
|--|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations or presentations | <ul style="list-style-type: none"> Surveys Mini-Project Hands on experience on focused topic |
|--|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentation or Report

Audit Course 5 Options

Audit Course Code	Audit Course Title
310250(A)	Cyber Security
310250(B)	Professional Ethics and Etiquette
310250(C)	Learn New Skills -Full Stack Developer
310250(D)	Engineering Economics
310250(E)	Foreign Language (one of Japanese/ Spanish/ French/ German). Course contents for Japanese (Module 3) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.

<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>
http://www.unipune.ac.in/university_files/syllabi.htm

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
Audit Course 5
310250(A): Cyber Security


[Home](#)

Prerequisites: Computer Network and Security (310244)

Course Objectives:

- To motivate students for understanding the various scenarios of cybercrimes
- To increase awareness about the cybercrimes and ways to be more secure in online activities
- To learn about various methods and tools used in cybercrimes
- To analyze the system for various vulnerabilities

Course Outcomes : On completion of the course, learners will be able to

CO 1: Understand and classify various cybercrimes

CO 2: Understand how criminals plan for the cybercrimes

CO 3: Apply tools and methods used in cybercrime

CO 4: Analyze the examples of few case studies of cybercrimes

Course Contents

- 1. Introduction to Cybercrime:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective.
- 2. Cyber offenses: How Criminals Plan Them:** Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.
- 3. Tools and Methods Used in Cybercrime :** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks (**Expected to cover the introduction to all these terms**).
- 4. Cybercrime: Illustrations, Examples and Mini-Cases :** Introduction, Real-Life Examples, Mini-Cases, Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital Forensics Case Illustrations, Online Scams.

Text Books :

1. Nina Godbole, Sunit Belapure , “Cyber Security- Understanding Cyber Crimes”, Computer Forensics and Legal Perspectives, Wiely India Pvt. Ltd, ISBN- 978-81-265-2179-1
2. William Stallings, “Computer Security: Principles and Practices”, Pearson 6thEd, ISBN 978-0-13-335469-0

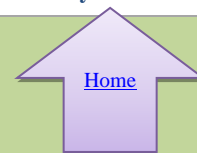
Reference Books :

1. Berouz Forouzan, “Cryptography and Network Security”, TMH, 2 edition, ISBN -978-00-707-0208-0. 5.
2. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed., ISBN- 978-81-317-1288-7
3. CK Shyamala et el., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1	1	2	1	-	3	-	1	-	2
CO2	1	1	1	1	1	1	-	3	-	1	-	2
CO3	1	1	1	1	1	1	-	3	-	1	-	2
CO4	1	1	1	1	1	1	-	3	-	1	-	2

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
Audit Course 5
310250(B): Professional Ethics and Etiquettes



Prerequisites: Business Communication Skill

Course Objectives:

- To learn importance of ethics and the rules of good behavior for today's most common social and business situations.
- To acquire basic knowledge of ethics to make informed ethical decisions when confronted with problems in the working environment.
- To develop an understanding towards business etiquettes and the proper etiquette practices for different business scenarios.
- To learn the etiquette requirements for meetings, entertaining, telephone, email and Internet business interaction scenario.

Course Outcomes:

On completion of the course, learners will be able to

CO1: Summarize the principles of proper courtesy as they are practiced in the workplace.

CO2: Apply proper courtesy in different professional situations.

CO3: Practice and apply appropriate etiquettes in the working environment and day to day life.

CO4: Build proper practices personal and business communications of Ethics and Etiquettes.

Course Contents

1. **Introduction to Ethics:** Basics, Difference Between Morals, Ethics, and Laws, Engineering Ethics: Purpose of Engineering Ethics-Professional and Professionalism, Professional Roles to be played by an Engineer, Uses of Ethical Theories, Professional Ethics, Development of Ethics.
2. **Professional Ethics:** IT Professional Ethics, Ethics in the Business World, Corporate Social Responsibility, Improving Corporate Ethics, Creating an Ethical Work Environment, Including Ethical Considerations in Decision Making, Ethics in Information Technology, Common Ethical issues for IT Users, Supporting the Ethical Practices of IT users.
3. **Business Etiquette:** ABC's of Etiquette, Developing a Culture of Excellence, The Role of Good Manners in Business, Enduring Words Making Introductions and Greeting People: Greeting Components, The Protocol of Shaking Hands, Introductions, Introductory Scenarios, Addressing Individuals Meeting and Board Room Protocol: Guidelines for Planning a Meeting, Guidelines for Attending a Meeting.
4. **Professional Etiquette:** Etiquette at Dining, Involuntary Awkward Actions, How to Network, Networking Etiquette, Public Relations Office(PRO)'s Etiquettes, Technology Etiquette : Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, interview Etiquette, Dressing Etiquettes : for interview, offices and social functions.

References Books:

1. Ghillyer, "Business Ethics Now", 3rd Edition, McGraw-Hill.
2. George Reynolds, "Ethics in information Technology", Cengage Learning, ISBN- 10:1285197151.
3. Charles E Harris, Micheat J. Rabins, "Engineering Ethics", Cengage Learning, ISBN- 13:978-1133934684, 4th Edition.

@The CO-PO Mapping Matrix

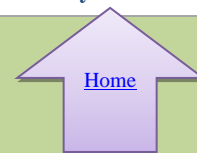
CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	3	1	2	-	2
CO2	-	-	-	-	-	1	1	3	1	2	-	2
CO3	-	-	-	-	-	1	1	3	1	2	-	2
CO4	-	-	-	-	-	1	1	3	1	2	-	2

Savitribai Phule Pune University

Third Year of Engineering (2019 Course)

Audit Course 5

310250(C): Learn New Skills- Full Stack Developer



Prerequisites: Programming Skills

Course Objectives:

- To understand the fundamental concepts in designing web based applications and applying frontend and backend technologies
- To understand the fundamental concepts in applying database techniques in application
- To progress the student towards term "industry ready engineer"

Course Outcomes:

On completion of the course, learners will be able to

CO1: Design and develop web application using frontend and backend technologies.

CO2: Design and develop dynamic and scalable web applications

CO3: Develop server side scripts

CO4: Design and develop projects applying various database techniques

Course Contents

Full stack Developer

1. HTML5
2. CSS3
3. Bootstrap
4. Vanilla JS (ES6+)
5. Flask or Django
6. Wagtail CMS
7. Node.js
8. MySQL
9. jQuery

Team Projects: Design and develop an e-commerce a dynamic, scalable and responsive web application. (Sample Project similar problem statements and be formulated).

Reference Books:

1. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, "Mastering HTML, CSS & Javascript Web Publishing", SAMS, BPB Publications
2. DT Editorial Services " HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)" 2Ed , Dreamtech Press.

Note: This is sample contents for Software Development Using Agility Approach, however the course instructor may design suitable course giving opportunity to the students for learning new skills.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	3	3	1	1	1	1	1	1	1
CO2	3	3	3	3	3	1	1	1	1	1	1	1
CO3	3	3	3	3	3	1	1	1	1	1	1	1
CO4	3	3	3	3	3	1	1	1	1	1	1	1

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
Audit Course 5
310250(D): Engineering Economics

Engineering economics is one of the most practical subject matters in the engineering curriculum, but it is an always challenging, ever-changing discipline. Engineers are planners and builders. They are also problem solvers, manager, decision makers. Engineering economics touches of these activities.

Course Objectives:

- To understand engineering economics and money management
- To understand financial project analysis
- To estimate project cost and apply for business
- To understand making financial decisions when acting as team member or manager in the engineering project

[Home](#)

Course Outcomes:

On completion of the course, learners will be able to

CO1: Understand economics, the cost money and management in engineering

CO2: Analyze business economics and engineering assets evaluation

CO3: Evaluate project cost and its elements for business

CO4: Develop financial statements and make business decisions

Course Contents

- 1. Understanding money and its management:** Engineering Economic Decisions, Time value of money, Money management, Equivalence calculations.
- 2. Evaluating business and engineering assets:** Present worth analysis, Annual equivalence Analysis, Rate of Return Analysis, Benefit Cost Analysis.
- 3. Development project cash flow:** Accounting of Income Taxes, Project cash flow Analysis, Handling Project Uncertainty.
- 4. Special topics in Engineering Economics:** Replacement decisions, understanding financial statements.

Reference Books :

1. Chan S Park, "Fundamentals of Engineering Economics", Pearson, ISBN-13: 9780134870076
2. James Riggs, "Engineering Economics", Tata McGraw-Hill, ISBN – 13: 9780070586703

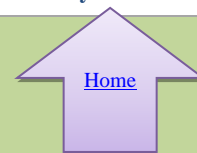
@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1	-	-	-	-	-	2	2	3	1
CO2	1	1	1	-	-	-	-	-	2	2	3	1
CO3	1	1	1	-	-	-	-	-	2	2	3	1
CO4	1	1	1	-	-	-	-	-	2	2	3	1

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)

Audit Course 5

310250(E): Foreign Language (Japanese)-Module 3



Prerequisites: We recommend that candidates should have previously completed AC3-V(210251) and AC4-V (210260)

Course Objectives:

- To open up more doors and job opportunities
- To introduce to Japanese society, culture and entertainment

Course Outcomes:

On completion of the course, learners will be able to

CO1: Apply language to communicate confidently and clearly in the Japanese language

CO2: Understand and use Japanese script to read and write

CO3: Apply knowledge for next advance level reading, writing and listening skills

CO4: Develop interest to pursue further study, work and leisure

Course Contents

1. The Kanji: Brief Historical Outline, Introduction to Kanji, From Pictures to characters
2. Read and Write 58 Kanji Characters, talk about yourself/family/others, things, time, events, and activities-in the present, future, and past tense; shop at stores and order food at restaurants;
3. Lessons: Karate, Park(Playground), The Grandpa's Inaka, The Sun and the Moon, My little sister, Rice Fields, My Teacher, People who Exit and People who Enter.

Reference Books :

1. Japanese Kanji and Kana, "A complete guide to the Japanese writing system", Wolfgang Hadamitzky & Mark Spahn, Tuttle Publishing, Third edition ISBN: 978-1-4629-1018-2(eBook)
2. Banno, Eri, Yoko Ikeda, et al. Genki I, "An Integrated Course in Elementary Japanese", 2nd ed. Japan Times/Tsai Fong Books, 2011. ISBN: 9784789014403.
3. Anna Sato and Eriko Sato, "My First Japanese Kanji Book, Learning kanji the fun and easy way", TUTTLE PUBLISHING, First Edition ISBN: 978-1-4629-1369-5 (eBook)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1

Semester VI

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310251: Data Science and Big Data Analytics



Teaching Scheme: Theory: 04 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
---	-------------------	---

Prerequisites Courses: Discrete Mathematics (210241), Database Management Systems (310341)

Companion Course: Data Science and Big Data Analytics Laboratory (310256)

Course Objectives:

- To understand the need of Data Science and Big Data
- To understand computational statistics in Data Science
- To study and understand the different technologies used for Big Data processing
- To understand and apply data modeling strategies
- To learn Data Analytics using Python programming
- To be conversant with advances in analytics

Course Outcomes:

After completion of the course, learners should be able to

CO1: Analyze needs and challenges for Data Science Big Data Analytics

CO2: Apply statistics for Big Data Analytics

CO3: Apply the lifecycle of Big Data analytics to real world problems

CO4: Implement Big Data Analytics using Python programming

CO5: Implement data visualization using visualization tools in Python programming

CO6: Design and implement Big Databases using the Hadoop ecosystem

Course Contents

Unit I	Introduction to Data Science and Big Data	07 Hours
Basics and need of Data Science and Big Data, Applications of Data Science, Data explosion, 5 V's of Big Data, Relationship between Data Science and Information Science, Business intelligence versus Data Science, Data Science Life Cycle, Data: Data Types, Data Collection. Need of Data wrangling, Methods: Data Cleaning, Data Integration, Data Reduction, Data Transformation, Data Discretization.		
#Exemplar/Case Studies	Create academic performance dataset of students and perform data pre-processing using techniques of data cleaning and data transformation.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Statistical Inference	07 Hours
Need of statistics in Data Science and Big Data Analytics, Measures of Central Tendency: Mean, Median, Mode, Mid-range. Measures of Dispersion: Range, Variance, Mean Deviation, Standard Deviation. Bayes theorem, Basics and need of hypothesis and hypothesis testing, Pearson Correlation, Sample Hypothesis testing, Chi-Square Tests, t-test.		
#Exemplar/Case Studies	For an employee dataset, create measure of central tendency and its measure of dispersion for statistical analysis of given data.	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Big Data Analytics Life Cycle	07 Hours
Introduction to Big Data, sources of Big Data, Data Analytic Lifecycle: Introduction, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communication results, Phase 6: Operation alize.		

#Exemplar/Case Studies	Case study: Global Innovation Social Network and Analysis (GINA).	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Predictive Big Data Analytics with Python	07 Hours
Introduction, Essential Python Libraries, Basic examples. Data Preprocessing: Removing Duplicates, Transformation of Data using function or mapping, replacing values, Handling Missing Data. Analytics Types: Predictive, Descriptive and Prescriptive. Association Rules: Apriori Algorithm, FP growth. Regression: Linear Regression, Logistic Regression. Classification: Naïve Bayes, Decision Trees. Introduction to Scikit-learn, Installations, Dataset, mat plotlib, filling missing values, Regression and Classification using Scikit-learn.		
#Exemplar/Case Studies	Use IRIS dataset from Scikit and apply data preprocessing methods	
*Mapping of Course Outcomes for Unit IV	CO4,CO2	
Unit V	Big Data Analytics and Model Evaluation	07 Hours
Clustering Algorithms: K-Means, Hierarchical Clustering, Time-series analysis. Introduction to Text Analysis: Text-preprocessing, Bag of words, TF-IDF and topics. Need and Introduction to social network analysis, Introduction to business analysis. Model Evaluation and Selection: Metrics for Evaluating Classifier Performance, Holdout Method and Random Sub sampling, Parameter Tuning and Optimization, Result Interpretation, Clustering and Time-series analysis using Scikit-learn, sklearn. metrics, Confusion matrix, AUC-ROC Curves, Elbow plot.		
#Exemplar/Case Studies	Use IRIS dataset from Scikit and apply K-means clustering methods	
*Mapping of Course Outcomes for Unit V	CO4, CO2	
Unit VI	Data Visualization and Hadoop	07 Hours
Introduction to Data Visualization, Challenges to Big data visualization, Types of data visualization, Data Visualization Techniques, Visualizing Big Data, Tools used in Data Visualization, Hadoop ecosystem, Map Reduce, Pig, Hive, Analytical techniques used in Big data visualization. Data Visualization using Python: Line plot, Scatter plot, Histogram, Density plot, Box- plot.		
#Exemplar/Case Studies	Use IRIS dataset from Scikit and plot 2D views of the dataset	
*Mapping of Course Outcomes for Unit VI	CO5, CO6	
Learning Resources		
Text Books:		
<div>1. David Dietrich, Barry Hiller, “Data Science and Big Data Analytics”, EMC education services, Wiley publication, 2012, ISBN0-07-120413-X</div> <div>2. Jiawei Han, Micheline Kamber, and Jian Pie, “Data Mining: Concepts and Techniques” Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807</div>		
Reference Books :		
<div>1. EMC Education Services, “Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data”</div> <div>2. DT Editorial Services, “Big Data, Black Book”, DT Editorial Services, ISBN: 9789351197577, 2016 Edition</div> <div>3. Chirag Shah, “A Hands-On Introduction To Data Science”, Cambridge University Press, (2020), ISBN : ISBN 978-1-108-47244-9</div> <div>4. Wes McKinney, “Python for Data Analysis ”, O' Reilly media, ISBN: 978-1-449-31979-3</div> <div>5. Trent Hauk, “Scikit-learn Cookbook”, Packt Publishing, ISBN: 9781787286382</div>		

6. Jenny Kim, Benjamin Bengfort, “Data Analytics with Hadoop”, OReilly Media, Inc., ISBN: 9781491913703
7. Venkat Ankam, “Big Data Analytics”, Packt Publishing, ISBN: 9781785884696
8. Seema Acharya, Subhashini Chellappan, “Big Data And Analytics”, Wiley publi ISBN: 9788126579518


[Home](#)
e-Books :

- An Introduction to Statistical Learning by Gareth James
<https://www.ime.unicamp.br/~dias/Intoduction%20to%20Statistical%20Learning.pdf>
- Python Data Science Handbook by Jake VanderPlas
<https://tanthiamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf>
- Introducing Data Science by Davy Ciele, Manning Publications
- Introducing Data Science [PDF]
- Handbook for visualizing : a handbook for data driven design by Andy krik
- A Handbook for Data Driven Design
- An introduction to data Science :
<https://docs.google.com/file/d/0B6iefdnF22XQeVZDSkxjZ0Z5VUE/edit?pli=1>
- Hadoop Tutorial :
https://www.tutorialspoint.com/hadoop/hadoop_tutorial.pdf?utm_source=7&utm_medium=affiliate&utm_content=5f34cd37cdf1050001b09537&utm_campaign=Admitad&utm_term=761c575424fc4a6b48d02f72157eb578
- Learning with Python; How to think like a computer scientist:
<http://openbookproject.net/thinkcs/python/english3e/>
- Python for everybody:
http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf
- Scikit Learn Tutorial
<https://scikit-learn.org/stable/>

MOOCs Courses links:

- Computer Science and Engineering - NOC:Data Science for Engineers
- Computer Science and Engineering - NOC:Python for Data Science
- Computer Science and Engineering - NOC:Data Mining
- Computer Science and Engineering - NOC:Big Data Computing
- Big Data Computing - Course

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	1	-	-	-	-	1	-	-	1
CO2	1	2	1	2	-	1	-	-	1	-	-	1
CO3	2	1	2	1	-	1	-	-	1	-	-	1
CO4	1	2	2	2	2	-	-	-	1	-	-	1
CO5	1	2	2	1	2	-	-	-	1	-	-	1
CO6	1	2	1	2	2	-	-	-	1	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310252: Web Technology


[Home](#)

Teaching Scheme:
Theory : 04 Hours/Week

Credit: 03

Examination Scheme:
Mid-Sem (TH) : 30 Marks
End-Sem (TH): 70 Marks

Prerequisites Courses: Database Management Systems (310341),
 Computer Networks and Security (310244)

Companion Course: Web Technology Laboratory (310257)

Course Objectives:

- To learn the fundamentals of web essentials and markup languages
- To use the Client side technologies in web development
- To use the Server side technologies in web development
- To understand the web services and frameworks

Course Outcomes:

On completion of the course, learners should be able to

CO1: Implement and analyze behavior of web pages using HTML and CSS

CO2: Apply the client side technologies for web development

CO3: Analyze the concepts of Servlet and JSP

CO4: Analyze the Web services and frameworks

CO5: Apply the server side technologies for web development

CO6: Create the effective web applications for business functionalities using latest web development platforms

Course Contents

Unit I

Web Essentials and Mark-up language- HTML

07 Hours

The Internet, basic internet protocols, the World Wide Web, HTTP Request message, HTTP response message, web clients, web servers. **HTML:** Introduction, history and versions. **HTML elements:** headings, paragraphs, line break, colors and fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5. **CSS:** Introduction to Style Sheet, CSS features, CSS core syntax, Style sheets and HTML, Style rule cascading and inheritance, text properties. Bootstrap.

#Exemplar/Case Studies

Create a style sheet suitable for blogging application using HTML and using style sheet

***Mapping of Course Outcomes for Unit I**

CO1

Unit II

Client Side Technologies: JavaScript and DOM

07 Hours

JavaScript: Introduction to JavaScript, JavaScript in perspective, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built in objects, JavaScript debuggers. **DOM:** Introduction to Document Object Model, DOM history and levels, intrinsic event handling, modifying element style, the document tree, DOM event handling, jQuery, Overview of Angular JS.

#Exemplar/Case Studies

Enhancement in created blogging application using JavaScript (Add Entry feature)

***Mapping of Course Outcomes for Unit II**

CO2

Unit III	Java Servlets and XML	07 Hours
Servlet: Servlet architecture overview, A “Hello World” servlet, Servlets generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, other Servlet capabilities, data storage, Servlets concurrency, databases (MySQL) and Java Servlets. XML: XML documents and vocabularies, XML declaration, XML Namespaces, DOM based XML processing, transforming XML documents, DTD: Schema, elements, attributes. AJAX: Introduction, Working of AJAX.		
#Exemplar/Case Studies	Develop server-side code for blogging application	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	JSP and Web Services	07 Hours
JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-View-Controller paradigm, JSP related technologies. Web Services: Web Service concepts, Writing a Java Web Service, Writing a Java web service client, Describing Web Services: WSDL, Communicating Object data: SOAP. Struts: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.		
#Exemplar/Case Studies	Transform the blogging application from a loose collection of various resources (servlets, HTML documents, etc.) to an integrated web application that follows the MVC paradigm	
*Mapping of Course Outcomes for Unit IV	CO3, CO4	
Unit V	Server Side Scripting Languages	07 Hours
PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling, files, cookies, session tracking, using MySQL with PHP, WAP and WML. Introduction to ASP.NET: Overview of the .NET Framework, Overview of C#, Introduction to ASP.NET, ASP.NET Controls, Web Services. Overview of Node JS.		
#Exemplar/Case Studies	Use of PHP in developing blogging application.	
*Mapping of Course Outcomes for Unit V	CO5, CO6	
Unit VI	Ruby and Rails	07 Hours
Introduction to Ruby: Origins & uses of Ruby, scalar types and their operations, simple input and output, control statements, fundamentals of arrays, hashes, methods, classes, code blocks and iterators, pattern matching. Introduction to Rails: Overview of Rails, Document Requests, Processing Forms, Rails Applications and Databases, Layouts, Rails with Ajax. Introduction to EJB.		
#Exemplar/Case Studies	Study of dynamic web product development using ruby and rails	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		
Text Books: 1. Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035		

- Robert W. Sebesta, "Programming the World Wide Web", 4th Edition, Pearson education, 2008

Reference Books :

- Marty Hall, Larry Brown, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.
- H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.
- Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2006.
- Xue Bai et al, "The web Warrior Guide to Web Programming", Thomson, 2003.

e-Books :

- <https://www.w3.org/html/>
- HTML, The Complete Reference <http://www.htmlref.com/>
- <http://w3schools.org/>
- <http://php.net/>
- <https://jquery.com/>
- <https://developer.mozilla.org/en-US/docs/AJAX>
- <http://www.tutorialspoint.com/css/>

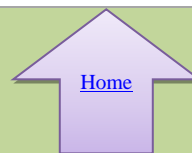
MOOCs Courses link:

- <http://www.nptelvideos.in/2012/11/internet-technologies.html>
- <https://freevideolectures.com/course/2308/internet-technology/25video> lecture by Prof. Indranil Sengupta, IIT, Kharagpur
- <https://www.digimat.in/nptel/courses/video/106105191/L01.html>
- http://www.nptelvideos.com/php/php_video_tutorials.php

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12
CO1	1	1	2	1	1	-	-	-	-	-	-	-
CO2	-	2	1	3	1	-	-	-	1	-	-	-
CO3	2	-	2	1	-	1	-	-	-	-	1	-
CO4	1	3	1	2	2	1	-	1	-	-	-	1
CO5	1	1	2	-	3	-	1	1	-	1	-	-
CO6	2	1	-	2	1	1	-	1	-	-	-	-

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310253: Artificial Intelligence



Teaching Scheme:
Theory: 04 Hours/Week

Credit: 03

Examination Scheme:
Mid-Sem (TH) : 30 Marks
End-Sem (TH): 70 Marks

Prerequisites Courses: Programming and Problem solving (110005),
 Data Structures and Algorithms (210252)

Companion Course: Laboratory Practice II (310258)

Course Objectives:

- To understand the concept of Artificial Intelligence (AI) in the form of various Intellectual tasks
- To understand Problem Solving using various peculiar search strategies for AI
- To understand multi-agent environment in competitive environment
- To acquaint with the fundamentals of knowledge and reasoning
- To devise plan of action to achieve goals as a critical part of AI
- To develop a mind to solve real world problems unconventionally with optimality

Course Outcomes:

After completion of the course, students should be able to

- CO1:** Identify and apply suitable Intelligent agents for various AI applications
CO2: Build smart system using different informed search / uninformed search or heuristic approaches
CO3: Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem
CO4: Apply the suitable algorithms to solve AI problems
CO5: Implement ideas underlying modern logical inference systems
CO6: Represent complex problems with expressive yet carefully constrained language of representation

Course Contents

Unit I	Introduction	07 Hours
Introduction to Artificial Intelligence, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Intelligent Agents, Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agents.		
#Exemplar/Case Studies	Kroger: How This U.S. Retail Giant Is Using AI And Robots To Prepare For The 4th Industrial Revolution	
*Mapping of Course Outcomes for Unit I	CO1, CO4	
Unit II	Problem-solving	07 Hours
Solving Problems by Searching, Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions, Search in Complex Environments, Local Search and Optimization Problems.		
#Exemplar/Case Studies	4th Industrial Revolution Using AI, Big Data And Robotics	
*Mapping of Course Outcomes for Unit II	CO2, CO4	

Unit III	Adversarial Search and Games	07 Hours
Game Theory, Optimal Decisions in Games, Heuristic Alpha–Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs.		
#Exemplar/Case Studies	Machine Learning At Google: The Amazing Use Case Of Becoming A Fully Sustainable Business	
*Mapping of Course Outcomes for Unit III	CO3, CO4	
Unit IV	Knowledge	07 Hours
Logical Agents, Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic, Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.		
#Exemplar/Case Studies	BBC To Launch AI - Enabled Interactive Radio Show For Amazon Echo And Google Home Chat bots	
*Mapping of Course Outcomes for Unit IV	CO3, CO4	
Unit V	Reasoning	07 Hours
Inference in First-Order Logic, Propositional vs. First-Order Inference, Unification and First-Order Inference, Forward Chaining, Backward Chaining, Resolution, Knowledge Representation, Ontological Engineering, Categories and Objects, Events, Mental Objects and Modal Logic, Reasoning Systems for Categories, Reasoning with Default Information		
#Exemplar/Case Studies	The Amazing Ways How Wikipedia Uses Artificial Intelligence	
*Mapping of Course Outcomes for Unit V	CO4, CO5	
Unit VI	Planning	07 Hours
Automated Planning, Classical Planning, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Time, Schedules, and Resources, Analysis of Planning Approaches, Limits of AI, Ethics of AI, Future of AI, AI Components, AI Architectures.		
#Exemplar/Case Studies	The Amazing Ways Samsung Is Using Big Data, Artificial Intelligence And Robots To Drive Performance	
*Mapping of Course Outcomes for Unit VI	CO4, CO6	
Learning Resources		
Text Books: 1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third edition, Pearson, 2003, ISBN :10: 0136042597 2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill Education(India), 2013, ISBN : 978-1-25-902998-1 3. Elaine Rich, Kevin Knight and Nair, “Artificial Intelligence”, TMH, ISBN-978-0-07-008770-5		

Reference Books:

1. Nilsson Nils J , “Artificial Intelligence: A new Synthesis”, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4
2. Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley Publishing Company, ISBN: 0-201-53377-4
3. Andries P. Engelbrecht-Computational Intelligence: An Introduction, 2nd Edition-Wiley India- ISBN: 978-0-470-51250-0
4. Dr. Lavika Goel, “Artificial Intelligence: Concepts and Applications”, Wiley publication, ISBN: 9788126519934
5. Dr. Nilakshi Jain, “Artificial Intelligence, As per AICTE: Making a System Intelligent”, Wiley publication, ISBN: 9788126579945

e-Books :

- <https://cs.calvin.edu/courses/cs/344/kvlinden/resources/AIMA-3rd-edition.pdf>
- <https://www.cin.ufpe.br/~tf12/artificial-intelligence-modern-approach.9780131038059.25368.pdf>
- <http://aima.cs.berkeley.edu/>

MOOCs Courses link:

- <https://nptel.ac.in/courses/106/102/106102220/>
- <https://nptel.ac.in/courses/106/105/106105077/>
- <https://nptel.ac.in/courses/106/105/106105078/>
- <https://nptel.ac.in/courses/106/105/106105079/>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	-	-	1	3	-	2	-	-
CO2	1	3	3	2	3	1	-	3	1	2	-	-
CO3	3	2	2	2	1	1	1	-	-	2	-	-
CO4	1	2	2	1	-	-	1	3	1	2	-	-
CO5	1	2	2	1	-	-	1	3	1	2	-	-
CO6	1	2	2	1	-	-	1	3	1	2	-	-

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective II
310254(A): Information Security



Teaching Scheme: Theory: 04 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
---	-------------------	---

Prerequisites Courses: --Computer Networks and Security (310244)

Companion Course: --Laboratory Practice II (310258)

Course Objectives:

- To understand the fundamental approaches, principles and apply these concepts in Information Security
- To acquire the knowledge of mathematics for cryptography, understand the concepts of basic cryptography
- To learn standard algorithms and protocols employed to provide confidentiality, integrity and authenticity
- To acquire the knowledge of security protocol deployed in web security
- To study Information Security tools

Course Outcomes:

On completion of the course, learners should be able to

CO1: Model the cyber security threats and apply formal procedures to defend the attacks

CO2: Apply appropriate cryptographic techniques by learning symmetric and asymmetric key cryptography

CO3: Design and analyze web security solutions by deploying various cryptographic techniques along with data integrity algorithms

CO4: Identify and Evaluate Information Security threats and vulnerabilities in Information systems and apply security measures to real time scenarios

CO5: Demonstrate the use of standards and cyber laws to enhance Information Security in the development process and infrastructure protection

Course Contents

Unit I	Introduction to Information Security	05 Hours
Foundations of Security, Computer Security Concepts, The OSI Security Architecture, Security attacks, Security services, Security mechanism, A Model for Network Security.		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: Clam AV antivirus engine, Anti Phishing, Anti Spyware, Wireshark	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Symmetric Key Cryptography	07 Hours
Classical Encryption Techniques: Stream Ciphers, Substitution Techniques: Caesar Cipher, Mono alphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Block Ciphers and Data Encryption standards, 3DES, Advanced Encryption standard		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: crypt tool	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Asymmetric Key Cryptography	07 Hours

Number theory: Prime number, Fermat and Euler theorems , Testing for primality, Chinese remainder theorem, discrete logarithm, Public Key Cryptography and RSA, Key Management, Diffie-Hellman key exchange, El Gamal algorithm, Elliptic Curve Cryptography		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: crypt tool	
*Mapping of Course Outcomes for Unit III	CO2	
Unit IV	Data Integrity Algorithms And Web Security	09 Hours
Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3, MD4, MD5. Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs. Digital Signatures: Digital Signatures, Schemes, Digital Signature standard, PKI X.509 Certificate. Web Security issues, HTTPS, SSH, Email security: PGP, S/MIME, IP Security : IPsec		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: Open SSL, Hash Calculator Tool : MD5, SHA1, SHA256, SHA 512	
*Mapping of Course Outcomes for Unit IV	CO3	
Unit V	Network and System Security	07 Hours
The OSI Security architecture, Access Control, Flooding attacks, DOS, Distributed DOS attacks Intrusion detection, Host based and network based Honeypot, Firewall and Intrusion prevention system, Need of firewall, Firewall characteristics and access policy, Types of Firewall, DMZ networks, Intrusion prevention system: Host based, Network based, Hybrid. Operating system Security, Application Security, Security maintenance, Multilevel Security, Multilevel Security for role based access control, Concepts of trusted system, Trusted computing.		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: DOS Attacks, DDOS attacks, Wireshark, Cain and Abel, iptables/ Windows Firewall, Suricata, fail2ban, Snort.	
*Mapping of Course Outcomes for Unit V	CO4	
Unit VI	Cyber Security and Tools	07 Hours
Introduction, Cybercrime and Information Security, Classification of Cybercrimes, The legal perspectives-Indian perspective, Global perspective, Categories of Cybercrime, Social Engineering, Cyber stalking, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and Cybercrime Scenario in India, Indian IT Act.		
#Exemplar/Case Studies	Study of any two network security scanners: Nmap, Metasploit, Open VAS, Aircrack,Nikito,Samurai,Safe3etc.	
*Mapping of Course Outcomes for Unit VI	CO5	
Learning Resources		
Text Books :		
1. William Stallings, “Cryptography and Network Security Principals and Practice”, Seventh edition, Pearson , ISBN : 978-1-292-15858		
2. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, 3rd_Edition, Pearson , ISBN : 978-0-13-3777392-7		
3. Nina Godbole, Sumit Belapure, “Cyber Security”. Wiley, ISBN: 978-81-265-2179-1		

Reference Books :

1. Atul Kahate, "Cryptography and Network Security", 3e, McGraw Hill Education
2. V.K. Pachghare, "Cryptography and Information Security", PHI Learning
3. Bernard Menezes, "Network Security and Cryptography", Cengage Learning India, 2014, ISBN No.: 8131513491
4. JoshephKizza, "Computer Network Security and Cyber Ethics", McFarland & Company, Inc., Publishers , Fourth Edition
5. Michael Whitman and Herbert Matford, "Principles of Information Security", Course Technnology Ink, 7th edition
6. Neena Godbole, "Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices" , Wiley publication, ISBN: 9788126564057

e-Books :


- Introduction to Cyber Security, "<http://www.uou.ac.in/sites/default/files/slm/FCS.pdf>", by Dr. Jeetendra Pande | Uttarakhand Open University, Haldwani
- "Information Security, The complete reference", Second Edition, Mark Rhodes-Ousley, McGrawHill

MOOCs Courses link:

- NPTEL course on <https://nptel.ac.in/courses/106/106/106106129/>(IIT Madras, Prof. V.Kamakoti)
- Introduction to cyber security, "https://swayam.gov.in/nd2_nou19_cs08/preview" by Dr. Jeetendra Pande | Uttarakhand Open University, Haldwani

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	2	-	1	-	-	-	1
CO2	3	3	2	3	-	2	-	-	-	-	-	-
CO3	3	3	2	3	-	2	-	-	-	1	-	-
CO4	3	3	2	2	-	-	1	-	-	-		-
CO5	3	2	1	2	-	2	1	2	-	1	1	1

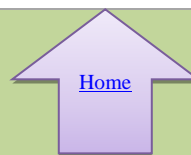
Savitribai Phule Pune University Third Year of Computer Engineering (2019 Course) Elective II 310254(B): Augmented and Virtual Reality			
Teaching Scheme: Theory: 04 Hours/Week	Credit: 03	Examination Scheme: Mid-Semester (TH) : 30 Marks End-Sem (TH): 70 Marks	
Prerequisites Courses: Computer Graphics (210244)			
Companion Course: Laboratory Practice II (310258)			
Course Objectives: <ul style="list-style-type: none"> To understand fundamentals of augmented and virtual reality To describe various elements and components used in AR/VR Hardware and Software To understand the methods used for representing and rendering the virtual world To create Augmented Reality application that allows users to interact with the immersive 3D world 			
Course Outcomes: On completion of the course, learners should be able to CO1: Understand the basics of Augmented and Virtual reality systems and list their applications CO2: Describe interface to the Virtual World with the help of input and output devices CO3: Explain representation and rendering system in the context of Virtual Reality CO4: Analyze manipulation, navigation and interaction of elements in the virtual world CO5: Summarize the basic concepts and hardware of Augmented Reality system CO6: Create Mobile Augmented Reality using Augmented Reality techniques and software			
Course Contents			
Unit I	Introduction	06 Hours	
Virtual Reality (VR): Introduction, Key Elements of VR, Experience, History, Applications. Augmented Reality (AR): Introduction, History, Key Aspects, and Applications.			
#Exemplar/Case Studies	Timeline of evolution of AR from VR and Case study of a single application using both VR and AR technologies		
*Mapping of Course Outcomes for Unit I	CO1		
Unit II	Interface to the Virtual World	08 Hours	
Input: User Monitoring, Position Tracking, Body Tracking, Physical input Devices, Speech Recognition (Audio Input) and World Monitoring: Persistent Virtual Worlds, Bringing the Real World into the Virtual World. Output: Visual Displays: Properties of Visual Displays, Monitor-based or Fishtank-VR, Projection-based VR, Head-based VR, See-through Head-based Displays, Handheld VR. Aural Displays: Properties of Aural Displays, Head-based Aural Displays- Headphones, Stationary Aural Displays-Speakers. Haptic Displays: Properties of Haptic Displays, Tactile Haptic Displays, End-effector Displays, Robotically Operated Shape Displays, Vestibular and Other Senses.			
#Exemplar/Case Studies	Study the use of Virtual Reality at NASA		

*Mapping of Course Outcomes for Unit II		CO2
Unit III	Representing and Rendering the Virtual World	08 Hours
Representation of the Virtual World: Visual Representation in Virtual Reality, Aural Representation and Haptic Representation in Virtual Reality. Rendering Systems: Visual Rendering Systems: Visual Rendering Methods, Geometrically Based Rendering Systems, Non-geometric Rendering Systems, Rendering Complex Visual Scenes, Computer Graphics System Requirements. Aural Rendering Systems: Visual Rendering Methods, Rendering Complex Sounds, Sound-Generation Hardware, Internal Computer Representation. Haptic Rendering Systems : Haptic Rendering Methods, Rendering Complex Haptic Scenes with Force Displays, Haptic Rendering Techniques.		
#Exemplar/Case Studies	GHOST (General Haptics Open Software Toolkit) software development toolkit.	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Interacting with the Virtual World and Virtual Reality Experience	07 Hours
User Interface Metaphors, Manipulating a Virtual World, Properties of Manipulation, Manipulation Operations, Navigating in a Virtual World-Way finding and Travelling, Classes of Travel Methods Interacting with Others-Shared Experience, Collaborative Interaction, Interacting with the VR System, Immersion, Rules of the Virtual World: Physics, Substance of the Virtual World.		
#Exemplar/Case Studies	Side effects of using VR systems/ VR sickness and Study of Iterative design of any VR game.	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Augmented Reality	06 Hours
Concepts: Computer Graphics, Dimensionality, Depth Cues, Registration and Latency, Working of Augmented Reality, Augmented Reality Hardware (Sensors, Processors, Displays), Ingredients of an AR Experience.		
#Exemplar/Case Studies	Augmented Reality (AR) and Virtual Reality (VR) headsets mainly find applications in gaming, movies, and other forms of entertainment. French startup Lynx has manufactured a standalone Mixed Reality (MR) headset for entertainment, medical, industrial, and defense applications. Analyze the technical specifications of Lynx – Mixed Reality Headset	
*Mapping of Course Outcomes for Unit V	CO1, CO5	
Unit VI	Augmented Reality Software and Mobile Augmented Reality	07 Hours
Augmented Reality Systems, Software Components, Software Tools for Content Creation, Interaction in Augmented Reality, Augmented Reality Techniques: Marker based and Marker less tracking, Mobile Augmented Reality.		

