



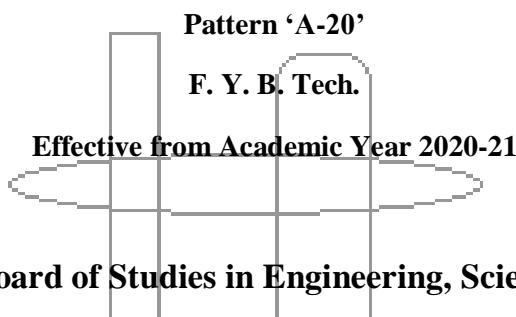
Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

Department of Engineering, Sciences & Humanities (DESH)



Prepared by: - Board of Studies in Engineering, Sciences & Humanities

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Contents

Sr. No.	Title	Page No.
	Program Outcomes	3
	Course Structure –	4

Course Syllabi for Module I (M₁) and Module II (M₂) Courses – Semester I and II

1	ES1031	Cognitive Aptitude	5
2	ES1032	Engineering Mathematics	6
3	ES1033	Systems Engineering	8
4	ES1037	Mobile Application Development	11
5	HS1033	Human Engineering	13

Course Syllabi for Module I (M₁) and Module II (M₂) Courses – Semester I

6	ES1034	Problem Solving and Programming	15
7	ES1035	Robot: Mechanics and Electronics	19
8	ES1036	Capstone Project 1	22
9	HS1034	General Proficiency and Professional Development	25

Course Syllabi for Module I (M₁) and Module II (M₂) Courses – Semester II

10	ES1038	Data Structures Using Python	27
11	ES1039	Mechatronics and Robotics	31
12	ES1040	Capstone Project 2	33
13	ES1014	Environmental Science	37

Program Outcomes

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. 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.
- 3. 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.
- 4. 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.
- 5. 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.
- 6. 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.
- 7. 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.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** 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.
- 11. 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.
- 12. 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

Academic Information – Please visit www.vit.edu

F. Y. B. Tech. Structure for Module I and II in Semester I and Semester II

F.Y. B. Tech. Structure for First Semester

Course Code	Course Name	Teaching Learning Scheme				
		Th	Tut	Lab	Hrs. / Week	Credits
Module I (M₁) Course – Semester I						
ES1031	Cognitive Aptitude	3	0	0	3	3
HS1033	Human Engineering	3	0	0	3	3
ES1037	Mobile Application Development	0	0	2	2	1
Module II (M₂) Course – Semester I						
ES1032	Engineering Mathematics	3	0	0	3	3
ES1033	Systems Engineering	3	0	2	5	4
Courses Irrespective Of Module In Semester I						
ES1034	Problem Solving and Programming	3	1	2	6	5
ES1035	Robot: Mechanics and Electronics	3	1	2	6	5
ES1036	Capstone Project 1	0	0	6	6	3
Audit Course						
HS1034	General Proficiency and Professional Development	2	0	0	2	0
Grand Total Module I / Module II – Semester I		14	2	12	28	20

F.Y. B. Tech. Structure for Second Semester

Course Code	Course Name	Teaching Learning Scheme				
		Th	Tut	Lab	Hrs. / Week	Credits
Module I (M₁) Course – Semester II						
ES1032	Engineering Mathematics	3	0	0	3	3
ES1033	Systems Engineering	3	0	2	5	4
Module II (M₂) Course – Semester II						
ES1031	Cognitive Aptitude	3	0	0	3	3
HS1033	Human Engineering	3	0	0	3	3
ES1037	Mobile Application Development	0	0	2	2	1
Courses Irrespective Of Module In Semester II						
ES1038	Computing With Python	3	1	2	6	5
ES1039	Mechatronics and Robotics	3	1	2	6	5
ES1040	Capstone Project 2	0	0	6	6	3
Audit Course						
ES1014	Environmental Science	2	0	0	2	0
Grand Total Module I / Module II – Semester II		14	2	12	28	20

Course Name: COGNITIVE APTITUDE

Course Code: ES1031

Credits: 3	Teaching Scheme: Theory: 3 Hours / Week
Section I	
Coding Decoding, Direction Sense, Blood Relations, Analogy (word, letter, number, mixed), Ranking and Ordering, Eligibility Testing, Syllogism, Inequalities, Sitting Arrangements, Clock and Calendar, Statements & Arguments, Statements & Course of Action, Cause and Effect, Cubes and Dice, Image Analysis (mirror & water images), Cubes and Cuboid, Error Detection, Grammar, Cloze Test, Comprehension, Double Fillers, Para jumbled sentences, One-word substitution	
Section II	
Divisibility Rules, Numbers, Factors and multiples, Applications of HCF and LCM, Ratio, Proportion, Variation, Linear Equations, Number Systems, Ages, Averages, Percentage, Ratio and Proportion, Simple Interest, Compound Interest, Mensuration. Time & Work, Pipes and Cisterns, Boats and Streams, Partnerships, Problems on Trains, Working with different efficiencies, Work equivalence, Division of wages, Relative Speed, Problems based on Races, Percentages as Fractions and Decimals, Fundamental Counting principle, Basics of Permutation and Combination, Probability	
Text Books:	
1. Dr. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. Chand Publications. 2. Dr. R. S. Aggarwal, "A Modern Approach to Logical Reasoning", S. Chand Publication.	
Reference Books:	
1. Peeyush Bhardwaj, "The Hands-on Guide to Analytical Reasoning and Logical Reasoning", Arihant Publication. 2. Arun Sharma, "How to Prepare for Logical Reasoning", McGraw Hill Publication. 3. Nishit Sinha, "Logical Reasoning and DI", Pearson Publication. 4. Moore, Parker, "Critical Thinking", McGraw Hill Publication. 5. Arun Sharma, "How to Prepare for Quantitative Aptitude", Tata McGraw Hill. 6. K. SarveshVerma, Quantitative Aptitude Quantum Cat Common Admission Test, Arihant Publications.	
Course Outcomes :	
The student will be able to –	
1. Improve analytical and logical reasoning ability. 2. Identify and Evaluate deductive and inductive arguments. 3. Identify logical errors and false conclusions. 4. Improve aptitude, problem solving skills and reasoning ability. 5. Critically evaluate various real-life situations by resorting to analysis of key issues and factors. 6. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.	