#Exemplar/Case Studies	Case study of Google Maps AR navigation and its use
*Mapping of Course Outcomes for Unit VI	CO6
Learning Resources	
Text Books:	
<ol style="list-style-type: none"> 1. William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design”, (The Morgan Kaufmann Series in Computer Graphics), Morgan Kaufmann Publishers, San Francisco, CA, 2002 2. Alan B Craig, “Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann Publishers, ISBN:978-0240824086 	
Reference Books:	
<ol style="list-style-type: none"> 1. Steven M. LaValle, “Virtual Reality”, Cambridge University Press, 2016 2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009. 3. Schmalstieg / Hollerer, “Augmented Reality: Principles & Practice”, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494 4. Sanni Siltanen, “Theory and applications of marker-based augmented reality”, Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0 	
e-Books :	
<ul style="list-style-type: none"> • http://lavallo.pl/vr/book.html • https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf 	
MOOC Courses link:	
<ul style="list-style-type: none"> • https://nptel.ac.in/courses/106/106/106106138/ • https://www.coursera.org/learn/introduction-virtual-reality • https://www.coursera.org/learn/ar 	

<u>@ The CO-PO Mapping Matrix</u>												
CO/ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	2	-	-	-	-	-	-	-	-	-
CO3	1	2	2	1	2	-	-	-	-	-	-	1
CO4	1	2	2	-	2	-	-	-	-	-	-	1
CO5	1	1	2	2	1	-	-	-	-	-	-	2
CO6	1	2	2	2	3	-	-	-	-	-	-	2

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective II
310254(C): Cloud Computing



Teaching Scheme: Theory: 04 Hours/Week	Credit: 03	Examination Scheme: Mid-Semester (TH) : 30 Marks End-Sem (TH): 70 Marks
---	-------------------	--

Prerequisites Courses: Computer Networks and Security(310244), Distributed Systems (310245C)

Companion Course: Laboratory Practice II (310258)

Course Objectives:

- To study fundamental concepts of cloud computing
- To learn various data storage methods on cloud
- To understand the implementation of Virtualization in Cloud Computing
- To learn the application and security on cloud computing
- To study risk management in cloud computing
- To understand the advanced technologies in cloud computing

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Understand the different Cloud Computing environment
CO2: Use appropriate data storage technique on Cloud, based on Cloud application
CO3: Analyze virtualization technology and install virtualization software
CO4: Develop and deploy applications on Cloud
CO5: Apply security in cloud applications
CO6: Use advance techniques in Cloud Computing

Course Contents

Unit I	Introduction to Cloud Computing	07 Hours
Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models.		
#Exemplar/Case Studies	Cloud Computing Model of IBM	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Data Storage and Cloud Computing	07 Hours
Data Storage: Introduction to Enterprise Data Storage, Direct Attached Storage, Storage Area Network, Network Attached Storage, Data Storage Management, File System, Cloud Data Stores, Using Grids for Data Storage. Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing. Cloud Storage from LANs to WANs: Cloud Characteristics, Distributed Data Storage.		
#Exemplar/Case Studies	Online Book Marketing Service, Online Photo Editing Service	

*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Virtualization in Cloud Computing	07 Hours
Introduction: Definition of Virtualization, Adopting Virtualization, Types of Virtualization, Virtualization Architecture and Software, Virtual Clustering, Virtualization Application, Pitfalls of Virtualization. Grid, Cloud and Virtualization: Virtualization in Grid, Virtualization in Cloud, Virtualization and Cloud Security. Virtualization and Cloud Computing: Anatomy of Cloud Infrastructure, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization.		
#Exemplar/Case Studies	Xen: Para virtualization, VMware: Full Virtualization, Microsoft Hyper-V	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Cloud Platforms and Cloud Applications	07 Hours
Amazon Web Services (AWS): Amazon Web Services and Components, Amazon Simple DB, Elastic Cloud Computing (EC2), Amazon Storage System, Amazon Database services (Dynamo DB). Microsoft Cloud Services: Azure core concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Computing Applications: Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Geosciences: Satellite Image Processing, Business and Consumer Applications: CRM and ERP, Social Networking, Google Cloud Application: Google App Engine. Overview of OpenStack architecture.		
#Exemplar/Case Studies	Multiplayer Online Gaming	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Security in Cloud Computing	07 Hours
Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing. Data Security in Cloud: Security Issues, Challenges, advantages, Disadvantages, Cloud Digital persona and Data security, Content Level Security. Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure Cloud Software Testing.		
#Exemplar/Case Studies	Cloud Security Tool: Acunetix.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Advanced Techniques in Cloud Computing	07 Hours
Future Trends in cloud Computing, Mobile Cloud, Automatic Cloud Computing: Comet Cloud. Multimedia Cloud: IPTV, Energy Aware Cloud Computing, Jungle Computing, Distributed Cloud Computing Vs Edge Computing, Containers, Docker, and Kubernetes, Introduction to DevOps. IOT and Cloud Convergence: The Cloud and IoT in your Home, The IOT and cloud in your Automobile, PERSONAL: IoT in Healthcare.		
#Exemplar/Case Studies	Case studies on Dev Ops: DocuSign, Forter, Gengo.	
*Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources

Text Books :

1. A. Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson, ISBN: 978-81-317-7651-3
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN-13:978-1-25-902995-0

Reference Books :

1. James Bond, "The Enterprise Cloud", O'Reilly Media, Inc. ISBN: 9781491907627
2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", Wiley Publications, ISBN: 978-0-470-97389-9
3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.
4. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications", Cambridge University Press, ISBN: 9780511778476
5. Tim Mather, Subra K, Shahid L., "Cloud Security and Privacy", Oreilly, ISBN-13 978-81-8404-815-5
6. Dr. Kumar Saurabh, "Cloud Computing, 4ed: Architecting Next-Gen Transformation Paradigms", Wiley publication, ISBN: 9788126570966
7. Rishabh Sharma, "Cloud Computing: Fundamentals, Industry Approach and Trends", Wiley publication, ISBN:

e-Books :

- <https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-and-Paradigms.pdf>
- <https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf>
- <https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf>
- <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.500-291r2.pdf>

MOOCs Courses link:

- Cloud Computing https://onlinecourses.nptel.ac.in/noc21_cs14/preview?
- Cloud Computing and Distributed System: https://onlinecourses.nptel.ac.in/noc21_cs15/preview?
- <https://www.digimat.in/nptel/courses/video/106105167/L01.html>
- <https://www.digimat.in/nptel/courses/video/106105167/L03.html>
- <https://www.digimat.in/nptel/courses/video/106105167/L20.html>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	-	-	-	-	-	-	-	1
CO2	1	2	1	-	-	-	-	-	-	-	-	-
CO3	1	2	1	-	2	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	1
CO5	1	2	2	2	-	-	-	-	-	-	-	-
CO6	1	2	2	1	1	-	-	-	-	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective II
310254(D): Software Modeling and Architecture



Teaching Scheme: Theory: 04 Hours/Week	Credit: 03	Examination Scheme: Mid-Semester (TH) : 30 Marks End-Sem (TH): 70 Marks
---	-------------------	--

Prerequisites Courses: Object Oriented Programming (210243), Software Engineering (210253)

Companion Course: Laboratory Practice II (310258)

Course Objectives:

- To understand and apply Object Oriented concept for designing Object Oriented based model or application
- To transform Requirement document to appropriate design
- To acquaint with the interaction between quality attributes and software architecture
- To understand different architectural designs, transform them into proper model and document them
- To understand software architecture with case studies and explore with examples, use of design pattern application

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Analyze the problem statement (SRS) and choose proper design technique for designing web-based/ desktop application
- CO2:** Design and analyze an application using UML modeling as fundamental tool
- CO3:** Evaluate software architectures
- CO4:** Use appropriate architectural styles and software design patterns
- CO5:** Apply appropriate modern tool for designing and modeling

Course Contents

Unit I	Concepts of Software Modeling	07 Hours
<p>Software Modeling: Introduction to Software Modeling, Advantages of modeling, Principles of modeling. Evolution of Software Modeling and Design Methods: Object oriented analysis and design methods, Concurrent, Distributed Design Methods and Real-Time Design Methods, Model Driven Architecture (MDA), 4+1 Architecture, Introduction to UML, UML building Blocks, COMET Use Case–Based Software Life Cycle. Requirement Study: Requirement Analysis, SRS design, Requirements Modeling. Use Case: Actor and Use case identification, Use case relationship (Include, Extend, Use case Generalization, Actor Generalization), Use case template.</p>		
#Exemplar/Case Studies	Requirement modeling and use case modeling for Real life applications (e.g., Online shopping system)	
*Mapping of Course Outcomes for Unit I	CO1, CO2	
Unit II	Static Modeling	07 Hours
<p>Study of classes (analysis level and design level classes). Methods for identification of classes: RUP (Rational Unified Process), CRC (Class, Responsibilities and Collaboration), Use of Noun Verb analysis (for identifying entity classes, controller classes and boundary classes). Class Diagram: Relationship between classes, Generalization/Specialization Hierarchy, Composition and Aggregation Hierarchies, Associations Classes, Constraints.</p> <p>Object diagram, Package diagram, Component diagram, Composite Structure diagram, Deployment Diagram.</p>		

#Exemplar/Case Studies	UML Static Diagrams for Real life applications (e.g., Online shopping system).	
*Mapping of Course Outcomes for Unit II	CO1 ,CO2	
Unit III	Dynamic Modeling	07 Hours
Activity diagram: Different Types of nodes, Control flow, Activity Partition, Exception handler, Interruptible activity region, Input and output parameters, Pins. Interaction diagram: Sequence diagram, Interaction Overview diagram, State machine diagram, Advanced State Machine diagram, Communication diagram, Timing diagram.		
#Exemplar/Case Studies	UML dynamic Diagrams of for Real life applications.	
*Mapping of Course Outcomes for Unit III	CO1 ,CO2	
Unit IV	Software Architecture and Quality Attributes	07 Hours
Introduction to Software Architecture, Importance of Software Architecture, Architectural Structure and Views. Architectural Pattern: common module, Common component-and-connector, Common allocation. Quality Attributes: Architecture and Requirements, Quality Attributes and Considerations		
#Exemplar/Case Studies	Case study of any real-life application	
*Mapping of Course Outcomes for Unit IV	CO3	
Unit V	Architectural Design and Documentation	07 Hours
Architecture in the Life Cycle: Architecture in Agile Projects, Architecture and Requirements, Designing an Architecture. Documenting Software Architecture: Notations, Choosing and Combining views, Building the documentation Package, Documenting Behavior, Documenting Architecture in an Agile Development Project.		
#Exemplar/Case Studies	Air Traffic Control.	
*Mapping of Course Outcomes for Unit V	CO4 , CO5	
Unit VI	Design Patterns	07 Hours
Design Patterns: Introduction, Different approaches to select Design Patterns. Creational patterns: Singleton, Factory, Structural pattern: Adapter, Proxy. Behavioral Patterns: Iterator, Observer Pattern with applications.		
#Exemplar/Case Studies	Flight Simulation	
*Mapping of Course Outcomes for Unit VI	CO4, CO5	
Learning Resources		
Text Books :		
1. Jim Arlow, Ila Neustadt, “UML 2 and the unified process –practical object-oriented analysis and design”, Addison Wesley, Second edition, ISBN 978-0201770605.		
2. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Second Edition, Pearson ,ISBN 978-81-775-8996-2		
3. Erich Gamma, “Design Patterns”, Pearson, ISBN 0-201-63361-2.		

Reference Books :

1. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures", Cambridge University Press, 2011, ISBN 978-0-521-76414-8
2. Gady Booch, James Rumbaugh, Ivar Jacobson, "The unified modeling language user guide", Pearson Education, Second edition, 2008, ISBN 0-321-24562
3. Ian Sommerville, "Software Engineering", Addison and Wesley, ISBN 0-13-703515-2

e-Books :

- <https://ebookpdf.com/roger-s-pressman-software-engineering>
- <https://dhomaseghanshyam.files.wordpress.com/2016/02/gomaa-softwaremodellinganddesign.pdf>
- <https://balu051989.files.wordpress.com/2011/06/the-unified-modeling-language-user-guide-by-grady-booch-james-rumbaugh-ivar-jacobson.pdf>
- [http://index-of.co.uk/Engineering/Software%20Engineering%20\(9th%20Edition\).pdf](http://index-of.co.uk/Engineering/Software%20Engineering%20(9th%20Edition).pdf)

MOOCs Courses link

- <https://nptel.ac.in/courses/106/105/106105224/>
- https://onlinecourses.nptel.ac.in/noc20_cs59/preview
- https://onlinecourses.nptel.ac.in/noc20_cs84/preview

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	-	3	-	-	-	-	-	-	1
CO2	1	1	3	-	3	-	-	-	-	-	-	1
CO3	1	1	2	1	2	-	-	-	-	-	-	1
CO4	1	1	3	2	3	-	-	-	-	-	-	1
CO5	1	1	3	-	3	-	-	-	-	-	-	2

Savitribai Phule Pune University**Third Year of Computer Engineering (2019 Course)****310255: Internship****[Home](#)**Teaching Scheme:**********Credit: 04****Examination Scheme:****Term work: 100 Marks****Course Objectives:**

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and understand real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To nurture professional and societal ethics.
- To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes:

On completion of the course, learners should be able to

CO1: To demonstrate professional competence through industry internship.

CO2: To apply knowledge gained through internships to complete academic activities in a professional manner.

CO3: To choose appropriate technology and tools to solve given problem.

CO4: To demonstrate abilities of a responsible professional and use ethical practices in day to day life.

CO5: Creating network and social circle, and developing relationships with industry people.

CO6: To analyze various career opportunities and decide carrier goals.

**** Guidelines:**

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Duration:

Internship is to be completed after semester 5 and before commencement of semester 6 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 6.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry[1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination and before academic schedule of semester VI.

Student can take internship work in the form of the following but not limited to:

- Working for consultancy/ research project,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship).

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks + Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills
- Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work

- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Diary/Work book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines and other sources)

Feedback from internship supervisor(External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership.....

Reference:

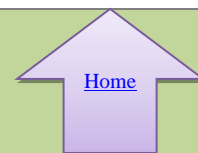
[1] <https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf>

[2] <https://internship.aicte-india.org/>

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	1	1	1	1	2	1	1
CO2	1	2	2	2	3	2	1	1	1	2	2	1
CO3	-	-	-	-	-	1	-	-	2	2	1	1
CO4	2	-	-	-	-	2	2	3	-	1	-	2
CO5	-	-	-	-	-	1	2	1	1	1	2	1
CO6	-	-	-	-	-	1	-	-	2	1	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310256:Data Science and Big Data Analytics Laboratory



Teaching Scheme
Practical: 04 Hours/Week

Credit:02

Examination Scheme and Marks
Term work: 50 Marks
Practical: 25 Marks

Companion Course: Data Science and Big Data Analytics (310251)

Course Objectives:

- To understand principles of Data Science for the analysis of real time problems
- To develop in depth understanding and implementation of the key technologies in Data Science and Big Data Analytics
- To analyze and demonstrate knowledge of statistical data analysis techniques for decision-making
- To gain practical, hands-on experience with statistics programming languages and Big Data tools

Course Outcomes:

On completion of the course, learners will be able to

- CO1:** Apply principles of Data Science for the analysis of real time problems
CO2: Implement data representation using statistical methods
CO3: Implement and evaluate data analytics algorithms
CO4: Perform text preprocessing
CO5: Implement data visualization techniques
CO6: Use cutting edge tools and technologies to analyze Big Data

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Set of suggested assignment list is provided in groups- A and B. Each student must perform 13 assignments (10 from group A, 3 from group B), 2 mini project from Group C

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - JAVA/Python/R/Scala

Virtual Laboratory:

- ["Welcome to Virtual Labs - A MHRD Govt of India Initiative"](#)
- <http://cse20-iiith.vlabs.ac.in/List%20of%20Experiments.html?domain=Computer%20Science>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A,B,C) are compulsory.

Sr. No.	Group A : Data Science
1.	<p>Data Wrangling, I</p> <p>Perform the following operations using Python on any open source dataset (e.g., data.csv)</p> <ol style="list-style-type: none"> 1. Import all the required Python Libraries. 2. Locate an open source data from the web (e.g. https://www.kaggle.com). Provide a clear description of the data and its source (i.e., URL of the web site). 3. Load the Dataset into pandas data frame. 4. Data Preprocessing: check for missing values in the data using pandas <code>isnull()</code>, <code>describe()</code> function to get some initial statistics. Provide variable descriptions. Types of variables etc. Check the dimensions of the data frame. 5. Data Formatting and Data Normalization: Summarize the types of variables by checking the data types (i.e., character, numeric, integer, factor, and logical) of the variables in the data set. If variables are not in the correct data type, apply proper type conversions. 6. Turn categorical variables into quantitative variables in Python. <p>In addition to the codes and outputs, explain every operation that you do in the above steps and explain everything that you do to import/read/scrape the data set.</p>
2.	<p>Data Wrangling II</p> <p>Create an “Academic performance” dataset of students and perform the following operations using Python.</p> <ol style="list-style-type: none"> 1. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them. 2. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them. 3. Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non-linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution. <p>Reason and document your approach properly.</p>

3.	Descriptive Statistics - Measures of Central Tendency and variability Perform the following operations on any open source dataset (e.g., data.csv) <ol style="list-style-type: none"> 1. Provide summary statistics (mean, median, minimum, maximum, standard deviation) for a dataset (age, income etc.) with numeric variables grouped by one of the qualitative (categorical) variable. For example, if your categorical variable is age groups and quantitative variable is income, then provide summary statistics of income grouped by the age groups. Create a list that contains a numeric value for each response to the categorical variable. 2. Write a Python program to display some basic statistical details like percentile, mean, standard deviation etc. of the species of 'Iris-setosa', 'Iris-versicolor' and 'Iris-versicolor' of iris.csv dataset. Provide the codes with outputs and explain everything that you do in this step.
4.	Data Analytics I Create a Linear Regression Model using Python/R to predict home prices using Boston Housing Dataset (https://www.kaggle.com/c/boston-housing). The Boston Housing dataset contains information about various houses in Boston through different parameters. There are 506 samples and 14 feature variables in this dataset. The objective is to predict the value of prices of the house using the given features.
5.	Data Analytics II <ol style="list-style-type: none"> 1. Implement logistic regression using Python/R to perform classification on Social_Network_Ads.csv dataset. 2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.
6.	Data Analytics III <ol style="list-style-type: none"> 1. Implement Simple Naïve Bayes classification algorithm using Python/R on iris.csv dataset. 2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.
7.	Text Analytics <ol style="list-style-type: none"> 1. Extract Sample document and apply following document preprocessing methods: Tokenization, POS Tagging, stop words removal, Stemming and Lemmatization. 2. Create representation of document by calculating Term Frequency and Inverse Document Frequency.
8.	Data Visualization I <ol style="list-style-type: none"> 1. Use the inbuilt dataset 'titanic'. The dataset contains 891 rows and contains information about the passengers who boarded the unfortunate Titanic ship. Use the Seaborn library to see if we can find any patterns in the data. 2. Write a code to check how the price of the ticket (column name: 'fare') for each passenger is distributed by plotting a histogram.
9.	Data Visualization II <ol style="list-style-type: none"> 1. Use the inbuilt dataset 'titanic' as used in the above problem. Plot a box plot for distribution of age with respect to each gender along with the information about whether they survived or not. (Column names : 'sex' and 'age') 2. Write observations on the inference from the above statistics.

10.	Data Visualization III Download the Iris flower dataset or any other dataset into a DataFrame. (e.g., https://archive.ics.uci.edu/ml/datasets/Iris). Scan the dataset and give the inference as: <ol style="list-style-type: none"> 1. List down the features and their types (e.g., numeric, nominal) available in the dataset. 2. Create a histogram for each feature in the dataset to illustrate the feature distributions. 3. Create a box plot for each feature in the dataset. 4. Compare distributions and identify outliers.
Group B- Big Data Analytics – JAVA/SCALA (Any three)	
1.	Write a code in JAVA for a simple Word Count application that counts the number of occurrences of each word in a given input set using the Hadoop Map-Reduce framework on local-standalone set-up.
2.	Design a distributed application using Map-Reduce which processes a log file of a system.
3.	Locate dataset (e.g., sample_weather.txt) for working on weather data which reads the text input files and finds average for temperature, dew point and wind speed.
4.	Write a simple program in SCALA using Apache Spark framework
Group C- Mini Projects/ Case Study – PYTHON/R (Any TWO Mini Project)	
1.	Write a case study on Global Innovation Network and Analysis (GINA). Components of analytic plan are 1. Discovery business problem framed, 2. Data, 3. Model planning analytic technique and 4. Results and Key findings.
2.	Use the following dataset and classify tweets into positive and negative tweets. https://www.kaggle.com/ruchi798/data-science-tweets
3.	Develop a movie recommendation model using the scikit-learn library in python. Refer dataset https://github.com/rashida048/Some-NLP-Projects/blob/master/movie_dataset.csv
4.	Use the following covid_vaccine_statewise.csv dataset and perform following analytics on the given dataset https://www.kaggle.com/sudalairajkumar/covid19-in-india?select=covid_vaccine_statewise.csv <ol style="list-style-type: none"> a. Describe the dataset b. Number of persons state wise vaccinated for first dose in India c. Number of persons state wise vaccinated for second dose in India d. Number of Males vaccinated d. Number of females vaccinated
5.	Write a case study to process data driven for Digital Marketing OR Health care systems with Hadoop Ecosystem components as shown. (Mandatory) <ul style="list-style-type: none"> ● HDFS: Hadoop Distributed File System ● YARN: Yet Another Resource Negotiator ● MapReduce: Programming based Data Processing ● Spark: In-Memory data processing ● PIG, HIVE: Query based processing of data services ● HBase: NoSQL Database (Provides real-time reads and writes) ● Mahout, Spark MLlib: (Provides analytical tools) Machine Learning algorithm libraries ● Solar, Lucene: Searching and Indexing
Learning Resources	

Reference Books :

1. Chirag Shah, "A Hands-On Introduction To Data Science", Cambridge University Press,(2020), ISBN : ISBN 978-1-108-47244-9.
2. Wes McKinney, "Python for Data Analysis", O' Reilly media, ISBN : 978-1-449-31979-3.
3. "Scikit-learn Cookbook", Trent hauk, Packt Publishing, ISBN: 9781787286382
4. R Kent Dybvig, "The Scheme Programming Language", MIT Press, ISBN 978-0-262-51298-5.
5. Jenny Kim, Benjamin Bengfort, "Data Analytics with Hadoop", O'Reilly Media, Inc.
6. Jake VanderPlas, "Python Data Science Handbook"
<https://tanthamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf>
7. Gareth James, "An Introduction to Statistical Learning"
<https://www.ime.unicamp.br/~dias/Intoduction%20to%20Statistical%20Learning.pdf>
8. Cay S Horstmann, "Scala for the Impatient", Pearson, ISBN: 978-81-317-9605-4,
9. Alvin Alexander, "Scala Cookbook", O'Reilly, SPD, ISBN: 978-93-5110-263-2

Web Links:

- <https://www.simplilearn.com/data-science-vs-big-data-vs-data-analytics-article>
- <https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html>
- <https://www.edureka.co/blog/hadoop-ecosystem>
- https://www.edureka.co/blog/mapreduce-tutorial/#mapreduce_word_count_example
- <https://github.com/vasanth-mahendran/weather-data-hadoop>
- <https://spark.apache.org/docs/latest/quick-start.html#more-on-dataset-operations>
- <https://www.scala-lang.org/>

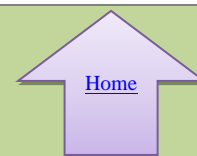
MOOCs Courses link:

- <https://nptel.ac.in/courses/106/106/106106212/>
- https://onlinecourses.nptel.ac.in/noc21_cs33/preview
- <https://nptel.ac.in/courses/106/104/106104189/>
- https://onlinecourses.nptel.ac.in/noc20_cs92/preview

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	-	-	-	1	-	1	3
CO2	2	2	3	1	2	-	-	-	1	-	-	3
CO3	2	2	3	2	2	2	-	-	2	-	1	3
CO4	2	2	2	2	2	-	-	-	-	-	-	3
CO5	2	2	3	3	3	1	-	-	2	-	2	3
CO6	2	2	1	1	3	2	1	-	2	-	2	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310257:Web Technology Laboratory



Teaching Scheme
Practical: 02 Hours/Week

Credit: 01

Examination Scheme and Marks
Term Work: 25 Marks
Oral: 25 Marks

Companion Course : Web Technology (310252)

Course Objectives:

- To learn the web based development environment
- To use client side and server side web technologies
- To design and develop web applications using front end technologies and backend databases

Course Outcomes:

On completion of the course, learners will be able to

- CO1:** Understand the importance of website planning and website design issues
CO2: Apply the client side and server side technologies for web application development
CO3: Analyze the web technology languages, frameworks and services
CO4: Create three tier web based applications

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, and punctuality.

Guidelines for Oral Examination

Oral examination should be jointly conducted by the internal examiner and external examiner. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementations in term work. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Mini project should be implemented by the students in a group of 2-3 students.

Suggested List of Laboratory Experiments/Assignments

(All assignments are compulsory)

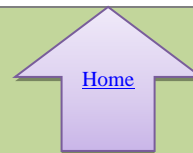
Sr. No.	Assignment Title												
1.	<p>Case study: Before coding of the website, planning is important, students should visit different websites (Min. 5) for the different client projects and note down the evaluation results for these websites, either good website or bad website in following format:</p> <table><tr><th>Sr. No.</th><th>Website URL</th><th>Purpose of Website</th><th>Things liked in the website</th><th>Things disliked in the website</th><th>Overall evaluation of the website (Good/Bad)</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> <p>From the evaluation, students should learn and conclude different website design issues, which should be considered while developing a website.</p>	Sr. No.	Website URL	Purpose of Website	Things liked in the website	Things disliked in the website	Overall evaluation of the website (Good/Bad)						
Sr. No.	Website URL	Purpose of Website	Things liked in the website	Things disliked in the website	Overall evaluation of the website (Good/Bad)								
2.	<p>Implement a web page index.htm for any client website (e.g., a restaurant website project) using following:</p> <ul style="list-style-type: none">a. HTML syntax: heading tags, basic tags and attributes, frames, tables, images, lists, links for text and images, forms etc.b. Use of Internal CSS, Inline CSS, External CSS												
3.	<p>Design the XML document to store the information of the employees of any business organization and demonstrate the use of:</p> <ul style="list-style-type: none">a) DTDb) XML Schema <p>And display the content in (e.g., tabular format) by using CSS/XSL.</p>												
4.	<p>Implement an application in Java Script using following:</p> <ul style="list-style-type: none">a) Design UI of application using HTML, CSS etc.b) Include Java script validationc) Use of prompt and alert window using Java Script <p>e.g., Design and implement a simple calculator using Java Script for operations like addition, multiplication, subtraction, division, square of number etc.</p> <ul style="list-style-type: none">a) Design calculator interface like text field for input and output, buttons for numbers and operators etc.b) Validate input valuesc) Prompt/alerts for invalid values etc.												
5.	<p>Implement the sample program demonstrating the use of Servlet.</p> <p>e.g., Create a database table ebookshop (book_id, book_title, book_author, book_price, quantity) using database like Oracle/MySQL etc. and display (use SQL select query) the table content using servlet.</p>												
6.	<p>Implement the program demonstrating the use of JSP.</p> <p>e.g., Create a database table students_info (stud_id, stud_name, class, division, city) using database like Oracle/MySQL etc. and display (use SQL select query) the table content using JSP.</p>												
7.	<p>Build a dynamic web application using PHP and MySQL.</p> <ul style="list-style-type: none">a. Create database tables in MySQL and create connection with PHP.b. Create the add, update, delete and retrieve functions in the PHP web app interacting with MySQL database												

8.	Design a login page with entries for name, mobile number email id and login button. Use struts and perform following validations <ol style="list-style-type: none"> Validation for correct names Validation for mobile numbers Validation for email id Validation if no entered any value Re-display for wrongly entered values with message Congratulations and welcome page upon successful entries
9.	Design an application using Angular JS. e.g., Design registration (first name, last name, username, password) and login page using Angular JS.
10.	Design and implement a business interface with necessary business logic for any web application using EJB. e.g., Design and implement the web application logic for deposit and withdraw amount transactions using EJB.
11.	Mini Project: Design and implement a dynamic web application for any business functionality by using web development technologies that you have learnt in the above given assignments.

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	3	1	-	1	1	-	-	1	-	-
CO2	2	2	-	2	1	-	-	-	1	-	-	-
CO3	2	-	3	-	-	1	-	-	-	1	1	-
CO4	1	2	2	1	2	1	1	-	-	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310258: Laboratory Practice II



Teaching Scheme
Practical: 04 Hours/Week

Credit: 02

Examination Scheme and Marks
Term Work: 50 Marks
Practical: 25 Marks

Companion Course: Artificial Intelligence (310253), Elective II (310254)

Course Objectives:

- To learn and apply various search strategies for AI
- To Formalize and implement constraints in search problems
- To understand the concepts of Information Security / Augmented and Virtual Reality/Cloud Computing/Software Modeling and Architectures

Course Outcomes:

On completion of the course, learner will be able to

- **Artificial Intelligence**

CO1: Design a system using different informed search / uninformed search or heuristic approaches

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning

CO3: Design and develop an interactive AI application

- **Information Security**

CO4: Use tools and techniques in the area of Information Security

CO5: Use the cryptographic techniques for problem solving

CO6: Design and develop security solution

OR

- **Augmented and Virtual Reality**

CO4: Use tools and techniques in the area of Augmented and Virtual Reality

CO5: Use the representing and rendering system for problem solving

CO6: Design and develop ARVR applications

OR

- **Cloud Computing**

CO4: Use tools and techniques in the area of Cloud Computing

CO5: Use cloud computing services for problem solving

CO6: Design and develop applications on cloud

OR

- **Software Modeling and Architectures**

CO4: Use tools and techniques in the area Software Modeling and Architectures

CO5: Use the knowledge of Software Modeling and Architectures for problem solving

CO6: Design and develop applications using UML as fundamental tool

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and

program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended :- 64-bit Windows OS and Linux

Programming tools recommended: -

Information Security : - C/C++/Java

Augmented and Virtual Reality :- Unity, C#, Blender, VRTK, ARTK, Vuforia

VR Devices: HTC Vive, Google Daydream and Samsung gear VR.

Software Modeling and Architectures:-Front end:HTML5, Bootstarp, JQuery, JS etc.

Backend: MySQL /MongoDB/NodeJS

Virtual Laboratory:

Software Modeling and Architectures : <http://vlabs.iitkgp.ernet.in/se>

Information Security : <http://cse29-iiith.vlabs.ac.in>

Part I : Artificial Intelligence

Suggested List of Laboratory Experiments/Assignments

Sr. No.	Group A All assignments are compulsory
1.	Implement depth first search algorithm and Breadth First Search algorithm, Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure.
2.	Implement A star Algorithm for any game search problem.
3.	Implement Greedy search algorithm for any of the following application: I. Selection Sort II. Minimum Spanning Tree III. Single-Source Shortest Path Problem IV. Job Scheduling Problem V. Prim's Minimal Spanning Tree Algorithm VI. Kruskal's Minimal Spanning Tree Algorithm VII. Dijkstra's Minimal Spanning Tree Algorithm
	Group B
4.	Implement a solution for a Constraint Satisfaction Problem using Branch and Bound and Backtracking for n-queens problem or a graph coloring problem.
5.	Develop an elementary catboat for any suitable customer interaction application.

Group C	
6.	Implement any one of the following Expert System <ol style="list-style-type: none"> Information management Hospitals and medical facilities Help desks management Employee performance evaluation Stock market trading Airline scheduling and cargo schedules
Part II : Elective II	
Suggested List of Laboratory Experiments/Assignments	
Sr. No.	Assignment Name
Information Security (Any five)	
1.	Write a Java/C/C++/Python program that contains a string (char pointer) with a value 'Hello World'. The program should AND or and XOR each character in this string with 127 and display the result.
2.	Write a Java/C/C++/Python program to perform encryption and decryption using the method of Transposition technique.
3.	Write a Java/C/C++/Python program to implement DES algorithm.
4.	Write a Java/C/C++/Python program to implement AES Algorithm.
5.	Write a Java/C/C++/Python program to implement RSA algorithm.
6.	Implement the different Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
7.	Calculate the message digest of a text using the MD5 algorithm in JAVA.
Cloud Computing (All assignments are compulsory)	
1.	Case study on Microsoft azure to learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, for building, deploying and managing applications and services through a global network of Microsoft-managed data centers. OR Case study on Amazon EC2 and learn about Amazon EC2 web services.
2.	Installation and configure Google App Engine. OR Installation and Configuration of virtualization using KVM.
3.	Creating an Application in Salesforce.com using Apex programming Language.
4.	Design and develop custom Application (Mini Project) using Sales force Cloud.
5.	Mini-Project Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement with HDFS . Implement the basic operations may be like to divide the file in segments/blocks and upload/ download file on/from cloud in encrypted form.
Augmented and Virtual Reality (Assignments 1,2, 3,7 are mandatory, any 2 from 4, 5 & 6)	
1.	Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
2.	Demonstration of the working of HTC Vive, Google Daydream or Samsung gear VR.
3.	Develop a scene in Unity that includes:

	<p>i. A cube, plane and sphere, apply transformations on the 3 game objects.</p> <p>ii. Add a video and audio source.</p>
4.	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the color, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the color and material/texture of the game objects dynamically on button click.
5.	Develop and deploy a simple marker based AR app in which you have to write a C# program to play video on tracking a particular marker.
6.	<p>Develop and deploy an AR app, implement the following using Vuforia Engine developer portal:</p> <ul style="list-style-type: none"> i. Plane detection ii. Marker based Tracking(Create a database of objects to be tracked in Vuforia) iii. Object Tracking
7.	<p style="text-align: center;">Mini-Projects/ Case Study</p> <p>Create a multiplayer VR game (battlefield game). The game should keep track of score, no. of chances/lives, levels(created using different scenes), involve interaction, animation and immersive environment.</p> <p style="text-align: center;">OR</p> <p>Create a treasure hunt AR application which should have the following features:</p> <ul style="list-style-type: none"> i. A help button for instruction box to appear. ii. A series of markers which would give hints on being scanned. iii. Involve interaction, sound, and good UI.
	<p>Software Modeling and Architectures</p> <p>(Problem statement 1, 2 , 5 are mandatory and any one from 3 and 4)</p>
1.	Consider a library, where a member can perform two operations: issue book and return it. A book is issued to a member only after verifying his credentials. Develop a use case diagram for the given library system by identifying the actors and use cases and associate the use cases with the actors by drawing a use case diagram. Use UML tool.
2.	<p>Consider online shopping system. Perform the following tasks and draw the class diagram using UML tool.</p> <p>Represent the individual classes, and objects</p> <p>Add methods</p> <p>Represent relationships and other classifiers like interfaces</p>
3.	<p>Consider the online shopping system in the assignment 2.</p> <p>Draw the sequence diagram using UML tool to show message exchanges</p>
4.	<p>Consider your neighboring travel agent from whom you can purchase flight tickets. To book a ticket you need to provide details about your journey i.e., on which date and at what time you would like to travel. You also need to provide your address. The agency has recently been modernized. So, you can pay either by cash or by card. You can also cancel a booked ticket later if you decide to change your plan. In that case you need to book a new ticket again. Your agent also allows you to book a hotel along with flight ticket. While cancelling a flight ticket you can also cancel hotel booking. Appropriate refund as per policy is made in case of cancellation.</p> <p>Perform the following tasks and draw the use case diagram using UML tool.</p> <ul style="list-style-type: none"> a. Identify the use cases from a given non-trivial problem statement. b. Identify the primary and secondary actors for a system. c. Use to generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase

Mini-Projects

5. Select a moderately complex system and narrate concise requirement Specification for the same. Design the system indicating system elements organizations using applicable architectural styles and design patterns with the help of a detailed Class diagram depicting logical architecture. Specify and document the architecture and design pattern with the help of templates. Implement the system features and judge the benefits of the design patterns accommodated.

Learning Resources**Text Books:****Artificial Intelligence**

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third edition, Pearson, 2003, ISBN :10: 0136042597
2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill Education(India), 2013, ISBN : 978-1-25-902998-1
3. Elaine Rich, Kevin Knight and Nair, “Artificial Intelligence”, TMH, ISBN-978-0-07-008770-5

Information Security

1. Atul Kahate, “Cryptography and Network Security”, 3e, McGraw Hill Education
2. Prakash C. Gupta, “Cryptography and Network Security”, PHI
3. V.K. Pachghare, “Cryptography and Information Security”, PHI Learning

Cloud Computing

1. A. Srinivasan, J. Suresh,” Cloud Computing: A Practical Approach for Learning and Implementation”, Pearson, ISBN: 978-81-317-7651-3
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, ISBN-13:978-1-25-902995-0

Augmented and Virtual Reality

1. William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design”, (The Morgan Kaufmann Series in Computer Graphics). Morgan Kaufmann Publishers, San Francisco, CA, 2002
2. Alan B Craig, “Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann Publishers, ISBN:978-0240824086

Software Modeling and Architectures

1. Jim Arlow, Ila Neustadt, “UML 2 and the unified process –practical object-oriented analysis and design”, Addison Wesley, Second edition, ISBN 978-0201770605
2. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Second Edition, Pearson ,ISBN 978-81-775-8996-2
3. Hassan Gomaa, “Software Modeling and Design- UML, Use cases, Patterns and Software Architectures”, Cambridge University Press, 2011, ISBN 978-0-521-76414-8
4. Erich Gamma, “Design Patterns”, Pearson, ISBN 0-201-63361-2

Reference Books:

1. Nilsson Nils J , “Artificial Intelligence: A new Synthesis”, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4
2. Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley Publishing Company, ISBN: 0-201-53377-4
3. Andries P. Engelbrecht, “Computational Intelligence: An Introduction”, 2nd Edition-Wiley India-

ISBN: 978-0-470-51250-0

Information Security

1. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, 3rd_Edition, Pearson
2. William Stallings, “Cryptography and Network Security Principals and Practice”, Fifth edition, Pearson
3. Nina Godbole, Sunit Belapure, “Cyber Security”, Wiley, ISBN: 978-81-265-2179-1

Augmented and Virtual Reality

1. Steven M. LaValle, “Virtual Reality”, Cambridge University Press, 2016
2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3. Schmalstieg / Hollerer, “Augmented Reality: Principles & Practice”, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
4. Sanni Siltanen, “Theory and applications of marker-based augmented reality”, Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

Cloud Computing

1. James Bond , “The Enterprise Cloud”, O'Reilly Media, Inc. ISBN: 9781491907627
2. Dr. Kris Jamsa, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more”, Wiley Publications, ISBN: 978-0-470-97389-9
3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 2010, The McGraw-Hill.

Software Modeling and Architectures

1. Gardy Booch, James Rumbaugh, Ivar Jacobson, “The unified modeling language user guide” , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8.
2. Lan Sommerville, “Software Engineering”, 9th edition, ISBN-13: 978-0-13-703515-1 ISBN-10: 0-13-703515-2.

@The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	3	-	-	2	2	2	1	2
CO2	1	-	2	2	3	2	-	2	2	2	1	2
CO3	1	-	2	2	3	2	-	2	2	2	2	2
CO4	1	-	2	-	3	-	-	2	2	2	2	2
CO5	1	-	2	-	3	-	-	2	2	2	2	2
CO6	1	-	2	-	3	-	-	2	2	2	2	2

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
310259: Audit Course 6


[Home](#)

In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself [1]

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

- | | |
|---|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations | <ul style="list-style-type: none"> Surveys Mini-Project Hands on experience on focused topic |
|---|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 6 Options

Audit Course Code	Audit Course Title
310259(A)	Digital and Social Media Marketing
310259(B)	Sustainable Energy Systems
310259(C)	Leadership and Personality Development
310259(D)	Foreign Language (one of Japanese/Spanish/French/German). Course contents for Japanese (Module 4) are provided. For other languages institute may design suitably.
310259(E)	Learn New Skills - Software Development Using Agility Approach

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.
<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>
http://www.unipune.ac.in/university_files/syllabi.htm

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
Audit Course 6
310259(A): Digital and Social Media Marketing


[Home](#)

Prerequisites: Internet Technologies

Course Objectives:

- To understand the importance of digital marketing
- To understand the social media and marketing

To understand the effective marketing strategies and ways

Course Outcomes:

On completion of the course, learners will be able to

CO1: Understand the fundamentals and importance of digital marketing

CO2: Use the power of social media for business marketing

CO3: Analyze the effectiveness of digital marketing and social media over traditional process

Course Contents

1. A Framework for Digital Marketing
2. Domain Names, Email, and Hosting
3. Yes, You need a Website
4. The Three Components of a Modern Website: Mobile, Fast, and Accessible
5. Lock It Down: Digital Privacy, Data Security, and the Law
6. Social Media
7. Email Marketing
8. Online Advertising

Reference Books :

1. Avery Swartz, “See You on the Internet: building your small business with Digital Marketing”, ISBN 978-1-989603-08-6.
2. Social Media Marketing Workbook (2021): How to Use Social Media for Business (2021 Social Media Marketing 1).

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	1	-	1	-	1	-	-	-	-
CO2	-	1	2	-	1	-	-	-	-	-	1	-
CO3	2	-	2	2	1	-	1	-	-	-	-	-

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
Audit Course 6
310259(B): Sustainable Energy Systems


[Home](#)

Prerequisites: General awareness of environment and natural resources of energy

Course Objectives:

- To understand the importance of sustainable energy systems development
- To create awareness about renewable energy sources and technologies
- To learn about adequate inputs on a variety of issues in harnessing renewable energy
- To recognize current and possible future role of renewable energy sources

Course Outcomes:

On completion of the course, learners will be able to

CO1: Comprehend the importance of Sustainable Energy Systems

CO2: Correlate the human population growth and its trend to the natural resource degradation and develop the awareness about his/her role towards Sustainable Energy Systems protection

CO3: Identify different types of natural resource pollution and control measures

CO4: Correlate the exploitation and utilization of conventional and non-conventional resources

Course Contents

1. **Wind Energy:** Power in the Wind, Types of Wind Power Plants (WPPs), Components of WPPs, Working of WPPs, Siting of WPPs, Grid integration issues of WPPs.
2. **Solar Pv and Thermal Systems:** Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds, Thermal Energy storage system with PCM, Solar Photovoltaic systems: Basic Principle of SPV conversion, Types of PV Systems, Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency and Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.
3. **Other Energy Sources:** Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC), Hydrogen Production and Storage. Fuel cell: Principle of working, various types, construction and applications. Energy Storage System, Hybrid Energy Systems.

Reference Books :

1. Joshua Earnest, Tore Wizeliu, "Wind Power Plants and Project Development", PHI Learning Pvt.Ltd, New Delhi, 2011.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt .Ltd, New Delhi, 2013.
3. A.K.Mukerjee and Nivedita Thakur, "Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12
CO1	-	-	-	-	-	-	1	-	-	-	-	-
CO2	-	-	-	-	-	-	2	-	-	-	-	1
CO3	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	2

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)

Audit Course 6

310259(C): Leadership and Personality Development

[Home](#)

Prerequisites: General awareness of communication and relationship.

Course Objectives:

- To understand the importance of communication
- To create awareness about teamwork and people skills
- To know thyself
- To recognize current and possible future of new-age thinking

Course Outcomes:

On completion of the course, learners will be able to

CO1: Express effectively through communication and improve listening skills

CO3: Develop effective team leadership abilities.

CO4: Explore self-motivation and practicing creative/new age thinking.

CO5: Operate effectively in heterogeneous teams through the knowledge of team work, people skills and leadership qualities.

Course Contents

1. Communication :

Listening Skills, Communication - 7 C's, Vision and Charisma, Planning and Organizing - Complex Tasks and Ideas --> Actionable Tasks, Presentation Skills.

2. Teamwork and People Skills :

Talent Picking skills, Strong networking and Employee engagement, Coach and Mentor the team, Influencing, Delegate and Empower, Generous, open communicator, Patience and Clarity of Mind, Inspire and Motivate, Ensure Team Cohesion, Empathy, Trust and Reliability.

3. New-age Thinking :

Strategic Thinking, Critical and Lateral Thinking, Problem Solving Skills, Flexibility, Change Management – VUCA.

4. Self-Awareness :

What is Self? – Real, Ideal and Social Self, Concepts related to Self - Self Concept, Self-Presentation, Self-Regulation and Impression Management, Definition and Causes of Prejudice, Relationship between Prejudice, Discrimination and Exclusion, Application – Attitudinal Change and Reducing Prejudices, Self Esteem and Self Awareness, SWOT – JOHARI, Self Esteem Quiz, Introduce Your Partner, Self Introduction - How to sell yourself?-appearance, voice modulation, verbal(simple language), Motivation and Optimism, Positive Emotions and Success.

Reference Books :

1. Paul Sloane, "The Leader's Guide to Lateral Thinking Skills Unlocking the Creativity and Innovation in You and Your Team", 2006
2. Ronald Bennett, Elaine Millam, "Leadership for engineers : the magic of mindset"
3. Urmila Rai and S.M. Rai, "Business Communication", Himalay Publication House
4. Baron R, Byrne D, Branscombe N, BharadwajG (2009), "Social Psychology, Indian adaptation", Pearson , New Delhi
5. Baumgartner S.R, Crothers M.K. (2009) "Positive Psychology", Pearson Education.

@The CO-PO Mapping Matrix

COP O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	2	-	1	1	3	-	2
CO2	-	-	-	-	-	-	-	1	-	2	1	2
CO3	-	-	-	-	-	1	-	-	2	1	-	1
CO4	-	-	-	-	-	-	-	1	-	-	2	1

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)

Audit Course 6

310259(D): Foreign Language (Japanese) Module 4


[Home](#)

Prerequisites: We recommend that candidates should have previously completed AC3-V(210251) , AC4-V (210260) and AC-5(310250)

Course Objectives:

- To open up more doors and job opportunities
- To introduce to Japanese society, culture and entertainment

Course Outcomes:

On completion of the course, learner will be able to

CO1: Have the ability to communicate confidently and clearly in the Japanese language

CO2: Understand the nature of Japanese script

CO3: Get introduced to reading, writing and listening skills

CO4: Develop interest to pursue further study, work and leisure

Course Contents

1. Introduction to types of adjectives (i and na)
2. Formation of adjectives (according to tense / negative / affirmative)
3. Introduction to more particles
4. Making sentences using various particles / verbs / adjectives
5. Topic based vocabulary (Places / Train travel related / Technical Katakana words)
6. More verb forms (te form, ta form, nai form, root verb etc.)
7. Question words
8. Further 25 Kanjis
9. Scenario based conversation practice / skits / role plays (At the market, At the hospital etc.)

Reference Books :

1. Minna No Nihongo, “JapaneseforEveryone”,ElementaryMainTextbook1-1(IndianEdition),GoyalPublishers and Distributors Pvt.Ltd.
2. <http://www.tcs.com>(http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japan-centric-Delivery-Center-Pune.aspx)
3. Kazuko Karasawa, Mikiko Shibuya, “Nihongo Challenge N4 N5 Kannji Tomoko Kigami”, ISBN-10 4872177576,Ask Publishing Co.,Ltd.

@The CO-PO Mapping Matrix

COP O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1

Savitribai Phule Pune University Third Year of Engineering (2019 Course)

Audit Course 6

310259(E): Learn New Skill- 'Software Development Using Agility Approach'


[Home](#)

Prerequisites: Software Engineering (210253)

Course Objectives:

- To understand the fundamentals of Dev Ops
- To understand the Agility and ways of Agility
- To understand the software development using Agility approach

Course Outcomes:

On completion of the course, learner will be able to

CO1: Illustrate the agility and principles

CO2: Understand the software development using agile methodology

CO3: Apply Dev Ops for the software product development

CO4: Develop software products for early delivery through continual feedback and learning

Course Contents

1. **THE THREE WAYS** :Agile, continuous delivery and the three ways, The First Way: The Principles of Flow, The Second Way: The Principle of Feedback, The Third Way: The Principles of Continual Learning.
2. **WHERE TO START** :Selecting which value stream to start with, Understanding the work in our value stream..., How to design our organization and architecture, How to get great outcomes by integrating operations into the daily work for development.
3. **THE FIRST WAY: THE TECHNICAL PRACTICES OF FLOW** : Create the foundations of our deployment pipeline, Enable fast and reliable automated testing, Enable and practice continuous integration, Automate and enable low-risk releases, Architect for low-risk releases.
4. **THE SECOND WAY: THE TECHNICAL PRACTICES OF FEEDBACK** :Create telemetry to enable seeing and solving problems, Analyze telemetry to better anticipate problems, Enable feedback so development and operation can safely deploy code, Integrate hypothesis-driven development and A/B testing into our daily work, Create review and coordination processes to increase quality of our current work.
5. **THE THRID WAY: THE TECHNICAL PRACTICES OF CONTINUAL LEARNING** : Enable and inject learning into daily work, Convert local discoveries into global improvements, Reserve time to create organizational learning, Information security as everyone's job, every day, Protecting the deployment pipeline.

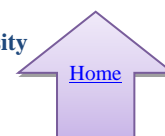
Reference Books :

1. Gene Kim, Jez Humble, Petrick Debois, "The Dev Ops Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations"
2. Len Bass, Ingo Weber, Liming Zhu, "Dev Ops: A Software Architect's Perspective " Publisher(s): Addison-Wesley Professional, ISBN: 9780134049885

Note: This is sample contents for Software Development Using Agility Approach, however the course instructor may design suitable course giving opportunity to the students for learning new skills.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	2	1	3	1	-	1	-	1	-	-
CO2	-	3	2	2	1	-	-	-	1	1	-	1
CO3	2	3	1	1	-	1	1	-	-	-	-	1
CO4	2	1	1	3	1	-	1	1	-	1	1	1



Acknowledgement

It is with great pleasure and honor that I share the curriculum for Third Year of Computer Engineering (2019 Course) on behalf of Board of Studies (BoS), Computer Engineering. We, members of BoS are giving our best to streamline the processes and curricula design at both UG and PG programs.

It is always the strenuous task to balance the curriculum with the blend of core courses, current developments and courses to understand social and human values. By considering all the aspects with adequate prudence the contents are designed satisfying most of the necessities as per AICTE guidelines and to make the graduate competent enough as far as employability is concerned. I sincerely thank all the minds and hands who work adroitly to materialize these tasks. I really appreciate everyone's contribution and suggestions in finalizing the contents.

Success is sweet. But it's sweeter when it's achieved thorough co-ordination, cooperation and collaboration. I am overwhelmed and I feel very fortunate to be working with such a fabulous team- the Members of Board of Studies, Computer Engineering!

Even in these anxious situation, during the time of this unfortunate pandemic, each and every person, including the course coordinators and their team members, have worked seamlessly to come up with this all-inclusive curriculum for Third Year of Computer Engineering.

Thank you to all of you for delivering such great teamwork. I don't think it would have been possible to achieve the goal without each and every one of your efforts! I would like to express my deep gratitude to **Dr. Pramod D. Patil (Dr. D. Y. Patil Institute of Technology, Pimpri), member BoS, Computer Engineering**, for coordinating the complete activity and getting it to completion in a smooth manner.

I deeply appreciate and thank the managements of various colleges affiliated to SPPU for helping us in this work. These colleges have helped us by arranging sessions for preliminary discussion in the initial stage and at the same time in conducting Faculty Development Programs for various courses of the revised curriculum. All your support is warmly appreciated.

I sincerely appreciate, the hard work put in by the course coordinators and their team members, without your intellectual work and creative mind, and it would have not been possible to complete this draft. You have been a valuable member of our team!

Special thanks are due to Dr. Santosh Kumar Chobe, Dr. Jyoti Rao, Dr. Swati Nikam, Dr. C. R. Jadhav, Dr. S. S. Das, Dr. Rachna Somkunwar, Prof. Rajesh D. Bharati, Prof. Rupesh Mahajan for helping with the formatting and crisp presentation of this draft. I would like to thank you from the core of my heart. Thank you for always being your best selves and contributing to the work.

I am thankful to Prof. Abhijit D. Jadhav, Dr. D. Y. Patil Institute of Technology, Pimpri for the time he has spent in critically reading the draft and giving the final touches. I appreciate his initiative and thank him for his time, patience and hard work!

Thank you all, for not only your good work but also for all the support you have given each other throughout the drafting process, that's what makes the team stronger! You took the meaning of teamwork to a whole new level.

Thank you for all your efforts!

Professor (Mrs.) Dr. Varsha H. Patil, Chairman, and
Members- Dr. Shirish Sane, Dr. Sunil Bhirud, Dr. Manik Dhore, Dr. Pramod Patil, Dr. Girish Khilari, Dr. Sachin Lodha, Dr. Parikshit Mahalle, Dr. Venkatesharan, Dr. Geetanjali Kale, Dr. Suhasini Itkar, Dr. R. V. Patil and Dr. P. M. Yawalkar.

**Board of Studies (BoS), Computer Engineering, Faculty of Science and Technology,
Savitribai Phule Pune University.**

Task Force at Curriculum Design

1. Advisors, the Team of Board of Studies-

Dr. Varsha Patil (Chairman), Dr. Shirish Sane, Dr. Sunil Bhirud, Dr. Manik Dhore, Dr. Pramod Patil, Dr. Rajesh Prasad, Dr. Girish Khilari, Dr. Sachin Lodha, Dr. Parikshit Mahalle, Dr. Venkatesharan, Dr. Geetanjali Kale, Dr. Suhasini Itkar, Dr. R. V. Patil and Dr. P. M. Yawalkar.

2. Team Leader- Dr. Pramod D. Patil, Dr. D. Y. Patil Institute of Technology, Pimpri

3. Teams, Course Design-


[Home](#)

Name of Course	Team Coordinator	Team Members	
Database Management Systems	Dr. Anuradha Thakare	Dr. Sarika Nitin Zaware Dr. S. B. Tambe Prof. Ranjit M. Gawande	Prof. Rahul Patil Prof. Prashant Ahire Dr. Sharmila Wagh
Theory of Computation	Dr. Sunil Dhore	Dr. Santosh Chobe Dr. Jyoti Rao Dr. G.R.Shinde Mr. Tushar Samnerkar (Industry)	Dr. Vaishali Tidake Prof. Anita Shinde Mr. Vivek Kulkarni (Industry)
Systems Programming and Operating Systems	Dr. Manisha Bhende	Dr. R.A. Satao Prof. Rupesh Mahajan Prof. Mrs.B.Mahalakshmi Prof. Mrs. Neelam Patil	Dr. V. S. Pawar Prof. S. R. Pandit Prof. Mrs. Dhanashree Patel
Computer Networks and Security	Dr. P. B. Kumbharkar	Dr. Aparna A. Junnarkar Dr. A.V. Dhumane Dr. Vinod V. Kimbahune	Prof. D. B. Gothwal Dr. M. L. Dhore
Elective I: Internet of Things and Embedded Systems	Dr. A. B. Pawar	Dr. Sandeep Chaware Dr. M.S. Chaudhari Dr. M.P. Wankhade	Mr. Rajnikant (Industry) Mr. Mahesh Aher (Industry)
Elective I: Human Computer Interface	Dr. S. D. Babar	Prof. Mrs. G. J. Chhajed Prof. D.D. Sapkal Prof. Mrs. Jayshree R. Pansare Mr. Mukesh Jain (Industry) Prof. Mrs. Shailaja N. Lohar	Prof. S. A. Thanekar Dr. Deepak Dharrao Dr. Ganesh Bhutkar Mr. Himmat Sankhala (Industry)
Elective I: Distributed System	Dr. Amar Buchade	Prof. Rajesh Bharati Dr. Suresh V. Limkar Mr. Pratik Dixit (Industry)	Dr. Swati A. Bhavsar Dr. Sonali Patil Dr. Rachna Somkunwar Mr. Vijay Bahiraji (Industry)
Elective I: Software Project Management	Dr. Sachin Sakhare	Dr. R. L. Paikrao Prof. Santosh Sambare Prof. Pimpalkar S.P.	Prof. Shinde Sushma S Prof. Mrs. Vina M Lomte Mr. Prashant Pund (Industry) Mr. Shekhar Dhupkar (Industry)
Database Management System Laboratory	Prof. Rahul Patil	Prof. Rajesh Bharati	Nitin Ghadage (Industry)
Computer Networks and Security Laboratory	Dr. Vinod V. Kimbahune	Dr. P. B. Kumbharkar Dr. Aparna A. Junnarkar Dr. A.V. Dhumane	Prof. D. B. Gothwal Dr. M. L. Dhore
Laboratory Practice I	Dr. Amol Potgantwar	Dr. Manisha Bhende Dr. M.P. Wankhade Mrs. Shailaja N. Lohar	Dr. Sonali Patil Prof. Santosh Sambare
Seminar	Dr. Swati A. Bhavsar	Mr. Rushikesh Jadhav (Industry) Mr. Krishna Auti (Industry)	Dr. (Mrs.) Nuzhat F. Shaikh Mr. Ranjit M. Gawande

Audit Course 5	Dr. Kishor Wagh	Dr. S. S. Das Dr. D. V. Patil	Dr. Sandeep Patil Dr. Bendre Mr. B. B. Gite
Data Science and Big Data Analytics	Dr. Sheetal Sonawane	Dr. H. K. Khanuja Prof. Devidas S. Thosar Dr. S. K. Shinde Mr. Anand Bhalerao (Industry) Mr. Amod Vaidya (Industry)	Dr. B. D. Phulpagar Dr. K. V. Metre Mr. Atul Bengeri (Industry) Mr. Summer Patil (Industry) Mr. Sanjeev Kumar (Industry)
Web Technology	Prof. Abhijit D. Jadhav	Prof. Jayvant Devare	Mr. Avinash Patil (Industry) Mr. Saikrishna Mamidishetty (Industry)
Artificial Intelligence	Dr. J. R. Prasad	Dr. Gayatri M. Bhandari Dr. V. P. Vikhe Dr. Snehal Mohan Kamalapur	Dr. K Rajeswari Dr. Mrs. Madhuri Potey
Elective II: Information Security	Dr. Swati Nikam	Dr. Pathan Mohd Shafi Dr. Mininath Nighot Dr. Ms. K.C. Nalavade	Dr. Lomte Archana C. Dr. Amol Potgantwar Mr. Akshay Kokil (Industry)
Elective II: Augmented and Virtual Reality	Dr. (Mrs.) Nuzhat F. Shaikh	Prof. Sagar Balasaheb Shinde Prof. Shweta Ashish Koparde	Prof. Sanjay Agrawal Prof. Priyanka More Mr. Soumya Ranjan (Industry) Mr. Ravi Kiran (Industry)
Elective II: Cloud Computing	Dr. S. K. Sonkar	Prof. Abhijit D. Jadhav Dr. Pankaj Agarkar Dr. N. M. Ranjan	Dr. A. S. Rumale Prof. Thombre B. H. Mr. Ashok Pomnar (Industry) Mr. Santosh Ugale (Industry)
Elective II: Software Modeling and Architectures	Dr. M. A. Pradhan	Prof. Mrs. Dipalee Divakar Rane Prof. Jyoti Kulkarni	Dr. Neeta Deshpande Prof. Nareshkumar Mustary Dr. Aarti D. K.
Internship	Dr. Gitanjali V. Kale	Mr. Arun Kadekodi - (Industry) Mr. Nilesh Deshmukh - (Industry) Prof. Pradnya Kulkarni	Prof. Dheeraj Agrawal Prof. Pranjali Joshi
Data Science and Big Data Analytics Laboratory	Dr. H. K. Khanuja	Dr. Sheetal Sonawane Prof. Devidas S. Thosar Dr. S. K. Shinde Mr. Anand Bhalerao (Industry) Mr. Amod Vaidya (Industry)	Dr. B. D. Phulpagar Dr. K. V. Metre Mr. Atul Bengeri (Industry) Mr. Summer Patil (Industry) Mr. Sanjeev Kumar (Industry)
Web Technology Laboratory	Prof. Abhijit D. Jadhav	Mr. Avinash Patil (Industry)	Mr. Saikrishna Mamidishetty (Industry)
Laboratory Practice II	Dr. Snehal Mohan Kamalapur	Dr. K Rajeswari Dr. Pathan Mohd Shafi Dr. Shaikh Nuzhat Faiz	Dr. N. M. Ranjan Dr. M. A. Pradhan
Audit Course 6	Dr. Sangve Sunil M.	Dr. S. S. Das	Prof. Abhijit D. Jadhav

[Back to Table of Contents](#)

Faculty of Engineering
Savitribai Phule Pune University, Pune
Maharashtra, India



Curriculum
for
Fourth Year of Computer Engineering
(2019 Course)
(With effect from 2022-23)

**Final Year of Computer Engineering
(2019 Course)
(With effect from 2022-23)**

Prologue

It is with great pleasure and honor that I share the syllabi for Fourth Year of Computer Engineering (2019 Course) on behalf of Board of Studies, Computer Engineering. We, members of BoS are giving our best to streamline the processes and curricula design.

While revising syllabus, honest and sincere efforts are put to tune Computer Engineering program syllabus in tandem with the objectives of Higher Education of India, AICTE, UGC and affiliated University (SPPU) by keeping an eye on the technological advancements and industrial requirements globally.

Syllabus revision is materialized with sincere efforts, active participation, expert opinions and suggestions from domain professionals. Sincere efforts have been put by members of BoS, teachers, alumni, industry experts in framing the draft with guidelines and recommendations.

Case Studies are included in almost all courses. Course Instructor is recommended to discuss appropriate related recent technology/upgrade/Case Studies to encourage students to study from course to the scenario and think through the largest issues/ recent trends/ utility/ developing real world/ professional skills.

I am sincerely indebted to all the minds and hands who work adroitly to materialize these tasks. I really appreciate your contribution and suggestions in finalizing the contents.

Thanks,

Dr. Varsha H. Patil

Chairman, Board of Studies (Computer Engineering), SPPU, Pune

links for First Year, Second Year and Third Year Computer Engineering Curriculum 2019:

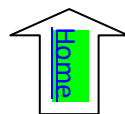
1. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/Rules%20and%20Regulations%20F.E.%202019%20Patt_10.012020.pdf
2. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202019/First%20Year%20Engineering%202019%20Patt.Syllabus_05.072019.pdf
3. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus2020/SE%20Computer%20Engg.%202019%20%20Patt_03.072020.pdf
4. http://collegecirculars.unipune.ac.in/sites/documents/Syllabus2021/Third%20Year%20Engineering%202019%20Pattern_16022022.rar

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2022-23)

Table of Contents

Sr. No.	Title	Page Number
1.	Program Outcomes	5
2.	Program Specific Outcomes	5
3.	Course Structure (Course titles, scheme for teaching, credit, examination and marking)	6
4.	General Guidelines	8
5.	Course Contents (Semester VII)	
	410241: Design and Analysis of Algorithms	10
	410242: Machine Learning	13
	410243: Blockchain Technology	17
	410244A: Pervasive Computing	20
	410244B: Multimedia Techniques	23
	410244C: Cyber Security And Digital Forensics	26
	410244D: Object Oriented Modeling And Design	29
	410244E: Digital Signal Processing	32
	410245A: Information Retrieval	35
	410245B: GPU Programming And Architecture	38
	410245C: Mobile Computing	41
	410245D: Software Testing And Quality Assurance	44
	410245E: Compilers	48
	410246: Laboratory Practice III	51
	410247: Laboratory Practice IV	56
	410248: Project Stage I	64
	410249: Audit Course 7	65
6.	Course Contents (Semester VIII)	
	410250: High Performance Computing	72
	410251: Deep Learning	75
	410252A: Natural Language Processing	78
	410252B: Image Processing	81
	410252C: Software Defined Networks	84

	410252D: Advanced Digital Signal Processing	87
	410252E: Open Elective I	90
	410253A: Pattern Recognition	91
	410253B: Soft Computing	94
	410253C: Business Intelligence	97
	410253D: Quantum Computing	101
	410253E: Open Elective II	104
	410254: Laboratory Practice V	105
	410255: Laboratory Practice VI	109
	410256: Project Stage II	118
	410257: Audit Course 8	119
7.	Acknowledgement	125
8.	Task Force at Curriculum Design	126



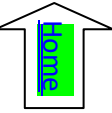
Savitribai Phule Pune University
Bachelor of Computer Engineering
Program Outcomes (POs)

Learners are expected to know and be able to–

PO1	Engineering knowledge	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences.
PO3	Design / Development of Solutions	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
PO4	Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and Sustainability	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.
PO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication Skills	Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project Management and Finance	Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.
PO12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

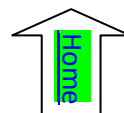
Program Specific Outcomes (PSO)

PSO1	Professional Skills- The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities.
PSO2	Problem-Solving Skills- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
PSO3	Successful Career and Entrepreneurship- The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.



BE Computer Engineering 2019 Course tentative Curriculum structure:

Savitribai Phule Pune University Fourth Year of Computer Engineering (2019 Course) (With effect from Academic Year 2022-23)														
Semester VII														
Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral\Pre	Total	Lecture	Practical	Tutorial	Total
410241	Design and Analysis of Algorithms	03	-	-	30	70	-	-	-	100	3	-	-	3
410242	Machine Learning	03	-	-	30	70	-	-	-	100	3	-	-	3
410243	Blockchain Technology	03	-	-	30	70	-	-	-	100	3	-	-	3
410244	Elective III	03	-	-	30	70	-	-	-	100	3	-	-	3
410245	Elective IV	03	-	-	30	70	-	-	-	100	3	-	-	3
410246	Laboratory Practice III	-	04	-	-	-	50	50	-	100	-	2	-	2
410247	Laboratory Practice IV	-	02	-	-	-	50	-	-	50	-	1	-	1
410248	Project Stage I	-	02	-	-	-	50	-	-	50	-	2	-	2
Total Credit											15	05	-	20
Total		15	08	-	150	350	150	50	-	700	15	05	-	20
410249	Audit Course 7										Grade			
Elective III					Elective IV									
410244(A) Pervasive Computing 410244(B) Multimedia Techniques 410244(C) Cyber Security and Digital Forensics 410244(D) Object Oriented Modeling and Design 410244(E) Digital Signal Processing					410245(A) Information Retrieval 410245(B) GPU Programming and Architecture 410245(C) Mobile Computing 410245(D)Software Testing and Quality Assurance 410245(E) Compilers									
Laboratory Practice III: Laboratory assignments Courses- 410241, 410242, 410243					Laboratory Practice IV: Laboratory assignments Courses- 410244, 410245									
Audit Course 7(AC7) Options: AC7- I MOOC- Learn New Skills AC7- II Entrepreneurship Development AC7- III Botnet of Things AC7- IV 3D Printing AC7- V Industrial Safety and Environment Consciousness														



Savitribai Phule Pune University
Final Year of Computer Engineering (2019 Course)
(With effect from Academic Year 2022-23)

Semester VIII

Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral/Pre	Total	Lecture	Practical	Tutorial	Total
410250	High Performance Computing	03	-	-	30	70	-	-	-	100	03			03
410251	Deep Learning	03	-	-	30	70	-	-	-	100	03			03
410252	Elective V	03	-	-	30	70	-	-	-	100	03			03
410253	Elective VI	03	-	-	30	70	-	-	-	100	03			03
410254	Laboratory Practice V	-	02	-	-	-	50	50	-	100		01		01
410255	Laboratory Practice VI	-	02	-	-	-	50	-	-	50		01		01
410256	Project Stage II	-	06	-	-	-	100	-	50	150		06		06
Total Credit											12	08	-	20
Total		12	10	-	120	280	200	50	50	700	12	08	-	20
410257	Audit Course 8										Grade			
Elective V						Elective VI								
410252(A) Natural Language Processing						410253(A) Pattern Recognition								
410252(B) Image Processing						410253(B) Soft Computing								
410252(C) Software Defined Networks						410253(C) Business Intelligence								
410252(D) Advanced Digital Signal Processing						410253(D) Quantum Computing								
410252(E) Open Elective I						410253(E) Open Elective II								
Lab Practice V: Laboratory assignments Courses- 410250, 410251						Lab Practice VI: Laboratory assignments Courses- 410252, 410253								
Audit Course 8(AC8) Options: AC8- I Usability Engineering AC8- II Conversational Interfaces AC8- III Social Media and Analytics AC8- IV MOOC- Learn New Skills AC8- V Emotional Intelligence														

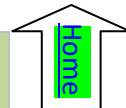
General Guidelines

- Every undergraduate program has its own objectives and educational outcomes. These objectives and outcomes are furnished by considering various aspects and impacts of the curriculum. These **Program Outcomes (POs)** are categorically mentioned at the beginning of the curriculum (ref: NBA Manual). There should always be a rationale and a goal behind the inclusion of a course in the curriculum. Course Outcomes though highly rely on the contents of the course, many a times are generic and bundled. The **Course Objectives, Course Outcomes and CO-PO mappings matrix** justifies the motives, accomplishment and prospect behind learning the course. **The Course Objectives, Course Outcomes and CO-PO Mapping Matrix are provided for reference and these are indicative only. The course instructor may modify them as per his or her perspective.**
- @CO and PO Mapping Matrix**(Course Objectives and Program Outcomes) attainment mapping matrix at end of course contents, indicates the correlation levels of 3, 2, 1 and '-'. The notation of 3, 2 and 1 denotes substantially (high), moderately (medium) and slightly (low). The mark '-' indicates that there is no correlation between CO and PO.
- For each course, contents are divided into six units-I, II, III, IV, V and VI.
#Elaborated examples/Case Studies are included at each unit to explore how the learned topics apply to real world situations and need to be explored so as to assist students to increase their competencies, inculcating the specific skills, building the knowledge to be applicable in any given situation along with an articulation. One or two sample exemplars or case studies are included for each unit; instructor may extend the same with more. **Exemplar/Case Studies may be assigned as self-study by students and to be excluded from theory examinations.**
- *For each unit contents, the content attainment mapping is indicated with Course Outcome(s). Instructor may revise the same as per their viewpoint.
- For laboratory courses, set of suggested assignments is provided for reference. Laboratory Instructors may design suitable set of assignments for respective course at their level. **Beyond curriculum assignments and mini-project may be included as the part of laboratory work.** Inclusion of it will be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners.
- For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorial may be as per guidelines of authority.
- For each course, irrespective of the examination head, the instructor should motivate students to read articles/research papers related to recent development and invention in the field.
- For laboratory, instructions have been included about the conduction and assessment of laboratory work. These guidelines are to be strictly followed.
- Term Work** –Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.
- Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.(In laboratory Practices the lab teachers can give different applications other than the indicated.)**

Abbreviations

TW: Term Work	TH: Theory	PR: Practical
OR: Oral	Sem: Semester	

SEMESTER VII



Savitribai Phule Pune University

Fourth Year of Computer Engineering (2019 Course)

410241: Design and Analysis of Algorithms

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
---	----------------------------	---

Prerequisites Courses: Discrete Mathematics (210241), Fundamentals of Data Structures(210242, Data Structures and Algorithms(210252), Theory of Computation (310242)

Companion Course: Laboratory Practice III(410246)

Course Objectives:

- To develop problem solving abilities using mathematical theories.
- To apply algorithmic strategies while solving problems.
- To analyze performance of different algorithmic strategies in terms of time and space.
- To develop time and space efficient algorithms.
- To study algorithmic examples in distributed and concurrent environments
- To Understand Multithreaded and Distributed Algorithms

Course Outcomes:

On completion of the course, student will be able to–

CO1: Formulate the problem

CO2: Analyze the asymptotic performance of algorithms

CO3: Decide and apply algorithmic strategies to solve given problem

CO4: Find optimal solution by applying various methods

CO5: Analyze and Apply Scheduling and Sorting Algorithms.

CO6: Solve problems for multi-core or distributed or concurrent environments

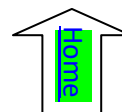
Course Contents

Unit I	Algorithms and Problem Solving	07 Hours
<p>Algorithm: The Role of Algorithms in Computing - What are algorithms, Algorithms as technology, Evolution of Algorithms, Design of Algorithm, Need of Correctness of Algorithm, Confirming correctness of Algorithm – sample examples, Iterative algorithm design issues.</p> <p>Problem solving Principles: Classification of problem, problem solving strategies, classification of time complexities (linear, logarithmic etc.)</p>		
#Exemplar/Case Studies	Towers of Hanoi	
*Mapping of Course Outcomes for Unit I	CO1,CO3	
Unit II	Analysis of Algorithms and Complexity Theory	07 Hours
<p>Analysis: Input size, best case, worst case, average case</p> <p>Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, O, Ω, Θ, o and ω notations, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P-class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle.</p>		
#Exemplar/Case Studies	Analysis of iterative and recursive algorithm	

*Mapping of Course Outcomes for Unit II		CO2
Unit III	Greedy And Dynamic Programming algorithmic Strate; 08 Hours	
Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem,scheduling algorithms-Job scheduling and activity selection problem. Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, binomialcoefficients, OBST, 0/1 knapsack, Chain Matrix multiplication.		
#Exemplar/Case Studies	Rail tracks connecting all the cities	
*Mapping of Course Outcomes for Unit III	CO3, CO4	
Unit IV	Backtracking and Branch-n-Bound 08 Hours	
Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem,graph coloring problem, sum of subsets problem. Branch-n-Bound: Principle, control abstraction, time analysis of control abstraction, strategies-FIFO, LIFO and LC approaches, TSP, knapsack problem.		
#Exemplar/Case Studies	Airline Crew Scheduling	
*Mapping of Course Outcomes for Unit IV	CO3, CO4	
Unit V	Amortized Analysis 07 Hours	
Amortized Analysis: Aggregate Analysis, Accounting Method, Potential Function method, Amortized analysis-binary counter, stack Time-Space tradeoff, Introduction to Tractable and Non-tractable Problems, Introduction to Randomized and Approximate algorithms, Embedded Algorithms: Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems.		
#Exemplar/Case Studies	cutting stock problem	
*Mapping of Course Outcomes for Unit V	CO3,CO5	
Unit VI	Multithreaded And Distributed Algorithms 07 Hours	
Multithreaded Algorithms - Introduction, Performance measures, Analyzing multithreaded algorithms,Parallel loops, Race conditions. Problem Solving using Multithreaded Algorithms - Multithreaded matrix multiplication, Multithreadedmerge sort. Distributed Algorithms - Introduction, Distributed breadth first search, Distributed Minimum SpanningTree. String Matching- Introduction, The Naive string matching algorithm, The Rabin-Karp algorithm.		
#Exemplar/Case Studies	Plagiarism detection	

***Mapping of Course Outcomes for UnitVI**

CO6

**Learning Resources****Text Books:**

1. Parag Himanshu Dave, Himanshu Bhalchandra Dave, “Design And Analysis of Algorithms”, Pearson Education, ISBN 81-7758-595-9
2. Gilles Brassard, Paul Bratley, “Fundamentals of Algorithmics”, PHI, ISBN 978-81-203-1131-2

Reference Books :

1. Michael T. Goodrich, Roberto Tamassia, “Algorithm Design: Foundations,” Analysis and Internet Examples, Wiley, ISBN 978-81-265-0986-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press; ISBN 978-0-262-03384-8
3. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN: 978 817371 6126, 81 7371 61262
4. Rajeev Motwani and Prabhakar Raghavan, “Randomized Algorithms” Cambridge University Press, ISBN: 978-0-521-61390-3
5. Dan Gusfield, “Algorithms on Strings, Trees and Sequences”, Cambridge University Press, ISBN: 0-521-67035-7

e-Books :

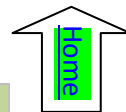
1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_tutorial.pdf
2. <https://www.ebooks.com/en-in/book/1679384/algorithms-design-techniques-and-analysis/m-h-alsuwaiyel>

MOOC Courses links :

- Design and Analysis of Algorithms - <https://nptel.ac.in/courses/106106131>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	2
CO2	2	3	-	-	-	-	-	-	-	-	-	2
CO3	2	3	2	-	-	-	-	-	-	-	-	3
CO4	2	3	3	2	-	-	-	-	-	-	-	3
CO5	2	2	2	2	-	-	-	-	-	-	-	3
CO6	2	2	1	2	-	-	-	-	-	-	-	-



Savitribai Phule Pune University

Fourth Year of Computer Engineering (2019 Course)

410242: Machine Learning

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
--	---------------------	---

Prerequisite Courses: Data Science and Big Data Analytics(310251)

Companion Course: Laboratory Practice III(410246)

Course Objectives:

- To understand the need for Machine learning
- To explore various data pre-processing methods.
- To study and understand classification methods
- To understand the need for multi-class classifiers.
- To learn the working of clustering algorithms
- To learn fundamental neural network algorithms.

Course Outcomes:

On completion of the course, student will be able to–

CO1: Identify the needs and challenges of machine learning for real time applications.

CO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms.

CO3: Select and apply appropriately supervised machine learning algorithms for real time applications.

CO4: Implement variants of multi-class classifier and measure its performance.

CO5 :Compare and contrast different clustering algorithms.

CO6: Design a neural network for solving engineering problems.

Course Contents

Unit I	Introduction To Machine Learning	07 Hours
<p>Introduction to Machine Learning, Comparison of Machine learning with traditional programming, ML vs AI vs Data Science.</p> <p>Types of learning: Supervised, Unsupervised, and semi-supervised, reinforcement learning techniques, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models.</p> <p>Important Elements of Machine Learning- Data formats, Learnability, Statistical learning approaches</p>		
<u>#Exemplar/Case Studies</u>	Suppose you are working for Uber where a task to increase sales is given. Understand the requirements of the client	
<u>*Mapping of Course Outcomes for Unit</u>	CO1	
Unit II	Feature Engineering	07 Hours

Concept of Feature, Preprocessing of data: Normalization and Scaling, Standardization, Managing missing values, Introduction to Dimensionality Reduction, Principal Component Analysis (PCA), Feature Extraction: Kernel PCA, Local Binary Pattern.

Introduction to various Feature Selection Techniques, Sequential Forward Selection, Sequential Backward Selection.

Statistical feature engineering: count-based, Length, Mean, Median, Mode etc. based feature vector creation.

Multidimensional Scaling, Matrix Factorization Techniques.

<u>#Exemplar/Case Studies</u>	<p>You are a Data Scientist, and a client comes to you with their data. Client is running a few campaigns from the past few months, but no campaign seem effective. Client provides you the data of customers, product sales and past campaign success. They want to increase their sales and figure out which marketing strategy is working the best for them?</p> <p>Questions for data scientists:</p> <ol style="list-style-type: none"> 1. What data analysis approach will you follow? 2. What statistical approach do you need to follow? <p>How will you select important features?</p>
---	---

<u>*Mapping of Course Outcomes for Unit II</u>	CO2
--	-----

Unit III	Supervised Learning : Regression	06 Hours
-----------------	---	-----------------

Bias, Variance, Generalization, Underfitting, Overfitting, Linear regression, Regression: Lasso regression, Ridge regression, Gradient descent algorithm.

Evaluation Metrics: MAE, RMSE, R2

<u>#Exemplar/Case Studies</u>	Stock market price prediction
<u>*Mapping of Course Outcomes for Unit III</u>	CO3

Unit IV	Supervised Learning : Classification	08 Hours
----------------	---	-----------------

Classification: K-nearest neighbour, Support vector machine.

Ensemble Learning: Bagging, Boosting, Random Forest, Adaboost.

Binary-vs-Multiclass Classification, Balanced and Imbalanced Multiclass Classification

Problems, Variants of Multiclass Classification: One-vs-One and One-vs-All

Evaluation Metrics and Score: Accuracy, Precision, Recall, Fscore, Cross-validation, Micro-Average Precision and Recall, Micro-Average F-score, Macro-Average Precision and Recall, Macro-Average F-score.

<u>#Exemplar/Case Studies</u>	Prediction of Thyroid disorders such as Hyperthyroid, Hypothyroid, Euthyroid-sick, and Euthyroid using multiclass classifier.
<u>*Mapping of Course Outcomes for Unit IV</u>	CO4

Unit V	Unsupervised Learning	07 Hours
---------------	------------------------------	-----------------

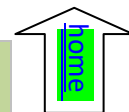
K-Means, K-medoids, Hierarchical, and Density-based Clustering, Spectral Clustering. Outlier analysis: introduction of isolation factor, local outlier factor.