Course Name: ENGINEERING MATHEMATICS

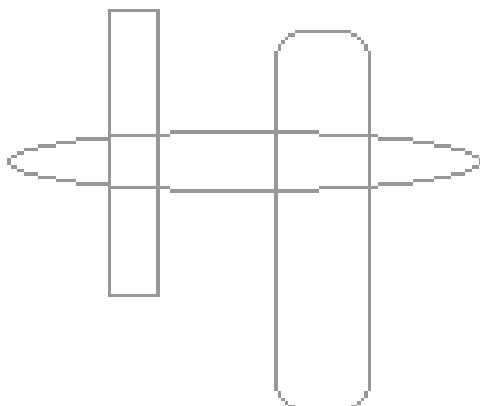
Course Code: ES1032

Credits: 3	Teaching Scheme: Theory: 3 Hours / Week
Section I	
<p>System of Linear Equations: Rank of matrix, Elementary Matrices, System of linear equations.</p>	
<p>Vector Spaces: Euclidean Vector space, Vector Space, Subspace, Span of a set, Spanning Set, Fundamental Subspaces, Linear Dependence, Independence, Basis and dimension of a vector space, Inner product, Orthogonal Bases: Gram Schmidt Process.</p>	
<p>Linear Transformation: Definition, Kernel, Range, Matrix of Linear Transformation, One-one, Onto transformation, Orthogonal Transformation, Geometric transformations in \mathbb{R}^2 and \mathbb{R}^3.</p>	
Section II	
<p>Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a matrix, Diagonalization, Symmetric Matrices and Orthogonal Diagonalization, Quadratic forms and its Applications.</p>	
<p>Functions of two or more variables: Introduction to functions of two or more variables, Level surfaces, limits and continuity, Partial derivatives, chain rules, Jacobian, maxima and minima of functions of two variables.</p>	
<p>Higher order Linear Differential equations: First order linear ode, Second order ODEs and its applications: Homogeneous Linear ODE's, Non homogeneous ODE's.</p>	
<p>System of Differential equations: Basics of system of differential equations, Solutions of system of differential equations.</p>	
<p>Text Books:</p> <ol style="list-style-type: none">1. Ron Larson and David C. Falvo, 'Linear Algebra :An Introduction', 1st Edition, Cengage Learning (Indian Edition).2. Ron Larson and Bruce H. Edwards, 'Text book of Calculus', Brooke/Cole, a part of Cengage Learning (Indian Edition), (c) 2011.3. Erwin Kreyszig, 'Advanced Engineering Mathematics'10th Edition, Dec. 2010, , John Wiley and sons, Inc.	
<p>Reference Books:</p> <ol style="list-style-type: none">1. David C. Lay, 'Linear Algebra and its Applications', 3rd Edition, Pearson.2. Jim DeFranza and Daniel Gagliardi, 'Introduction to Linear Algebra with Applications', Tata McGraw-Hill Edition.3. Gilbert Strang, 'Linear Algebra and its Applications', 4th Edition, Cengage Learning.4. B.V. Ramana, 'Higher Engineering Mathematics' Tata McGraw-Hill publishing co. Ltd.5. Michael D. Greenberg; Advanced Engineering Mathematics; Pearson Education Asia6. Peter V. O'Neil; Advanced Engineering Mathematics; 5th edition, Thomson Brooks/Cole.	

Course Outcomes:

The student will be able to –

1. solve and analyze the system of linear equations.
2. recognize the concepts of spanning set, basis, dimension linear transformation, inner product, linear dependence/independence, Basis and Dimension
3. find eigen values and eigen vectors
4. demonstrate the knowledge of partial derivative and its applications
5. solve linear differential equations and interpret the solution
6. translate a physical problem into a mathematical model and find a solution of the model by selecting and applying a suitable mathematical method.



Course Name: SYSTEMS ENGINEERING

Course Code: ES1033

Credits: 3

Teaching Scheme: Theory: 3 Hours / Week

Lab: 2 Hours / Week

Section I

Operations Strategy : Manufacturing vs Service Operations, Concept of Process as applied to manufacturing and services, SIPOC (Supplier-Input-Process-Output-Customer), Process Choices in Manufacturing: Project, Job Shop/Job Order, Batch, Mass/Assembly, Continuous Process, Terry Hill's Operations Strategy Framework, Order Winners vs Order Qualifiers.

Logistics & Supply Chain Management : Logistics Management, Functions – Transportation, transportation Cost calculations, Feasible Value & Optimal value calculation, Assignment Model, Product mix strategies, Calculation of total maximum profit, Warehousing, Warehouse space constraint, Ware House Inventory Cost Constraint, Inventory Management, EOQ vs EBQ, Selective Inventory Control Procedures like ABC,XYZ,FSN,SDE,HML,VED,SOS,GOLF etc Practical constraints used for modifying Theoretical EOQ, Quantity Discount method, Material handling & Packaging, Order (Information) Processing, Supply Chain – Types: Product SC, Service Spares SC, Service SC, Sustainable SC – Green SC, Reverse Logistics. Inventory Under deterministic and probabilistic cases.

Conventional & Renewable Energy Systems: Various sources of renewable energy and their systems; Bio energy: introduction to bio fuels, biogas and bio fuels, Solar energy: solar thermal conversion devices, storage and applications, solar cell fundamentals, different solar cell technologies, photovoltaic systems, solar assisted heating and cooling systems; Thermal energy, Hydro-thermal energy, wave energy and ocean thermal energy conversion; Fuel cell: importance for fuel cell, classification of fuel cells, basic principle, design, materials used for developing fuel cells, applications and future prospects; Non-conventional energy: wind energy conversion, tidal energy, hydro energy and Nuclear energy

Section II

Project Management: Projects – Definition, Characteristics, Classification, Project Life Cycle Phases – Concept/Initiation, Feasibility, Planning & Organization, Implementation, Clean-up & Shut Down Phase, Project Planning – Project Charter, Statement of Works, Network Analysis – PERT/CPM, Project Crashing, Usage of software for drawing and calculating values of CPM & PERT, Resource Levelling and Resource Smoothing.

Quality Assurance : Quality – Concept, Definitions, Quality attributes for products & services, Cost & Value of quality, Inspection – 100% vs Sampling, Sampling Plans, Statistical Process Control, TQM, Six Sigma Concept – Measurements, DMAIC & DMADV, 7 QC Tools – Check sheets, Histogram, Fishbone diagram, Pareto diagram, Scatter Diagram, Lean Manufacturing System.

Sustainability : Energy – Requirements, Forms, Environment – Types of Pollution – Air, Water, Soil, Solid Waste Management, Important Legislations related to Energy & Environment, Hazardous & toxic waste management.

List of Practical: (Any Ten)

1. Case study on Product Design Philosophy
2. Use of 7 quality tools implementation (using MS Excel)
3. Use of Statistical process Control (SPC) for manufacturing/Service industry (using MS Excel)
4. Implementation of Define and Measure phase of Six Sigma to manufacturing/Service industry (using standard templates made in MS Excel)
5. Case studies on Operation strategies
6. Coordinate Measuring machine
7. Implementation of Project Management concepts for managing projects (using MS Excel & MS Project Software tool)
8. 3D Printing Machine
9. Injection Molding Machine
10. Study of basic measuring instruments, Vernier Caliper, Micrometer, Dial Indicator, Profile Projector etc.
11. Experiment on profile projector and vision measuring system
12. Tension test on Mild Steel and Aluminum
13. Brinell hardness test on different materials
14. Demonstration on Lathe Machine, Milling and drilling Machine.
15. Demonstration of CNC Lathe Machine Operation
16. Demonstration of various welding methods
17. Laser Beam Machining
18. Simulation model making using any software (Simio 3 D Software) (2 sessions)
19. Simulation software application to a real life problem of any organization
20. Use of excel solver tool for solving optimization problems
21. Design of solar system

Text Books:

1. R . Panneerselvam, Production & Operations Management,3rd Edition, PHI Publishers
2. Krishna Kumar Dwivedi and Mukesh Pandey, Fundamentals of Systems Engineering , Wiley, ISBN-13 : 978-8126566549
3. Benjamin S. Blanchard and Wolter J. Fabrycky, Systems Engineering and Analysis, 5th ed., PrenticeHall International Series in Industrial and Systems Engineering, (Upper Saddle River, NJ), 2006. ISBN-13: 978-0-13-221735-4

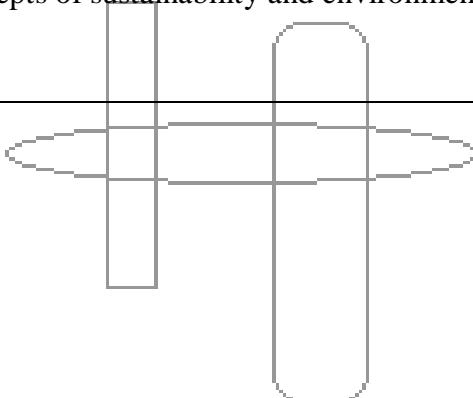
Reference Books:

1. Miller, John. *QBQ!* The Question Behind the Question: Practicing Personal Accountability at Work and in Life. East Rutherford, NJ: Putnam Publishing Group, 2004. ISBN: 9780399152337.
2. Altshuller, Genrich, Dana W. Clarke, Uri Fedozev, and Steve Rodman. *40 Principles: TRIZ Keys to Innovation*. Worcester, MA: Technical Innovation Center, Inc., 2005. ISBN: 9780964074057
3. Inventory management by L.C.Jhamb, Everest Publishing House ISBN: 9788176314541

Course Outcomes:

The student will be able to –

1. Understand nature of manufacturing and service operations and apply principles of operations strategy for process choice.
2. Identify the key elements and processes in supply chain and their interaction.
3. Understand conventional and renewable energy systems.
4. Learn the basic concepts of project and project management.
5. Understand and apply principles of quality management, quality tools and six sigma methodology
6. Understand basic concepts of sustainability and environmental issues and its remedial measures