Evaluation metrics and score: elbow method, extrinsic and intrinsic methods

Faculty of Engineering		Savitribai Phule Pune University
#Exemplar/Case Studies	Market basket analysis/Customer Segmentation	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Introduction To Neural Networks	07 Hours
Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Functional Link Artificial Neural Network, and Radial Basis Function Network, Activation functions, Introduction to Recurrent Neural Networks and Convolutional Neural Networks		
#Exemplar/Case Studies	Movie Recommendation System	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		
Text Books:		
<ol style="list-style-type: none">1. Bishop, Christopher M., and Nasser M. Nasrabadi, "Pattern recognition and machine learning", Vol. 4.No. 4. New York: springer, 2006.2. Ethem Alpaydin, "Introduction to Machine Learning", PHI 2nd Edition-2013		
Reference Books:		
<ol style="list-style-type: none">1. Tom Mitchell, "Machine learning", McGraw-Hill series in Computer Science, 19972. Shalev-Shwartz, Shai, and Shai Ben-David, "Understanding machine learning: From theory to algorithms", Cambridge university press, 2014.3. Jiawei Han, Micheline Kamber, and Jian Pie, "Data Mining: Concepts and Techniques", Elsevier Publishers Third Edition, ISBN: 9780123814791, 97801238148074. Hastie, Trevor, et al., "The elements of statistical learning: data mining, inference, and prediction", Vol. 2. New York: springer, 2009.5. McKinney, "Python for Data Analysis", O'Reilly media, ISBN : 978-1-449-31979-36. Trent hauk, "Scikit-learn", Cookbook, Packt Publishing, ISBN: 97817872863827. Goodfellow I.,Bengio Y. and Courville, "A Deep Learning", MIT Press, 2016		
e-Books :		
<ol style="list-style-type: none">1. Python Machine Learning : http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/207_05_01_Rajchka_Using-Python-for-machine-learning-2015.pdf2. Foundation of Machine Learning: https://cs.nyu.edu/~mohri/mlbook/3. Dive into Deep Learning: http://d2l.ai/4. A brief introduction to machine learning for Engineers: https://arxiv.org/pdf/1709.02840.pdf5. Feature selection: https://dl.acm.org/doi/pdf/10.5555/944919.9449686. Introductory Machine Learning Nodes : http://lcs.mit.edu/courses/ml/1718/MLNotes.pdf		
MOOC Courses Links:		
<ul style="list-style-type: none">• Introduction to Machine Learning : https://nptel.ac.in/courses/106105152• Introduction to Machine Learning (IIT Madras): https://onlinecourses.nptel.ac.in/noc22_cs29/preview• Deep learning: https://nptel.ac.in/courses/106106184		

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	2	-	-	1	1	1	1	1	1
CO2	2	1	-	1	1	1	1	1	1	1	1	1
CO3	2	2	2	1	1	1	1	1	1	1	1	1
CO4	2	2	2	1	1	1	1	1	1	1	1	1
CO5	2	2	2	1	1	1	1	1	1	1	1	1
CO6	2	-	2	1	1	1	1	1	1	1	1	1



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410243: Blockchain Technology

Teaching Scheme:
TH: 03 Hours/Week

Credit
03

Examination Scheme:
In-Sem (Paper): 30 Marks
End-Sem (Paper): 70 Marks

Prerequisite Courses: Computer Networks and Security(310244)

Companion Course: Laboratory Practice III(410246)

Course Objectives:

- Technology behind Blockchain
- Crypto currency, Bitcoin and Smart contracts
- Different consensus algorithms used in Blockchain
- Real-world applications of Blockchain
- To analyze Blockchain Ethereum Platform using Solidity
- To Describe Blockchain Case Studies

Course Outcomes:

On completion of the course, student will be able to–

CO1: Interpret the fundamentals and basic concepts in Blockchain

CO2: Compare the working of different blockchain platforms

CO3: Use Crypto wallet for cryptocurrency based transactions

CO4: Analyze the importance of blockchain in finding the solution to the real-world problems.

CO5: Illustrate the Ethereum public block chain platform

CO6: Identify relative application where block chain technology can be effectively used and implemented.

Course Contents

Unit I	Mathematical Foundation for Blockchain	06 Hours
Cryptography: Symmetric Key Cryptography and Asymmetric Key Cryptography, Elliptic Curve Cryptography (ECC), Cryptographic Hash Functions: SHA256, Digital Signature Algorithm (DSA), Merkel Trees.		
#Exemplar/Case Studies	Compare the Symmetric and Asymmetric Cryptography algorithms	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Feature Engineering	07 Hours
History, Centralized Vs. Decentralized Systems, Layers of Blockchain: Application Layer, Execution Layer, Semantic Layer, Propagation Layer, Consensus Layer, Why is Block chain important? Limitations of Centralized Systems, Blockchain Adoption So Far.		
#Exemplar/CaseStudies	Study of a research paper based on Blockchain.	

<u>*Mapping of Course Outcomes for Unit II</u>		CO1
Unit III	Blockchain Platforms and Consensus in Blockchain	06 Hours
Types of Blockchain Platforms: Public, Private and Consortium, Bitcoin, Ethereum, Hyperledger, IoT, Corda, R3. Consensus in Blockchain: Consensus Approach, Consensus Elements, Consensus Algorithms, Proof of Work, Byzantine General problem, Proof of Stake, Proof of Elapsed Time, Proof of Activity, Proof of Burn.		
<u>#Exemplar/Case Studies</u>	Compare different consensus algorithms used in Blockchain Technology.	
<u>*Mapping of Course Outcomes for Unit III</u>	CO2	
Unit IV	Cryptocurrency – Bitcoin, and Token	06 Hours
Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics Types of Cryptocurrency, Cryptocurrency Usage, Cryptowallets: Metamask, Coinbase, Binance		
<u>#Exemplar/Case Studies</u>	Create your own wallet for crypto currency using any of the Blockchain Platforms.	
<u>*Mapping of Course Outcomes for Unit IV</u>	CO3	
Unit V	Blockchain Ethereum Platform using Solidity	06 Hours
What is Ethereum, Types of Ethereum Networks, EVM (Ethereum Virtual Machine), Introduction to smart contracts, Purpose and types of Smart Contracts, Implementing and deploying smart contracts using Solidity, Swarm (Decentralized Storage Platform), Whisper (Decentralized Messaging Platform)		
<u>#Exemplar/Case Studies</u>	Study Truffle Development Environment.	
<u>*Mapping of Course Outcomes for Unit V</u>	CO4	
Unit VI	Blockchain Case Studies	06 Hours
Prominent Blockchain Applications, Retail, Banking and Financial Services, Government Sector, Healthcare, IOT, Energy and Utilities, Blockchain Integration with other Domains		
<u>#Exemplar/Case Studies</u>	Study 2 uses cases of Blockchain and write a detailed report on every aspect implemented in the same	
<u>*Mapping of Course Outcomes for Unit VI</u>	CO5, CO6	
Learning Resources		

Text Books:

1. Martin Quest, "Blockchain Dynamics: A Quick Beginner's Guide on Understanding the Foundations of Bit coin and Other Crypto currencies", Create Space Independent PublishingPlatform, 15-May-2018
2. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018
3. Alex Leverington, "Ethereum Programming", Packt Publishing, 2017

Reference Books:

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions", 2018
2. Chris Dannen, "Introducing Ethereum and Solidity", Foundations of Crypto currency and Blockchain Programming for Beginners
3. Daniel Drescher, "Blockchain Basics", A Non -Technical Introduction in 25Steps.
4. Ritesh Modi, "Solidity Programming Essentials", Packt Publishing, 2018
5. Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, "Blockchain Technology", Universities Press, ISBN-9789389211634

e-Books :

1. https://users.cs.fiu.edu/~prabakar/cen5079/Common/textbooks/Mastering_Blockchain_2nd_Edition.pdf
2. https://www.lopp.net/pdf/princeton_bitcoin_book.pdf
3. <https://www.blockchainexpert.uk/book/blockchain-book.pdf>

MOOC Courses Links:

1. NPTEL Course on "Introduction to Blockchain Technology & Applications"
<https://nptel.ac.in/courses/106/104/106104220/>
2. NPTEL Course on b
<https://nptel.ac.in/courses/106/105/106105184/>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	2	2	-	-	-	-	-	-	-	-
CO4	3	-	2	-	2	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	2
CO6	2	2	2	2	-	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective III
410244(A): Pervasive Computing

Teaching Scheme:**TH: 03 Hours/Week****Credit****03****Examination Scheme:****In-Sem (Paper): 30 Marks****End-Sem (Paper): 70 Marks****Prerequisite Courses:**-Internet of Things and Embedded Systems(310245A)**Companion Course:** Laboratory Practice IV(410247)**Course Objectives:**

- To introduce the characteristics, basic concepts and systems issues in pervasive computing.
- To illustrate smart devices and architectures in pervasive computing.
- To introduce intelligent systems and interactions in Pervasive computing.
- To identify the trends and latest development of the technologies in the area.
- To Understand Interaction Design – HCI and Wearable Computing Environment.
- To identify Security Challenges & Ethics in Pervasive Computing

Course Outcomes:

On completion of the course, student will be able to–

CO1.Demonstrate fundamental concepts in pervasive computing.

CO2.Explain pervasive devices and decide appropriate one as per the need of real time applications.

CO3.Classify and analyze context aware systems for their efficiency in different ICT systems.

CO4.Illustrate intelligent systems and generic intelligent interactive applications.

CO5.Design HCI systems in pervasive computing environment.

CO6.Explore the security challenges and know the role of ethics in the context of pervasive computing.

Course Contents**Unit I****Introduction To Pervasive Computing****07 Hours**

Pervasive Computing: History, Principles, Characteristics, Problems/Issues & Challenges, Advantages of Pervasive Computing

Pervasive Computing Applications: Pervasive computing devices and interfaces, Device technology trends, Connecting issues and protocols.

#Exemplar/Case Studies

Pervasive Computing for Personalized medicine

***Mapping of Course Outcomes for Unit I**

CO1

Unit II**Smart Computing with Pervasive Computing Devices****07 Hours**

Smart Devices: CCI, Smart Environment: CPI and CCI, Smart Devices: iHCI and HPI, Wearable devices, Application and Requirements, Device Technology and Connectivity, PDA Device characteristics - PDA Based Access Architecture, Voice Enabling Pervasive Computing: Voice Standards, Speech Applications in Pervasive Computing.

<u>#Exemplar/CaseStudies</u>	Amazon Alexa	
<u>*Mapping of Course Outcomes for Unit II</u>	CO2	
Unit III	Context Aware Systems	07 Hours
Introduction, Types of Context, Context Aware Computing and Applications, Modelling Context-Aware Systems, Mobility awareness, spatial awareness, temporal awareness:Coordinating and scheduling, ICT system awareness, Middleware Support		
<u>#Exemplar/Case Studies</u>	Mobile Hanging Services systems	
<u>*Mapping of Course Outcomes for Unit III</u>	CO3	
Unit IV	Intelligent Systems and Interaction	07 Hours
Introduction, Basic Concepts, IS Architectures, Semantic KBIS, Classical Logic IS, Soft Computing IS Models, IS System Operations, Interaction Multiplicity, IS Interaction Design, Generic Intelligent Interaction Applications.		
<u>#Exemplar/Case Studies</u>	Curious information displays: A motivated reinforcement learning IE application.	
<u>*Mapping of Course Outcomes for Unit IV</u>	CO4	
Unit V	User Interaction Design – HCI and Wearable Computing	07 Hours
Introduction of Interaction Design, Basics of Interaction Design and its Concepts, Importance of Interaction Design, Difference between Interaction Design and UX. What is HCI? Importance of HCI, Advantages and Disadvantages of HCI, Elements of HCI, HCI Design and Architecture,Define Wearable Computing, Importance of Wearable Computing, Security issues in Wearable Computing, Wearable Computing Architecture and Applications, Wearable Computing Challenges and Opportunities for Privacy Protection		
<u>#Exemplar/Case Studies</u>	Smart Fabric/ Textile, Sensory Fabric for Ubiquitous interfaces	
<u>*Mapping of Course Outcomes for Unit V</u>	CO5	
Unit VI	Security Challenges & Ethics in Pervasive Computing	07 Hours
Security issues in Pervasive Computing: security model, authentication & authorization, access control, secure resource discovery, open issues. Pervasive computing security challenges & requirements: Privacy & trust issues, social & user interaction issues, solution for pervasive computing challenges, Role of Ethics in pervasive computing security: Autonomy and Self-determination, Responsibility: legal, moral & social, distributive justice, digital divide and sustainable development		
<u>#Exemplar/Case Studies</u>	Pervasive Computing Security Gaia Project	
<u>*Mapping of Course Outcomes for Unit VI</u>	CO6	
Learning Resources		

Text Books:

1. Stefan Poslad, "Ubiquitous Computing: Smart Devices: Environments and Interactions", Wiley Publication, Student Edition, ISBN 9788126527335.
2. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtroff, Thomas Schack, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Pearson Education, ISBN 9788177582802
3. Frank Adelstein, Sandeep K. S. Gupta, Golden G. Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing" McGraw Hill Education, Indian Edition, ISBN 9780070603646

Reference Books:

1. Sen Loke, "Context Aware Pervasive Systems; Architectures for new Breed of applications", Taylor and Fransis, ISBN 0-8493-7255-0
2. LaurnceYang, Evi Syukur, Seng Loke, "Handbook on Mobile and Ubiquitous Computing : Status and Perspectivel", CRC Press, 2013 ISBN 978-1-4398-4811-1
3. M. Haque and S. I. Ahamed, "Security in pervasive computing: Current status and open issues", Int. J. Netw. Secur., vol. 3, no. 3, pp. 203–214, 2006.

e-Books :

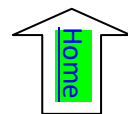
1. M. Hilty, "Ubiquitous Computing in the Workplace: What Ethical Issues?" no. August, pp. 1–16, 2014, [Online]. <http://link.springer.com/bookseries/11156L>.
2. <https://web.uettaxila.edu.pk/CMS/SP2014/teMPCms/tutorial%5CFundamentalsOfMobilePervasiveComputing.pdf>
3. http://pervasivecomputing.se/M7012E_2014/material/Wiley.Ubiquitous.Computing.Smart.Devices.Environments.And.Interactions.May.2009.eBook.pdf
4. http://media.techtarget.com/searchMobileComputing/downloads/Mobile_and_pervasive_computing_Ch06.pdf

MOOC Courses Links:

<https://www.georgiancollege.ca/academics/part-time-studies/courses/mobile-and-pervasive-computing-comp-3025/>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	--	--	--	--	--	--	--	--	--	--
CO2	2	3	2	2	--	--	--	--	--	--	--	--
CO3	3	3	3	3	--	--	--	--	--	--	--	--
CO4	3	2	3	3	--	--	--	--	--	--	--	--
CO5	3	3	3	3	--	--	--	--	--	--	--	--
CO6	1	2	-	3	--	--	--	--	--	--	--	--



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective III
410244(B): Multimedia Techniques

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks
		End-Sem (Paper): 70 Marks

Prerequisite Courses: Computer Graphics (210241)

Companion Course: Laboratory Practice IV(410247)

Course Objectives:

- To understand input and output devices, device drivers, control signals and protocols, DSPs
- To study and use standards (e.g., audio, graphics, video)
- To implement applications, media editors, authoring systems, and authoring by studying streams/structures, capture/represent/transform, spaces/domains, compression/coding
- To design and develop content-based analysis, indexing, and retrieval of audio, images, animation, and video
- To demonstrate presentation, rendering, synchronization, multi-modal integration/interfaces
- To Understand IoT architecture's and Multimedia Internet of things

Course Outcomes:

On completion of the course, student will be able to—

- CO1: Describe the media and supporting devices commonly associated with multimedia information and systems.
- CO2: Demonstrate the use of content-based information analysis in a multimedia information system.
- CO3: Critique multimedia presentations in terms of their appropriate use of audio, video, graphics, color, and other information presentation concepts.
- CO4: Implement a multimedia application using an authoring system.
- CO5: Understanding of technologies for tracking, navigation and gestural control.
- CO6: Implement Multimedia Internet of Things Architectures.

Course Contents

Unit I	Introduction to multimedia	07 Hours
What is Multimedia and their Components, History of Multimedia; Hypermedia, WWW, and Internet; Multimedia Tools: Static (text, graphics, and still images), Active (sound, animation, and video, etc.); Multimedia Sharing and Distribution; Multimedia Authoring Tools: Adobe Premiere, Adobe Director, Adobe Flash.		
#Exemplar/Case Studies	To study and install open-source multimedia Tools	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Graphics and Data Representation Techniques	07 Hours

What are Graphics data types, 1-bit Images, 8 –bit grey level ,16-bit grey level images, Image data type, Image data type: 8 bit & 24-bit color images, Higher bit depth images, Color Lookup tables. File Formats: GIF, JPEG, PNG, TIFF, PSD, APS, AI, INDD, RAW, Windows BMP, Windows WMF, Netpbm format, EXIF, PTM, Text file format: RTF, TGA Applications/Use of text in Multimedia

#Exemplar/CaseStudies

To study conversion of image file formats from one to Other.

***Mapping of Course Outcomes for Unit II**

CO2

Unit III**Multimedia Representations Techniques****07 Hours**

Principal concepts for the analog video: CRT, NTSC Video (National Television System Committee), PAL Video (Phase Alternating Line), SECAM Video (System Electronic Couleur Avec Memoire), Digital Video: Chroma Subsampling, High-Definition TV, Ultra High Definition TV (UHDTV), Component Video: High-Definition Multimedia Interface (HDMI), 3D Video and TV: various cues, Basics of Digital Audio: What is Sound?, Nyquist Theorem, SNR, SQNR, Audio Filtering, Synthetic Sounds, MIDI Overview: Hardware, Structure, Conversion to WAV, Coding of Audio: PCM, DPCM, DM (Delta Modulation)

#Exemplar/Case Studies

Install and use Handbrake (link is <https://handbrake.fr>) software to understand the concept of interlaced, deinterlace, noise filters, bitrate, and frame rate for any sample 30 min video, and note down the observations from the output video.

***Mapping of Course Outcomes for Unit III**

CO3

Unit IV**Compression Algorithms****07 Hours**

Introduction to multimedia – Graphics, Image and Video representations – Fundamental concepts of video, digital audio – Storage requirements of multimedia applications – Need for compression – Types of compression algorithms- lossless compression algorithms RLC, VLC, DBC, AC, lossless image compression, differential coding of Images, lossy compression algorithms-Rate distortion theory, Quantization, Transform coding, wavelet based coding, embedded Zerotress of wavelet coefficients. Image compression standard -JPEG standard, JPEG 2000 standard, LS standard, Bilevel image compression standard. Introduction to video compression - video compression based on motion compensation, Search for motion vectors, MPEG Video coding I, MPEG 1,2,4,7 onwards. Basic Audio Compression Techniques -ADPCM in speech coding, Vocoder, MPEG audio compression

#Exemplar/Case Studies

Implementation of compression algorithms

***Mapping of Course Outcomes for Unit IV**

CO3, CO4

Unit V Augmented Reality(AR), Virtual Reality (VR) and Mixed Reality (MR)**07 Hours**

Basics of Virtual Reality, difference between Virtual Reality and Augmented Reality, Requirement of Augmented Reality, Components and Performance issues in AR, Design and Technological foundations for Immersive Experiences. Input devices – controllers, motion trackers and motion capture technologies for tracking, navigation and gestural control. Output devices – Head Mounted VR Displays, Augmented and Mixed reality glasses. 3D interactive and procedural graphics. Immersive surround sound. Haptic and vibrotactile devices. Best practices in VR, AR and MR Future applications of Immersive Technologies. VRML Programming Modeling objects and virtual environments Domain Dependent applications:

Medical, Visualization, Entertainment, etc.

#Exemplar/Case Studies Navigation Assistance System

***Mapping of Course Outcomes for Unit V** CO5

Unit VI Multimedia Internet of Things 07 Hours

IoT and Multimedia IoT Architecture: IoT Architecture; M-IoT Architectures: Multi-Agent Based, AI-Based Software-Defined, Big Data Layered; Applications of M-IoT: Road Management System, Multimedia IoT in Industrial Applications, Health Monitoring

#Exemplar/Case Studies Traffic Monitoring System

***Mapping of Course Outcomes for Unit VI** CO6

Learning Resources

Text Books:

1. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2011, ISBN: 978-0-07-174850-6 MHID: 0-07-174850-4, eBook print version of this title: ISBN: 978-0-07-174846-9, MHID: 0-07-174846-6
2. Ze-Nian Li, Mark S. Drew and Jiang chuan Liu, "Fundamentals of Multimedia", Second Edition, Springer, 2011, ISSN 1868-0941 ISSN 1868-095X (electronic), ISBN 978-3-319-05289-2 ISBN 978-3-319-05290-8 (eBook), DOI 10.1007/978-3-319-05290-8, Pearson Education, 2009.

Reference Books:

1. Ali Nauman et al. "Multimedia Internet of Things: A Comprehensive Survey", Special Section on Mobile Multimedia: Methodology and Applications, IEEE Access, Volume 8, 2020
2. Kelly S. Hale (Editor), Kay M. Stanney (Editor). 2014. Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition (Human Factors and Ergonomics) ISBN-13: 978-1466511842. Amazon

e-Books :

1. https://users.dimi.uniud.it/~antonio.dangelo/MMS/materials/Fundamentals_of_Multimedia.pdf
2. <https://mu.ac.in/wp-content/uploads/2021/04/Multimedia.pdf>
3. https://www.baschools.org/pages/uploaded_files/chap13.pdf

MOOC Courses Links:

- <https://nptel.ac.in/courses/117105083>

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	1	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-
CO3	2	1	-	2	3	-	-	-	-	1	-	-
CO4	3	3	2	2	1	1	1	1	1	1	1	1
CO5	2	1	2	-	-	-	-	-	-	-	-	-
CO6	3	3	2	1	2	-	-	-	-	-	-	-



<p align="center">Savitribai Phule Pune University Fourth Year of Computer Engineering (2019 Course) Elective III 410244(C): Cyber Security and Digital Forensics</p>		
Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
Prerequisite Courses: Computer Networks and Security(310244), Information Security(310254(A))		
Companion Course: 410246: Laboratory Practice IV		
Course Objectives: <ul style="list-style-type: none"> • To enhance awareness cyber forensics. • To understand issues in cyber crime and different attacks • To understand underlying principles and many of the techniques associated with the digital forensic practices • To know the process and methods of evidence collection • To analyze and validate forensic data collected. • To apply digital forensic knowledge to use computer forensic tools and investigation report writing. 		
Course Outcomes: At the end of the course, the student should be able to: CO1: Analyze threats in order to protect or defend it in cyberspace from cyber-attacks. CO2: Build appropriate security solutions against cyber-attacks. CO3:Underline the need of digital forensic and role of digital evidences. CO4: Explain rules and types of evidence collection CO5: Analyze, validate and process crime scenes CO6: Identify the methods to generate legal evidence and supporting investigation reports.		
Course Contents		
Unit 1	Introduction to Cyber Security	06 Hours
Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: crime against an individual, Crime against property, Cyber extortion, Drug trafficking, cyber terrorism. Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.		
#Exemplar/Case Studies	Data Breach Digest – Perspective & Reality : http://verizonenterprise.com/databreachdigest	
*Mapping of Course Outcome for Unit I	CO1	
Unit 2	Cyber Crime Issues and Cyber attacks	06 Hours
Unauthorized Access to Computers, Computer Intrusions, Viruses, and Malicious Code, Internet Hacking and Cracking, Virus and worms, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Cybercrime prevention methods, Application security (Database, E-mail, and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Hardware protection mechanisms, OS Security		
#Exemplar/Case Studies	Cyber Stalking types & their cases respectively	
*Mapping of Course Outcome for Unit II	CO2	
Unit 3	Introduction to Digital Forensics	06 Hours
What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of		

Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology, Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined, Data Back-up and Recovery, The Role of Back-up in Data Recovery, The Data-Recovery Solution.

#Exemplar/Case Studies	Demonstrate practice Linux networking security recovery commands.& Study Tools viz; FTK & The Sleuth Kit	
*Mapping of Course Outcome for Unit III	CO3	
Unit 4	Evidence Collection and Data Seizure	06 Hours
Why Collect Evidence? Collection Options ,Obstacles, Types of Evidence — The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps, Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication, Practical Consideration, Practical Implementation.		
#Exemplar/Case Studies	Understand how computer forensics works by visiting: http://computer.howstuffworks.com/computer-forensic.htm/printable (23 December 2010)	
*Mapping of Course Outcome for Unit IV	CO4	
Unit 5	Computer Forensics analysis and validation	06 Hours
Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, and performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case		
#Exemplar/Case Studies	Discuss cases under Financial Frauds, Matrimonial Frauds, Job Frauds, Spoofing, and Social media. Then write down safety tips, precautionary measures for the discussed fraud cases.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit 6	Current Computer Forensic tools	06 Hours
Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.		
#Exemplar/Case Studies	Install Kali Linux & practice following examples: 1. https://www.youtube.com/watch?time_continue=6&v=MZXZctqIU-w&feature=emb_logo	
*Mapping of Course Outcome for Unit VI	CO6	
Learning Resources		
Text Books: 1. John R. Vacca, “Computer Forensics”, Computer Crime Investigation Firewall Media, New Delhi. 2. Nelson, Phillips Enfinger, Steuart, “Computer Forensics and Investigations”, CENGAGE Learning		
Reference Books:		

1. Keith J. Jones, Richard Bejtich, Curtis W. Rose, “Real Digital Forensics”, Addison-Wesley Pearson Education

2. Tony Sammes and Brian Jenkinson, “Forensic Compiling”, A Tractitioneris Guide, Springer International edition.

3. Christopher L.T. Brown, “Computer Evidence Collection & Presentation”, Firewall Media.

4. Jesus Mena, “Homeland Security, Techniques & Technologies”, Firewall Media.

e books:

1. <https://www.pdfdrive.com/computer-forensics-investigating-network-intrusions-and-cyber-crime-e15858265.html>

2. <https://dokumen.pub/handbook-of-computer-crime-investigation-forensic-tools-and-technology-1stnbsped-0121631036-9780121631031.html>

3. Massachusetts Institute of Technology Open Courseware: <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/>

MOOC Courses Links:

- MIT Open CourseWare: <https://ocw.mit.edu/courses/>

@The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	2
CO2	1	3	-	-	-	-	-	-	-	-	-	2
CO3	2	3	2	-	-	-	-	-	-	-	-	3
CO4	2	3	3	-	-	-	-	-	-	-	-	3
CO5	2	2	2	2	-	-	-	-	-	-	-	3
CO6	2	3	2	3	-	-	-	-	-	-	-	3

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective III

410244(D): Object oriented Modeling and Design

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks
		End-Sem (Paper): 70 Marks

Prerequisite Courses: Software Engineering (210245)

Companion Course: Laboratory Practice IV (410247)

Course Objectives:

- Describe the concepts involved in Object-Oriented modelling and their benefits.
- Demonstrate concept of use-case model, sequence model and state chart model for a given problem.
- Explain the facets of the unified process approach to design and build a Software system.
- Translate the requirements into implementation for Object Oriented design.
- Choose an appropriate design pattern to facilitate development procedure. Select suitable design pattern depending on nature of application.
- To describe Designing and Management of Patterns.

Course Outcomes:

On completion of the course, student will be able to–

CO1: Describe the concepts of object-oriented and basic class modelling.

CO2: Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.

CO3: Choose and apply a befitting design pattern for the given problem

CO4: To Analyze applications, architectural Styles & software control strategies

CO5: To develop Class design Models & choose Legacy Systems.

CO6: To Understand Design Patterns

Course Contents

Unit I	Introduction To Modeling	06 Hours
What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.		
#Exemplar/Case Studies	Case Study of ATM System	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Advanced Class Modeling and State Modeling	06 Hours
Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips. State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram		

behavior; Practical tips.

#Exemplar/CaseStudies Case Study of Train Reservation System

***Mapping of Course** CO2

Outcomes for Unit II

Unit III Advanced State Modeling and Interaction Modeling 06 Hours

Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

#Exemplar/Case Studies Case Study of Coffee Vending Machine

***Mapping of Course** CO2, CO3
Outcomes for Unit III

Unit IV User Application Analysis : System Design 06 Hours

Application Analysis: Application interaction model; Application class model; Application state model; Adding operations. Overview of system design; Estimating performance; Making a reuse plan; Breaking a system into sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example

#Exemplar/Case Studies Case System of ATM System

***Mapping of Course** CO3, CO4
Outcomes for Unit IV

Unit V Class Design ,Implementation Modeling, Legacy Systems 06 Hours

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance

#Exemplar/Case Studies Case study of College Library System

***Mapping of Course** CO4, CO5
Outcomes for Unit V

Unit VI Design Pattern 06 Hours

What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

Management Patterns: Command processor; View handler. Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example

#Exemplar/Case Studies	Design Pattern for Any suitable System
*Mapping of Course Outcomes for Unit VI	CO6

Learning Resources

Text Books:

1. Michael Blaha, James Rumbaugh, “Object-Oriented Modeling and Design with UML”, 2nd Edition, Pearson Education, 2005.
2. Frank Buchmann, Regine Meunier, Hans Rohnert, Peter Sommer lad, Michael Stal, “Pattern-Oriented Software Architecture, A System of Patterns”, Volume 1, John Wiley and Sons, 2007

Reference Books:

1. Grady Booch et al, “Object-Oriented Analysis and Design with Applications”, 3rd Edition, Pearson Education, 2007
2. Brahma Dathan, Sarnath Ramnath, “Object-Oriented Analysis, Design, and Implementation”, UniversitiesPress, 2009
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, “ UML 2 Toolkit”, Wiley-Dreamtech India, 2004
4. Simon Bennett, Steve McRobb and Ray Farmer, “ UML 2 Toolkit, Object- Oriented Systems Analysis and Design Using UML, 2 nd Edition, Tata McGraw-Hill, 2002

e-Books :

1. [Object Oriented Modeling and Design - https://www.pdfdrive.com/object-oriented-design-and-modeling-d10014860.html](https://www.pdfdrive.com/object-oriented-design-and-modeling-d10014860.html)
2. <https://www.gopalancolleges.com/gcem/course-material/computer-science/course-plan/sem-VII/object-oriented-modeling-and-design-10CS71.pdf>

MOOC Lectures Links:

- <https://nptel.ac.in/courses/106105153>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	--	--	--	--	--	--
CO2	2	2	2	2	2	2	--	--	--	--	--	--
CO3	2	2	2	2	2	2	--	--	--	--	--	--
CO4	2	2	2	2	2	2	--	--	--	--	--	--
CO5	2	2	2	2	2	2	--	--	--	--	--	--
CO6	2	2	2	2	2	2	--	--	--	--	--	--



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective III
410244(E): Digital Signal Processing

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks
		End-Sem (Paper): 70 Marks

Prerequisite Courses: Engineering Mathematics III(207003)

Companion Course: Laboratory Practice IV(410247)

Course Objectives:

- To Study and understand representation and properties of signals and systems.
- To learn methodology to analyze signals and systems
- To study transformed domain representation of signals and systems
- To explore Design and analysis of Discrete Time (DT) signals and systems
- To Understand Design of filters as DT systems
- To get acquainted with the DSP Processors and DSP applications

Course Outcomes:

On completion of the course, student will be able to–

CO1: Understand the mathematical models and representations of DT Signals and Systems

CO2: Apply different transforms like Fourier and Z-Transform from applications point of view.

CO3: Understand the design and implementation of DT systems as DT filters with filter structures and different transforms.

CO4: Demonstrate the knowledge of signals and systems for design and analysis of systems

CO5: Apply knowledge and use the signal transforms for digital processing applications

CO6: To understand Filtering and Different Filter Structures

Course Contents

Unit I	Signals and Systems	08 Hours
---------------	----------------------------	-----------------

Continuous time (CT), Discrete-time (DT) and Digital signals, Basic DT signals and Operations. Discrete-time Systems, Properties of DT Systems and Classification, Linear Time Invariant (LTI) Systems, Impulse response, Linear convolution, Linear constant coefficient difference equations, FIR and IIR systems, Periodic Sampling, Relationship between Analog and DT frequencies, Aliasing, Sampling Theorem, A to D conversion Process: Sampling, quantization and encoding

#Exemplar/Case Studies Audio/Music Sampling

***Mapping of Course Outcomes for Unit I** CO1

Unit II	Frequency Domain Representation of Signal	08 Hours
----------------	--	-----------------

Introduction to Fourier Series, Representation of DT signal by Fourier Transform (FT), Properties of FT: Linearity, periodicity, time shifting, frequency shifting, time reversal, differentiation, convolution theorem, windowing theorem Discrete Fourier Transform (DFT), DFT

and FT, IDFT, Twiddle factor, DFT as linear transformation matrix, Properties of DFT, circular shifting, Circular Convolution, DFT as Linear filtering, overlap save and add, DFT spectral leakage

#Exemplar/Case Studies Spectral Analysis using FFT

*Mapping of Course CO1

Outcomes for Unit II

Unit III Fast Fourier Transform (FFT) and Z-Transform(ZT) 08 Hours

Effective computation of DFT, Radix-2 FFT algorithms: DIT FFT, DIF FFT, Inverse DFT using FFT, Z-transform (ZT), ZT and FT, ZT and DFT, ROC and its properties, ZT Properties, convolution, initial value theorem, Rational ZT, Pole Zero Plot, Behavior of causal DT signals, Inverse Z Transform (IZT): power series method, partial fraction expansion (PFE), Residue method.

#Exemplar/Case Studies Discrete Hilbert Algorithm

*Mapping of Course CO2

Outcomes for Unit III

Unit IV Analysis of DT - LTI Systems 08 Hours

System function $H(z)$, $H(z)$ in terms of Nth order general difference equation, all pole and all zero systems, Analysis of LTI system using $H(Z)$, Unilateral Z-transform: solution of difference equation, Impulse and Step response from difference equation, Pole zero plot of $H(Z)$ and difference equation, Frequency response of system, Frequency response from pole-zero plot using Simple geometric construction.

#Exemplar/Case Studies Schur Algorithm

*Mapping of Course CO3

Outcomes for Unit IV

Unit V Digital Filter Design 08 Hours

Concept of filtering, Ideal filters and approximations, specifications, FIR and IIR filters, Linear phase response, FIR filter Design: Fourier Series method, Windowing method, Gibbs Phenomenon, desirable features of windows, Different window sequences and its analysis, Design examples IIR filter design: Introduction, Mapping of S-plane to Z-plane, Impulse Invariance method, Bilinear Z transformation (BLT) method, Frequency Warping, Pre-warping, Design examples, Comparison of IIR and FIR Filters.

#Exemplar/Case Studies Realization of an Analogue Second-order Differentiator

*Mapping of Course CO5

Outcomes for Unit V

Unit VI Filter Structures and DSP Processors 08 Hours

Filter Structures for FIR Systems: direct form, cascade form, structures for linear phase FIR Systems, Examples, Filter structures for IIR Systems: direct form, cascade form, parallel form, Examples DSP Processors: ADSP 21XX Features, comparison with conventional processor, Basic Functional Block diagram, SHARC DSP Processor Introduction to OMAP (Open Multimedia Application Platform).

#Exemplar/Case Studies Architectures and Design techniques for energy efficient embedded DSP

Faculty of Engineering	and multimedia processing											
<u>*Mapping of Course Outcomes for Unit VI</u>	CO6											
Learning Resources												
Text Books:												
<ol style="list-style-type: none">1. Proakis J, Manolakis D, "Digital Signal Processing", 4th Edition, Pearson Education, ISBN97881317100052. Oppenheim A, Schaffer R, Buck J, "Discrete time Signal Processing", 2nd Edition, Pearson Education, ISBN 9788131704929												
Reference Books:												
<ol style="list-style-type: none">1. Mitra S., "Digital Signal Processing: A Computer Based Approach", Tata McGraw-Hill, 1998, ISBN 0-07-044705-52. Ifleachor E. C., Jervis B. W., "Digital Signal Processing: A Practical Approach", Pearson Education, 2002, , ISBN-13: 978-0201596199, ISBN-10: 02015961993. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, "Digital Signal Processing", McGraw-Hill, ISBN 0-07-463996-X4. S. Poornachandra, B. Sasikala, "Digital Signal Processing", 3rd Edition, McGraw-Hill, ISBN-13: 978-07-067279-6												
e-Books :												
<ol style="list-style-type: none">1. An Introduction to Digital Signal Processing: A Focus on Implementation https://www.riverpublishers.com/pdf/ebook/RP_E9788792982032.pdf												
MOOC Courses Links:												
<ul style="list-style-type: none">• Digital signal Processing Introduction- https://nptel.ac.in/courses/117102060												
CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	-	-	-	-	-	-	-
CO2	3	3	2	2	3	-	-	-	-	-	-	-
CO3	1	2	2	2	1	-	-	-	-	-	-	-
CO4	3	3	2	3	3	-	-	-	-	-	-	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-
CO6	2	2	2	2	2	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective IV
410245(A): Information Retrieval

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks

Prerequisite Courses: Database Management Systems(310241)

Companion Course: Laboratory Practice IV(410247)

Course Objectives:

- To study basic concepts of Information Retrieval.
- To study concepts of Indexing for Information Retrieval.
- To analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
- To provide comprehensive details about various Evaluation methods.
- To understand the changes necessary to transfer a Basic IR system into large scale search service system.
- To understand Parallel Information retrieval and Web structures .

Course Outcomes:

On completion of the course, student will be able to–

CO1:Implement the concept of Information Retrieval

CO2:Generate quality information out of retrieved information

CO3:Apply techniques such as classification, clustering, and filtering over multimedia to analyze the information

CO4:Evaluate and analyze retrieved information

CO5:Understand the data in various Application and Extensions of information retrieval

CO6: Understand Parallel information retrieving and web structure.

Course Contents

Unit I	Introduction , Basic techniques, &Token	07 Hours
---------------	--	-----------------

Introduction: The IR System, The Software Architecture Of The IR System.

Basic IR Models: Boolean Model, TF-IDF (Term Frequency/Inverse Document Frequency) Weighting, Vector Model, Probabilistic Model and Latent Semantic Indexing Model.

Basic Tokenizing: Simple Tokenizing, Stop-Word Removal and Stemming.

#Exemplar/Case Studies	A Case Study Of Onitsha Divisional Library Which Aims At Finding The Causes And Solutions To The Problems Of Information Retrieval Methods By The Library.
-------------------------------	--

*Mapping of Course Outcomes for Unit I	CO 1
---	------

Unit II	Static Inverted Indices and Query Processing	07 Hours
----------------	---	-----------------

Static Inverted Indices : Inverted Index Construction, Index Components and Index Life Cycle, **The Dictionary :** Sort-based dictionary ,Hash-based dictionary, Interleaving Dictionary and Postings Lists,

Index Construction: Different types of Index Construction, In-Memory Index Construction, Sort-Based Index Construction, Merge-Based Index Construction, Disk-Based Index Construction),

Other types of Indices.

Query Processing : Query Processing for Ranked Retrieval , Document-at-a-Time Query Processing, Term-at-a-Time Query Processing, Pre-computing Score Contributions, Impact Ordering)

Query optimization, Lightweight Structure : Generalized Concordance Lists, Operators, Implementation & Examples

#Exemplar/Case Studies

Match the search statement with the stored database

*Mapping of Course Outcomes for Unit II

CO2

Unit III Index Compression and Dynamic Inverted Indices

07 Hours

General-Purpose Data Compression,

Data Compression : Modeling and Coding, Huffman Coding, Arithmetic Coding, Symbolwise Text Compression

Compressing Postings Lists:

Nonparametric Gap Compression, Parametric Gap Compression, Context-Aware Compression Methods, Index Compression for High Query Performance, Compression Effectiveness, Decoding Performance, Document Reordering.