Course Name: MOBILE APPLICATION DEVELOPMENT

Course Code: ES1037

Credits: 1	Teaching Scheme: Lab: 2 Hours / Week
Section I	
Introduction: About Android, Pre-requisites to learn Android, Dalvik Virtual Machine & .apk file extension, Android API levels (versions & version names)	
Android Java Basics: Getting started with Android development, project folder structure, simple programming, running project, generating build/APK of the app from Android Studio	
First application: Creating Android Project, Android Virtual Device Creation, Set up debugging environment, Workspace set up for development, Launching emulator, debugging on mobile devices.	
Basic UI design: Basics about Views, Layouts, Drawable Resources, Input controls, Input Events, Toasts.	
More UI Components: Layouts – Grid View and List View, Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers - Date and Time, Spinners.	
Section II	
Activity and Fragment: Activity, Fragment, Activity Lifecycle and Fragment Lifecycle.	
Intents: Implicit Intents, Explicit intents, communicating data among Activities.	
Navigation Drawer: Panel that displays the app's main navigation screens on the left edge of the screen	
Android Notifications – Toast, Dialogs (Time Picker, Date Picker, Progress, Alert), Notification Manager and Push Notification	
Introducing SQ Lite – SQ Lite Open Helper and creating a database - Opening and closing a database, Working with cursors Inserts, updates, and deletes	
As a term project students should implement a mobile app with the following:	
<ul style="list-style-type: none">• Understand the app idea and design user interface/wireframes of mobile app• Set up the mobile app development environment	
List of Practical:	
<ol style="list-style-type: none">1. Develop an application that uses GUI components, Font and Colors.2. Develop an application that uses Layout Managers and event listeners.3. Develop a native calculator application.4. Write an application that draws basic graphical primitives on the screen.5. Develop an application that makes use of database.6. Develop an application that makes use of RSS Feed.7. Implement an application that implements Multi threading.8. Develop a native application that uses GPS location information.9. Implement an application that writes data to the SD card.10. Implement an application that creates an alert upon receiving a message.11. Write a mobile application that creates alarm clock.	
Screen Shots of the application :	

- | | |
|-------------------------------------|---|
| 1. GUI components, Font and Colors. | 2. Layout Managers and event listeners. |
| 3. Calculator. | 4. Basic graphical primitives. |
| 5. Database Application. | 6. RSS Feed Application. |
| 7. Multi-threading Application. | 8. GPS location information. |
| 9. Writes data to the SD card. | 10. Alert upon receiving a message. |
| 11. Alarm clock Application. | |

Text Books:

1. Head first Android Development.
2. Android Programming: Pushing the Limits, Wiley By Erik Hellman
3. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

Reference Books:

1. Pradeep Kothari, Android Application Development Black Book, Dreamtech Press, KLSI

Course Outcomes:

The student will be able to –

1. identify various concepts of mobile programming that make it unique from programming for other platforms
2. program mobile applications for the Android operating system that use basic and advanced phone features
3. analyse mobile applications on their design pros and cons
4. utilize rapid prototyping techniques to design
5. develop sophisticated mobile interfaces

Course Name: HUMAN ENGINEERING**Course Code: ES1033**

Credits: 3	Teaching Scheme: Theory: 3 Hours / Week
<p>Philosophy: The system of nyaya (logic) and analysis of various means of acquiring knowledge: empiric, speculative and from a person of authority.</p> <p>Philosophy of sankhya (counting the elements) and an analysis of the 24 elements found in the universe as per sankhya and its basis. Connection to modern science and related research of body, mind and consciousness studies , Influence of three modes or qualities of nature on the mind and the individual. Discussion of various examples where one observes each of these qualities or a combination of them. A brief study of the Patanjali yoga sutras and the various stages of kriya yoga and their application. Role of Asanas (sitting postures) and pranayama (breath control) with respect to ones' body and mind. Summary of the six systems of Indian philosophy and their applications to one's personal and professional life.</p>	
<p>Psychology: Introduction, Personality & memory: factors influencing personality, Models of memory, types, forgetting, Youth Psychology: Identity, Relationships, and Careers.</p> <p>Social Application of Psychology : Emotional Intelligence gender differences, applications in family setting and in interpersonal skills, Motivation, motivational cycle, theories, Stress: common sources, Fight and flight response, managing stress, Social Psychology, Crowd psychology, collective animal behavior, Aggressive behavior, Prosocial and Antisocial Behaviour, impact of social media on mental health.</p>	
<p>Health Sciences: - Human Anatomy, General Diseases that causes impact on Human health and their Prevention and Cure. Ideal Human Health Parameters and their Measurement,</p> <p>Diet and their Impact on Health and Lifestyle and their Side Effects, Life Style Management for Better Health (Modern and Vedic)</p>	
<p>Text Books:</p> <ol style="list-style-type: none">1. BKS Iyengar, Light on yoga sutras of Patanjali2. Rajiv Malhotra, "Being Different: An Indian Challenge to Western Universalism", Happer Collins Publishers India, ISBN No: 978-93-5116-050-2.3. Suhutra Dasa, Tapovanachari, "The Six systems of Vedic Philosophy", (Online PDF book)4. Robert S. Feldman, "Understanding Psychology", 10th Edition by McGraw Hill.5. Saundra Ciccarelli and Glenn Meyer, "Psychology", Pearson Publication.6. K. Park, Preventive and Social Medicine, Bhanot Publishers	
<p>Reference Books:</p>	

1. Devamrita Swami, "Searching for the Vedic India", Bhaktivedanta Book Trust, ISBN 0-89213-350-3.
2. Patita Pavan, "Sri Chanakya Niti: Ancient Sense for Modern Success", ISBN 978-93-82109-25-9. Abhay Ashram Publishing.
3. Govinda das, "Voice your Choice: Ethics from Epics", White Woods Publishing House. ISBN: 978-93-81-283042.
4. Morgan, King, Weisz, Schopler , "Introduction to Psychology", McGraw Hill.
5. B. K. Mahajan, M. C. Gupta, Textbook of Preventive and Social Medicine
6. Jostien Garder, ."Sophies World - A Novel about the History of Philosophy", Berkeley Books, New York, USA, 1996.
7. Devamrita Swami, "Searching for Vedic India", Bhaktivedanta Book Trust.
8. F. Max. Muller, "The six systems of Indian Philosophy".

Course Outcomes:

The student will be able to –

1. apply the most appropriate tool of acquiring knowledge for a suitable object of knowledge.
2. evaluate the purpose of the 8 steps of the Yoga sutras and their consequence on the human mind.
3. understand the subject matter of Psychology as a science &its various applications, Social Psychology to become an aware and responsible citizen.
4. study the concept of emotions and motivation to be able to apply in various areas of their life.
5. classify disease categories and identify various diseases and their impact
6. recognize ideal human health parameters and their measurements, basic emergency managements and demonstrate selection and maintenance of personal protective equipment

Course Name: PROBLEM SOLVING AND PROGRAMMING

Course Code: ES1034

Credits: 5

Teaching Scheme: Theory: 3 Hours / Week

Tutorial: 1 Hour / Week

Lab: 2 Hours / Week

Section I

Computing Fundamentals: How a data value is represented using binary symbols? Introduction to numbering systems: Decimal, Binary, Hexadecimal, Octal. Introduction to computing jargons: Nibble, Bit, Byte, Word, double word, KB, MB, GB etc.

Overview: Introduction to C programming, Introduction to Compiler, Interpreter, Loader, linker, debugger. Indentations and comments,

data types, variables, Constants: language Reserved words,data types and modifiers, Identifier naming rules, variable declaration, variable storage, character constants – character set, escape sequence, string constants, Integer constant, float and double constants

Control Statements: if statement, if-else statement, if-else-if ladder, compound and nested if statement, switch case statement, Loop Statements: while, do while and for loops, continue statement, break statement.

Operators and Expressions: Operators: Arithmetic operator, relational operator, logical operators, bitwise operators, stray operators ~~operator precedence & associativity~~

Arrays: Array Basic, Array Types, Array Declaration, initialization of array, Array Accessing, Contiguous Memory, Applications illustrating use of arrays to store ordered and unordered sequences, Multidimensional Array, Initializing and accessing multidimensional array. Row and column representation of array in memory

Section II

Strings: Strings Basics, Strings Declaration, Strings Initialization, NULL terminated string , reading and printing strings using gets(), puts(), scanf() and printf() function, string library functions

Functions: Function purpose, function declaration, definition and calling, function parameters and return value, passing array to function, introduction to call by value vs call by reference, Local and global variables. Recursive function – how, when, advantages and limitations.