Dynamic Inverted Indices:

Incremental Index Updates, Contiguous Inverted Lists, Noncontiguous Inverted,

Document Deletions: Invalidation List, Garbage Collection, Document Modifications,

#Exemplar/Case Studies

Translating Short Segments with NMT: A Case Study in English-to-Hindi

*Mapping of Course Outcomes for Unit III

CO2

Unit IV Probabilistic Retrieval and Language Modeling & Related Methods , Categorization & Filtering

07 Hours

Probabilistic Retrieval: Modeling Relevance, The Binary Independence Model, Term Frequency,

Document Length: BM25, Relevance Feedback, Field Weights; **Language Modeling and Related**

Methods: Generating Queries from Documents, Language Models and Smoothing, Ranking with Language Models, Divergence from Randomness, Passage Retrieval and Ranking **Categorization**

and Filtering: Detailed Examples, Classification, Linear, Similarity- Based, Probabilistic Classifiers, Generalized Linear Models. Information-Theoretic Model.

#Exemplar/Case Studies

E-Mail on the Move: Study of E-mail Categorization, Filtering, and Alerting on Mobile Devices

*Mapping of Course Outcomes for Unit IV

CO3

Unit V Measuring Effectiveness and Measuring Efficiency

07 Hours

Measuring Effectiveness - Traditional effectiveness measure, The Text Retrieval Conference (TREC), Using statistics in evaluation, Minimizing adjudication Effort, Nontraditional effectiveness measures, **Measuring Efficiency** – Efficiency criteria, Query Scheduling, Caching, Introduction to Redis and Memcached

Faculty of Engineering		Savitribai Phule Pune University	
<u>#Exemplar/Case Studies</u>	Study of API Handling		
<u>*Mapping of Course Outcomes for Unit V</u>	CO4		
Unit VI	Parallel Information retrieval , Web Search		07 Hours
Parallel Information retrieval - Parallel Query Processing, MapReduce			
Web Search- The structure of the web, Quires and Users, Static ranking, Dynamic ranking			
Evaluation web search, Web Crawlers, Web crawler libraries, Python Scrapy, Beautiful Soup			
<u>#Exemplar/Case Studies</u>	Study of Google Map / Facebook information retrieval		
<u>*Mapping of Course Outcomes for Unit VI</u>	CO5, CO6		

Learning Resources

Text Books:

1. S. Buttcher, C. Clarke and G. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines" MIT Press, 2010, ISBN: 0-408-70929-4.
2. C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008, -13: 9780521865715
3. Ricardo Baeza , Yates and Berthier Ribeiro Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", 2nd Edition, ACM Press Books 2011.
4. Bruce Croft, Donald Metzler and Trevor Strohman, "Search Engines: Information Retrieval in Practice", 1st Edition Addison Wesley, 2009, ISBN: 9780135756324

Reference Books:

1. C.J. Rijsbergen, "Information Retrieval", (<http://www.dcs.gla.ac.uk/Keith/Preface.html>)
2. W.R. Hersh, "Information Retrieval: A Health and Biomedical Perspective", Springer, 2002.
3. G. Kowalski, M.T. Maybury. "Information storage and Retrieval System" , Springer, 2005
4. W.B. Croft, J. Lafferty, "Language Modeling for Information Retrieval", Springer, 2003

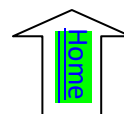
e-Books :

1. Information Retrieval- www.informationretrieval.org

MOOC Courses Links:

- <https://nptel.ac.in/courses/117102060>

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	1	2	1	-	-	-	-	-	-	-	-
CO3	1	1	2	1	-	-	-	-	-	-	-	-
CO4	1	1	2	1	-	-	-	-	-	-	-	-
CO5	1	1	2	3	2	-	-	-	-	-	-	-
CO6	1	2	2	2	1	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective IV

410245(B): GPU Programming and Architecture

Teaching Scheme: TH: 03Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
--	----------------------------	---

Prerequisites Courses: Computer Graphics(210244)

Companion Course: Laboratory Practice IV(410247)

Course Objectives:

- To Understand Graphics Processing Unit (GPU) Concepts.
- To understand the basics of GPU architectures
- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce different GPU programming models
- To examine the architecture and capabilities of modern GPUs.

Course Outcomes:

After completion of the course, students should be able to-

CO1: Describe GPU architecture

CO2: Write programs using CUDA, identify issues and debug them.

CO3: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication

CO4: Write simple programs using OpenCL

CO5: Identify efficient parallel programming patterns to solve problems

CO6: Explore the modern GPUs architecture and it's Applications.

Course Contents

Unit I	Introduction to Graphics Processing Unit (GPU)	07 Hours
Evolution of GPU architectures – Understanding Parallelism with GPU –Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.		
#Exemplar/Case Studies	Review of traditional Computer Architecture	
*Mapping of Course Outcomes for Unit I	CO 1	
Unit II	Cuda Programming	07 Hours
Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.		
#Exemplar/Case Studies	Write basic CUDA programs.	
*Mapping of Course Outcomes for Unit II	CO 2	
Unit III	Programming Issues	07 Hours

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

#Exemplar/Case Studies	Study of various CUDA errors
*Mapping of Course Outcomes for Unit III	CO 3

Unit IV	OpenCL Basics	07 Hours
----------------	----------------------	-----------------

OpenCL Standard, Kernels, Host Device Interaction, Execution Environment, Memory Model, Basic OpenCL Examples.

#Exemplar/Case Studies	Write OpenCL basic program
*Mapping of Course Outcomes for Unit IV	CO 4

Unit V	Algorithms on GPU	07 Hours
---------------	--------------------------	-----------------

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster

#Exemplar/Case Studies	Describe multi-dimensional mapping of dataspace.
*Mapping of Course Outcomes for Unit V	CO 5

Unit VI	OpenCL and Application Design	07 Hours
----------------	--------------------------------------	-----------------

OpenCL for Heterogeneous Computing, Application Design: Efficient Neural Network Training/Inferencing

#Exemplar/Case Studies	Describe OpenCL for Heterogeneous computing
*Mapping of Course Outcomes for Unit VI	CO6

Learning Resources

Text Books:

1. Shane Cook, “CUDA Programming: A Developer’s Guide to Parallel Computing with GPUs (Applications of GPU Computing)”, First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, “Heterogeneous computing with OpenCL”, 3rd Edition, Morgan Kauffman, 2015.
3. Benedict Gaster, Lee Howes, David R. Kaeli, “Heterogeneous Computing with OpenCL”

Reference Books :

1. Nicholas Wilt, “CUDA Handbook: A Comprehensive Guide to GPU Programming”, Addison – Wesley, 2013.
2. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming”, Addison – Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors“, A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4. http://www.nvidia.com/object/cuda_home_new.html
5. <http://www.openCL.org>

e-Books :

1. <https://www.perlego.com/book/1418742/cuda-handbook-a-comprehensive-guide-to-gpu-programming-the-pdf>

NPTEL/YouTube video lecture link

- https://onlinecourses.nptel.ac.in/noc20_cs41/preview

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	1	-	-	-	-	-
CO2	1	2	2	2	2	-	-	-	-	-	-	-
CO3	1	2	2	2	2	-	-	-	-	-	-	-
CO4	1	2	2	2	2	-	-	-	-	-	-	-
CO5	1	2	2	2	2	-	-	-	-	-	-	-
CO6	1	2	2	1	2	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)

Elective IV
410245(C) : Mobile Computing

Teaching Scheme: TH: 3 Hours/Week	Credit 3	Examination Scheme: In-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
---	--------------------	--

Prerequisites Courses: Computer Networks and Security(310244)

Companion Course: Laboratory Practice IV(410247)

Course Objectives:

- To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications
- To demonstrate the protocols of mobile communication.
- To know GSM architecture and support services
- To Study on location, handoff management and wireless fundamentals.
- To summarize VLR and HLR identification algorithms
- To learn current technologies being used on field and design and development of various network protocol using simulation tools.

Course Outcomes:

CO1: Develop a strong grounding in the fundamentals of mobile Networks
 CO2: Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network
 CO3: Illustrate Global System for Mobile Communications
 CO4: Use the 3G/4G technology based network with bandwidth capacity planning, VLR and HLR identification algorithms
 CO5: Classify network and transport layer of mobile communication
 CO6: Design & development of various wireless network protocols using simulation tools

Course Contents

Unit I	Introduction to Mobile Computing	07 Hours
Introduction to Mobile computing, Constraints in mobile computing, Application of mobile computing, Generations of mobile wireless 1G to 5G, Future of mobile computing, Radio frequency Technology, Public Switched Telephone network, (PSTN), Public Communication service (PCS), PCS Architecture, , Blue tooth, Ad-hoc Networks.		
#Exemplar/Case Studies	5G Network , Spectrum sharing for D2D communication in 5G cellular networks	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Mobile Wireless protocols	07 Hours
Introduction of WAP, WAP applications, WAP Architecture, WAP Protocol Stack, Challenges in WAP . Introduction, Benefits, Difference, Routing protocols for ad hoc wireless networks: DSDV and AODV, Wireless Application protocols: MAC,SDMA, FDMA,TDMA,CDMA, Cellular Wireless Networks. Wireless Communication: Cellular systems, Frequency Management and Channel Assignment Types of handoff		

and their characteristics.

#Exemplar/Case Studies	IPoC: A New Core Networking Protocol for 5G Networks.	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Global System for Mobile Communication	07 Hours
Global System for Mobile Communications (GSM) architecture , Mobile Station, Base Station System, Switching subsystem, Security, Data Services, HSCSD, GPRS - GPRS system and protocol architecture 2.3 UTRAN, UMTS core network; Improvements on Core Network, 802.11 Architecture 802.11a, 802.11b standard		
#Exemplar/Case Studies	5G mobile communications	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	GSM Networking Signaling and Mobile Management	07 Hours
GSM MAP Service framework, MAP protocol machine, GSM location management, Transaction management, Mobile database, Introduction to location management HLR and LR VLR and HLR Failure restoration, VLR identification algorithm, O-I, O-II algorithm etc. Overview of handoff process; Factors affecting handoffs and performance evaluation metrics; Handoff strategies; Different types of handoffs (soft, hard, horizontal, vertical).		
#Exemplar/Case Studies	5G Mobility Management , Micro Mobility: CellularIP, HAWAII, HMIPv6	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Mobile Network and Transport Layers	07 Hours
Mobile IP , IP packet delivery, Tunnelling and encapsulation, IPv6, DHCP, Vehicular Ad Hoc networks (VANET), MANET , Traditional TCP, Snooping TCP, Mobile TCP, 3G wireless network, Wireless Application Protocol, WDP WTP, WML, WTA architecture, Cellular IP		
#Exemplar/Case Studies	5G Network and Transport Layers	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	3G and 4G Technologies	07 Hours
3G and 4G Technologies for GSM and CDMA:, W-CDMA, UMTS, HSPA (High Speed Packet Access), HSDPA, HSUPA, HSPA+, TD-SCDMA, LTE (E-UTRA) 3GPP2 family CDMA2000 1x, 1xRTT, EV-DO (Evolution-Data Optimized), Long Term Evolution (LTE) in 4G. Architecture of 5G. Role of 5G in IoT.		

#Exemplar/Case Studies	Long-Term Evolution (LTE) of 3GPP
*Mapping of Course Outcomes for Unit VI	CO6

Learning Resources

Text Books:

1. Jochen Schiller, “Mobile Communications”, Pearson Education, 2009.
2. Martin Sauter, “3G, 4G and Beyond: Bringing Networks, Devices and the Web Together”, 2012, ISBN-13: 978-1118341483
3. Raj Kamal, “Mobile Computing”, 2/e, Oxford University Press

Reference Books :

1. William Stallings, “Wireless Communications & Networks”, Second Edition, Pearson Education
2. Christopher Cox, “An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications”, Wiley publications
3. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2012.

e-Books :

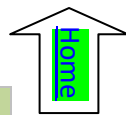
1. <http://www.dauniv.ac.in/downloads/Mobilecomputing/Microsoft%20%20MobileCompChap02L02HandhelCompandMobileOSes.pdf>

MOOC Courses Links :

- <https://nptel.ac.in/courses/106106147>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	-	-	-	1
CO6	2	2	-	2	-	-	-	-	-	-	-	1



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective IV

410245 (D): Software Testing and Quality Assurance

Teaching Scheme:
TH: 03 Hours/Week

Credit
03

Examination Scheme:
In-Sem (Paper): 30 Marks
End-Sem (Paper): 70 Marks

Prerequisite Courses: Software Engineering (210253), Software Project Management(310245(D))

Companion Course: Lab Practice IV

Course Objectives:

- Introduce basic concepts of software testing.
- Understand the best way to increase the effectiveness, test coverage, and execution speed in software testing.
- Understand white box, block box, object oriented, web based and cloud testing.
- Understand the importance of software quality and assurance software systems development.
- Know in details automation testing and tools used for automation testing.
- To learn and understand the combination of practices and tools that are designed to help QA professionals test more efficiently.

Course Outcomes:

On completion of the course, student will be able to–

CO1: Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance.

CO2: Design and Develop project test plan, design test cases, test data, and conduct test operations.

CO3: Apply recent automation tool for various software testing for testing software.

CO4: Apply different approaches of quality management, assurance, and quality standard to software system.

CO5: Apply and analyze effectiveness Software Quality Tools.

CO6: Apply tools necessary for efficient testing framework.

Course Contents

Unit I

Introduction to Software Testing

07 Hours

Introduction: historical perspective, Definition, Core Components, Customers suppliers and process, Objectives of Testing, Testing and Debugging, Need of Testing, Quality Assurance and Testing, Why Software has Errors, Defects and Failures and its Causes and Effects, Total Quality Management(TQM), Quality practices of TQM, Quality Management through- Statistical process Control, Cultural Changes, Continual Improvement cycle, Benchmarking and metrics, Problem Solving Techniques and Software Tools. Software Quality, Constraints of Software product Quality assessment, Quality and Productivity Relationship, Requirements of Product, Software Development Process, Types of Products, Software Development Lifecycle Models, Software Quality Management, Processes related to Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.

#Exemplar/Case Studies

1. Offshore delivery model for an Airline Company.
2. SAP test automation CoE for Financial Service Provider.

*Mapping of Course Outcomes for Unit I		CO1
Unit II	Test Planning and Quality Management	07 Hours
Test Planning –Artifacts, Strategy, Test Organization –Test Manager & Tester Role, Test plan purpose & contents, Test Strategy and Approach, Test cases & Test Data, Test Entry-Exit criteria, Test Execution Schedule, Use case Testing, Scenario Testing, Test Monitoring & Control- Test Metrics –Test Case Productivity, Test case Coverage, Defect Acceptance & Rejection, Test Efficiency, Efforts and Schedule Variance, Test Efforts biasing Factors, Test Report & configuration Management, Quality Assurance Process, Documentation Risk & Issues. Software Quality, Quality Management Importance, Quality Best practices.		
#Exemplar/CaseStudies	1. Online Recommendation System 2. Quality Engineering services for Medical Devices company CaseStudy (cigniti.com)	
*Mapping of Course Outcomes for Unit II		CO2
Unit III	Test Case Design Techniques	07 Hours
Software Testing Methodologies: White Box Testing, Black Box Testing, Grey Box Testing. Test Case Design Techniques: Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspection. Dynamic Techniques: Structural Techniques: Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing Black Box Techniques: Boundary Value Analysis, Equivalence Class Partition, State Transition Technique, Cause Effective Graph, Decision Table, Use Case Testing, Experienced Based Techniques: Error guessing, Exploratory testing Levels of Testing: Functional Testing: Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest. Non-Functional Testing: Performance Testing, Memory Test, Scalability Testing, Compatibility Testing, Security Testing, Cookies Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L1ON Testing, Compliance Testing. Link: https://www.besanttechnologies.com/training-courses/software-testing-training/manual-testing-training-institute-in-chennai		
#Exemplar/Case Studies	1. Case Study: Manual Testing (Online Marketing SoftwarePlatform) Link: https://www.360logica.com/blog/case-study-manual-testing-online-marketing-software-platform/ 2. Case Study: Decision Table Testing (transferring money online to an account which is already added and approved.)	
*Mapping of Course Outcomes for Unit III		CO3
Unit IV	Software Quality Assurance and Quality Control	07 Hours
Software Quality Assurance: Introduction, Constraints of Software Product Quality Assessment, Quality and Productivity Relationship, Requirements of a Product, Characteristics of Software,		

Software Development Process, Types of Products, Schemes of Criticality Definitions, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, Important Aspects of Quality Management.

Software Quality Control: Software quality models, Quality measurement and metrics, Quality plan, implementation and documentation, Quality tools including CASE tools, Quality control and reliability of quality process, Quality management system models, Complexity metrics and Customer Satisfaction, International quality standards – ISO, CMM

<u>#Exemplar/Case Studies</u>	<ol style="list-style-type: none"> 1. Case Study #1 – Android Application Acceptance Test Suite 2. Case Study #2 – API Acceptance Test Suite <p>Link for above case studies - <u>Software Quality Assurance Case Studies - Beta Breakers</u></p>
---	--

<u>*Mapping of Course Outcomes for Unit IV</u>	CO4
--	-----

Unit V	Automation Testing Tools / Performance Testing Tools	07 Hours
---------------	---	-----------------

Automation Testing: What is automation testing, Automated Testing Process, Automation Frameworks, Benefits of automation testing, how to choose automation testing tools. Selenium Automation Tools: Selenium's Tool Suite- Selenium IDE, Selenium RC, Selenium Web driver, Selenium Grid. Automation Tools: SoapUI, Robotic Process Automation (RPA), Tosca, Appium.

[Performance Testing : What is Performance Testing what is use of it? Tools used for performance testing - Apache Jmeter.](#)

<u>#Exemplar/Case Studies</u>	<ol style="list-style-type: none"> 1. Case Study: Cucumber open-source automation testing framework. 2. Case Study: <u>(PDF) Automated Software Testing—A Case Study(researchgate.net)</u>
---	--

<u>*Mapping of Course Outcomes for Unit V</u>	CO5
---	-----

Unit VI	Testing Framework	07 Hours
----------------	--------------------------	-----------------

Testing Framework: Software Quality, Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance Elements of SQA, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan, Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic tools, Flow Chart, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness and Process.

<u>#Exemplar/Case Studies</u>	<ol style="list-style-type: none"> 1. Case study: Software Quality In Academic Curriculum. 2. Case study: <u>Evaluation of an Automated Testing Framework: A Case Study (scielo.sa.cr)</u>
---	--

<u>*Mapping of Course Outcomes for Unit VI</u>	CO6
--	-----

Learning Resources

Text Books:

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN:9780070139909 0070139903
2. Srinivasan Desikan, Gopal Swamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X

Reference Books:

1. Naresh Chauhan, "Software Testing Principles and Practices", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2. Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

e-Books :

1. M G Limaye, "Software Testing Principles, Techniques and Tools"
https://books.google.co.in/books?id=zUm8My7SiakC&printsec=frontcover&source=gbp_ge_summary_r&cad=0#v=onepage&q&f=false
2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices"
https://kupdf.net/queue/software-testing-principles-and-practices-by-srinivasan_5b0ae8eae2b6f51f7d862d26_pdf?queue_id=-1&x=1656562364&z=MTE1LjI0Mi4yNDIuNzA=
3. Naresh Chauhan, "Software Testing Principles and Practice"
<https://pdfcoffee.com/download/se-4-pdf-free.html>

MOOC Courses Links:

- <https://nptel.ac.in/courses/106105150>
- NPTEL : NOC: Software Testing (2017) (Computer Science and Engineering) (digimat.in)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	2	-	-	1	2	1	2	1
CO2	1	3	3	2	1	-	-	1	2	1	2	-
CO3	1	-	1	2	3	-	-	-	2	1	1	-
CO4	1	1	2	3	1	1	1	2	2	2	2	-
CO5	1	2	1	2	3	1	-	-	1	1	2	-
CO6	1	2	3	2	3	1	-	-	2	1	1	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective IV
410245(E): Compilers

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks

Prerequisite Courses: Theory of Computation(310241), Systems Programming and Operating System (310251)

Companion Course :Laboratory Practice IV (410247)

Course Objectives:

- To aware about language translation theories and compiler design stages
- To illustrate the various parser configurations
- To exemplify the use of syntax directed translation in intermediate code
- To Understand Storage Management and Control Structure Environment .
- Learn to develop a Code generator
- To demonstrate the numerous optimization methods used in the creation of different optimizing compilers

Course Outcomes:

On completion of the course, student will be able to–

CO1: **Design** and **implement** a lexical analyzer using LEX tools

CO2: **Design** and **implement** a syntax analyzer using YACC tools

CO3: **Understand** syntax-directed translation and run-time environment

CO4 : **Generate** intermediate codes for high-level statements.

CO5 : **Construct** algorithms to produce computer code.

CO6: **Analyze and transform** programs to improve their time and memory efficiency

Course Contents

Unit I	Notion and Concepts	08 Hours
Introduction to compilers Design issues, passes, phases, symbol table Preliminaries Memory management, Operating system support for compiler, Lexical Analysis Tokens, Regular Expressions, Process of Lexical analysis, Block Schematic, Automatic construction of lexical analyzer using LEX, LEX features and specification.		
<u>#Exemplar/Case Studies</u>	Study of LEX Compiler	
<u>*Mapping of Course Outcomes for Unit</u>	CO1	
Unit II	Parsing	08 Hours
Syntax Analysis CFG, top-down and bottom-up parsers, RDP, Predictive parser, SLR, LR(1), LALR parsers, using ambiguous grammar, Error detection and recovery, automatic construction of parsers using YACC, Introduction to Semantic analysis, Need of semantic analysis, type checking and type conversion.		

Faculty of Engineering		Savitribai Phule Pune University
<u>#Exemplar/Case Studies</u>	Study of YAAC	
<u>*Mapping of Course Outcomes for Unit II</u>	CO2	
Unit III	Syntax Translation Schemes	08 Hours
Syntax Directed Translation - Attribute grammar, S and L attributed grammar, bottom up and top down evaluations of S and L attributed grammar, Syntax directed translation scheme, Intermediate code - need, types: Syntax Trees, DAG, Three-Address codes: Quadruples, Triples and Indirect Triples, Intermediate code generation of declaration statement and assignment statement.		
<u>#Exemplar/Case Studies</u>	Applications of Syntax Directed Translation	
<u>*Mapping of Course Outcomes for Unit III</u>	CO3	
Unit IV	Run-time Storage Management	08 Hours
Storage Management – Static, Stack and Heap, Activation Record, static and control links, parameter passing, return value, passing array and variable number of arguments, Static and Dynamic scope, Dangling Pointers, translation of control structures – if, if-else statement, Switch-case, while, do -while statements, for, nested blocks, display mechanism, array assignment, pointers, function call and return. Translation of OO constructs: Class, members and Methods.		
<u>#Exemplar/Case Studies</u>	CARAT - Compiler and runtime based address translation model	
<u>*Mapping of Course Outcomes for Unit IV</u>	CO4	
Unit V	Code Generation	07 Hours
Code Generation - Issues in code generation, basic blocks, flow graphs, DAG representation of basic blocks, Target machine description, peephole optimization, Register allocation and Assignment, Simple code generator, Code generation from labeled tree, Concept of code generator.		
<u>#Exemplar/Case Studies</u>	Code Generator for a Virtual Machine Code based JavaScript Compiler (http://article.nadiapub.com/IJAST/vol119/11.pdf)	
<u>*Mapping of Course Outcomes for Unit V</u>	CO5	
Unit VI	Code Optimization	07 Hours
Need for Optimization, local, global and loop optimization, Optimizing transformations, compile time evaluation, common sub-expression elimination, variable propagation, code movement, strength reduction, dead code elimination, DAG based local optimization, Introduction to global data flow analysis, Data flow equations and iterative data flow analysis.		
<u>#Exemplar/Case Studies</u>	Execution of super-scalar processors	
<u>*Mapping of Course Outcomes for Unit VI</u>	CO6	
Learning Resources		

Text Books:

1. V Aho, R Sethi, J D Ullman, "Compilers: Principles, Techniques, and Tools", Pearson Edition, ISBN 81-7758-590-8
2. Dick Grune, Bal, Jacobs, Langendoen, "Modern Compiler Design", Wiley, ISBN 81-265-0418-8

Reference Books:

1. Anthony J. Dos Reis, "Compiler Construction Using Java", JavaCC and Yacc Wiley, ISBN 978-0-470-94959-7
2. K Muneeswaran, "Compiler Design", Oxford University press, ISBN 0-19-806664-3
3. J R Levin, T Mason, D Brown, "Lex and Yacc", O'Reilly, 2000 ISBN 81-7366-061-X

eBooks:

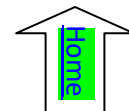
1. Basics of Compiler Design
http://hjemmesider.diku.dk/~torbenm/Basics/basics_lulu2.pdf
2. Modern Compiler Design
<http://160592857366.free.fr/joe/ebooks/ShareData/Modern%20Compiler%20Design%202e.pdf>

MOOC Courses Links:

- <https://nptel.ac.in/courses/106105190>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	-	-	-	-	-	-	-
CO2	1	2	2	2	2	-	-	-	-	-	2	-
CO3	1	2	1	1	1	-	-	-	-	-	-	-
CO4	1	2	1	1	1	-	-	-	-	-	-	-
CO5	1	2	2	2	-	-	-	-	-	-	-	-
CO6	1	2	2	2	-	-	-	-	-	-	-	-



Savitribai Phule Pune University Fourth Year of Computer Engineering (2019 Course) 410246: Laboratory Practice III		
Teaching Scheme: Practical: 04 Hours/Week	Credit 02	Examination Scheme: Term work: 50 Marks Practical: 50 Marks
Companion Course: Design and Analysis of Algorithms (410241), Machine Learning(410242), Blockchain Technology(410243)		
Course Objectives: <ul style="list-style-type: none"> Learn effect of data preprocessing on the performance of machine learning algorithms Develop in depth understanding for implementation of the regression models. Implement and evaluate supervised and unsupervised machine learning algorithms. Analyze performance of an algorithm. Learn how to implement algorithms that follow algorithm design strategies namely divide and conquer, greedy, dynamic programming, backtracking, branch and bound. Understand and explore the working of Blockchain technology and its applications. 		
Course Outcomes: After completion of the course, students will be able to CO1: Apply preprocessing techniques on datasets. CO2: Implement and evaluate linear regression and random forest regression models. CO3: Apply and evaluate classification and clustering techniques. CO4: Analyze performance of an algorithm. CO5: Implement an algorithm that follows one of the following algorithm design strategies: divide and conquer, greedy, dynamic programming, backtracking, branch and bound. CO6: Interpret the basic concepts in Blockchain technology and its applications		
Guidelines for Instructor's Manual The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.		
Guidelines for Student's Laboratory Journal The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as a softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to a journal must be avoided. Use of DVD containing student programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.		

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Assessment of each Laboratory assignment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality, documentation and neatness.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy needs to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to each branch beyond the scope of the syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - C++, Java, Python, Solidity, etc.

Virtual Laboratory:

- <http://cse01-iiith.vlabs.ac.in/>
- <http://vlabs.iitb.ac.in/vlabs-dev/labs/blockchain/labs/index.php>
- http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php

Suggested List of Laboratory Experiments/Assignments. Assignments from all the Groups (A, B, C) are compulsory.

Course Contents

Group A: Design and Analysis of Algorithms

Any 5 assignments and 1 mini project are mandatory.

- | | |
|----|--|
| 1. | Write a program non-recursive and recursive program to calculate Fibonacci numbers and analyze their time and space complexity. |
| 2. | Write a program to implement Huffman Encoding using a greedy strategy. |
| 3. | Write a program to solve a fractional Knapsack problem using a greedy method. |
| 4. | Write a program to solve a 0-1 Knapsack problem using dynamic programming or branch and bound strategy. |
| 5. | Design n-Queens matrix having first Queen placed. Use backtracking to place remaining Queens to generate the final n-queen's matrix. |
| 6. | Write a program for analysis of quick sort by using deterministic and randomized variant. |

7.	Mini Projects Mini Project - Write a program to implement matrix multiplication. Also implement multithreaded matrix multiplication with either one thread per row or one thread per cell. Analyze and compare their performance.
8.	Mini Project - Implement merge sort and multithreaded merge sort. Compare time required by both the algorithms. Also analyze the performance of each algorithm for the best case and the worst case.
9.	Mini Project - Implement the Naive string matching algorithm and Rabin-Karp algorithm for string matching. Observe difference in working of both the algorithms for the same input.
10.	Mini Project - Different exact and approximation algorithms for Travelling-Sales-Person Problem

Group B: Machine Learning

Any 5 assignments and 1 Mini project are mandatory.

1.	Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks: <ol style="list-style-type: none"> 1. Pre-process the dataset. 2. Identify outliers. 3. Check the correlation. 4. Implement linear regression and random forest regression models. 5. Evaluate the models and compare their respective scores like R2, RMSE, etc. Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset
2.	Classify the email using the binary classification method. Email Spam detection has two states: a) Normal State – Not Spam, b) Abnormal State – Spam. Use K-Nearest Neighbors and Support Vector Machine for classification. Analyze their performance. Dataset link: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv
3.	Given a bank customer, build a neural network-based classifier that can determine whether they will leave or not in the next 6 months. Dataset Description: The case study is from an open-source dataset from Kaggle. The dataset contains 10,000 sample points with 14 distinct features such as CustomerId, CreditScore, Geography, Gender, Age, Tenure, Balance, etc. Link to the Kaggle project: https://www.kaggle.com/barelydedicated/bank-customer-churn-modeling Perform following steps: <ol style="list-style-type: none"> 1. Read the dataset. 2. Distinguish the feature and target set and divide the data set into training and test sets. 3. Normalize the train and test data. 4. Initialize and build the model. Identify the points of improvement and implement the same. 5. Print the accuracy score and confusion matrix (5 points).
4.	Implement Gradient Descent Algorithm to find the local minima of a function. For example, find the local minima of the function $y=(x+3)^2$ starting from the point $x=2$.

5.	Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compute confusion matrix, accuracy, error rate, precision and recall on the given dataset. Dataset link : https://www.kaggle.com/datasets/abdallahgoub/diabetes
6.	Implement K-Means clustering/ hierarchical clustering on sales_data_sample.csv dataset. Determine the number of clusters using the elbow method. Dataset link : https://www.kaggle.com/datasets/kyanyoga/sample-sales-data
7.	Mini Project Mini Project - Use the following dataset to analyze ups and downs in the market and predict future stock price returns based on Indian Market data from 2000 to 2020. Dataset Link: https://www.kaggle.com/datasets/sagara9595/stock-data
8.	Mini Project - Build a machine learning model that predicts the type of people who survived the Titanic shipwreck using passenger data (i.e. name, age, gender, socio-economic class, etc.). Dataset Link: https://www.kaggle.com/competitions/titanic/data
9.	Mini Project - Develop a application for signature identification by creating your own dataset of your college student

Group C: Blockchain Technology

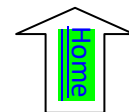
Any 5 assignments and 1 Mini project are mandatory.

1.	Installation of MetaMask and study spending Ether per transaction.
2.	Create your own wallet using Metamask for crypto transactions.
3.	Write a smart contract on a test network, for Bank account of a customer for following operations: <ul style="list-style-type: none"> • Deposit money • Withdraw Money • Show balance
4.	Write a program in solidity to create Student data. Use the following constructs: <ul style="list-style-type: none"> • Structures • Arrays • Fallback Deploy this as smart contract on Ethereum and Observe the transaction fee and Gas values.
5.	Write a survey report on types of Blockchains and its real time use cases.
6.	Write a program to create a Business Network using Hyperledger
7.	Mini Projects Mini Project - Develop a Blockchain based application dApp (de-centralized app) for e-voting system.

8.	Mini Project - Develop a Blockchain based application for transparent and genuine charity
9.	Mini Project - Develop a Blockchain based application for health related medical records
10.	Mini Project - Develop a Blockchain based application for mental health

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	1	-	1	2	-	2	3
CO2	3	3	3	2	2	1	-	1	2	-	2	3
CO3	3	3	3	2	2	2	-	1	2	-	2	3
CO4	3	2	2	-	1	-	-	1	2	-	2	2
CO5	3	2	3	-	1	-	-	1	2	-	-	2
CO6	3	3	2	2	2	-	-	1	2	-	-	2



Savitribai Phule Pune University
Fourth Year of Computer Engineering(2019Course)
410247:Laboratory Practice IV

Teaching Scheme Practical: 02 Hours/Week	Credit 01	Examination Scheme : Term Work: 50 Marks
---	----------------------------	---

Companion Course: Elective III(410244), Elective IV(410245)

Course Objectives:

- Learn android application development related to pervasive computing
- Understand various multimedia file formats
- Understand various vulnerabilities and use of various tools for assessment of vulnerabilities
- Understand information retrieval process using standard tools available
- Learn GPU programming and implementation of same using open source libraries
- Learn installation and use of open source software testing tools

Course Outcomes:

After completion of the course, students will be able to

- CO1: Apply android application development for solving real life problems
- CO2: Design and develop system using various multimedia components.
- CO3: Identify various vulnerabilities and demonstrate using various tools.
- CO4: Apply information retrieval tools for natural language processing
- CO5: Develop an application using open source GPU programming languages
- CO6: Apply software testing tools to perform automated testing

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory/Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes and punctuality.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the

problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Virtual Laboratory:

- <https://hci-iitg.vlabs.ac.in/>
- <http://vlabs.iitkgp.ernet.in/se/>
- <https://vlab.amrita.edu/?sub=3&brch=179&sim=1293&cnt=2>

410244(A): Pervasive Computing

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory.

Group 1

1. Develop an indoor location system to Library guide system where it can direct a user to the bookshelf from a mobile device.
2. Design a pervasive application in which remote computer monitors our health statistics & will determine when one is in trouble & will take appropriate action for rescue.
3. Develop an Android application in which car will use the Internet to find nearby open parking space.
4. Android User Activity Recognition – Still, Walking, Running, Driving etc.
5. Design and build a sensing system using micro-controllers like - Arduino / Raspberry Pi / Intel Galileo to sense the environment around them and act accordingly.
6. Smart Mobile Application with orientation sensing for users to put the phone in meeting / silent mode- OR- outdoor/ loud mode based on the orientation of the device.

Group 2

7. **PMini project:** Develop Food Ordering System which uses the GPS of an Android-based Smartphone to record and analyze various locations that could give alert to the user, then asking the user to select particular food from given hotel list and place an order.
8. **Mini Project:** Design a mobile sensing platform mounted on a glove that integrates several sensors, such as touch pressure, imaging, inertial measurements, localization and a Radio Frequency Identification (RFID) reader for fruit classification and grading system.
9. **Mini Project:** Sensor-Based Assistive Devices for Visually Impaired People. It should cover following points:
 - Determining obstacles around the user body from the ground to the head;
 - Affording some instructions to the user about the movement surface consists of gaps or textures;
 - Finding items surrounding the obstacles;
 - Providing information about the distance between the user and the obstacle with essential direction instructions.

10.	Mini Project: Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user's approval.
-----	--

410244(B): Multimedia Techniques

Group 1

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory.

1.	To study and install open-source multimedia tools and create an application using appropriate tool to design the college webpage
2.	To create JPEG Image that demonstrates various features of an Image editing tool.
3.	Create or play a sample MIDI format sound file using LMMS / MuseScore / Tuxguitar software tool. Edit the sample file by applying effects like bend, slide, vibrato, and hammer-on/pull-off. Export / Convert final MIDI to WAV file format.
4.	Implement transform coding, quantization, and hierarchical coding for the encoder and decoder of three-level Hierarchical JPEG.
5.	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models.
6.	Create a web page for a clothing company which contains all the details of that company and atleast five links to other web pages.

Group 2

Group2

7.	Mini Project: Design and develop a Navigation Assistance System.
8.	Mini Project: Design and Develop a Traffic Monitoring System.
9.	Mini Project: Design and develop a Tool for converting image format (e.g. bmp to jpeg)
10.	Mini Project: Design and develop a Tool for converting audio format (e.g. wav to mp3)

410244(C): Cyber Security and Digital Forensics

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory.

Group 1

1.	Write a program for Tracking Emails and Investigating Email Crimes. i.e. Write a program to analyze e-mail header
2.	Implement a program to generate and verify CAPTCHA image
3.	A person on a nearby road is trying to enter into a WiFi network by trying to crack the Password to use the IP Printer resource; write a program detect such attempt and prohibit the access. Develop the necessary scenario by Using an IEEE 802.11, configure a Wi-Fi adapter and Access Point

4.	Write a computer forensic application program for Recovering permanent Deleted Files and Deleted Partitions
5.	Write a program for Log Capturing and Event Correlation
6.	Configure and demonstrate use of vulnerability assessment tool like Wireshark or SNORT
7.	Study of Honeypot

Group 2

8.	Mini-project- Design and develop a tool for digital forensic of images
9.	Mini Project - Design and develop a tool for digital forensic of audio
10.	Mini Project :- Design and develop a tool for digital forensic of video
11.	Mini Project - Design a system for the analysis of cyber crime using various cyber forensic techniques and compare each technique with respect to integrity, confidentiality, availability

410244(D): Object Oriented Modeling And Design

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory.

Group 1

1.	Draw state model for telephone line, with various activities.
2.	Draw basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships.
3.	Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include template showing description and steps of the Use Case for various scenarios.
4.	Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include template showing description and steps of the Use Case for various scenarios.
5.	Draw activity diagrams to display either business flows or like flow charts
6.	Draw component diagrams assuming that you will build your system reusing existing components along with a few new ones
7.	Draw deployment diagrams to model the runtime architecture of your system.

Group 1

8.	Mini Project: Draw all UML diagrams for your project work.
9.	Mini Project - Develop a Blockchain based application for health related medical records Draw following UML Diagrams for Bank Management application a. Class Diagram b. Object Diagram c. ER Diagram d. Component Diagram

410244(E): Digital Signal Processing

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1

1.	Develop a program to generate samples of sine, Cosine and exponential signals at specified sampling frequency and signal parameters. (Test the results for different analog frequency (F) and
----	---

	sampling frequency (F_s)). 23. 4. 5. 6. 7.
2.	Find the output of a system described by given difference equation and initial conditions for given input sequence. (Solution of difference equation) (Obtain the response for different systems by changing Degree of difference equation (N) and coefficients and also for different input sequence $x(n)$. Observe the response by considering system as FIR and IIR system).
3.	Write a program to plot the magnitude and phase response of a Fourier Transform (FT). (Observe the spectrum for different inputs. Observe the Periodicity).
4.	Find the N point DFT / IDFT of the given sequence $x(n)$. Plot the magnitude spectrum $ X(K) $ Vs K . (Analyze the output for different N and the same input sequence $x(n)$. Also observe the periodicity and symmetry property).
5.	Find the N point circular convolution of given two sequences. Test it for Linear convolution. Compute the circular convolution of given two sequences using DFT and IDFT.
6.	Develop a program to plot the magnitude and phase response of a given system (given: $h(n)$: impulse response of system S) (Observe the frequency response for different systems. Compare the frequency response of a system (filter) for different length $h(n)$ i.e filter coefficients).

Group 2:

7.	Mini-Project: Design and Develop the N -point radix-2 DIT or DIF FFT algorithm to find DFT or IDFT of given sequence $x(n)$. (Analyze the output for different N . Program should work for any value of N and output should be generated for all intermediate stages.) 8 9.
8.	Mini-Project: Obtain the Fourier transform of different window functions to plot the magnitude and phase spectrums. (Window functions: Rectangular, Triangular, Bartlett, Hamming, Henning, Kaiser. Observe and compare the desirable features of window sequences for different length. Observe the main and side lobes).
9.	Mini-Project: Design an FIR filter from given specifications using windowing method. (Application should work for different types of filter specifications i.e. LPF, HPF, BPF etc and all window sequences. Plot the frequency response for different frequency terms i.e. analog and DT frequency). 10.
10	Mini-Project: Design of IIR filter for given specifications using Bilinear Transformation. (Generalized code to accept any filter length for a transfer function $H(Z)$. Application should work for different types of filter specifications that is LPF, HPF, BPF etc. and for different transfer functions of an analog filter).