Pointers in C: pointer basic concept, pointer variable – declaration and initialization, pointer & and * operators, why pointer to different data types are different?, void pointer, pointer memory organization, pointer operations - incrementing pointer, decrementing pointer, adding and subtracting integer value and pointer, subtracting two pointer variables, comparing two pointer variables, pointer invalid operations, swap function – the wrong way and the correct way, pass by value Vs pass by reference

Array and pointers: array name is pointer, how [] operator operates on array name, passing array to a function, Dynamic memory allocation.

Introduction to files: file handling, read, write and create.

List of Tutorials:

All tutorials must be focusing on development of a logic, flowchart, algorithm and pseudo code for the given problem statement.

1. Generate the Fibonacci series of elements.
2. Round off an integer to the next largest multiple of another integer.
3. Interchange the contents of two variables without using third variable.
4. Calculate the average of given numbers
5. Write a logic to find whether the given point (x, y) lies inside the circle with radius r, on the circle or outside the circle.
6. To calculate the monthly interest of customers fixed deposit.
7. To calculate the sum of series given as $1, \frac{1}{2}!, \frac{1}{3}!, \frac{1}{4}!, \dots, \frac{1}{n}!$
8. Test the given number as prime number
9. Test whether the given number is Armstrong number
10. Convert the binary to decimal and decimal to Binary number
11. Write the logic to print the factorial of a number
12. Reverse the given string and separate the alphabets of string.
13. Find the smallest and largest numbers from given N numbers.
14. Calculate whether the given number is divisible by 3/5/7 etc.
15. Multiplication of two matrices
16. Calculate the surface area and volume of a cylinder
17. Addition of two matrices and algorithm for use of functional pointer
18. Exchange a string from one variable to another using pointers.
19. Debugging test cases at different instance of program

For example

```
Void main()
{
    int a;
    a=12;
    printf("%d%d%d,"a, a++, ++a");
}
```

20. Check whether the odd size given matrix is magic square or not
21. Enumeration of all subset, permutation, etc

List of Practical:

1. Assignment based on different operators and expressions in C.
2. Assignment based Control Statements and Looping Statements in C.
3. Assignment based on 1 D Array.
4. Assignment Based on Multidimensional array.
5. Assignment based on Strings.
6. Assignment Based on Functions in C.
7. Assignment based on Pointers in C.
8. Assignment based on Array pointers.
9. Assignment Based on Function Pointers in C.
10. Assignment based on Double Pointers in C.
11. Assignment based on File handling in C

List of Projects Areas:

- | | |
|--|---|
| 1. Science and Numeric Applications. | 2. Number theoretic algorithms |
| 3. 3D Graphics and Animations. | 4. Large integer Arithmetic using string processing |
| 5. To solve the problems of rotational motion, Heat transfer problems etc | |
| 6. Database/File Handling Application. | 7. Game development using C |
| 8. Algorithms in computational geometry(eg. convex-hull, closest pair of points) | |
| 9. Desktop GUIs. | 10. Solving statistical problems |

Text Books:

1. Herbert Schildt E. Horwitz, “C: The Complete reference”, TMH Publication
2. YashwantKanetkar, “Let Us C”, BPB Publication.

Reference Books:

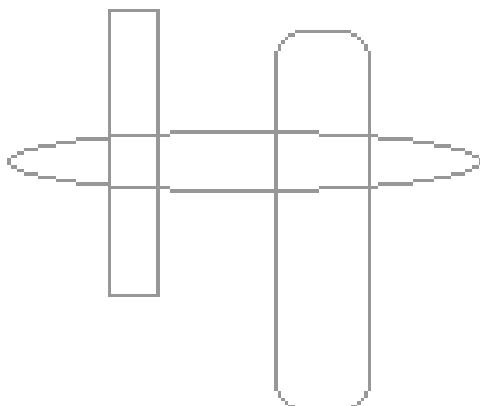
1. Harry. H. Chaudhary, “C Programming :The Definitive Beginner's Reference” , First MIT-CreateSpace Inc. O-D, Publishing, LLC USA .
2. R. G. Dromey, “ How to solve it by Computer” Prentice Hall, ISBN 978-0134340012
3. Brian Kernighan and Dennis Ritchie, “The C programming Language” PHI; 2nd edition , ISBN-10 : 0131103628

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

The student will be able to:

1. gain a broad perspective about the uses of Computer Programming in engineering industry.
2. develop basic understanding of computer programming, the concept of procedural programming and algorithmic thinking.
3. develop the ability to analyze a problem & provide a programming solution to it.
4. implement programming constructs to solve real world problems.
5. justify modular programming approach by making use of elementary as well as superior data structures.
6. apply programming fundamentals to construct concise solutions.



Course Name: ROBOT: MECHANICS AND ELECTRONICS

Course Code: ES1035

Credits: 5

Teaching Scheme: Theory: 3 Hours / Week

Tutorial: 1 Hour / Week

Lab: 2 Hours / Week

Section I

Mechanisms and Actuators : Robot Terminology : History and future of Robotics, Basics of Robotics, Anatomy and specification of a Robot, Classification and configurations of robots, Mechanical, Electrical and Electronics Components used in Robotics, Degree of Freedom, Robot coordinates, Roll-Pitch-Yaw, terms like accuracy, precision, resolution, repeatability etc. Robot software interface, Robot analogy with human body.

Mechanics of Robots : Concepts of mechanics, Force, Torque, Equilibrium, Free body diagrams, friction, concept of centre of gravity, centre of mass, centroid and moment.

Robot Kinematics : Kinematic linkages, Forward and Inverse kinematics, numerical examples. Introduction to trajectory planning.

Actuators : Pneumatic, Hydraulic, Electrical – Solenoid coil, Construction, working principle of PMDC, BLDC, Stepper and Servo motors, Merits and Demerits, Applications and selection of actuators.

Section II

Electronics: Semiconductor Devices : Diodes, Rectifiers, zener, LED, photo diode, opto-isolators, BJT (as switch and amplifier), Op-Amps, multivibrators.

Power devices : Introduction to SCR, Diac, Triac, FET, MOSFET, IGBT, motor driver circuits.

Digital Electronics : Number system Overview, logic gates, Flip-flops, counters, registers, ADC, DAC.

Power supply : AC to DC conversion, regulated power supply, SMPS.

List of Tutorials:

- | | |
|--------------------------------|---------------------------|
| 1. KCL, KVL | 2. Superposition theorem |
| 3. Thevenin's theorem | 4. Number System |
| 5. Logic Gates | 6. Kinematics – 1 |
| 7. Kinematics – 2 | 7. Kinematics – 3 |
| 9. Study of IC 555 as timer IC | 10. Operational Amplifier |

List of Practical:(Any 4 from first 10 and remaining 6 on Lego Robo Kits are Compulsory)

- | | |
|--|--|
| 1. Study of Mechanical components | |
| 2. Study of Electrical components and Electronic components – 1 | |
| 3. Study of Electrical components and Electronic components – 2 | |
| 4. Study of electronic device data sheet | |
| 5. Study of Breadboard, DMM and CRO | |
| 6. Application of Kinematics on MATLAB | |
| 7. Application of Transistor as a switch. (Relay based DC motor drive circuit) | |
| 8. Study of Regulated DC Power Supply (7805 / 7812, | |
| 9. Rectifier & Filter Circuit) | |
| 10. Application of IC 555 as a timer IC. | 10. Robot control using Robot Analyser |
| 11. Robo kit 1 – Know your Kit | 12. Robo kit 2 – Build a robot |
| 13. Robo kit 3 – Robot locomotion | 14. Robo kit 4 – Line tracer |
| 15. Robo kit 5 – Wall follower | 16. Robo kit 6 – Obstacle Avoidance |

Text Books:

1. R. K. Mittal, I. J. Nagrath, Robotics and Control, Tata McGraw Hill Publication
2. David G. Alciatore, Michael B. Histand, Introduction to Mechatronics and Measurement Systems , 3 rd Edition, Tata McGraw Hill Publication.
3. Ferdinand P. Beer, E. Russell Johnston, Mechanics of Materials.
4. P. S. Bimbhra, Power electronics, Khanna Publishers,
5. S. B. Dewan, G. R. Slemon & A. Stranghan, Power Semiconductor controlled Drives, John Wiley Pub.
6. T. Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.
7. T. Kenjo and S. Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.