410245(A): Information Retrieval

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1

1.	Write a program to Compute Similarity between two text documents.
2.	Implement Page Rank Algorithm.
3.	Write a program for Pre-processing of a Text Document: stop word removal.
4.	Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive (i.e., include both upper-case and lower-case versions of the letter; Ignore non-alphabetic characters).
5.	Write a program to implement simple web crawler.
6.	Write a program to parse XML text, generate Web graph and compute topic specific page

Group 2

7.	Mini project: Develop Document summarization system
8.	Mini Project: Develop Tweet sentiment analysis system
9.	Mini Project: Develop Fake news detection system
10.	Mini Project: Develop a Abstractive summarization system

410245(B): GPU Programing And Architecture

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1

1.	Write a program using OpenCL for Heterogeneous computing
2.	Write CUDA programming with some simple things such as dot product, calculation of pi using integration method etc.
3.	Write CUDA programming for matrix transpose and matrix multiplication
4.	Write OpenCL "Hello World" basic program
5.	Develop program using combining abilities of OpenGL and CUDA to accelerate the performance of simple graphics.
6.	Case study on "Review of traditional Computer Architecture"

Group 2:

7	Mini Project : Huge data computation
8	Mini Project : Visualization to develop project for image processing and then video processing
9	Mini Project : Parallel Algorithm for Searching
10	Mini Project : Parallel Algorithm for Sorting

410245(C): Mobile Computing

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1

1.	To implement a basic function of Code Division Multiple Access (CDMA) to test the orthogonally and autocorrelation of a code to be used for CDMA operation. Write an application based on the above concept.
2.	Implementation of GSM security algorithms (A3/A5/A8)
3.	Write an application that draws basic graphical primitives on the screen.
4.	Develop a native application that uses GPS location information.
5.	Design an android Application for Frame Animation
6.	Create a simulation to show working of 3G Mobile network
7.	Create a simulation to show working of 4G Mobile network

Group 2

8. Mini Project:	Create an application for Bank using spinner, intent i) Form 1: Create a new account for customer ii) Form 2: Deposit money in customer account. iii) Link both forms, after completing of first form the user should be directed to second form iv) Provide different menu options
9. Mini Project:	Create the module for collecting cellular mobile network performance parameters using telephony API Manager i) Nearest Base Station ii) Signal Strengths iii) SIM Module Details iv) Mobility Management Information
10. Mini Project:	Create the module for payment of fees for College by demonstrating the following methods. i) FeesMethod()- for calculation of fees ii) Use customized Toast for successful payment of fees iii) Implement an alarm in case someone misses out on the fee submission deadline iv) Demonstrate the online payment gateway
11. Mini Project:	Create an app to add of a product to SQLite database and make sure to add following features i) SMS messaging and email provision ii) Bluetooth options iii) Accessing Web services iv) Asynchronous remote method call v) Use Alert box for user notification

410245(D): Software Testing and Quality Assurance

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1:

1.	Write TEST Scenario for Gmail Login Page
2.	Test Scenario for Gmail Login Page
3.	Write Test cases in excel sheet for Social Media application or website
4.	Create Defect Report for Any application or web application
5.	Installation of Selenium grid and selenium Web driver java eclipse (automation tools).
6.	Prepare Software requirement specification for any project or problem statement

Group 2:

7.	Mini Project : Software Testing and Quality Assurance Mini Project Dynamic website of covid-19 information using HTML, CSS, JAVASCRIPT And PHP, MySQL database used to store user account, comment, and registration form details. Regular Expression testcases for testing purpose
8.	Mini Project : Create a small application by selecting relevant system environment / platform and programming languages. Narrate concise Test Plan consisting features to be tested and bug taxonomy. Prepare Test Cases inclusive of Test Procedures for identified Test Scenarios.

	Perform selective Black-box and White-box testing covering Unit and Integration test by using suitable Testing tools. Prepare Test Reports based on Test Pass/Fail Criteria and judge the acceptance of application developed
9.	Mini Project : Create a small web-based application by selecting relevant system environment / platform and programming languages. Narrate concise Test Plan consisting features to be tested and bug taxonomy. Narrate scripts in order to perform regression tests. Identify the bugs using Selenium WebDriver and IDE and generate test reports encompassing exploratory testing.

410245(E) : Compilers

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1

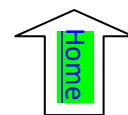
1.	Implement a Lexical Analyzer using LEX for a subset of C. Cross check your output with Stanford LEX.
2.	Implement a parser for an expression grammar using YACC and LEX for the subset of C. Cross check your output with Stanford LEX and YACC.
3.	Generate and populate appropriate Symbol Table.
4.	Implement Semantic Analysis Operations like type checking, verification of function parameters, variable declarations and coercions possibly using an Attributed Translation Grammar.
5.	Implement the front end of a compiler that generates the three address code for a simple language.
6.	Implementation of Instruction Scheduling Algorithm.
7.	Implement Local and Global Code Optimizations such as Common Sub-expression Elimination, Copy Propagation, Dead-Code Elimination, Loop and Basic-Block Optimizations. (Optional)
8.	Implement a Lexical Analyzer using LEX for a subset of C. Cross check your output with Stanford LEX.

Group 2:

9.	Mini-Project 1: Implement POS tagging for simple sentences written Hindi or any Indian Language
----	--

@TheCO-POMappingMatrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	3	-	-	2	2	2	1	2
CO2	1	-	2	2	3	2	-	2	2	2	1	2
CO3	1	-	2	2	3	2	-	2	2	2	2	2
CO4	1	-	2	-	3	-	-	2	2	2	2	2
CO5	1	-	2	-	3	-	-	2	2	2	2	2
CO6	1	-	2	-	3	-	-	2	2	2	2	2



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410248: Project Work Stage I

Teaching Scheme:	Credit	Examination Scheme:
Practical:02Hours/Week	02	Presentation:50Marks

Course Objectives:

- To Apply the knowledge for solving realistic problem
- To develop problem solving ability
- To Organize, sustain and report on a substantial piece of team work over a period of several months
- To Evaluate alternative approaches, and justify the use of selected tools and methods
- To Reflect upon the experience gained and lessons learned
- To Consider relevant social, ethical and legal issues
- To find information for yourself from appropriate sources such as manuals, books, research journals and from other sources, and in turn increase analytical skills.
- To Work in Team and learn professionalism

Course Outcomes:

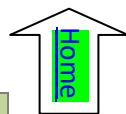
On completion of the course, student will be able to–

- Solve real life problems by applying knowledge.
- Analyze alternative approaches, apply and use most appropriate one for feasible solution.
- Write precise reports and technical documents in a nutshell.
- Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work
- Inter-personal relationships, conflict management and leadership quality.

Guidelines

Project work Stage – I is an integral part of the Project work. In this, the student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design. The student is expected to complete the project at least up to the design phase. As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.

Follow guidelines and formats as mentioned in Project Workbook recommended by Board of Studies



Savitribai Phule Pune University
Fourth Year of Engineering (2019 Course)
410249: Audit Course 7

In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [\[1\]](#) and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at Institute level itself [\[1\]](#)

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

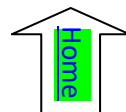
- | | |
|--|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations or presentations | <ul style="list-style-type: none"> Surveys Mini-Project Hands on experience on focused topic |
|--|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentation or Report

Audit Course 5 Options

Audit Course Code	Audit Course Title
AC7-I	MOOC- Learn New Skills
AC7-II	Entrepreneurship Development
AC7-III	Botnet of Things
AC7-IV	3D Printing
AC7-V	Industrial Safety and Environment Consciousness



Savitribai Phule Pune University
Fourth Year of Engineering (2019 Course)
410249: Audit Course 7
AC7 – I: MOOC-learn New Skill

This course aims to create awareness among the students regarding various courses available under MOOC and learn new skills through these courses.

Course Objectives:

- To promote interactive user forums to support community interactions among students, professors, and experts
- To promote learn additional skills anytime and anywhere
- To enhance teaching and learning on campus and online

Course Outcomes:

On completion of the course, , students will be able to

CO1: To acquire additional knowledge and skill.

About Course

MOOCs (Massive Open Online Courses) provide affordable and flexible way to learn new skills, pursue lifelong interests and deliver quality educational experiences at scale. Whether you're interested in learning for yourself, advancing your career or leveraging online courses to educate your workforce, SWAYAM, NPTEL, edx or similar ones can help. World's largest SWAYAM MOOCs, a new paradigm of education for anyone, anywhere, anytime, as per your convenience, aimed to provide digital education free of cost and to facilitate hosting of all the interactive courses prepared by the best more than 1000 specially chosen faculty and teachers in the country. SWAYAM MOOCs enhances active learning for improving lifelong learning skills by providing easy access to global resources.

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy. This is done through an indigenous developed IT platform that facilitates hosting of all the courses, taught in classrooms from 9th class till post-graduation to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to the residents in India. More than 1,000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.

The courses hosted on SWAYAM is generally in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology. In order to ensure best quality content are produced and delivered, seven National Coordinators have been appointed: They are NPTEL for engineering and UGC for post-graduation education.

Guidelines:

Instructors are requested to promote students to opt for courses (not opted earlier) with proper mentoring. The departments will take care of providing necessary infrastructural and facilities for the learners.

References:

1. <https://swayam.gov.in/>
2. <https://onlinecourses.nptel.ac.in/>
3. <https://www.edx.org>

Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410249: Audit Course 7
AC7 – II: Entrepreneurship Development

This Course aims at instituting Entrepreneurial skills in the students by giving an overview of, who the entrepreneurs are and what competences are needed to become an entrepreneur

Course Objectives:

- To introduce the aspects of Entrepreneurship
- To acquaint with legalities in product development
- To understand IPR, Trademarks, Copyright and patenting
- To know the facets of functional plans, Entrepreneurial Finance and Enterprise Management

Course Outcomes:

On completion of the course, learner will be able to–

- CO1: Understand the legalities in product development
- CO2: Undertake the process of IPR, Trademarks, Copyright and patenting
- CO3: Understand and apply functional plans
- CO4: Manage Entrepreneurial Finance
- CO5: Inculcate managerial skill as an entrepreneur

Course Contents

1. Introduction: Concept and Definitions, Entrepreneur v/s Intrapreneur; Role of entrepreneurship in economic development; Entrepreneurship process; Factors impacting emergence of entrepreneurship; Managerial versus entrepreneurial Decision Making; Entrepreneur v/s Investors; Entrepreneurial attributes and characteristics; Entrepreneurs versus inventors; Entrepreneurial Culture; Women Entrepreneurs; Social Entrepreneurship; Classification and Types of Entrepreneurs; EDP Programmers; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs.

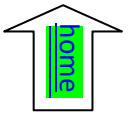
2. Creating Entrepreneurial Venture : Generating Business idea- Sources of Innovation, methods of generating ideas, Creativity and Entrepreneurship; Business planning process; Drawing business plan; Business plan failures; Entrepreneurial leadership – components of entrepreneurial leadership; Entrepreneurial Challenges; Legal issues – forming business entity, considerations and Criteria, requirements for formation of a Private/Public Limited Company, Intellectual Property Protection - Patents Trademarks and Copyrights.

3. Functional plans: Marketing plan–for the new venture, environmental analysis, steps in preparing marketing plan, marketing mix, contingency planning; Organizational plan – designing organization structure and Systems; Financial plan – pro forma income statements, Ratio Analysis.

4. Entrepreneurial Finance: Debt or equity financing, Sources of Finance - Commercial banks, private placements, venture capital, financial institutions supporting entrepreneurs; Lease Financing; Funding opportunities for Startups in India. 5. Enterprise Management: Managing growth and sustenance- growth norms; Factors for growth; Time management, Negotiations, Joint ventures, Mergers and acquisition

Books:

1. Kumar, Arya, ``Entrepreneurship: Creating and Leading an Entrepreneurial Organization'', Pearson ISBN-10: 8131765784; ISBN-13: 978-8131765784
2. Hishrich., Peters, ``Entrepreneurship: Starting, Developing and Managing a New Enterprise'', ISBN 0-256-14147- 9
3. Irwin Taneja, ``Entrepreneurship, '' Galgotia Publishers. ISBN: 978-93-84044-82-4
4. Charantimath, Poornima, ``Entrepreneurship Development and Small Business Enterprises, '' Pearson Education, ISBN, 8177582607, 9788177582604.



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410249: Audit Course 7
AC7 – III: Botnet of Things

This course aims to provide an understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities. It gives an outline of the techniques for developing a secure application.

Course Objectives:

- To Understand the various IoT Protocols
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To learn the concept of Botnet

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Implement security as a culture and show mistakes that make applications vulnerable to attacks.

CO2: Understand various attacks like DoS, buffer overflow, web specific, database specific, web -spoofing attacks.

CO3: Demonstrate skills needed to deal with common programming errors that lead to most security problems and to learn how to develop secure applications

Course Contents

1. Introduction

2. IRC-Based Bot Networks

3. Anatomy of a Botnet: The Gaobot Worm

4. IoT Sensors and Security : Sensors and actuators in IoT, Communication and networking in IoT, Real-time data collection in IoT, Data analytics in IoT , IoT applications and requirements, Security threats and techniques in IoT, Data trustworthiness and privacy in IoT, Balancing utility and other design goals in IoT , Future of Botnets in the Internet of Things, Thingbots, Elements of Typical IRC Bot Attack , Malicious use of Bots and Botnet

5. Service Layer Protocols and Security : Security: PHP Exploits, Cross-Site Scripting and Other Browser-Side Exploits, Bots and Botnets, Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols –MAC 802.15.4 , 6LoWPAN, RPL, Application Layer Transport and Session layer protocols-transport Layer (TCP, MPTCP, UDP, DCCP, SCTP) - (TLS, DTLS) –

Session Layer - HTTP, CoAP, XMPP, AMQP, MQTT

Books:

1. Bernd Scholz - Reiter, Florian Michahelles, “Architecting the Internet of Things”, Springer ISBN 978 –3 – 642 – 19156 - 5 e - ISBN 978 – 3 -642 - 19157 - 2,
 2. Threat Modeling, Frank Swiderski and Window Snyder, Microsoft Professional, 1 st Edition 2004
 3. Gunter Ollmann 2007. The Phishing Guide Understanding and Preventing Phishing Attacks. IBM Internet Security Systems.
 4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978 – 1 – 118 – 47347 - 4, Willy Publications
 5. White Papers :- <https://www.sans.org/reading-room/whitepapers/malicious/bots-botnet-overview-1299>
 6. <https://www-01.ibm.com/marketing/iwm/dre>
- Mike Kuniavsky, “Smart Things: Ubiquitous Computing User Experience Design,” Morgan Kaufmann Publishers.

Savitribai Phule Pune University
Fourth Year of Engineering (2019 Course)
410249: Audit Course 7
AC7 – IV: 3D Printing

This course aims to provide knowledge of 3D printing devices and explore the business side of 3D printing.

Course Objectives:

- To **acquire** basic knowledge of drafting terminology and construction of geometrical figures using drawing instruments, procedure to prepare a drawing sheet as per SP-46:2003
- To **inculcate** skill of technical sketching, multi-view drawings, Lettering, tolerance, and metric construction
- To **impart** practical aspects to generate detailed and assembly views with dimensions, annotations, in 3D Modeling software.
- To **develop** prototype/ end use product for 3D Printing

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the basic knowledge of Shop Floor Safety rules and regulations basics of Machinetools and 3D printing machines

CO2: Understand the concept of concept of technical sketching, multi-view drawings, Lettering, tolerance, and metric construction

CO3: Identify and Distinguish drafting terminologies and construction of geometrical figures using drawing instruments, procedure to prepare a drawing sheet as per SP-46:2003

CO4: Describe and Explain practical aspects to generate detailed and assembly views with dimensions, annotations, in 3D Modeling software.

CO5: Apply concepts and **Fabricate** the simple mechanical parts, prototype/ end use product for 3D Printing

Course Contents

1. Getting Started with 3D Printing: How 3D Printers Fit into Modern Manufacturing, Exploring the Types of 3D Printing, Exploring Applications of 3D Printing.

2. Outlining 3D Printing Resources: Identifying Available Materials for 3D Printing, Identifying Available Sources for 3D Printable Objects.

3. Exploring the Business Side of 3D Printing: Commoditizing 3D Printing, Understanding 3D Printing's Effect on Traditional lines of Business, Reviewing 3D Printing Research.

4. Employing Personal 3D printing Devices: Exploring 3D printed Artwork, Considering Consumer level 3D Printers, Deciding on RepEap of Your Own.

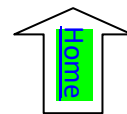
Books:

1. Richard Horne, Kalani Kirk Hausman, “3D Printing for Dummies”, Taschenbuch, ISBN: 9781119386315

2. Greg Norton, “3D Printing Business - 3D Printing for Beginners - How to 3D Print”, ISBN: 9781514785669

2. Liza Wallach Kloski and Nick Kloski, “Getting Started with 3D Printing: A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution”, Maker Media, ISBN: 1680450204

4. Jeff Heldrich, “3D Printing: Tips on Getting Started with 3D Printing to Help you make Passive income for your Business”



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410249: Audit Course 7
AC7 – V: Industrial Safety and Environment Consciousness

This course aims to provide knowledge of industrial safety performance planning and accident prevention.

Course Objectives:

- To understand Industrial hazards and Safety requirements with norms
- To learn the basics of Safety performance planning
- To know the means of accident prevention
- To understand the impact of industrialization on environment
- To know the diversified industrial requirements of safety and security

Course Outcomes:

On completion of the course, learner will be able to–

- CO1: Develop the plan for Safety performance
- CO2: Demonstrate the action plan for accidents and hazards
- CO3: Apply the safety and security norms in the industry
- CO4: Evaluate the environmental issues of Industrialization

Course Contents

1. Introduction: Elements of safety programming, safety management, Upgrading developmental programmers: safety procedures and performance measures, education, training and development in safety.

2. Safety Performance Planning

Safety Performance: An overview of an accident, It is an accident, injury or incident, The safety professional, Occupational health and industrial hygiene. Understanding the risk: Emergency preparedness and response, prevention of accidents involving hazardous substances.

3. Accident Prevention

What is accident prevention?, Maintenance and Inspection, Monitoring Techniques, General Accident Prevention, Safety Education and Training.

4. Organization Safety

Basic Elements of Organized Safety, Duties of Safety Officer, Safe work Practices, Safety Sampling and Inspection, Job Safety Analysis(JSA), Safety Survey, On- site and Off-site Emergency Plan, Reporting of Accidents and Dangerous Occurrences.

5. Industrial Pollution

Introduction, Work Environment, Remedy, pollution of Marine Environment and Prevention, Basic Environmental Protection Procedures, Protection of Environment in Global Scenario, Greenhouse Gases, Climate Change Impacts, GHG Mitigation Options, Sinks and Barriers,

6. Industrial Security(Industry wise)

General security Systems in Factories, Activation Security, Computer Security, Banking Security, V.I.P. Security, Women Security, Event Security, Security in Open Environments.

Books :

1. Basudev Panda ,“Industrial Safety, Health Environment and Security”,Laxmi Publications, ISBN-10: 9381159432, 13: 978-9381159439
2. L.M. Deshmukh, “Industrial Safety Management”, TMH , ISBN: 9780070617681

SEMESTER VIII



Savitribai Phule Pune University Fourth Year of Computer Engineering (2019 Course) 410250: High Performance Computing		
Teaching Scheme: TH: 3 Hours/Week	Credit 3	Examination Scheme: In- Sem (TH) : 30 End- Sem (TH): 70
Prerequisites Courses: -Microprocessor (210254), Principles of Programming Languages(210255), Computer Networks and Security(310244)		
Companion Course: Laboratory Practice V(410254)		
Course Objectives: <ul style="list-style-type: none"> To understand different parallel programming models To analyze the performance and modeling of parallel programs To illustrate the various techniques to parallelize the algorithm To implement parallel communication operations. To discriminate CUDA Architecture and its components. To Understand Scope of Parallel Computing and its search algorithms. 		
Course Outcomes: <p>CO1: Understand various Parallel Paradigm</p> <p>CO2: Design and Develop an efficient parallel algorithm to solve given problem</p> <p>CO3: Illustrate data communication operations on various parallel architecture</p> <p>CO4: Analyze and measure performance of modern parallel computing systems</p> <p>CO5: Apply CUDA architecture for parallel programming</p> <p>CO6: Analyze the performance of HPC applications</p>		
Course Contents		
Unit I	Introduction to Parallel Computing	09 Hours
Introduction to Parallel Computing: Motivating Parallelism, Modern Processor: Stored-program computer architecture, General-purpose Cache-based Microprocessor architecture. Parallel Programming Platforms: Implicit Parallelism, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines. Levels of parallelism, Models: SIMD, MIMD, SIMT, SPMD, Data Flow Models, Demand-driven Computation, Architectures: N-wide superscalar architectures, multi-core, multi-threaded.		
#Exemplar/Case Studies	Case study: Multi-core System	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Parallel Algorithm Design	09 Hours
Global System for Mobile Communications (GSM) architecture , Mobile Station, Base Station System, Switching subsystem, Security, Data Services, HSCSD, GPRS - GPRS system and protocol architecture 2.3 UTRAN, UMTS core network; Improvements on Core Network, 802.11 Architecture 802.11a, 802.11b standard		
#Exemplar/Case Studies	IPoC: A New Core Networking Protocol for 5G Networks.	

*Mapping of Course Outcomes for Unit II		CO2
Unit III	Parallel Communication	09 Hours
Basic Communication: One-to-All Broadcast, All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Collective Communication using MPI:Scatter, Gather, Broadcast, Blocking and non blocking MPI, All-to-All Personalized Communication, Circular Shift, Improving the speed of some communication operations.		
#Exemplar/Case Studies	Case study: Monte-Carlo Pi computing using MPI	
*Mapping of Course Outcomes for UnitIII	CO3	
Unit IV	Analytical Modeling of Parallel Programs	09 Hours
Sources of Overhead in Parallel Programs, Performance Measures and Analysis: Amdahl's and Gustafson's Laws, Speedup Factor and Efficiency, Cost and Utilization, Execution Rate and Redundancy, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost, Optimal Execution Time, Asymptotic Analysis of Parallel Programs. Matrix Computation: Matrix-Vector Multiplication, Matrix-Matrix Multiplication.		
#Exemplar/Case Studies	Case study: The DAG Model of parallel computation	
*Mapping of Course Outcomes for UnitIV	CO4	
Unit V	CUDA Architecture	09 Hours
Introduction to GPU: Introduction to GPU Architecture overview, Introduction to CUDA C- CUDA programming model, write and launch a CUDA kernel, Handling Errors, CUDA memory model, Manage communication and synchronization, Parallel programming in CUDA- C.		
#Exemplar/Case Studies	Case study: GPU applications using SYCL and CUDA on NVIDIA	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	High Performance Computing Applications	09 Hours
Scope of Parallel Computing, Parallel Search Algorithms: Depth First Search(DFS), Breadth First Search(BFS), Parallel Sorting: Bubble and Merge, Distributed Computing: Document classification, Frameworks – Kuberbets, GPU Applications, Parallel Computing for AI/ ML		
#Exemplar/Case Studies	Case study: Disaster detection and management/ Smart Mobility/Urban planning	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Seyed H. Roosta, "Parallel Processing and Parallel Algorithms Theory and Computation", Springer-Verlag 2000, ISBN 978-1-4612-7048-5 ISBN 978-1-4612-1220-1
3. John Cheng, Max Grossman, and Ty McKercher, "Professional CUDA C Programming", John Wiley & Sons, Inc., ISBN: 978-1-118-73932-7

Reference Books :

1. Kai Hwang,, "Scalable Parallel Computing", McGraw Hill 1998.
2. George S. Almasi and Alan Gottlieb, "Highly Parallel Computing", The Benjamin and Cummings Pub. Co., Inc
3. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3
4. Pacheco, Peter S., "An Introduction to Parallel Programming", Morgan Kaufmann Publishers ISBN 978-0-12-374260-5
5. Rieffel WH.EG, Polak, "Quantum Computing: A gentle introduction", MIT Press, 2011, ISBN 978-0-262-01506-6
6. Ajay D. Kshemkalyani , Mukesh Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge March 2011, ISBN: 9780521189842

e Books :

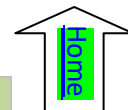
1. http://prdrklaina.weebly.com/uploads/5/7/7/3/5773421/introduction_to_high_performance_computing_for_scientists_and_engineers.pdf
2. https://www.vssut.ac.in/lecture_notes/lecture1428643084.pdf

NPTEL/YouTube video lecture link

- <https://nptel.ac.in/courses/106108055>
- <https://www.digimat.in/nptel/courses/video/106104120/L01.html>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	-	-	-	1
CO6	2	2	-	2	-	-	-	-	-	-	-	1



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410251: Deep Learning

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks

Prerequisite Courses: Machine Learning (410242)

Companion Course: Laboratory Practice V(410254)

Course Objectives:

- To understand the basics of neural networks.
- Comparing different deep learning models.
- To understand the Recurrent and Recursive nets in Deep Learning
- To understand the basics of deep reinforcement Learning models.
- To analyze Types of Networks.
- To Describe Reinforcement Learning.

Course Outcomes:

On completion of the course, student will be able to–

- CO1:** Understand the basics of Deep Learning and apply the tools to implement deep learning applications
- CO2:** Evaluate the performance of deep learning models (e.g., with respect to the bias-variance trade-off, overfitting and underfitting, estimation of test error).
- CO3:** To apply the technique of Convolution (CNN) and Recurrent Neural Network (RNN) for implementing Deep Learning models
- CO4:** To implement and apply deep generative models.
- CO5:** Construct and apply on-policy reinforcement learning algorithms
- CO6:** To Understand Reinforcement Learning Process

Course Contents

Unit I	Foundations of Deep learning	07 Hours
What is machine learning and deep learning?, Supervised and Unsupervised Learning, bias variance tradeoff, hyper parameters, under/over fitting regularization, Limitations of machine learning, History of deep learning, Advantage and challenges of deep learning. Learning representations from data, Understanding how deep learning works in three figures, Common Architectural Principles of Deep Network, Architecture Design, Applications of Deep learning, Introduction and use of popular industry tools such as TensorFlow, Keras, PyTorch, Caffe, Shogun.		
#Exemplar/Case Studies	Deep Mind, AlphaGo, Boston Dynamics	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Deep Neural Networks(DNNs)	07 Hours

Introduction to Neural Networks :The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks , **Training Neural Networks** :Backpropagation and Forward propagation **Activation Functions** :Linear ,Sigmoid, Tanh, Hard Tanh, Softmax, Rectified Linear, **Loss Functions** :Loss Function Notation , Loss Functions for Regression , Loss Functions for Classification, Loss Functions for Reconstruction, **Hyperparameters** : Learning Rate, Regularization, Momentum, Sparsity, Deep Feedforward Networks – Example of XOR, Hidden Units, cost functions, error backpropagation, Gradient-Based Learning, Implementing Gradient Descent, vanishing and Exploding gradient descent, Sentiment Analysis, Deep Learning with Pytorch, Jupyter, colab.

<u>#Exemplar/CaseStudies</u>	A Case Study for Music Genre Classification
<u>*Mapping of Course Outcomes for Unit II</u>	CO2

Unit III	Convolution Neural Network(CNN)	07 Hours
-----------------	--	-----------------

Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolutional Network

<u>#Exemplar/Case Studies</u>	AlexNet, VGG
<u>*Mapping of Course Outcomes for Unit III</u>	CO3

Unit IV	Convolution Neural Network(CNN)	07 Hours
----------------	--	-----------------

Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory. **Practical Methodology:** Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyper parameters.

<u>#Exemplar/Case Studies</u>	Multi-Digit Number Recognition
<u>*Mapping of Course Outcomes for Unit IV</u>	CO3

Unit V	Deep Generative Models	08 Hours
---------------	-------------------------------	-----------------

Introduction to deep generative model, Boltzmann Machine, Deep Belief Networks, Generative adversarial network (GAN), discriminator network, generator network, types of GAN, Applications of GAN networks

<u>#Exemplar/Case Studies</u>	GAN for detection of real or fake images
<u>*Mapping of Course Outcomes for Unit V</u>	CO4

Unit VI	Reinforcement Learning	07 Hours
----------------	-------------------------------	-----------------

Introduction of deep reinforcement learning, Markov Decision Process, basic framework of reinforcement learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning, Q Learning and Deep Q-Networks, Deep Q recurrent networks, Simple reinforcement learning for Tic-Tac-Toe.

#Exemplar/Case Studies

Self driving cars, Deep learning for chatbots

***Mapping of Course Outcomes for Unit VI**

CO5

Learning Resources**Text Books:**

1. Goodfellow, I., Bengio, Y., Courville, A, “Deep Learning”, MIT Press, 2016.
2. Josh Patterson & Adam Gibson, “Deep Learning”
3. Charu Agarwal, “Neural Networks and deep learning”, A textbook
4. Nikhil Buduma, “Fundamentals of Deep Learning”, SPD
5. Francois chollet, “Deep Learning with Python”

Reference Books:

1. Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction”
2. by Seth Weidman, “Deep Learning from Scratch: Building with Python from First Principles” O'Reilly
3. Francois Duval, “Deep Learning for Beginners, Practical Guide with Python and Tensorflow”

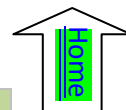
e-Books :

1. <http://csis.pace.edu/ctappert/cs855-18fall/DeepLearningPractitionersApproach.pdf>
2. https://www.dkriesel.com/_media/science/neuronaleetze-en-zeta2-1col-dkrieselcom.pdf

MOOC Courses Links:

- <https://www.my-mooc.com/en/categorie/deep-learning>

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3	-	-	-	-	-	-	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1
CO3	3	2	2	2	2	-	1	-	-	-	-	1
CO4	1	2	1	1	2	-	1	-	-	-	-	1
CO5	2	2	3	2	2	-	-	-	-	-	-	1
CO6	1	2	2	2	2	-	-	-	-	-	2	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective V
410252(A): Natural Language Processing

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks
		End-Sem (Paper): 70 Marks

Prerequisite Courses: Discrete Mathematics (210241), Theory of Computation (310242), Data Science and Big Data Analytics (310251)

Companion Course: Laboratory Practice VI(410255)

Course Objectives:

- To be familiar with fundamental concepts and techniques of natural language processing (NLP)
- To acquire the knowledge of various morphological, syntactic, and semantic NLP tasks
- To develop the various language modeling techniques for NLP
- To use appropriate tools and techniques for processing natural languages
- To comprehend the advance real world applications in NLP domain.
- To Describe Applications of NLP and Machine Translations.

Course Outcomes:

On completion of the course, student will be able to–

CO1: Describe the fundamental concepts of NLP, challenges and issues in NLP

CO2: Analyze Natural languages morphologically, syntactical and semantically OR Describe the concepts of morphology, syntax, semantics of natural language

CO3: Illustrate various language modelling techniques

CO4: Integrate the NLP techniques for the information retrieval task

CO5: Demonstrate the use of NLP tools and techniques for text-based processing of natural languages

CO6: Develop real world NLP applications

Course Contents

Unit I	Introduction to Natural Language Processing	07 Hours
Introduction: Natural Language Processing, Why NLP is hard? Programming languages Vs Natural Languages, Are natural languages regular? Finite automata for NLP, Stages of NLP, Challenges and Issues(Open Problems) in NLP		
Basics of text processing: Tokenization, Stemming, Lemmatization, Part of Speech Tagging		
#Exemplar/Case Studies	Why English is not a regular language: http://cs.haifa.ac.il/~shuly/teaching/08/nlp/complexity.pdf#page=20	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Language Syntax and Semantics	07 Hours

Morphological Analysis: What is Morphology? Types of Morphemes, Inflectional morphology & Derivational morphology, Morphological parsing with Finite State Transducers (FST)

Syntactic Analysis: Syntactic Representations of Natural Language, Parsing Algorithms, Probabilistic context-free grammars, and Statistical parsing

Semantic Analysis: Lexical Semantic, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Word Sense Disambiguation (WSD), Dictionary

based approach, Latent Semantic Analysis

#Exemplar/CaseStudies	Study of Stanford Parser and POS Tagger https://nlp.stanford.edu/software/lex-parser.html https://nlp.stanford.edu/software/tagger.html
*Mapping of Course Outcomes for Unit II	CO2
Unit III Language Modelling 07 Hours	
Probabilistic language modeling, Markov models, Generative models of language, Log-Liner Models, Graph-based Models N-gram models: Simple n-gram models, Estimation parameters and smoothing, Evaluating language models, Word Embeddings/ Vector Semantics: Bag-of-words, TFIDF, word2vec, doc2vec, Contextualized representations (BERT) Topic Modelling: Latent Dirichlet Allocation (LDA), Latent Semantic Analysis, Non Negative Matrix Factorization	
#Exemplar/Case Studies	Study of language modelling for Indian languages.
*Mapping of Course Outcomes for Unit III	CO3
Unit IV Information Retrieval using NLP 07 Hours	
Information Retrieval: Introduction, Vector Space Model Named Entity Recognition: NER System Building Process, Evaluating NER System Entity Extraction, Relation Extraction, Reference Resolution, Coreference resolution, Cross Lingual Information Retrieval	
#Exemplar/Case Studies	Natural Language Processing based Information Extraction & Retrieval: https://www.cdac.in/index.aspx?id=mc_cli_cross_lingual_info
*Mapping of Course Outcomes for Unit IV	CO4
Unit V NLP Tools and Techniques 08 Hours	
Prominent NLP Libraries: Natural Language Tool Kit (NLTK), spaCy, TextBlob, Gensim etc. Linguistic Resources: Lexical Knowledge Networks, WordNets, Indian Language WordNet (IndoWordnet), VerbNets, PropBank, Treebanks, Universal Dependency Treebanks Word Sense Disambiguation: Lesk Algorithm Walker’s algorithm, WordNets for Word Sense Disambiguation	
#Exemplar/Case Studies	Hindi Wordnet: https://www.cfilt.iitb.ac.in/wordnet/webhwn/ Sanskrit WordNet: https://www.cfilt.iitb.ac.in/wordnet/webswn/ Indic Library: http://anoopkunchukuttan.github.io/indic_nlp_library/

<u>*Mapping of Course Outcomes for Unit V</u>	CO5	
Unit VI	Applications of NLP	07 Hours
Machine Translation: Rule based techniques, Statistical Machine Translation (SMT), Cross Lingual Translation Sentiment Analysis, Question Answering, Text Entailment, Discourse Processing, Dialog and Conversational Agents, Natural Language Generation		
<u>#Exemplar/Case Studies</u>	Study working of Google Translate Study working of IBM Watson Natural Language Processing	
<u>*Mapping of Course Outcomes for Unit VI</u>	CO6	

Learning Resources

Text Books:

1. Jurafsky, David, and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing”, Computational Linguistics and Speech Recognition, PEARSON Publication
2. Manning, Christopher D., and rich Schütze, “Foundations of Statistical Natural Language Processing”, Cambridge, MA: MIT Press

Reference Books:

1. Steven Bird, Ewan Klein, Edward Loper, “Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit”, O’Reilly Publication
2. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data”, Apress Publication ISBN: 9781484223871
3. Alexander Clark, Chris Fox, and Shalom Lappin, “The Handbook of Computational Linguistics and Natural Language Processing”, Wiley Blackwell Publications
4. Jacob Eisenstein, “Natural Language Processing”, MIT Press
5. Jacob Eisenstein, “An Introduction to Information Retrieval”, Cambridge University Press

e-Books :

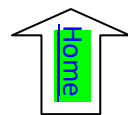
1. <https://web.stanford.edu/~jurafsky/slp3/ed3book.pdf>
2. <https://www3.cs.stonybrook.edu/~cse521/L16NLP.pdf>

NPTEL Courses links:

- <https://nptel.ac.in/courses/106101007>
- <https://nptel.ac.in/courses/106106211>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	1
CO3	2	3	3	2	2	-	-	-	-	-	-	2
CO4	2	2	3	3	3	-	2	2	-	-	-	3
CO5	2	2	3	3	3	-	-	-	-	-	-	3
CO6	3	3	3	3	3	2	1	1	-	-	-	3



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective V
410252 (B): Image Processing

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
---	----------------------------	---

Prerequisites Courses: Discrete Mathematics (210241)

Companion Course: Laboratory Practice VI (410255)

Course Objectives:

- To Understand Digital Image Processing Concepts.
- To Study Various Methods for Image Enhancement using Spatial and Frequency Domain.
- To Learn Classification Techniques for Image Segmentation.
- To Understand Image Compression and Object Recognition.
- To Study Various Image Restoration Techniques.
- To Understand various Medical and Satellite Image Processing Applications.

Course Outcomes:

On completion of the course, student will be able to—

CO1: Apply Relevant Mathematics Required for Digital Image Processing.

CO2: Apply Spatial and Frequency Domain Method for Image Enhancement.

CO3: Apply algorithmic approaches for Image segmentation.

CO4: Summarize the Concept of Image Compression and Object Recognition.

CO5: Explore the Image Restoration Techniques.

CO6: Explore the Medical and Satellite Image Processing Applications.

Course Contents

Unit I	Introduction to Digital Image Processing	07 Hours
Introduction, Fundamental steps in Digital Image Processing, Components, Elements of visual perception, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, different Color Models, Image Types, Image File Formats, Component Labeling algorithm.		
Introduction to OpenCV tool to Open and Display Images using Python or Eclipse C/C++.		
#Exemplar/Case Studies	Write a program to create a simple image file, save the same in .jpg, .tiff, .bmp format and display it.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Image Enhancement	08 Hours
. Introduction to Image Enhancement and its Importance, Types of Image Enhancement- Spatial Domain Image Enhancement: Intensity Transformations, Contrast Stretching, Histogram Equalization, Correlation and Convolution, Smoothing Filters, Sharpening Filters, Gradient and Laplacian		
Frequency Domain Image Enhancement: Low Pass filtering in Frequency Domain (Ideal,		

Butterworth, Gaussian), High Pass filter in Frequency Domain (Ideal, Butterworth, Gaussian).

#Exemplar/Case Studies	Write a program for image enhancement using suitable algorithm for Histogram equalization, Local enhancement, Smoothing and Sharpening.
*Mapping of Course Outcomes for Unit II	CO2

Unit III	Image Segmentation and Analysis	08 Hours
Introduction to Image Segmentation and its need. Classification of Image Segmentation Techniques: Threshold Based Image Segmentation, Edge Based Segmentation, Edge Detection, Edge Linking, Hough Transform, Watershed Transform, Clustering Techniques, region approach		
#Exemplar/Case Studies	Study the different image segmentation techniques for image segmentation	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Image Compression and Object Recognition	06 Hours
Image Compression: Introduction to Image Compression and its need, Classification of Image Compression Techniques- run-length coding, Shannon Fano coding, Huffman coding, Scalar and vector quantization, Compression Standards-JPEG/MPEG, Video compression. Object Recognition: Introduction, Computer Vision, Tensor Methods in Computer Vision, Classifications Methods and Algorithm, Object Detection and Tracking, Object Recognition.		
#Exemplar/Case Studies	Explain image compression and object recognition techniques.	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Image Restoration and Reconstruction	07 Hours
Introduction, Model of Image degradation, Noise Models, Classification of image restoration techniques, Blind-deconvolution techniques, Lucy Richardson Filtering, Wiener Filtering		
#Exemplar/Case Studies	Explain classification of image restoration techniques.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Medical and Satellite Image Processing	07 Hours
Medical Image Processing: Introduction, Medical Image Enhancement, Segmentation, Medical Image Analysis (Images of Brain MRI or Cardiac MRI or Breast Cancer). Satellite Image Processing: Concepts and Foundations of Remote Sensing, GPS, GIS, Elements of Photographic Systems, Basic Principles of Photogrammetry, Multispectral, Thermal, and Hyper spectral Sensing, Earth Resource Satellites Operating in the Optical Spectrum		
#Exemplar/Case Studies	Implement application for medical image processing or satellite image processing using OpenCV or Python.	