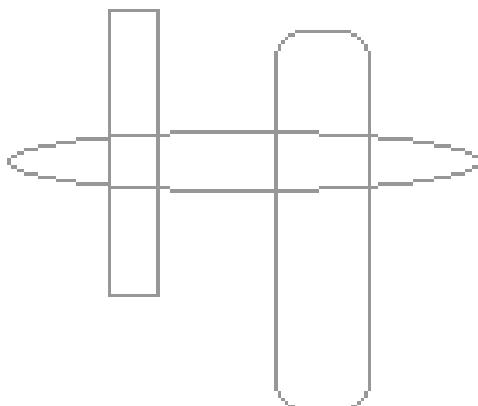
Reference Books :

1. John J. Craig, Introduction to robotics: Mechanics and Control, Prentice Hall, 2004.
2. Richard D. Klafter, Thomas A. Chmielewski, Michel Negin, Robotic Engineering: An Integrated Approach, Prentice Hall Publication.
3. Lawnthorn, Ray, Electrical machines and actuators - Electric Motors for Robots : Mechanical Power, Kindle Edition

Course Outcomes:

The student will be able to –

1. understand importance of Robotics and the terminology w.r.t. different mechanical, electrical and electronics components and their applications in Robotics.
2. understand the significance and make basic calculations based on Robot Mechanics.
3. understand the working principle and working of different actuators used in Robotics.
4. understand the concept, significance and make basic calculations based on Robot Kinematics.
5. understand use of different electronic and power devices in circuits related to Robotics.
6. understand use of different digital components and devices in circuits related to Robotics.



Course Name: CAPSTONE PROJECT 1

Course Code: ES1036

Credits: 3	Teaching Scheme: Lab: 6 Hours/Week
Section I	
Fundamentals of Research (What is research?)	
Meaning of the terms Discovery, Research, Invention, Innovation, Novelty, Creativity and the difference between them with example. Videos of great inventions, Need for Research:- Socio-economic development, research impact on society and research impact on economy, explanation with one example for each, Examples of Engineering Research, Research Types Fundamental and applied with example and importance of both, and Research Components:-Tools, techniques and algorithms and domains in which it is used innovatively Identification of research problem:- Finding and reviewing the literature, Sources of literature, Types of research papers: Conference, Journals etc, framing of research problem statement and synopsis.	
Conference	
What is a conference? (International and National), Format of a conference, conference Theme, Invitation, selection process, keynote address, parallel sessions, oral and poster presentation, valedictory, selected papers for journals and explorer, conference proceedings.	
Research Journals	
What is a Research Journal? (International and National), Types of journals, Scopus, peer reviewed, refereed, Transactions and letters, various journal publishers like Elsevier, Springer, Taylor and Francis, ASME etc. Journal formats List of standard professional societies like IEEE, ASME, SAE etc	
Literature Review	
Meaning, Effective searching of literature, cross referencing, identifying research gaps, organizing the selected papers, Summary of literature review.	
Section II	

Research Paper Writing

Structure of research paper; Title and abstract, Introduction, Method, Evaluation, Conclusion, References, Writing a research paper-Style of writing and formatting, Processing and Displaying Data:- Charts –Various types of charts through ms-excel format, Types of charts, Error bars, trend line; Figures; Tables, PPT, Preparation of posters. Referencing: Writing reference to research paper; Use of referencing style and tool, typical format of references like Books, Book Chapters, Journal Articles, Conference Papers, Technical Reports and Internet Sources.

Journal Ratings and Evaluation (How to rate a Journal?)

Meaning of impact factor and citation index like h-index. Who gives it and how gives it? Calculation of impact factor, Example for calculation of impact factor and h-index, Importance of publication house in selecting a journal, Process for journal paper review

Intellectual property (IP)

Introduction to IPR, Overview & Importance, Patents, their definition; Patent search, process of patent application; Copyrights, their definition; granting; searching & filing, Trademarks, role in commerce, importance, protection, registration; Case studies in IPR, charges for filing patents.

Research Ethics

Plagiarism, Authorship, use of language, Protecting confidentiality, Conflicts of interest, Research with humans and animals

Entrepreneurship:

Introduction to Entrepreneurship, Meaning and concept of entrepreneurship, The Entrepreneur, Meaning of entrepreneur, the skills required to be an entrepreneur, the entrepreneurial decision process, Business Opportunity Identification: Business ideas, methods of generating ideas, and opportunity recognition, Preparing a Business Plan: Meaning and significance of a business plan, components of a business plan, and feasibility study, Financing the New Venture: Importance of new venture financing.

Text Books:

1. C.R. Kothari , Research Methodology, Methods and Techniques ,2nd Edition, New Age International Pvt. Ltd., Publishers (2004)
2. R. Panneerselvam, Research Methodology, Prentice Hall Of India, New Delhi,2004
3. Vinayak Bairagi, Mousami V. Munot, Research Methodology: A Practical and Scientific Approach, 1st Edition, CRC Press, (2019)

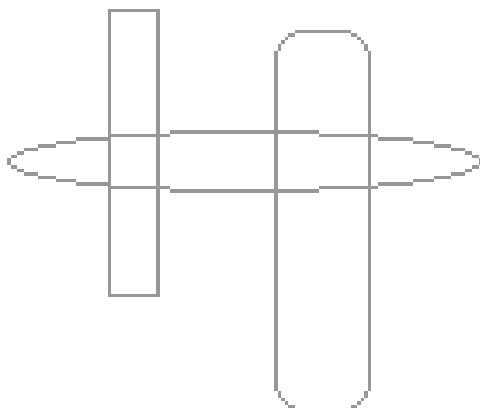
Reference Books:

1. W. M. Trochim, Research Methods: the concise knowledge base, Atomic Dog Publishing, 2005.

Course Outcomes:

The student will be able to –

1. understand concepts of discovery, invention, innovation and research
2. know socio-economic impact of research
3. understand various research tools, its applications and
4. understand the process of paper presentation
5. understand the concept and process of IPR , ethical practices in research
6. understand the concept and process of entrepreneurship and business planning