***Mapping of Course Outcomes for UnitVI**

CO6

Learning Resources**Text Books:**

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image processing", Pearson Education, Fourth Impression, 2008, ISBN: 978-81-7758-898- 9.
2. A. K. Jain, "Fundamentals of Digital Image Processing", PHI, ISBN-978-81- 203- 0929-6.
3. S. Annadurai, R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education, First Edition, 2007, ISBN-8177584790.
4. Boguslaw Cyganek, "Object Detection and Recognition in Digital Images: Theory and Practice", Wiley, First Edition, 2013, ISBN: 978-0-470-97637-1.
5. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann (MK), ISBN: 978-0-12- 372585-1.
6. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, "Remote Sensing and Image Interpretation", Wiley, Seventh Edition, 2015, ISBN: 978-1-118-91947-7

Reference Books :

1. Isaac Bankman, "Handbook of Medical Imaging", Academic Press, Second Edition, 2008, ISBN: 9780080559148.
2. Jayaraman, Esakkirajan, Veerakumar, "Digital image processing" , , Mc Graw Hill, Second reprint- 2010, ISBN(13): 978-0-07-01447-8, ISBN(10):0-07-014479-6.

e-Books :

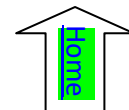
- <https://bookboon.com/en/3d-video-processing-and-transmission-fundamentals-ebook>

MOOC Courses links :

- <http://nptel.ac.in/courses/117105079>.

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	-	-	-	-	1	-	-	-
CO2	1	2	2	2	2	1	-	-	1	-	-	1
CO3	1	2	2	2	2	1	-	-	1	-	-	1
CO4	1	1	2	2	2	1	-	-	1	-	-	1
CO5	1	1	1	2	2	1	-	-	1	-	-	1
CO6	1	2	3	2	2	1	1	-	1	-	1	1



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective V
410252(C): Software Defined Networks

Teaching Scheme: TH: 3 Hours/Week	Credit 3	Examination Scheme: In-Sem (Paper):30 Marks End-Sem(Paper):70 Marks
--	---------------------------	--

Prerequisites Courses: Computer Networks and Security(310244)

Companion Course: Laboratory Practice VI(410255)

Course Objectives:

- To learn the fundamentals of software defined networks and understand Differentiation between traditional networks and software defined networks
- To gain conceptual understanding of Software Defined Networking (SDN) and its role in Data Center.
- To study about the SDN Programming.
- To study industrial deployment use-cases of SDN.
- To study about the various applications of SDN
- To Describe SDN Framework.

Course Outcomes:

On completion of the course, student will be able to–

- CO1: Interpret the need of Software Defined networking solutions.
 CO2: Analyze different methodologies for sustainable Software Defined Networkingsolutions.
 CO3: Select best practices for design, deploy and troubleshoot of next generation networks.
 CO4: Develop programmability of network elements.
 CO5: Demonstrate virtualization and SDN Controllers using Open Flow protocol
 CO6: Design and develop various applications of SDN

Course Contents

Unit I	Introduction	07 Hours
Challenges of traditional networks, History of Software Defined Networking (SDN), Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Data Planes.		
#Exemplar/Case Studies	Video Streaming https://kempsdn.com/what-is-sdn-and-use-cases/video-streaming/	
*Mapping of Course Outcomes for Unit I	CO1,CO2	
Unit II	OPEN FLOW & SDN CONTROLLERS	07 Hours
Open Flow Overview, The Open Flow Switch, The Open Flow Controller, Open Flow Ports, Message Types, Pipeline Processing, Flow Tables, Matching, Instructions, Action Set and List, Open Flow Protocol, Proactive and Reactive Flow, Timers, Open Flow Limitations, Open Flow Advantages and Disadvantages, Open v Switch Features, Drawbacks of Open SDN, Introduction to SDN controller.		

#Exemplar/Case Studies		Behavior Anomaly Detection in SDN Control Plane: A Case Study of Topology Discovery Attacks https://www.hindawi.com/journals/wcmc/2020/8898949/
*Mapping of Course Outcomes for Unit II		CO2,CO3
Unit III	DATA CENTERS	07 Hours
Data Center Definition, Data Center Demands (Adding, Moving, Deleting Resources, Failure Recovery, Multitenancy, Traffic Engineering and Path Efficiency), Tunneling Technologies for the Data Center, SDN Use Cases in the Data Center, SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE		
#Exemplar/Case Studies		The World’s Second Largest Tier IV Data Center A Yotta Infrastructure case study https://www.missioncriticalmagazine.com/articles/94105-the-worlds-secondz-d-largest-tier-iv-data-center
*Mapping of Course Outcomes for Unit III		CO2
Unit IV	SDN PROGRAMMING	07 Hours
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Introduction of Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications		
#Exemplar/Case Studies		Case study: Ballarat Grammar uses SDN to fight malware https://www.zdnet.com/home-and-office/networking/case-study-ballarat-grammar-uses-sdn-to-fight-malware/
*Mapping of Course Outcomes for Unit IV		CO4
Unit V	Network Functions Virtualization (NFV)	07 Hours
Definition of NFV, SDN Vs NFV, In-line network functions, Benefits of Network Functions Virtualization, Challenges for Network Functions Virtualization, Leading NFV Vendors, Comparison of NFV and NV.		
#Exemplar/Case Studies		NFV deployment case study failure migrate https://www.dell.com/en-us/blog/nfv-deployment-case-study-failure-migrate/
*Mapping of Course Outcomes for Unit V		CO5
Unit VI	SDN Use Cases	07 Hours
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration		
#Exemplar/Case Studies		CloudSeeds automate IaaS using SDN and a high-performance network from Juniper.
*Mapping of Course Outcomes for Unit VI		CO6

Learning Resources

Text Books:

1. Paul Goransson and Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann, 2014, ISBN: 9780124166752, 9780124166844.
2. Siamak Azodolmolky, “Software Defined Networking with Open Flow”, Packt Publishing, 2013, ISBN: 9781849698726
3. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks”, An Authoritative Review of Network Programmability Technologies, 2013, ISBN : 10:1-4493-4230-2, 9781-4493-4230-2

Reference Books :

1. Vivek Tiwari, “SDN and Open Flow for Beginners”, Amazon Digital Services, Inc., 2013.
2. Fei Hu, Editor, “Network Innovation through Open Flow and SDN: Principles and Design”, CRC Press, 2014.

e-Books :

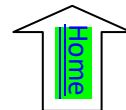
1. <https://ridhanegara.staff.telkomuniversity.ac.id/files/2017/04/Paul-Goransson-and-Chuck-Black-Auth.-Software-Defined-Networks.-A-Comprehensive-Approach.pdf>
2. https://speetis.fei.tuke.sk/KomunikacnaTechnika1/prednasky/7_11_2016/kniha_sietovan_ie.pdf
3. https://ridhanegara.staff.telkomuniversity.ac.id/files/2017/04/Thomas-D.-Nadeau-Ken-Gray-SDN-Software-Defined-Networks-O_039_Reilly-Media-2013.pdf

MOOC Courses Links:

- <https://nptel.ac.in/courses/108107107>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	-	1	-	-	-	-	-
CO2	1	2	2	1	2	-	-	-	-	-	1	-
CO3	2	1	3	1	2	-	-	-	-	-	2	-
CO4	1	2	2	1	2	-	-	-	-	-	2	-
CO5	3	2	2	3	3	-	-	-	-	-		-
CO6	1	2	1	3	3	-	-	-	-	-	1	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective V

410252(D): Advanced Digital Signal Processing

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
---	----------------------------	---

Prerequisite Courses: 410244(A) Digital Signal Processing

Companion Course: Laboratory Practice VI(410255)

Course Objectives:

- To study the parametric methods for power spectrum estimation.
- To study adaptive filtering techniques and applications of adaptive filtering.
- To learn and understand Multi-rate DSP and applications
- To explore appropriate transforms
- Understand basic concepts of speech production, speech analysis, speech coding and parametric representation of speech
- Acquire knowledge about different methods used for speech coding and understand various applications of speech processing
- Learn and understand basics of Image Processing and various image filters with its applications

Course Outcomes:

On completion of the course, student will be able to—

CO1: Understand and apply different transforms for the design of DT/Digital systems

CO2: Explore the knowledge of adaptive filtering and Multi-rate DSP

CO3: Design DT systems in the field/area of adaptive filtering, spectral estimation and multi-rate DSP

CO4: Explore use of DCT and WT in speech and image processing

CO5: Develop algorithms in the field of speech, image processing and other DSP applications

CO6: Identify Image Processing Techniques

Course Contents

Unit I	DFT and Applications	08 Hours
DFT and Applications – Linear filtering, spectral leakage, Spectral resolution and selection of Window Length, Frequency analysis, 2-D DFT, applications in Image and Speech Processing		
#Exemplar/Case Studies	Case Study of Image / Speech Processing Application	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Adaptive FIR and IIR filter Design	08 Hours

Adaptive FIR and IIR filter Design – DT Filters, FIR and IIR filters, Adaptive FIR Filter design: Steepest descent and Newton method, LMS method, Applications, Adaptive IIR Filter design: Padé Approximation, Least square design, Applications

#Exemplar/Case Studies	Demonstration of DT filter and FIR filter with suitable application	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Multi-rate DSP and applications	08 Hours
Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals Linear Prediction And Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.		
#Exemplar/Case Studies	Implementation for sampling rate Conversion Multi-rate Digital Signal Processing	
*Mapping of Course Outcomes for Unit II	CO3	
Unit IV	Spectral Estimation	08 Hours
Spectral Estimation – Estimation of density spectrum, Nonparametric method, Parametric method, Evaluation ,DCT and WT – DCT and KL transform, STFT, WT, Harr Wavelet and Dubecheis Wavelet, Applications of DCT and WT.		
#Exemplar/Case Studies	A spectral estimation case study in frequency-domain by subspace methods	
*Mapping of Course Outcomes for Unit II	CO4	
Unit V	Speech processing	08 Hours
Speech processing - Speech coding: Phase Vocoder, LPC, Sub-band coding, Adaptive Transform Coding, Harmonic Coding, Vector Quantization based Coders. Fundamentals of Speech recognition, Speech segmentation, Text-to-speech conversion, speech enhancement, Speaker Verification, Applications.		
#Exemplar/Case Studies	Investigation of data augmentation techniques for disordered speech recognition	
*Mapping of Course Outcomes for Unit II	CO5	
Unit VI	Image Processing	08 Hours
Image Processing – Image as 2D signal and image enhancement techniques, filter design: low pass, highpass and bandpass for image smoothing and edge detection, Optimum linear filter and order statistic filter, Examples – Wiener and Median filters, Applications		
#Exemplar/Case Studies	Medical image processing for coronavirus (COVID-19) pandemic: A survey	
*Mapping of Course Outcomes for Unit II	CO6	

Books:**Text:**

1. J. G. Proakis, D. G. Manolakis, “ Digital Signal Processing: Principles, Algorithms, and Applications,” Prentice Hall, 2007, 4th edition, ISBN: 10: 0131873741
2. Dr. Shaila D. Apate , “ Advanced Digital Signal Processing,” Wiley Publ., 2013, ISBN-10: 8126541245
3. S. K. Mitra, “Digital Signal Processing : A Computer Based Approach”, McGraw Hill Higher Education, 2006, 3rd edition, ISBN-10: 0070429537
4. Rabiner and Juang, “Fundamentals of Speech Recognition”, Prentice Hall, 1994, ISBN:0-13-015157-2 .
5. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing and Analysis”, Pearson Education, 3d Ed., 2007, ISBN: 81-7808-629-8

References:

1. Chanda, Muzumdar, “Digital Image Processing and Analysis,” Eastern Economy Edition, PHI, 2nd Ed., ISBN: 978-81-203-4096-1
2. Tarun Rawat, “Digital Signal Processing”, Oxford University Press, 2015, ISBN-10:0198062281
3. Roberto Crist, “Modern Digital Signal Processing,” Thomson Brooks/Cole 2004, ISBN:978-93-80026-55-8.
4. Nelson Morgan and Ben Gold, “ Speech and Audio Signal Processing: Processing and Perception Speech and Music”, 1999, John Wiley and Sons, ISBN: 0387951547
5. Raghuveer. M. Rao, Ajit S. Bopardikar, “Wavelet Transforms: Introduction to Theory and applications,” Pearson Education, Asia, 2000. Dale Grover and John R. (Jack) Deller, “Digital Signal Processing and the Microcontroller”, Prentice Hall, ISBN:0-13-754920-2

eE Books:

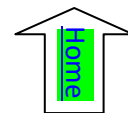
1. Foundations of Signal Processing- <http://fourierandwavelets.org/>
2. <http://www.tka4.org/materials/lib/Articles-Books/Speech%20Recognition/advanced-digital-signal-processing-and-noise-reduction.9780470094945.26435.pdf>
3. https://www.riverpublishers.com/pdf/ebook/RP_E9788792982032.pdf
4. <https://fmipa.umri.ac.id/wp-content/uploads/2016/03/Andreas-Intoniou-Digital-signal-processing.9780071454247.31527.pdf>
5. http://www.syscom.univ-mlv.fr/~zaidi/teaching/dsp-esipe-oc2/Course-Notes__Advanced-DSP.pdf
6. <https://dl.icdst.org/pdfs/files/25f1b31b38872a4aea5584206534368a.pdf>

MOOC Courses Links:

- https://onlinecourses.nptel.ac.in/noc22_ee86/preview

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	-	-	-	-	-	-	-
CO2	1	2	2	2	2	-	-	-	-	-	-	-
CO3	2	2	3	2	2	-	-	-	-	-	3	-
CO4	1	2	2	2	2	-	-	-	-	-	-	-
CO5	3	2	2	3	2	-	-	-	-	-	-	-
CO6	1	2	1	1	1	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective V
410252(E): Open Elective I

Teaching Scheme:

Credit

Examination Scheme: In-Sem

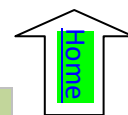
TH: 03 Hours/Week

03

(Paper): 30 Marks

End-Sem (Paper): 70 Marks

The open elective included, so as to give the student a wide choice of subjects from other Engineering Programs. To inculcate the out of box thinking and to feed the inquisitive minds of the learners the idea of open elective is need of the time. Flexibility is extended with the choice of open elective allows the learner to choose interdisciplinary/exotic/future technology related courses to expand the knowledge horizons. With this idea learner opts for the course without any boundaries to choose the approved by academic council and Board of Studies



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective VI
410253(A): Pattern Recognition

Teaching Scheme:

TH: 03 Hours/Week

Credit

03

Examination Scheme:

In-Sem (Paper): 30 Marks

End-Sem (Paper): 70 Marks

Prerequisite Courses: Fundamentals of Data Structures(210242), Data Structures and Algorithms(210252)

Companion Course: Laboratory Practice VI(410255)

Course Objectives:

- To learn the basic concept of Pattern recognition
- To study different approaches of pattern recognition
- To learn various pattern classification techniques
- To survey on recent advances and applications in pattern recognition
- To implement Optimal Path Searching techniques.
- To Illustrate Pattern Recognition Techniques.

Course Outcomes:

On completion of the course, student will be able to–

CO1: Analyze various type of pattern recognition techniques

CO2: Identify and apply various pattern recognition and classification approaches to solve the problems

CO3: Evaluate statistical and structural pattern recognition

CO4: Percept recent advances in pattern recognition confined to various applications

CO5: Implement Bellman's optimality principle and dynamic programming

CO6: Analyze Patterns using Genetic Algorithms & Pattern recognition applications.

Course Contents

Unit I	Pattern Recognition	07 Hours
Introduction of Pattern Recognition with its application, Pattern Recognition system, Design cycle of pattern recognition, Learning and adaption, Representation of Patterns and classes, Feature Extraction, pattern recognition models/approaches.		
#Exemplar/Case Studies	Evaluation on spatial and temporal variations in water quality by pattern recognition techniques.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Error Estimation & Decision Theory	07 Hours
Introduction, Error estimation methods, various distance measures (Euclidean, Manhattan, cosine, Mahalanobis) and distance based classifier, Feature selection based on statistical hypothesis testing, ROC curve.		
Introduction, Bayesian decision theory-continuous and discrete features, two- category classification, minimum error rate classification, discriminant functions,		

Parametric Techniques:- Maximum Likelihood Estimation, Bayesian Parameter Estimation, Sufficient Statistics; Problems of dimensionality.

Non-Parametric Techniques:-Density estimation, Parzen Window, Metrics and Nearest-Neighbor classification; Fuzzy classification

#Exemplar/Case Studies	Spatial and temporal air quality pattern recognition using environmental techniques
-------------------------------	---

*Mapping of Course Outcomes for Unit II	CO2
--	-----

Unit III	Structural Pattern Recognition	06 Hours
-----------------	---------------------------------------	-----------------

Tree Classifiers-Decision Trees, Random Forests, **Structural Pattern recognition**: Elements of formal grammars, String generation as pattern description, Recognition of syntactic description, Parsing, Stochastic grammars and applications, Graph based structural representation, **Stochastic method**: Boltzmann Learning.

#Exemplar/Case Studies	Case Study on spoken word recognition
-------------------------------	---------------------------------------

*Mapping of Course Outcomes for Unit III	CO3
---	-----

Unit IV	Clustering	08 Hours
----------------	-------------------	-----------------

Introduction, Hierarchical Clustering, agglomerative clustering algorithm, the single linkage, complete, linkage and average, linkage algorithm. Ward's method, Partition clustering, K-means algorithm, clustering algorithms based on graph theory (Minimum spanning tree algorithm), Optimization methods used in clustering: clustering using simulated Annealing.

#Exemplar/Case Studies	Case Study on disease recognition from a list of symptoms
-------------------------------	---

*Mapping of Course Outcomes for Unit IV	CO3
--	-----

Unit V	Template Matching and Unsupervised Learning	07 Hours
---------------	--	-----------------

Measures based on Optimal Path Searching techniques: Bellman's optimality principle and dynamic programming, The Edit distance, Dynamic time Warping, Measures based on correlations, Deformable template models

#Exemplar/Case Studies	Pattern recognition in time series database: A case study on financial database.
-------------------------------	--

*Mapping of Course Outcomes for Unit V	CO4
---	-----

Unit VI	Fuzzy Logic and Pattern Recognition	07 Hours
----------------	--	-----------------

Fuzzy logic, Fuzzy pattern classifiers, Pattern classification using Genetic Algorithms
Pattern recognition applications: Application of pattern recognition techniques in object recognition, biometric, facial recognition, IRIS scanner, Finger prints, 3D object recognition

#Exemplar/Case Studies	Study of fingerprint recognition
-------------------------------	----------------------------------



***Mapping of Course Outcomes for Unit VI**

CO5

Learning Resources

Text Books:

1. R. O. Duda, P. E. Hart, D. G. Stork, "Pattern Classification", 2nd Edition, Wiley-Inter-science, John Wiley & Sons, 2001
2. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Elsevier, Academic Press, ISBN: 978-1-59749-272-0
3. B.D. Ripley, "Pattern Recognition and Neural Networks", Cambridge University Press. ISBN 0 521 46086 7

Reference Books:

1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
2. David G. Stork and Elad Yom-Tov, "Computer Manual in MATLAB to accompany Pattern Classification", Wiley Inter-science, 2004, ISBN-10: 0471429775
3. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", PHI, ISBN-978-81-203-4091-6
4. eMedia at NPTEL : <http://nptel.ac.in/courses/106108057/33>

e-Books :

1. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.320.4607&rep=rep1&type=pdf>
2. https://cds.cern.ch/record/998831/files/9780387310732_TOC.pdf
3. [https://darmanto.akakom.ac.id/pengenalnpola/Pattern%20Recognition%204th%20Ed.%20\(2009\).pdf](https://darmanto.akakom.ac.id/pengenalnpola/Pattern%20Recognition%204th%20Ed.%20(2009).pdf)
4. <https://readyforai.com/download/pattern-recognition-and-machine-learning-pdf/>

MOOC Courses Links:

- <https://nptel.ac.in/courses/117105101>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	2	-	-	1	1	1	1	1	1
CO2	2	1	-	1	1	1	1	1	1	1	1	1
CO3	2	2	2	1	1	1	1	1	1	1	1	1
CO4	2	2	2	1	1	1	1	1	1	1	1	1
CO5	2	2	2	1	1	1	1	1	1	1	1	1
CO6	2	-	2	1	1	1	1	1	1	1	1	1

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective VI
410253(B): Soft Computing

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
---	----------------------------	---

Prerequisite Courses: Computer Graphics(210244)

Companion Course: Laboratory Practice VI(410255)

Course Objectives:

- To study the various soft computing approaches.
- To understand the soft computing techniques and algorithms for problem solving.
- To be familiar with the various application areas of soft computing.
- To apply the soft computing techniques for developing intelligent systems
- To Explore and solve problems using genetic Algorithms.
- To Understand hybrid systems paradigm and Application Areas of Soft Computing.

Course Outcomes:

On completion of the course, student will be able to—

CO1: Understand requirement of soft computing and be aware of various soft computing techniques.

CO2: Understand Artificial Neural Network and its characteristics and implement ANN algorithms.

CO3: Understand and Implement Evolutionary Computing Techniques.

CO4: Understand the Fuzzy logic and Implement fuzzy algorithms for solving real life problems.

CO5: Apply knowledge of Genetic algorithms for problem solving.

CO6: Develop hybrid systems for problem solving.

Course Contents

Unit I	Introduction To Soft Computing	07 Hours
Introduction to Soft Computing and Computational Intelligence, Characteristics of Soft computing, Comparison Soft Computing Vs Hard Computing, Requirements of Soft Computing, Soft Computing Techniques – Artificial Neural Network, Fuzzy Logic., Evolutionary computing and Hybrid systems, Applications of Soft Computing		
#Exemplar/Case Studies	1. Study of Soft Computing techniques for Waste WaterManagement 2. Study of IBM Research Neuro-symbolic AI- a new look for neuromorphic computing	
*Mapping of Course Outcomes for Unit	CO1	
Unit II	Artificial Neural Network	07 Hours

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation, functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetero-associative memory, perceptron model, single layer artificial neural network, multilayer perceptron model; back propagation learning methods, effect of learning rule coefficient; back propagation algorithm, factors affecting backpropagation training, applications.

#Exemplar/Case Studies

Study of Handwriting recognition using ANN.

*Mapping of Course

CO2

Outcomes for Unit II

Unit III	Evolutionary Computing	07 Hours
----------	------------------------	----------

Problem Solving as A Search Task, Hill Climbing And Simulated Annealing, Evolutionary Computing, Evolution Strategies, Evolutionary Programming, Genetic Programming, Selected Applications From The Literature: A Brief Description, Scope Of Evolutionary Computing, Introduction to Evolutionary Single-Objective Optimization, Particle Swarm Optimization: Introduction, inspiration, mathematical model, standard and binary PSO. Artificial hummingbird algorithm

#Exemplar/Case Studies

Study of Engineering application of Artificial hummingbird algorithm

*Mapping of Course

CO3

Outcomes for Unit III

Unit IV	Fuzzy logic	08 Hours
---------	-------------	----------

Introduction to Fuzzy Logic, Classical Set, Fuzzy Set- Introduction, Operations on classical sets, properties of classical sets, fuzzy set operations, properties of fuzzy sets, Classical Relation, Fuzzy Relation, **Fuzzy Inference process** – Membership functions, Fuzzification, Membership value Assignment- Inference, Rank ordering, defuzzification – Weighted Average Method, Mean-Max Membership, Fuzzy Bayesian Decision Making, **Developing a Fuzzy Control** – System Architecture and Operation of FLC System, FLC System Models, Application of FLC System

#Exemplar/Case Studies

Study of Object Detection Robot Using Fuzzy Logic Controller

*Mapping of Course

CO4

Outcomes for Unit IV

Unit V	Genetic Algorithm	07 Hours
--------	-------------------	----------

Introduction To Basic Terminologies in Genetic Algorithm: Individuals, Genes, Fitness, Populations; **Simple GA; General Genetic Algorithm; Operators in Genetic Algorithm:** Encoding, Selection, Crossover (Recombination), Mutation; **Stopping Condition for GA Flow; Constraints in Genetic Algorithms; Problem Solving Using Genetic Algorithm; Holland Classifier System:** The Production System, The Bucket Brigade Algorithm and Rule Generation; **Advantages and Limitations of Genetic Algorithms; Applications of Genetic Algorithms.**

#Exemplar/Case Studies

Use Genetic Algorithm to design a solution to the Traveling Salesman Problem. **Solution:** 1. Use Permutation Encoding 2. Define Objective Function. 3. Apply Selection Method 4. Crossover 5. Mutation 6. Repeat Until stopping criteria is met. 7. Stop

*Mapping of Course

CO5

Outcomes for Unit V

Unit VI	Hybrid System and Application Areas of Soft Computing	07 Hours
---------	---	----------

Hybrid System towards comprehensive Soft Computing: The hybrid systems paradigm, Hybrid connectionist production systems, Hybrid connectionist logic programming systems, Hybrid fuzzy connectionist production systems, Hybrid systems for speech and language processing, Hybrid systems for decision making.

Application Areas of Soft Computing: Fuzzy-filtered Neural Networks-Plasma Spectrum Analysis, Hand-written Numeral Recognition, Fuzzy sets and Genetic Algorithms in Game Playing, Soft Computing for Color Recipe Prediction.

#Exemplar/Case Studies	Study of Hybrid models for disease prediction.
------------------------	--

*Mapping of Course Outcomes for Unit VI	CO6
---	-----

Learning Resources

Text Books:

1. S.N. Sivanandam, "Principles of Soft Computing", Wiley India- ISBN- 9788126527410
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing A Computational Approach to Learning and Machine Intelligence", Prentice Hall, ISBN: 978-0132610667
3. L. N. de Castro, "Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications", 2006, CRC Press, ISBN-13: 978-1584886433 (Chapter 3)
4. S.Rajasekaran, and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms : Synthesis, and Applications", Prentice Hall of India

Reference Books:

Reference Books :

1. Nikola K. Kasabov, "Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering", MIT Press, ISBN:978-0-262-11212-3
2. Seyedali Mirjalili, "Evolutionary Algorithms and Neural Networks Theory and Applications, Studies in Computational Intelligence", Vol 780, Springer, 2019, ISBN 978-3-319-93024-4
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley India, ISBN: 978-0-470-74376-8

e-Books :

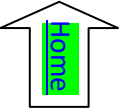
1. <https://kamenpenkov.files.wordpress.com/2016/01/pso-m-clerc-2006.pdf>
2. <http://www.shahed.ac.ir/stabaii/Files/CompIntelligenceBook.pdf>
3. <https://ctb.iau.ir/Files/%D9%88%D8%A8%20%D8%B3%D8%A7%DB%8C%D8%AA%20%D8%A7%D8%B3%D8%A7%D8%AA%DB%8C%D8%AF/fuzzy%20logic%20with%20engineering%20application-3rdEdition.pdf>
4. http://www.soukalfi.edu.sk/01_NeuroFuzzyApproach.pdf
5. <https://www.yumpu.com/en/document/read/34361976/evolutionary-computation-a-unified-approach>

MOOC Courses Links :

- NPTEL Course – Introduction of Soft Computing, IIT Kharagpur by Prof. Debidas Samanta <https://nptel.ac.in/courses/106105173>
- NPTEL Course – Neural Network and Applications, IIT Kharagpur by Prof. Somnath Sengupta, <https://nptel.ac.in/courses/117105084>
- NPTEL Course – Fuzzy Logic and Neural Networks, IIT Kharagpur by Dilip Kumar Pratihari <https://nptel.ac.in/courses/127105006>

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	1	-	-	-	-	-	1
CO2	3	2	2	3	1	2	-	-	-	-	-	2
CO3	3	2	2	3	1	2	-	-	-	-	-	2
CO4	3	2	2	3	1	2	-	-	-	-	-	2
CO5	3	2	2	3	1	2	-	-	-	-	-	2
CO6	3	2	2	3	1	2	-	-	-	-	-	3



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective VI
410253(C): Business Intelligence

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper) : 30 Marks End-Sem (Paper): 70 Marks
---	----------------------------	--

Prerequisites Courses: Database Management System(310241), Data Science & Big data Analytics(310251), Machine Learning (410242)

Companion Course: Laboratory Practice VI(410256)

Course Objectives:

- To introduce the concepts and components of Business Intelligence (BI)
- To evaluate the technologies that make up BI (data warehousing, OLAP)
- To identify the technological architecture of BI systems.
- To explain different data preprocessing techniques
- To identify machine learning model as per business need
- To understand the BI applications in marketing, logistics, finance and telecommunication sector

Course Outcomes: On completion of this course, the students will be able to

CO1: Differentiate the concepts of Decision Support System & Business Intelligence

CO2: Use Data Warehouse & Business Architecture to design a BI system.

CO3: Build graphical reports

CO4: Apply different data preprocessing techniques on dataset

CO5: Implement machine learning algorithms as per business needs

CO6: Identify role of BI in marketing, logistics, and finance and telecommunication sector

Course Contents

Unit I	Introduction to Decision support systems and Business intelligence	07 Hours
<p>Decision support systems: Definition of system, representation of the decision-making process, evolution of information systems, Decision Support System, Development of a decision support system, the four stages of Simon's decision-making process, and common strategies and approaches of decision makers</p> <p>Business Intelligence: BI, its components & architecture, previewing the future of BI, crafting a better experience for all business users, End user assumptions, setting up data for BI, data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence</p>		
#Exemplar/Case Studies	Decision support system in business intelligence: https://www.riverlogic.com/blog/five-decision-support-system-examples	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	The Architecture of DW and BI	07 Hours

BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Different OLAP Architectures-Data Models-Tools in Business Intelligence-Role of DSS, EIS, MIS and digital Dash boards – Need for Business Intelligence Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations.		
#Exemplar/Case Studies	A case study on Retail Industry : https://www.diva-portal.org/smash/get/diva2:831050/FULLTEXT01.pdf	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Reporting Authoring	07 Hours
Building reports with relational vs Multidimensional data models; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.		
#Exemplar/Case Studies	Power BI Case Study – How the tool reduced hassles of Heathrow & Edsby: https://data-flair.training/blogs/power-bi-case-study/	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Data preparation	07 Hours
Data validation: Incomplete data , Data affected by noise . Data transformation: Standardization , Feature extraction. Data reduction : Sampling, Feature selection, Principal component analysis, Data discretization . Data exploration : 1.Univariate analysis :Graphical analysis of categorical attributes ,Graphical analysis of numerical attributes , Measures of central tendency for numerical attributes , Measures of dispersion for numerical attributes, Identification of outliers for numerical attributes 2.Bivariate analysis: Graphical analysis , Measures of correlation for numerical attributes , Contingency tables for categorical attributes, 3.Multivariate analysis: Graphical analysis , Measures of correlation for numerical attributes		
#Exemplar/Case Studies	Case study on Data preparation phase of BI system https://blog.panoply.io/load-and-transform-how-to-prepare-your-data-for-business-intelligence	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Impact of Machine learning in Business Intelligence Process	07 Hours
Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression. Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models. Association Rule: Structure of Association Rule, Apriori Algorithm		
#Exemplar/Case Studies	Business applications for comparing the performance of a stock over a period of time https://cleartax.in/s/stock-market-analysis	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	BI Applications	07 Hours

Tools for Business Intelligence, Role of analytical tools in BI, Case study of Analytical Tools: WEKA, KNIME, Rapid Miner, R;
Data analytics, Business analytics, ERP and Business Intelligence, BI and operation management, BI in inventory management system, BI and human resource management, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI in salesforce management

#Exemplar/Case Studies	Logistics planning in the food industry https://www.foodlogistics.com/case-studies https://www.barrettdistribution.com/food-distribution-case-study
*Mapping of Course Outcomes for Unit VI	CO6

Learning Resources

Text Books:

1. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer, 2015
2. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support, 10th Edition. Pearson/Prentice Hall, 2015

Reference Books :

1. Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.
2. Introduction to business Intelligence and data warehousing, IBM, PHI
3. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis, Wiley, 2019
4. Data Mining for Business Intelligence, Wiley
5. EMC Educational Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley ISBN-13 978 1118876138
6. Ken W. Collier, Agile Analytics: A value driven Approach to Business Intelligence and Data
7. Warehousing, Pearson Education, 2012, ISBN-13 978 8131786826

e-Books :

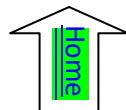
1. https://www.knime.com/sites/default/files/inline-images/KNIME_quickstart.pdf
2. www.cs.ccsu.edu/~markov/weka-tutorial.pdf
3. http://www.biomedicahelp.altervista.org/Magistrare/Clinics/BIC_PrimoAnno/IdentificazioneModelliDataMining/Business%20Intelligence%20-%20Carlo%20Vercellis.pdf
4. <https://download.e-bookshelf.de/download/0000/5791/06/L-G-0000579106-0002359656.pdf>

NPTEL/YouTube video lecture links:

- Business Analytics for management decision : <https://nptel.ac.in/courses/110105089>
- Business analytics and data mining modeling using R : <https://nptel.ac.in/courses/110107092>
- Business Analysis for Engineers : <https://nptel.ac.in/courses/110106050>

@The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	-	-	-	-	-	-
CO2	1	1	1	1	1	-	-	-	-	-	-	-
CO3	1	2	1	1	1	-	-	-	-	-	-	-
CO4	2	2	2	1	1	-	-	-	-	-	-	-
CO5	2	2	2	2	1	-	-	-	-	-	-	-
CO6	-	1	-	1	1	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective VI

410253(D): Quantum Computing

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper): 30 Marks
		End-Sem (Paper): 70 Marks

Prerequisite Courses: Data Structures and Algorithms(210243), Data Science and Big Data Analytics (310251)

Companion Course: Laboratory Practice IV(410247)

Course Objectives:

- To provide introduction and necessary expertise to the learner in the upcoming discipline of Quantum Computing and Machine Learning.
- To enable the students to learn Quantum Computing and Quantum Machine Learning in practical-oriented learning sessions so that he/she can independently use existing open-source Quantum Computing Hardware and Software Frameworks
- To teach the students to develop hybrid solutions by applying Quantum Machine Learning to potential business application areas.
- To study Quantum Information Theory and Quantum Computing Programming Model of Computation.
- To study Quantum Algorithms and apply these to develop hybrid solutions .
- To study Quantum Concepts necessary for understanding the Quantum Computing Paradigm and compare the available hardware and software infrastructure and frameworks made available open source by major players in the Industry and Academia.

Course Outcomes:

On completion of the course, student will be able to–

- CO1: To understand the concepts of Quantum Computing
 CO2: To understand and get exposure to mathematical foundation and quantum mechanics
 CO3: To understand and implement building blocks of Quantum circuits
 CO4: To understand quantum information, its processing and Simulation tools
 CO5: To understand basic signal processing algorithms FT, DFT and FFT
 CO6 : To study and solve examples of Quantum Fourier Transforms and their applications

Course Contents

Unit I	Introduction to Quantum Computing	07 Hours
Fundamental Concepts of Quantum computing: Introduction and Overview, Global Perspective, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum information and Quantum information processing,		
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Mathematical foundation of Quantum Computing	07 Hours
Quantum Mechanics: Linear Algebra and Quantum mechanics, Postulates of Quantum mechanics, state space, evolution, Quantum measurement, distinguishing quantum states, projective measurements, POVM measurements, Phase, Composite systems, Global view and applications, Density operator		

<u>*Mapping of Course Outcomes for Unit II</u>	CO2	
Unit III	Building Blocks for Quantum Program	07 Hours
Quantum Computations: Quantum circuits, Quantum algorithms and qubit operations, Controlled operations, Principal deferred and Principal implicit Measurements, Universal Quantum Gates, Two level unitary gates, single qubit and CNOT , discrete set of universal operations, Quantum computational complexity		
<u>*Mapping of CourseOutcomes for Unit III</u>	CO3	
Unit IV	Quantum Simulation Algorithms and Fourier Transform	07 Hours
Simulation of Quantum Systems, Simulation in action,exponential complexity growth of quantum systems,, Quantum simulation algorithm, examples of quantum simulations, perspectives of quantum simulation, Understanding Basics of Fourier transform, Discrete Fourier Transform, Fast Fourier Transform, Definitions, mathematical representations of FT, DFT and FFT		
<u>*Mapping of CourseOutcomes for Unit IV</u>	CO3,CO4	
Unit V	Quantum Fourier Transform and Applications	07 Hours
Quantum Fourier Transform , Phase estimation performance and requirements, order finding application, factoring application, General applications of Quantum Fourier transform, period finding, discrete algorithms, Other Quantum Algorithms.		
<u>*Mapping of CourseOutcomes for Unit V</u>	CO5	
Unit VI	Quantum Machine Learning	07 Hours
Quantum Machine Learning and Quantum AI, Quantum Neural Networks, Quantum Natural Language Understanding, Quantum Cryptography, Application Domains for Quantum Machine Learning: Chemistry/Material Science, Space Tech, Finance related Optimization Problems, Swarm Robotics, Cyber security		
<u>*Mapping of CourseOutcomes for Unit VI</u>	CO6	
Learning Resources		
Text Books: 1. Michael A. Nielsen, “Quantum Computation and Quantum Information”, Cambridge University 2. Wittek, “Quantum Machine Learning (What Quantum Computing Means to Data Mining)”, Peter University of Boras, Sweden - Elsevier Publications 3. Andreas Winchert, “Principles of Quantum Artificial Intelligence”,Instituto Superior Técnico - Universidade de Lisboa, Portugal - World Scientific Publishing, British Library Cataloguing-in-Publication Data		

Reference Books:

1. Press Stephen Kan, “Metrics and Models in Software Quality Engineering”, Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086
2. Michael A. Nielsen, “Quantum Computation and Quantum Information”, Cambridge University Press
3. David McMahon, “Quantum Computing Explained”, Wiley
4. Microsoft Quantum Development Kit <https://www.microsoft.com/enus/quantum/development-kit> Forest SDK PyQuil: <https://pyquil.readthedocs.io/en/stable/>
5. Amazon Bracket Documentation on AWS: <https://aws.amazon.com/braket/> 7 D-Wave Systems Documentation: <https://docs.dwavesys.com/docs/latest/index.html>

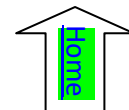
e-Books :

1. <http://mmrc.amss.cas.cn/tlb/201702/W020170224608149940643.pdf>
2. <http://mmrc.amss.cas.cn/tlb/201702/W020170224608150244118.pdf>

MOOC Courses Links:

- https://onlinecourses.nptel.ac.in/noc21_cs103/preview
- <https://www.coursera.org/learn/introduction-to-quantum-information>

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	2	-	-	-	2	-	2	2
CO2	1	3	3	2	3	-	-	-	2	-	2	-
CO3	1	3	3	2	3	-	-	-	2	-	2	-
CO4	1	3	3	2	3	-	-	-	2	-	2	-
CO5	1	3	3	2	3	-	-	-	-	-	2	1
CO6	3	2	1	3	1	-	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective IV
410253(E): Open Elective II

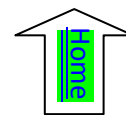
Teaching Scheme:	Credit	Examination Scheme:
TH: 03Hours/Week	03	In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks

Companion Course: Laboratory Practice VI (410255)

The open elective included, so as to give the student a wide choice of subjects from other Engineering Programs. To inculcate the out of box thinking and to feed the inquisitive minds of the learners the idea of open elective is need of the time.

Flexibility is extended with the choice of open elective allows the learner to choose interdisciplinary/exotic/future technology related courses to expand the knowledge horizons.

With this idea learner opts for the course without any boundaries to choose the approved by academic council and Board of Studies.