Course Name: GENERAL PROFICIENCY AND PROFESSIONAL DEVELOPMENT

Course Code: HS1034

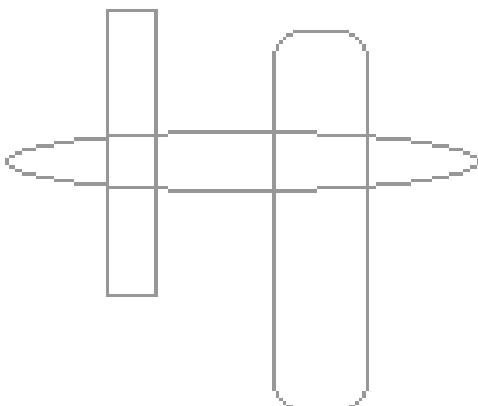
Credits: Audit	Teaching Scheme: Lab: 2 Hours/Week
Section I: Campus Awareness and Self Awareness	
<p>➤ Institute information- Overall orientation, tour to college campus, Guidance to students about future.</p> <p>➤ Branch wise Opportunities -Exposure to the department level activities, scope of the department</p> <p>➤ Rules, dress code & Ethics-Rules to be followed on college campus, Dress code to be followed by students</p> <p>➤ SWOC Analysis- Doing SWOC of organization, a well known personality or friend.</p> <p>➤ Importance of mandatory documents. Indian students must possess Aadhar, Passport, Driving License, Voter Id, Credit/ debit card, International students must have valid passport & visa approval, driving license, address proof.</p> <p>➤ Life Skills- Appreciating skills like negotiation, time management, positive thinking, recognizing diversity, networking etc. Contribution towards society, social initiatives.</p> <p>➤ Effective utilization of winter & summer vacation.</p> <p>➤ SWOC Analysis-Self Analysis, Doing SWOC for self (Strengths, Weakness', Opportunities, Challenges)</p> <p>➤ Career opportunities- Finding the future career opportunities, Guidance by expert, Finding own long term short term and medium term goals.</p> <p>➤ Importance of English and foreign languages. Formal mechanisms of Language proficiency certifications like TOFEL, IELTS, PET, JLPT, TestDaF, DSH, TCF etc.</p> <p>➤ Career planning, making choices of career - Filling up career choices form.</p> <p>➤ Project, Innovation & Research - comparison. Writing SOPs. Importance of peer review & publications, protecting intellectual property - trademark, copyright & patents.</p>	
Section II: General Awareness and Professional Awareness	
General knowledge and awareness, Current affairs, General awareness -technical, Financial and business, Personal training – physiology, Family background and networking, Attitude - Mathematical skills, Complex problem solving, Critical thinking, Career Opportunity-Corporate job-types, Skills required, Higher studies, Public sectors, Entrepreneurship Corporate Jobs- IT and Non IT Jobs, Higher Studies – Education India- IIM, IIT, NIT, IIIT, Education Abroad- Country, Cost and Documents required, MBA. Public Sectors- Jobs, DRDO, IUCAA, ISRO, HAL Entrepreneurship – Startup Vs job, who wants to start, Type of start-up, Beneficial for start-up – grants , Steps for start-up, Patents, Success rate of start-up Resume writing, Selection Process	
Submissions: Submissions to be accepted as scanned soft copy. Checklist to be prepared as follows	

- | | |
|---|---|
| 1. Aadhar card /(India & abroad Address proof for international students) | 2. Passport |
| 3. Driving License | 4. Voter ID |
| 5. English or foreign language proficiency proof | 6. Aptitude assessment proof (Must) |
| 7. SOP of one research statement (Must) | 8. Career planning form submission (Must) |
| 9. SWOC Self – Analysis (Must) | |

Course Outcomes:

The student will be able to –

1. find opportunities available in his domain.
2. be ready to explore opportunities.
3. analyze strengths, weakness, opportunities and challenges.
4. decide his career goal.
5. explore different career opportunities.
6. develop necessary professional skills.
7. Write resume in efficient and presentable format.



Course Name: DATA STRUCTURES USING PYTHON

Course Code: ES1038

Credits: 5

Teaching Scheme: Theory: 3 Hours / Week

Tutorial: 1 Hour / Week

Lab: 2 Hours / Week

Section I

Fundamentals of Python

Features of Python, How to Run Python code, Identifiers, Reserved Keywords, Variables, Comments in Python, Indentation in Python, Input, Output statements.

Operators: Arithmetic Operators, relational Operators, Logical Operators, bitwise operators, other stray operators, Operator Precedence. Mathematical Functions, Trigonometric Functions, Random Number Functions, Strings in python : subscript operator, indexing, slicing a string, string methods

Flow Control and Loops

Decision Making: if statement, if...else statement, if..elif ..else statement, Nested if statement; Loops : while loop , for loop, range() function, continue and break statement, while and for loop with else statement , pass statement.

In-built Data Structures in Python

List, Tuple, Set, Dictionary; Mutable and Immutable Objects, Data Type Conversion, Built-in methods and comprehensions.

Section II

Functions and Modules

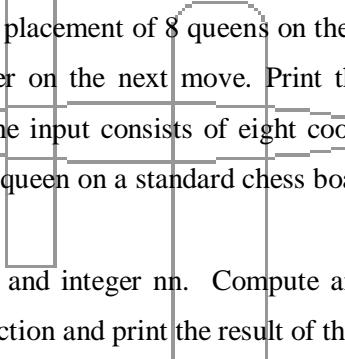
Function Definition, Function Calling, Function Arguments, Anonymous Functions (Lambda Functions), recursive function, Function with more than one return value, default value to parameter, keyword parameter.

Modules and Packages : Built-in Modules , Creating Modules , import Statement , import with renaming , from...import statement , import all names , Locating Modules , PYTHONPATH variable Namespaces and Scope : dir() , reload() functions , Packages in Python.

File Handling and Database Programming

Opening a File, Modes for Opening a File , Attributes of file object , Closing a File , Reading from a File, writing to a File, File Methods.

List of Tutorials: (Any Three)

1. A timestamp is three numbers: a number of hours, minutes and seconds. Given two timestamps, calculate how many seconds is between them. The moment of the first timestamp occurred before the moment of the second timestamp.
2. Hour hand turned by α degrees since the midnight. Determine the angle by which minute hand turned since the start of the current hour. Input and output in this problems are floating-point numbers.
3. Write a program that solves a linear equation $ax = b$ in integers. Given two integers a and b (a may be zero), print a single integer root if it exists and print "no solution" or "many solutions" otherwise.
4. A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. Given two integers A and B , print the number of primes between them, inclusively.
5. Given a string. Cut it into two "equal" parts (If the length of the string is odd, place the center character in the first string, so that the first string contains one more character than the second). Now print a new string on a single row with the first and second half's interchanged (second half first and the first half second) Don't use the statement if in this task.
6. A sequence consists of integer numbers and ends with the number 0. Determine how many elements of this sequence are equal to its largest element.
7. In chess it is known that it is possible to place 8 queens on an 8×8 chess board such that none of them can attack another. Given a placement of 8 queens on the board, determine if there is a pair of queens that can attack each other on the next move. Print the word NO if no queen can attack another, otherwise print YES. The input consists of eight coordinate pairs, one pair per line, with each pair giving the position of a queen on a standard chess board with rows and columns numbered starting at 1.

8. Given a positive real number a and integer n . Compute a^n . Write a function $\text{power}(a, n)$ to calculate the results using the function and print the result of the expression.
Don't use the same function from the standard library.
9. To keep record of patients' medical data, manipulate files to store, update, and delete such information.
10. Insert and retrieve data of an insurance company by manipulating database tables.

List of Practical: (Any Six)

1. A school decided to replace the desks in three classrooms. Each desk sits two students. Given the number of students in each class, print the smallest possible number of desks that can be purchased. The program should read three integers: the number of students in each of the three classes, a, b and c respectively. In the first test there are three groups. The first group has 20 students and thus needs 10 desks. The second group has 21 students, so they can get by with no fewer than 11 desks. 11 desks is also enough for the third group of 22 students. So we need 32 desks in total.
2. H hours, M minutes and S seconds are passed since the midnight ($0 \leq H < 12$, $0 \leq M < 60$, $0 \leq S < 60$). Determine the angle (in degrees) of the hour hand on the clock face right now.
3. Given integer coordinates of three vertices of a rectangle whose sides are parallel to the coordinate axes, find the coordinates of the fourth vertex of the rectangle. In the first test the three given vertices are (1, 4), (1, 6), (7, 4). The fourth vertex is thus (7, 6).
4. There was a set of cards with numbers from 1 to N. One of the card is now lost. Determine the number on that lost card given the numbers for the remaining cards.

Given a number N, followed by $N - 1$ integers – representing the numbers on the remaining cards (distinct integers in the range from 1 to N). Find and print the number on the lost card.

5. Given a string. Delete from it all the characters whose indices are divisible by 3.
6. Given a sequence of integer numbers ending with the number 0. Determine the length of the widest fragment where all the elements are equal to each other.
7. In bowling, the player starts with 10 pins at the far end of a lane. The object is to knock all the pins down. For this exercise, the number of pins and balls will vary. Given the number of pins N and then the number of balls K to be rolled, followed by K pairs of numbers (one for each ball rolled), determine which pins remain standing after all the balls have been rolled. The balls are numbered from 1 to N (inclusive) for this situation. The subsequent number pairs, one for each K represent the start to stop (inclusive) positions of the pins that were knocked down with each role. Print a sequence of N characters, where "I" represents a pin left standing and "." represents a pin knocked down.
8. Given a sequence of integers that end with a 00. Print the sequence in reverse order.
Don't use lists or other data structures. Use the force of recursion instead.
9. To keep record of students' data, manipulate files to store, update, and delete students' information.
10. Insert and retrieve data of a company by manipulating database tables.