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410255: Laboratory Practice V

Teaching Scheme: Practical: 2 Hours/Week	Credit 01	Examination Scheme Term Work: 50 Marks Practical: 50 Marks
---	----------------------------	---

Companion Course: High Performance Computing(410250), Deep Learning(410251)

Course Objectives:

- To understand and implement searching and sorting algorithms.
- To learn the fundamentals of GPU Computing in the CUDA environment.
- To illustrate the concepts of Artificial Intelligence/Machine Learning(AI/ML).
- To understand Hardware acceleration.
- To implement different deep learning models.

Course Outcomes:

- CO1: Analyze and measure** performance of sequential and parallel algorithms.
CO2: Design and Implement solutions for multicore/Distributed/parallel environment.
CO3: Identify and apply the suitable algorithms to solve AI/ML problems.
CO4: Apply the technique of Deep Neural network for implementing Linear regression and classification.
CO5: Apply the technique of Convolution (CNN) for implementing Deep Learning models.
CO6: Design and develop Recurrent Neural Network (RNN) for prediction.

Guidelines for Instructor's Manual

Laboratory Practice V is for practical hands on for core courses High Performance Computing and Data Learning. The instructor's manual is to be developed as a hands-on resource and as ready reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction and Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, references among others.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may

consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness reserving weightage for successful mini-project completion and related documentation.

Guidelines for Practical Examination

- Both internal and external examiners should jointly frame suitable problem statements for practical examination based on the term work completed.
- During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.
- The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation.
- Encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising boost to the student's academics.

Guidelines for Laboratory Conduction

- List of recommended programming assignments and sample mini-projects is provided for reference.
- Referring these, Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.
- Preferably there should be multiple sets of assignments/mini-project and distribute among batches of students.
- Real world problems/application based assignments/mini-projects create interest among learners serving as foundation for future research or startup of business projects.
- Mini-project can be completed in group of 2 to 3 students.

- Software Engineering approach with proper documentation is to be strictly followed.
- Use of open source software is to be encouraged.
- Instructor may also set one assignment or mini-project that is suitable to respective course beyond the scope of syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming Languages: Object Oriented Languages

C++/JAVA/PYTHON/R

Programming tools recommended: Front End: Java/Perl/PHP/Python/Ruby/.net, Backend :

MongoDB/MYSQL/Oracle, Database Connectivity : ODBC/JDBC

Suggested List of Laboratory Experiments/Assignments

410250 : High Performance Computing

Any 4 Assignments and 1 Mini Project are Mandatory

Group 1

- | | |
|----|---|
| 1. | Design and implement Parallel Breadth First Search and Depth First Search based on existing algorithms using OpenMP. Use a Tree or an undirected graph for BFS and DFS . |
| 2. | Write a program to implement Parallel Bubble Sort and Merge sort using OpenMP. Use existing algorithms and measure the performance of sequential and parallel algorithms. |
| 3. | Implement Min, Max, Sum and Average operations using Parallel Reduction. |
| 4. | Write a CUDA Program for : <ol style="list-style-type: none"> 1. Addition of two large vectors 2. Matrix Multiplication using CUDA C |
| 5. | Implement HPC application for AI/ML domain. |

Group 2

- | | |
|----|--|
| 6. | Mini Project: Evaluate performance enhancement of parallel Quicksort Algorithm using MPI |
| 7. | Mini Project: Implement Huffman Encoding on GPU |
| 8. | Mini Project: Implement Parallelization of Database Query optimization |
| 9. | Mini Project: Implement Non-Serial Polyadic Dynamic Programming with GPU Parallelization |

410251 : Deep Learning

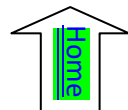
Any 3 Assignments and 1 Mini Project are Mandatory

Group 1

1.	Linear regression by using Deep Neural network: Implement Boston housing price prediction problem by Linear regression using Deep Neural network. Use Boston House price prediction dataset.
2.	Classification using Deep neural network (Any One from the following) <ol style="list-style-type: none"> 1. Multiclass classification using Deep Neural Networks: Example: Use the OCR letter recognition dataset https://archive.ics.uci.edu/ml/datasets/letter+recognition 2. Binary classification using Deep Neural Networks Example: Classify movie reviews into "positive" reviews and "negative" reviews, just based on the text content of the reviews. Use IMDB dataset
3.	Convolutional neural network (CNN) (Any One from the following) <ul style="list-style-type: none"> • Use any dataset of plant disease and design a plant disease detection system using CNN. • Use MNIST Fashion Dataset and create a classifier to classify fashion clothing into categories.
4.	Recurrent neural network (RNN) Use the Google stock prices dataset and design a time series analysis and prediction system using RNN.
Group 2	
5.	Mini Project: Human Face Recognition
6.	Mini Project: Gender and Age Detection: predict if a person is a male or female and also their age
7.	Mini Project: Colorizing Old B&W Images: color old black and white images to colorful images

@The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	1	-	2	1	-	-	-	-	-
CO2	1	2	1	-	-	1	-	-	-	-	-	1
CO3	-	1	1	1	1	1	-	-	-	-	-	-
CO4	3	3	3	-	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-
CO6	3	3	3	3	3	-	-	-	-	-	-	-
CO7	3	3	3	3	3		-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410256: Laboratory Practice VI

Teaching Scheme: Practical: 2 Hours/Week	Credit 01	Examination Scheme : Term Work: 50 Marks
---	----------------------------	---

Companion Course: Elective V (410252), Elective VI(410253)

Course Objectives:

- To understand the fundamental concepts and techniques of natural language processing (NLP)
- To understand Digital Image Processing Concepts
- To learn the fundamentals of software defined networks
- Explore the knowledge of adaptive filtering and Multi-rate DSP
- To be familiar with the various application areas of soft computing.
- To introduce the concepts and components of Business Intelligence (BI)
- To study Quantum Algorithms and apply these to develop hybrid solutions

Course Outcomes:

On completion of this course, the students will be able to

CO1: Apply basic principles of elective subjects to problem solving and modeling.

CO2: Use tools and techniques in the area of software development to build mini projects

CO3: Design and develop applications on subjects of their choice.

CO4: Generate and manage deployment, administration & security.

Guidelines for Instructor's Manual

List of recommended programming assignments and sample mini-projects is provided for reference. Referring to these, Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses. Preferably there should be multiple sets of assignments/mini-project and distributed among batches of students. Real world problems/application based assignments/mini-projects create interest among learners serving as foundation for future research or startup of business projects. Mini-project can be completed in group of 2 to 3 students. Software Engineering approach with proper documentation is to be strictly followed. Use of open source software is to be encouraged. Instructor may also set one assignment or mini-project that is suitable to the respective course beyond the scope of syllabus.

Operating System recommended: - 64-bit Open source Linux or its derivative **Programming**

Languages: C++/JAVA/PYTHON/R

Programming tools recommended: Front End: Java/Perl/PHP/Python/Ruby/.net, **Backend:**

MongoDB/MYSQL/Oracle, Database Connectivity: ODBC/JDBC, **Additional Tools:** Octave, Matlab, WEKA, powerBI

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal may consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of digital storage media/DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab Home Faculty of Engineering Savitribai Phule Pune University

Syllabus for Fourth Year of Computer Engineering assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness reserving weightage for successful mini-project completion and related documentation.

Guidelines for Practical Examination

It is recommended to conduct examination based on Mini-Project(s) Demonstration and related skill learned. Team of 2 to 3 students may work on mini-project. During the assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation and software engineering approach followed. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding, effective and efficient implementation and demonstration skills. Encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Guidelines for Laboratory Conduction

The instructor's manual is to be developed as a hands-on resource and as ready reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction and Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/assignments/ guidelines, references among others.

Recommended / Sample set of assignments and mini projects for reference for four courses offered for Elective III and for four courses offered for Elective IV. Respective Student has to complete laboratory work for elective III and IV that he/she has opted.

410252(A): Natural Language Processing

Any 5 Assignments and 1 Mini Project are mandatory

Group 1	
1.	Perform tokenization (Whitespace, Punctuation-based, Treebank, Tweet, MWE) using NLTK library. Use porter stemmer and snowball stemmer for stemming. Use any technique for lemmatization. Input / Dataset –use any sample sentence
2	Perform bag-of-words approach (count occurrence, normalized count occurrence), TF-IDF on data. Create embeddings using Word2Vec. Dataset to be used: https://www.kaggle.com/datasets/CooperUnion/cardataset
3	Perform text cleaning, perform lemmatization (any method), remove stop words (any method), label encoding. Create representations using TF-IDF. Save outputs. Dataset: https://github.com/PICT-NLP/BE-NLP-Elective/blob/main/3-Preprocessing/News_dataset.pickle
4	Create a transformer from scratch using the Pytorch library
5	Morphology is the study of the way words are built up from smaller meaning bearing units. Study and understand the concepts of morphology by the use of add delete table
Group 2	
6	Mini Project (Fine tune transformers on your preferred task) Finetune a pretrained transformer for any of the following tasks on any relevant dataset of your choice: <ul style="list-style-type: none"> • Neural Machine Translation • Classification • Summarization
7	Mini Project - POS Taggers For Indian Languages
8	Mini Project -Feature Extraction using seven moment variants
9	Mini Project -Feature Extraction using Zernike Moments
Virtual Lab: https://nlp-iiith.vlabs.ac.in/	
410252(B) Image Processing	
Any 5 Assignments and 1 Mini Project are mandatory	
Group 1	
Programming language: Python/C/C++ using OpenCV	

1.	Consider any image with size 1024*1024. Modify the image to the sizes 512*512, 256*256, 128*128, 64*64 and 32*32 using subsampling technique. Create the original image from all the above subsampled images using resampling technique. Read any image. Display the histogram, Equalized histogram, and image with equalized histogram
2	Consider any image with size 1024*1024. Modify the image to the sizes 512*512, 256*256, 128*128, 64*64 and 32*32 using subsampling technique. Create the original image from all the above subsampled images using resampling technique.
3	Read any image. Display the histogram, Equalized histogram, and image with equalized histogram
4	Read any image. Display the outputs of contrast stretching, intensity level slicing
5	Compare the results of any three edge detection algorithms on the same image dataset and do the analysis of the result.
6	Compare the result of any two image segmentation algorithm on the same image data set
7	Write a program for image compression using any three compression techniques and compare the results.

Group 2

8	Mini project: Implement visual surveillance applications and detect moving objects using object detection and tracking algorithm Or Implement any medical image processing application for freely available medical image dataset.
9	Mini Project - Implement image segmentation to detect object in the background of image.

410252(C) : Software Defined Networks

Any 5 Assignments and 1 Mini Project are mandatory

Group 1

1.	Prepare setup for Mininet network emulation environment with the help of Virtual box and Mininet. Demonstrate the basic commands in Mininet and emulate different custom network topology(Simple, Linear, and Tree).View flow tables.
2	After studying open source POX and Floodlight controller, Install controller and run custom topology using remote controller like POX and floodlight controller. Recognize inserted flows by controllers.
3	Create a SDN environment on Mininet and configure a switch to provide a firewall functionality using POX controller. Ref: https://github.com/mininet/openflow-tutorial/wiki/Create-Firewall

4	Using Mininet as an Emulator and POX controller, build your own internet router. Write simple outer with a static routing table. The router will receive raw Ethernet frames and process the packet forwarding them to correct outgoing interface. You must check the Ethernet frames are received and the forwarding logic is created so packets go to the correct interface. Ref: https://github.com/mininet/mininet/wiki/SimpleRouter
5	Emulate and manage a Data Center via a Cloud Network Controller: create a multi-rooted tree-like (Clos) topology in Mininet to emulate a data center. Implement specific SDN applications on top of the network controller in order to orchestrate multiple network tenants within a data center environment, in the context of network virtualization and management. Ref: https://opencourses.uoc.gr/courses/pluginfile.php/13576/mod_resource/content/2/exercise_5.pdf
6	Study Experiment: Study in details Cloud seeds automates IAAS using SDN and a high-performance network from Juniper SDN Framework.

410252(D) : Advanced Digital Signal Processing

Any 5 Assignments and 1 Mini Project are mandatory

Group 1

Use

A] MATLAB or other equivalent software working with speech and image signals/files and for analysis purpose.

B] C++ or JAVA for working with sampled data (n – point data samples of DT/Digital signal)

C] JAVA or other for image processing assignments

1.	Apply 1-D DFT to observe spectral leakage and frequency analysis of different window sequences, plot the frequency spectrums.
2.	Adaptive FIR and IIR filter design: A] Steepest descent and Newton method, LMS method, B] Adaptive IIR Filter design: Pade Approximation, Least square design
3.	Power spectrum estimation and analysis: Take a speech signal and perform A] Non parametric method: DFT and window sequences B] Parametric methods: AR model parameters
4.	Multi-rate DSP and applications – Decimation, Interpolation, sampling rate conversion A] Take a speech signal with specified sampling frequency. Decimate by factor D(e.g. factor B] Take a speech signal with specified sampling frequency. Interpolate by factor I(e.g. factor C] Sampling rate conversion by factor of I/D
5.	Write a program to calculate LPC coefficients, reflection coefficients using Levinson Durbin algorithm

- | | |
|----|--|
| 6. | Feature Extraction of speech signal
A] Using LPC and other methods
B] Apply different coding methods: harmonic coding, vector quantization |
|----|--|

Group 2:

- | | |
|---|--|
| 7 | Mini-Project : Discrete Cosine Transform (DCT)
A] To find DCT of NxN image block
B] To plot spectrum of the speech signal using DCT and find the correlation of DCT transformed signal
C] Image filtering using DCT : LPF, edge detection
D] Image compression using DCT, Image resizing
OR
Mini-Project : Image Processing
A] Histogram and Equalization
B] Image Enhancement Techniques
C] Image Filtering: LPF, HPF, Sobel/Prewitt Masks
D] Image Smoothing with special filters: Median, Weiner, Homomorphic filters |
|---|--|

410252(E) : Open Elective

- | | |
|----|--|
| 1. | Suitable set of programming assignments/Mini-projects for open elective Opted. |
|----|--|

PART II 410253 : Elective VI

410253(A) Pattern Recognition

Any 5 Assignments and 1 Mini Project are mandatory

Group 1

- | | |
|---|---|
| 1 | Extraction of features using structural and feature space methods for Indian Fruits |
| 2 | Face Recognition using PCA and multiclass LDA. |
| 3 | Fruit shape recognition using Eigen Faces and Fisher Faces |
| 4 | Perform sentiment analysis on the IMDB movie reviews dataset |
| 5 | Perform a classification task on a dataset of modulated radio signals. |
| 6 | Perform image segmentation on the Berkley Segmentation dataset |

Group 2

- | | |
|---|--|
| 6 | Mini Project - Real-time face detection in multi-scale images with an attentional cascade of boosted classifiers. |
|---|--|

7

Mini Project - Printed Devanagari Text Recognition using structural approach.**410253(B) : Soft Computing**

Any 5 Assignments and 1 Mini Project are mandatory

Group 1

1

Design an X-OR Gate with feed-forward neural network (also popularly known as a Multilayer Perceptron) classifier.

2

Symmetric and Asymmetric implementation of Particle Swarm Optimization for Traveling Salesman Problem.

3

Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

4

Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

5

Implement genetic algorithm for benchmark function (eg. Square, Rosenbrock function etc) Initialize the population from the Standard Normal Distribution. Evaluate the fitness of all its individuals. Then you will do multiple generation of a genetic algorithm. A generation consists of applying selection, crossover, mutation, and replacement.

Use:

- Tournament selection without replacement with tournament size s
- One point crossover with probability P_c
- bit-flip mutation with probability P_m
- use full replacement strategy

Group 2

6

Mini Project - Create a small hybrid system for solving a chosen problem by following the given steps below.

1. Explain on one page the main characteristics of hybrid systems.
2. For the task chosen from the list below, create a multimodular block diagram of a possible solution to the problem.
3. Choose appropriate techniques for solving each sub problem represented as a module. What alternatives are there for each of them?
4. Create subsystems for solving each of the sub problems. Compile the whole hybrid system.
5. Make experiments with the hybrid system and validate the results.

Mini Project: Handwritten digits recognition
Mini Project: Bank loan approval decision-making system
Mini Project: Stock market prediction
Mini Project: Unemployment prediction
Mini Project: Spoken words recognition, for example, "on"/"off"; "yes"/"no"; "stop"/ "go."
Mini Project: Loan approval

410253(C) : Business Intelligence

Any 5 Assignments and 1 Mini Project are madatory

Group 1

1	Import the legacy data from different sources such as (Excel , Sql Server, Oracle etc.) and load in the target system. (You can download sample database such as Adventure works, Northwind, foodmart etc.)
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sql server.
3	Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.
4	Import the data warehouse data in Microsoft Excel and create the Pivot table and Pivot Chart
5	Perform the data classification using classification algorithm. Or Perform the data clustering using clustering algorithm.

Group 2

6	Mini Project: Each group of 4 Students (max) assigned one case study for this; A BI report must be prepared outlining the following steps: a) Problem definition, identifying which data mining task is needed. b) Identify and use a standard data mining dataset available for the problem.
---	---

410253(D) :Quantum Computing

Any 4 Assignments and 1 Mini Project are mandatory

Group 1

1	Analyze simple states of superposition and the effect of doing the measurement in different basis states .
2	Build simple quantum circuits with single and two-qubit gates
3	Install Setup for running quantum programs on IBM machines.

4	Analyze the effectiveness of simple error correction scheme
5	Implement quantum programs in NISQ model of computing
6	Make a script for visualizing the energy levels of Hamiltonians.

Group 2

6	Mini Project: Build a Quantum Random Number Generator.
7	Mini Project: Implement Grover's Search Algorithm.
7	Mini Project: Use Shor's Algorithm to Factor a Number.

410253(E) : Open Elective

1.	Suitable set of programming assignments/Mini-projects for open elective Opted.
----	--

@The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	3	-	-	-
CO4	2	-	2	-	-	3	-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410256: Project Work Stage II

Teaching Scheme:	Credit	Examination Scheme:
TH: 06 Hours/Week	06	Term work: 100 Marks Presentation: 50Marks

Prerequisite Courses: Project Stage I(410248)

Course Objectives:

- To follow SDLC meticulously and meet the objectives of proposed work
- To test rigorously before deployment of system
- To validate the work undertaken
- To consolidate the work as furnished report

Course Outcomes:

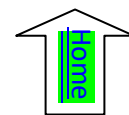
On completion of the course, student will be able to–

- CO1: Show evidence of independent investigation
- CO2: Critically analyze the results and their interpretation.
- CO3: Report and present the original results in an orderly way and placing the open questions in the right perspective.
- CO4: Link techniques and results from literature as well as actual research and future research lines with the research.
- CO5: Appreciate practical implications and constraints of the specialist subject

Guidelines

In Project Work Stage–II, the student shall complete the remaining project work which consists of Selection of Technology and Tools, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems and comparative analysis and validation of results and conclusions. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is duly certified by the concerned guide and head of the Department/Institute

Follow guidelines and formats as mentioned in Project Workbook recommended by Board of Studies



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410257: Audit Course 8

In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at Institute level itself [1]

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

- | | |
|--|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations or presentations | <ul style="list-style-type: none"> Surveys Mini-Project Hands on experience on focused topic |
|--|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentation or Report

Audit Course 5 Options

Audit Course Code	Audit Course Title
AC8-I	Usability Engineering
AC8- II	Conversational Interface
AC8-III	Social Media and Analytics
AC8-IV	MOCC-Learn New Skills
AC8-V	Emotional Intelligence



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410257: Audit Course 8
AC8 – I: Usability Engineering

In this course you will have a hands-on experience with usability evaluation and user-centered design. This course will not help to learn how to implement user interfaces, but rather how to design based on the needs of users, which you will determine, and learn how to evaluate your designs rigorously. This help in knowing more about the usability; human computer interaction, the psychological aspects of computing, evaluation.

Course Objectives:

- To understand the human centered design process and usability engineering process and their roles in system design and development.
- To know usability design guidelines, their foundations, assumptions, advantages, and weaknesses
- Understand the user interface based on analysis of human needs and prepare a prototype system

Course Outcome:

On completion of the course, learner will be able to–

CO1: Describe the human centered design process and usability engineering process and their roles in system design and development.

CO2: Discuss usability design guidelines, their foundations, assumptions, advantages, and weaknesses.

CO3: Design a user interface based on analysis of human needs and prepare a prototype system.

CO4: Assess user interfaces using different usability engineering techniques.

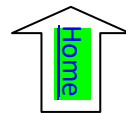
CO5: Present the design decisions

Course Contents:

1. What Is Usability?: Usability and Other Considerations, Definition of Usability, Example: Measuring the Usability of Icons, Usability Trade-Offs, Categories of Users and Individual User Differences
2. Usability in Software Development : The Emergence of Usability, Human Computer Interaction, Usability Engineering
3. The usability Engineering Lifecycle: Requirement Analysis, Design, Testing, Development
4. Usability Assessment Methods beyond Testing
5. International User Interfaces

Books:

1. Mary Beth Rosson, John Millar Carroll, “Usability Engineering: Scenario- based Development of Human- Computer Interaction”
2. Jakob Nielsen, “Usability Engineering”
1. Deborah J. Mayhew, “ The usability engineering lifecycle”



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410257: Audit Course 8
AC8 – II: Conversational Interfaces

Effective information security at the enterprise level requires participation, planning, and practice. It is an ongoing effort that requires management and staff to work together from the same script. Fortunately, the information security community has developed a variety of resources, methods, and best practices to help modern enterprises address the challenge. Unfortunately, employing these tools demands a high degree of commitment, understanding, and skill attributes that must be sustained through constant awareness and training.

Course Objectives:

- To understand the basics of conversation
- To know the interactive environments for conversational skills
- To acquaint with the speech to text and text to speech techniques

Course Outcome:

On completion of the course, learner will be able to–

CO1: Develop an effective interface for conversation

CO2: Explore advanced concepts in user interface

Course Contents:

- 1. Introduction to Conversational Interface:** Preliminaries, Developing a speech based Conversational Interface, Conversational Interface and devices.
- 2. A technology of Conversation:** Introduction, Conversation as Action, The structure of Conversation, The language of Conversation.
- 3. Developing a Speech-Based Conversational Interface:** Implementing Text to Speech: Text Analysis, Wave Synthesis, Implementing Speech Recognition: Language Model, Acoustic Model, Decoding. Speech Synthesis Markup Language.
- 4. Advanced voice user interface design**

Books:

1. Cathy Pearl, “Designing Voice User Interfaces: Principles of Conversational Experiences”
2. Michael McTear, Zoraida Callejas, David Griol, “The Conversational Interface: Talking to Smart Devices”
3. Martin Mitrevski, “Developing Conversational Interfaces for iOS: Add Responsive Voice Control”
4. Srinivasan, “Hands-On Chatbots and Conversational UI Development: Build chatbots”



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering(2019Course)
410257:Audit Course8
AC8–III: Social Media And Analytics

This course aims to create awareness among the students regarding social media and analytics.

Course Objectives:

- Get strategic understanding of Digital Marketing and Social Media Marketing.
- Understand how to use it for branding and sales.
- Understand its advantages& limitations.
- Become familiar with Best Practices, Tools & Technologies.
- Blend digital and social marketing with offline marketing.
- Plan and manage digital marketing budget.
- Manage Reporting & Tracking Metrics.
- Understand the future of Digital Marketing and prepare for it.

Course Outcome:

On completion of the course, learner will be able to–

CO1: Develop a far deeper understanding of the changing digital land scape.

CO2: Identify some of the latest digital marketing trends and skill sets needed for today's marketer.

CO3: Successful planning, prediction, and management of digital marketing campaigns

CO4: Assess user interfaces using different usability engineering techniques.

CO5: Implement smart management of different digital assets for marketing needs.

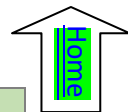
CO6: Assess digital marketing as a long term career opportunity.

Course Contents:

1. Digital Marketing, History of Digital Marketing, Importance of Digital Marketing, Effective use of Digital Marketing, Effects of wrong Digital Marketing, Digital Marketing to develop brands, Digital Marketing for sales, Digital Marketing for product and service development.
2. Techniques for effective Email Marketing and pitfalls, Various online email marketing platforms such as Campaign Monitor and Mail Chimp, Web content, web usability, navigation and design, Bookmarking and News Aggregators, Really Simple Syndication (RSS), Blogging, Live Chat, User Generated Content (Wikipedia etc), Multi-media - Video (Video Streaming, YouTube etc), Multi-media - Audio & Podcasting (iTunes etc), Multi-media - Photos/Images (Flickr etc), Google Alerts and Giga Alert (Brand, product and service monitoring online), Crowd sourcing, Virtual Worlds.
3. Search Engine Optimization (SEO), Search Engine Optimization (SEO) tips and techniques, Google Adwords, Google various applications such as 'Google Analytics', Maps, Places etc to enhance a brand's products, services and operations.
4. Facebook & LinkedIn and other Social Media for areal marketing, Utilizing Facebook and LinkedIn's Advertising functionality and Applications, Brand reputation management techniques, Systems for 'buzz monitoring' for brands, products and services, Effective Public Relations (PR) online and business development.

References:

1. Vandana Ahuja, “Digital Marketing”, Oxford Press, ISBN:9780199455447, 1st Edition.
2. Wiley, Jeanniey, Mullen, David Daniels, David Gilmour, “Email Marketing: An Hour a Day, -ISBN:978-0-470-38673-6, 1st Edition.



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410257: Audit Course 8
AC8 – IV: MOOC-learn New Skill

This course aims to create awareness among the students regarding various courses available under MOOC and learn new skills through these courses.

Course Objectives:

- To promote interactive user forums to support community interactions among students, professors, and experts
- To promote learn additional skills anytime and anywhere
- To enhance teaching and learning on campus and online

Course Outcomes:

On completion of the course, , students will be able to
 CO1: To acquire additional knowledge and skill.

About Course

MOOCs (Massive Open Online Courses) provide affordable and flexible way to learn new skills, pursue lifelong interests and deliver quality educational experiences at scale. Whether you're interested in learning for yourself, advancing your career or leveraging online courses to educate your workforce, SWAYAM, NPTEL, edx or similar ones can help. World's largest SWAYAM MOOCs, a new paradigm of education for anyone, anywhere, anytime, as per your convenience, aimed to provide digital education free of cost and to facilitate hosting of all the interactive courses prepared by the best more than 1000 specially chosen faculty and teachers in the country. SWAYAM MOOCs enhances active learning for improving lifelong learning skills by providing easy access to global resources.

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy. This is done through an indigenous developed IT platform that facilitates hosting of all the courses, taught in classrooms from 9th class till post-graduation to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to the residents in India. More than 1,000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.

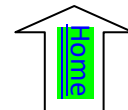
The courses hosted on SWAYAM is generally in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology. In order to ensure best quality content are produced and delivered, seven National Coordinators have been appointed: They are NPTEL for engineering and UGC for post-graduation education.

Guidelines:

Instructors are requested to promote students to opt for courses (not opted earlier) with proper mentoring. The departments will take care of providing necessary infrastructural and facilities for the learners.

References:

4. <https://swayam.gov.in/>
5. <https://onlinecourses.nptel.ac.in/>
6. <https://www.edx.org>



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410249: Audit Course 8
AC8 – V: Emotional Intelligence

This Emotional Intelligence (EI) training course will focus on the five core competencies of emotional intelligence: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Participants will learn to develop and implement these to enhance their relationships in work and life by increasing their understanding of social and emotional behaviors, and learning how to adapt and manage their responses to particular situations. Various models of emotional intelligence will be covered.

Course Objectives:

- To develop an awareness of EI models
- To recognize the benefits of EI
- To understand how you use emotion to facilitate thought and behavior
- To know and utilize the difference between reaction and considered response

Course Outcomes:

On completion of the course, learner will be able to–

- CO1: Expand your knowledge of emotional patterns in yourself and others
 CO2: Discover how you can manage your emotions, and positively influence yourself and others
 CO3: Build more effective relationships with people at work and at home
 CO4: Positively influence and motivate colleagues, team members, managers
 CO5: Increase the leadership effectiveness by creating an atmosphere that engages others

Course Contents

- 1. Introduction to Emotional Intelligence (EI) :** Emotional Intelligence and various EI models, The EQ competencies of self-awareness, self-regulation, motivation, empathy, and interpersonal skills, Understand EQ and its importance in life and the workplace
- 2. Know and manage your emotions:** emotions, The different levels of emotional awareness, Increase your emotional knowledge of yourself, Recognize „negative“ and „positive“ emotions. The relationship between emotions, thought and behavior, Discover the importance of values, The impact of not managing and processing „negative“ emotions, Techniques to manage your emotions in challenging situations
- 3. Recognize emotions in others :** The universality of emotional expression, Learn tools to enhance your ability to recognize and appropriately respond to others' emotions, Perceiving emotions accurately in others to build empathy
- 4. Relate to others:** Applying EI in the workplace, the role of empathy and trust in relationships, Increase your ability to create effective working relationships with others (peers, subordinates, managers, clients, Find out how to deal with conflict, Tools to lead, motivate others and create a high performing team.

Books:

1. Daniel Goleman, “[Emotional Intelligence – Why It Matters More Than IQ](#),” , BantamBooks, ISBN-10: 055338371X ISBN-13: 978-0553383713
2. Steven Stein , “[The EQ Edge](#)” , Jossey-Bass, ISBN : 978-0-470-68161-9
3. Drew Bird , “[The Leader’s Guide to Emotional Intelligence](#)” , ISBN: 9781535176002



Acknowledgement

It is with great pleasure and honor that I share the curriculum for Fourth Year of Computer Engineering (2019 Course) on behalf of Board of Studies (BoS), Computer Engineering. We, members of BoS are giving our best to streamline the processes and curricula design at both UG and PG programs.

It is always the strenuous task to balance the curriculum with the blend of core courses, current developments and courses to understand social and human values. By considering all the aspects with adequate prudence the contents are designed satisfying most of the necessities as per AICTE guidelines and to make the graduate competent enough as far as employability is concerned. I sincerely thank all the minds and hands who work adroitly to materialize these tasks. I really appreciate everyone's contribution and suggestions in finalizing the contents.

Success is sweet. But it's sweeter when it's achieved thorough co-ordination, cooperation and collaboration. I am overwhelmed and I feel very fortunate to be working with such a fabulous team- the Members of Board of Studies, Computer Engineering!

Even in these anxious situation, during the time of this unfortunate pandemic, each and every person, including the course coordinators and their team members, have worked seamlessly to come up with this all-inclusive curriculum for Fourth Year of Computer Engineering.

Thank you to all of you for delivering such great teamwork. I don't think it would have been possible to achieve the goal without each and every one of your efforts! I would like to express my deep gratitude to Dr. Pramod D. Patil (Dr. D. Y. Patil Institute of Technology, Pimpri), member BoS, Computer Engineering, for coordinating the complete activity and getting it to completion in a smooth manner.

I deeply appreciate and thank the managements of various colleges affiliated to SPPU for helping us in this work. These colleges have helped us by arranging sessions for preliminary discussion in the initial stage and at the same time in conducting Faculty Development Programs for various courses of the revised curriculum. All your support is warmly appreciated.

I sincerely appreciate, the hard work put in by the course coordinators and their team members, without your intellectual work and creative mind, and it would have not been possible to complete this draft. You have been a valuable member of our team!

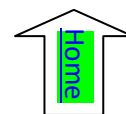
Special thanks are due to Dr. Santosh Kumar Chobe, Dr. Jyoti Rao, Dr. Swati Nikam, Dr. C. R. Jadhav, Dr. S. S. Das, Dr. Rachna Somkunwar, Prof. Rajesh D. Bharati, Prof. Rupesh Mahajan, Prof. Yogesh S. Sapnar for helping with the formatting and crisp presentation of this draft. I would like to thank you from the core of my heart. Thank you for always being your best selves and contributing to the work.

I am thankful to Prof. Yogesh Shivaji Sapnar SCTR's Pune Institute of Computer Technology, Pune for the time he has spent in critically reading the draft and giving the final touches. I appreciate his initiative and thank him for his time, patience and hard work!

Thank you all, for not only your good work but also for all the support you have given each other throughout the drafting process, that's what makes the team stronger! You took the meaning of teamwork to a whole new level. Thank you for all your efforts!

Professor (Mrs.) Dr. Varsha H. Patil, Chairman, and Members- Dr. Shirish Sane, Dr. Sunil Bhirud, Dr. Manik Dhore, Dr. Pramod Patil, Dr. Girish Khilari, Dr. Sachin Lodha, Dr. Parikshit Mahalle, Dr. Venkatesharan, Dr. Geetanjali Kale, Dr. Suhasini Itkar, Dr. R. V. Patil, Dr. P. M. Yawalkar, and Dr. Swati A. Bhavsar.

Board of Studies (BoS), Computer Engineering, Faculty of Science and Technology, Savitribai Phule Pune University



Task Force at Curriculum Design

1. Advisors, the Team of Board of Studies-

Dr. Varsha Patil (Chairman), Dr. Shirish Sane, Dr. Sunil Bhirud, Dr. Manik Dhore, Dr. Pramod Patil, Dr. Rajesh Prasad, Dr. Girish Khilari, Dr. Sachin Lodha, Dr. Parikshit Mahalle, Dr. Venkatesharan, Dr. Geetanjali Kale, Dr. Suhasini Itkar, Dr. R. V. Patil Dr. P. M. Yawalkar, and Dr. Swati A. Bhavsar.

2. Team Leader- Dr. Pramod D. Patil, Dr. D. Y. Patil Institute of Technology, Pimpri

3. Teams, Course Design -

Name of Course	Team Coordinator	Team Members	
Design and Analysis of Algorithms	Dr. Santosh V. Chobe	Dr. Sunil Dhore Dr. Rachna Somkunwar Prof. S. P. Pingat	Mrs.Pragati Chaudhari Dr.Vaihsali Tidake
Machine Learning	Dr. Sheetal Sonawane	Mr. Rajesh Bharati Mr. Abhijit D. Jadhav Dr. K. V. Metre Mr.Pratik Ratadiya(Industry)	Dr.Ajitkumar Shitole Mrs.Arпита Gupta(Industry) Mr.Rajvardhan Oak(Industry)
Blockchain Technology	Dr. Sonali Patil	Dr.Geeta.S.Navale Dr. Aparna A. Junnarkar Dr. Amar Buchade	Dr. Swati Nikam Dr.Mininath Nighot
Elective III: Pervasive Computing	Prof.R.L.Paikrao	Prof.Sagar B. Shinde Prof. Dhondiram D. Pukale Mr. B.B.Gite	Prof.Sanjay Agrawal Prof.Priyanka More
Elective III : Multimedia Techniques	Dr. B.A.Sonkamble	Dr.Madhuri P. Borawake Prof Gosavi	Mr. Ranjit M. Gawande Prof.Shweta Koparde
Elective III : Cyber Security and Digital Forensics	Dr. Girija G. Chiddarwar	Prof. B.L.Dhote Prof. N. D. Kale Dr.Nikita Kulkarni Dr.Uma Godase	Prof. P.A. jain
Elective III: Object Oriented Modeling and Design	Prof. Rahul Patil	Mr.Balasaheb S. Tarle Mr.Kishor R. Pathak Mr. Santosh Sambare	Prof.Ashwini A. Jarali Mrs.Neelam Patil
Elective III: Digital Signal Processing	Prof. M.S. Wakode	Prof. P.A. Jain Prof.Yogesh S. Sapnar	
Elective IV:Information Retrieval	Dr. Sharmila Wagh	Dr. Jayadevan R. Mr. Prashant Ahire Dr. Dinesh Hanchate	Mr.Devidas Thosar Dr.S. B . Tambe
Elective IV:GPU Programming and Architecture	Mrs.Jayshree R. Pansare	Mr. S. A. Thanekar Mrs.Asha Sathe Dr.sandip kadam	Dr.Deepak Mane Mr. D.D.Sapkal Prof. Manisha V. Marathe

Elective IV:Mobile Computing	Dr. Manisha Bhende	Dr.R. M. Wahul Dr.Archana Kale Ms. S. V. Bodake	Dr. D. P. Gaikwad Mrs.Nadaph A. Gulab Dr.M.L. Dhore Prof.Yogesh S. Sapnar
Elective IV:Software Testing and Quality Assurance	Dr. Uday C. Patkar	Dr.S.K.Sonkar Dr. S. U. Kadam Mr.Rahul G. Teni Prof. Vina M. Lomte	Dr. Sunil Khatal Ms. Ila Shridhar Savant Prof. Vandana S. Rupnar Prof.Yogesh S. Sapnar
Elective IV:Quantum Computing	Dr. M. U. Kharat	Dr. M. U. Kharat	Prof.Yogesh S Sapnar
Lab Practice III	Dr.Vaihsali Tidake	Dr. Santosh V. Chobe Dr. Sheetal Sonawane DR.S.D. Babar	
Lab Practice IV	Mr. Rajesh Bharati	Prof.R.L.Paikrao Dr. B.A.Sonkamble Dr. Jyoti Rao Prof. Rahul Patil Dr. Sharmila Wagh	Dr. A.V. Dhumane Dr. Manisha Bhende Dr. Uday C. Patkar
Project Stage I	Dr. Swati A. Bhavsar	Dr. Swati A. Bhavsar	
Audit Course 7	Prof.Satish S. Banait	Prof.Satish S. Banait	
High Performance Computing	Dr. Rachna Somkunwar	Mrs. Archana S. Vaidya Mrs. Rushali Patil Prof.S.P.Khedkar	Dr. G.R.Shinde Mrs.B.Mahalakshmi
Deep Learning	Dr. Archana Chaugule	Mr. Abhijit D. Jadhav Prof. A.G.Phakatkar Dr. N. K. Bansode	Dr.Kamini A.Shirsath Mr.Jameer kotwal
Natural Language Processing	Dr. M.S.Takalikar	Dr. Pankaj Agarkar Prof. Dr. S. V. Shinde Dr. S. B. Chaudhari	Prof. Deptii Chaudhari Mrs. Dipalee D. Rane
Image Processing	Dr. Sudeep D. Thepade	Prof.M.P. Wankhade Dr. S. R. Dhore	Dr. B.D.Phulpagar Dr.Jayshree Pansare
Software Defined Networks	Dr. S. D. Babar	Dr. A. A. Dandavate Dr. K.S. Wagh Dr.Vinod V. Kimbahune	Dr. Geetika Narang Ms. D. B. Gothwal
Advanced Digital Signal Processing	Dr.P. A. Khadkikar	Prof.Yogesh S. Sapnar Prof.M.S.Wakode	
Compiler Construction	Prof.Yogesh S Sapnar	Ms. Kainjan Sanghavi Dr. Swati A. Bhavsar	
Pattern Recognition	Dr. A. S. Ghotkar	Dr. Amol Potgantwar Dr. Sable N. Popat Dr.Sandeep Chaware	Mr. P. M. Kamde Dr. V. S. Pawar Dr.P. A. Khadkikar

Soft Computing	Dr. Madhuri A. Potey	Prof. Dr. D. V. Patil Dr. Sandeep Patil Dr. D. V. Medhane	Prof. P.S.Game Dr. Archana Kollu
Business Intelligence	Dr. K. Rajeswari	Dr. Zaware S. Nitin Prof. Y.A.Handage Dr. M. R. Sanghavi	Mr. D.G.Modani Mr. Subhash G. Rathod
Lab Practice V	Dr. G. R. Shinde	Dr. Rachna Somkunwar Dr. Archana Chaugule	
Lab Practice VI	Dr.Kamini A. Shirsath	Dr. M.S.Takalikar Dr. Sudeep D. Thepade Dr. Sonali Patil Dr. S. D. Babar	Dr. A.S.Ghotkar Dr. Sulochana Sonkamble Dr. Madhuri A. Potey Prof. Dr. K. Rajeswari
Project Stage II	Dr. Swati A. Bhavsar	Dr. Swati A. Bhavsar	
Audit Course 8	Dr. Shaikh Nuzhat Faiz	Dr. Shaikh N. Faiz	