List of Projects:

Students will be doing course projects in different areas of application of python programming such as web application, data analysis, computer vision, machine learning, artificial intelligence, web technologies, numerical analysis etc.

Text Books:

1. "Programming And Problem Solving With Python", Ashok Kamthane and Amit Ashok Kamthane , ISBN 9789387067578
2. "Beginning Programming with Python for Dummies", John Paul Mueller , Wiley Publishing, ISBN 9788126553488

Reference Books:

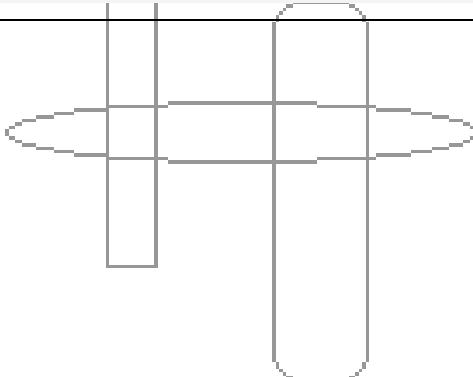
1. Dive into Python 3: Mark Pilgrim, Jesse Noller, Wiley Publishing , ISBN 9788184899115.
2. Python in Easy Steps, Tata McGraw Hill Education, ISBN 9789351343080
3. Learning Python, 5th Edition, Mark Lutz, O'Reilly, ISBN 978-1449355739

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

The student will be able to –

1. understand Python programming basics and paradigm
2. demonstrate different mathematical functions and string manipulation functions in Python.
3. learn to apply core Python scripting elements such as flow control structures and loops.
4. develop essential skills in python programming concepts like data structures and different built in functions.
5. justify modular programming approach by making use of functions and modules
6. demonstrate the ability to handle files in different modes and database connectivity



Course Name: MECHATRONICS AND ROBOTICS

Course Code: ES1039

Credits: 5

Teaching Scheme: Theory: 3 Hours / Week

Tutorial: 1 Hour / Week

Lab: 2 Hours / Week

Section I

Sensors : Proximity sensor (Range sensor), Tactile sensor (Contact sensor), Current sensor, Tilt sensors, Gyroscope, Encoders, Hall effect sensors, Temperature sensor, Acceleration sensor, Image sensor, Camera etc.

Microcontrollers : Microcontroller, ATmega, architecture, peripherals, ports, registers, timer, counter, serial communications, ADC, interrupts etc.

Microcontroller programming & Interfacing : Introduction to Assembly language programming, Embedded C Programming, Port configuration- for Signal in and Signal out configuration and programming, Interfacing of relay, stepper motor, LCD display, keyboard, RS232, ADC etc.

Section II

Actuators and Control : Interfacing of Relay, Solenoid, pneumatic, hydraulic actuator basics, programming for control, motor driver and speed control – PWM.

Communication Systems : Introduction to Serial communication - RS232, I2C, SPI. Basics of Wired and Wireless Communication, WiFi, Bluetooth.

Industrial Robotics and Applications: Introduction to different systems in Industrial Robotics, Automation, PLC, Basics of Ladder programming, Ladder logic, basic instructions, Introduction to SCADA.

List of Tutorials:

Hands on preparation and coding review for.....

- | | | |
|----------------------|-------------------------|-------------------------------|
| 1. LED | 2. LDR | 3. Push Button / Micro Switch |
| 4. Ultrasonic Sensor | 5. IR array | 6. Temperature sensor |
| 7. 16x2 LCD | 8. Segment Display | 9. Bluetooth module |
| 10. DC Motor Control | 11. Servo Motor Control | |

List of Practical:

Interfacing of

- | | | |
|----------------------|-------------------------|-------------------------------|
| 1. LED with Arduino | 2. LDR | 3. Push Button / Micro Switch |
| 4. Ultrasonic Sensor | 5. IR array | 6. Temperature sensor |
| 7. 16x2 LCD | 8. Segment Display | 9. Bluetooth module |
| 10. DC Motor Control | 11. Servo Motor Control | |

Text Books:

1. R. K. Mittal, I. J. Nagrath, Robotics and Control, Tata McGraw Hill Publication
2. Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd edition, Pearson
3. Kenneth Ayala ,The 8051 Microcontroller (with CD) ,Cengage Learning
4. – Fu, Lee ,Robotics – Control, Sensing, Vision and Intelligence,TataMcGraw Hill
5. Vijay Singh ,Fundamentals of Programmable Logic Controllers, New Age International (P) Ltd.
6. Hackworth, Programmable Logic Controllers Programming Methods And Applications with CD, Pearson India.
7. George Kennedy and Bernard Davis, S R M Prasanna,Kennedy's Electronic Communication System (SIE), McGraw Hill Education.
8. Arduino Made Simple: With Interactive Projects
9. Brock Craft ,Arduino Projects for Dummies, John Wiley & Sons Inc.
10. Serial Communication by :-Dr.UditSatija, IIT Patna.Lecture 16 : Embedded System- Serial Communication (Synchronous, Asynchronous, UART, CAN)-Part 1 and Lecture 17 : Embedded System-Serial Communication (I2C, SPI, RS-232)-Part 2.

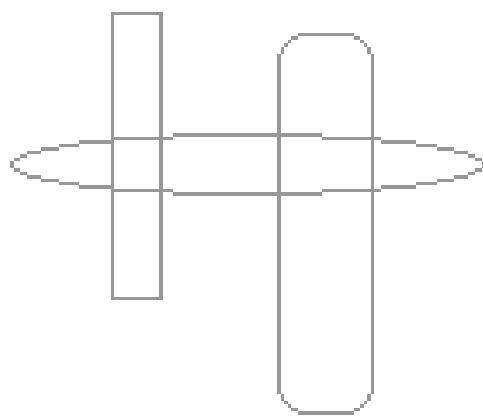
Reference Books:

1. John J. Craig ,Introduction to Robotics: Mechanics and Control, Prentice Hall, 2004.
2. Richard D. Klafter, Robotic Engineering: An Integrated Approach, Thomas A. Chmielewski, Michel Negin, Prentice Hall Publication.
3. Lawnthorn, Ray, Electrical machines and actuators - Electric Motors for Robots : Mechanical Power, Kindle Edition

Course Outcomes:

The student will be able to –

1. identify different sensors, understand their significance related to Robotics and select a sensor as per the requirement.
2. understand the internal configuration and architecture of microcontroller.
3. interface different sensors and peripherals to a microcontroller and program the same.
4. interface different display devices, actuators and control them using a program.
5. Use different communication protocols to control a robot.
6. understand significance of different systems used in Robotics and Automation.



Course Name: CAPSTONE PROJECT 2

Course Code: ES1040

Credits: 3	Teaching Scheme: Lab: 6 Hour / Week
Section I	
<p>Team Formation and Documentation: Team Building Domain Selection (Society/Industry project), Importance of Documentation, Strategy Design</p>	
<p>Design Thinking Exercise: Formation of Team and aspects for the selection, Domain selection, Observation exercise, Design activities, Brainstorming for the problem, Users Interview conduction</p>	
<p>Problem Solving Skills Introduction: Developing logical thinking, Errors in reasoning, analogy problems lateral thinking</p>	
<p>Problem Solving Techniques: Deductive and hypothetical reasoning; computational problem solving; generating, implementing, and evaluating solutions; interpersonal problem solving</p>	
<p>Reverse Engineering: Introduction, Reverse Engineering Leads to New Understanding about Products, Reasons for Reverse Engineering, Reverse Engineering Process, Case Study</p>	
<p>Domain Project Areas: Awareness and identification of appropriate areas for project work such as: Agriculture, Defense, Healthcare, Smart city, Smart energy, Security Systems, Automobile, Space, Green Earth, Automobiles, Assistive Aid, Water Management, Swachh Bharat (any other socially relevant research area)</p>	
<p>Tools: <i>Self learning Activity</i> Learn and use latest engineering tools as per the project need. A few are listed below</p>	
<p>Tools in Computer Engineering:</p> <p>Programming / Coding Tools :- JavaScript, Python, Java, C#, C++, PHP, Computer Vision Tools :- OPENCV, MATLAB, Single board computers: Raspberry Pi, Neural network simulators Tools:- Neural Lab, NEST , Machine Learning Tools:- Torch, TensorFlow, Data Science Tools :- R language programming, SQL.</p>	
<p>Tools in Electronics and Electronics & Telecommunication Engineering:</p> <p>Electronic Design Simulation Integrated Circuit Tools:- VHDL, Xilinx, Modelsim , Cadence learn, Embedded System Tools:- AVR Studio, Arduino ,Kiel µvision, Circuit Simulation Tools:-Pspice, Simulink, Workbench, Tinkercad, ThingSpeak, Proteus, CircuitPro ,Processor based integrated circuits :Microcontroller, electronic prototype platforms: Arduino, Networking Tools :- Wired / Wireless and Ad-hoc Networking NS-2 , Packet Tracer, Signal Processing Tools:- Code Composer Studio along with Integrated circuits</p>	
<p>Tools in Instrumentation and Control Engineering:- System Automation Tools:- PLC , SCADA , PADS, ORCAD, Eagle, Kicad,</p>	
<p>Tools in Mechanical, Industrial, Production, Engineering:- Engineering Design Tools:- AutoCAD, CATIA,COMSOL Multiphysics, Solidworks, Inventor, PTC Creo Fluid Dynamics:- Fluent, HyperWorks, Finite Element/ Structural Analysis:-Ansy's, Ansy's Free Student software Thermal</p>	

Simulation:- FlowTherm, AnsysIcepak

Tools in Chemical Engineering :-

Chemical process simulator:-DSIM - Open Source Process Simulator, chemical simulation software:- Schrödinger.

(Any other suitable tool as per the project requirement)

Section II

Technology: Map the appropriate technology:

Emerging Technologies :- Artificial Intelligence, 5G networks, IoT, Serverless Computing, Blockchain ,Virtual reality (VR)/Augmented reality (AR), Drone, Quantum Computing, Robotics

Interdisciplinary Technologies:- Nanotechnology, Nanomaterials, Nanoelectronics, Quantum Computing , Spintronics

Computer Technologies: - Big Data, Cloud Computing, Human Machine Interface (HMI), Cyber Security

Medical and Healthcare Technologies:- Biomedical Technology

Energy Technologies :- Solar Energy Based Technologies, Wind energy, Green energy Technologies, Energy Storage

Electronics, Communication Technologies:- Wireless, GPS, Bluetooth, Mobile/social Internet Automation, Mobile Technologies, Voice Assistants, signal processing, image processing, Machine vision, Sensors, Optoelectronics,

Other imp Technologies:- Automobile ,3 D printing

(any other technology as per the project requirement)

Project Implementation: Selection of the domain area, Literature review, Identify and finalize the Problem Statement (student in consultation with Guide), Understand and select and use the appropriate tools, Map the technologies learned with the project needs (refer available online offline Resources, books, soft materials, relevant MOOCs, consult with domain expertise) Self Learning:- learn the required tools, skill sets, acquire knowledge to do the project

Designing & Testing: Designing of project prototype based on domain areas by incorporating appropriate tools and technology, validation and Testing of the prototype to give the best possible solution

Documentation and Final Assessment : Develop and demonstrate the optimized prototype /working model of project , Documentation of project report in stipulated standard format as per the preset norms i.e. IEEE Research paper format, Present Project work at final viva voce

Text Books:

1. K Nagrajan , Project Management 2nd Edition, New age International Ltd.(2004)
2. PradeepPai, Project Management, 1st Edition, PEARSON INDIA (2019)
3. YousefHaik and Tamer M. Shahin, “Engineering Design Process”, Cengage Learning, Second Edition, 2011.

Reference Books:

1. H. S. Fogler and S. E. LeBlanc, "Strategies for Creative Problem Solving", 2nd edition, Pearson, Upper Saddle River, NJ, 2008.
 2. A. Whimbey and J. Lochhead, "Problem Solving & Comprehension", 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.
 3. M. Levine, "Effective Problem Solving", 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.
- John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengagelearning (International edition) Second Edition, 2013.

MOOCs Links and additional reading material:

1. <https://nptel.ac.in/courses/106/105/106105077/> (Artificial Intelligence - by IIT Kharagpur)
2. <https://nptel.ac.in/courses/112/103/112103280/> (Fundamentals of Artificial Intelligence by IIT Guwahati)
3. <https://nptel.ac.in/courses/106/106/106106212/> (Python for Data science .By IIT Madras)
<https://nptel.ac.in/courses/106/106/106106179/> (Data science for Engineers, by IIT Madras)

Course Outcomes:

The student will be able to –

1. identify projects relevant to societal needs and use design thinking as a tool of innovation.
2. map the technologies learned with the project needs
3. apply design thinking process with technological knowledge to design various feasible solutions
4. select the best possible solution to solve the problem using reverse engineering approach
5. develop/Fabricate a working model of the proposed solution
6. testing and validate product performance

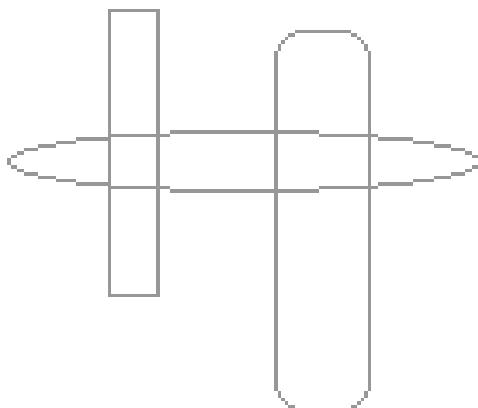
Course Name: ENVIRONMENTAL SCIENCE

Course Code: ES1014

Credits: Audit	Teaching Scheme: Lab: 2 Hours / Week
Section I	
<p>Nature of environmental studies: Definition, scope, importance, multidisciplinary nature of environmental studies, need of public awareness, Role of an individual in conservation and equitable use of natural resources, sustainable lifestyles, Natural resources and associated problems : Forest, water, mineral, food, energy, land resources</p>	
<p>Ecosystems: Concept, Structure, function, characteristics of ecosystems, energy flow in ecosystem, producers, consumers, and decomposers, ecological succession</p>	
<p>Biodiversity and its conservation: Introduction, value, hot spots of biodiversity, threats to biodiversity, conservation of biodiversity</p>	
Section II	
<p>Environment pollution: Introduction, definition, types of pollution, cause and effect of pollution, solid waste management, role of an individual in prevention of pollution, disaster management</p>	
<p>Social issues and the environment: Unsustainable to sustainable development, urban problems related to energy, water conservation, environmental ethics, climate change, global warming, ozone layer depletion, wasteland reclamation, consumerism and waste products</p>	
<p>Environmental protection: Environmental protection act, AIR (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection act, Forest conservation act, population growth and human health, human rights</p>	
<p>Text Books:</p> <ol style="list-style-type: none">1. Erich Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Second Edition, UGC Publications.2. Mackenzie L. Davis and David A. Cornwell, "Introduction to Environmental Engineering", 4e, Tata McGraw-Hill Education Private Limited New Delhi, 2010.3. J. Tyler Jr. Miller and Spoolman, "Environmental Science with Mindtap", 14th Edition, Cengage Learning, 2014.	
<p>Reference Books:</p> <ol style="list-style-type: none">1. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2e, Pearson Education. Dorling Kindersley (India) Pvt. Ltd. Delhi, 2007.2. J. Glynn Henry and Gary W. Heinke, "Environmental Science and Engineering", 2e. Pearson Education (Singapore) Pte. Ltd, 2004.	
<p>Course Outcomes:</p>	

The student will be able to –

1. Recognize renewable and non-renewable resources and associated problems and plan different activities to create awareness among the people and hence to conserve resources by minimizing degradation of environment.
2. Understand different types of ecosystems and their importance in balancing the nature.
3. Understand concept of biodiversity at national and global level and need to preserve it.
4. Understand different types of pollutions and hence to find the remedial measures to minimize ill effects.
5. Recognize various disaster and solid waste management techniques.
6. Understand and appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.





Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus

B.Tech. (Computer Engineering)

Effective from Academic Year 2021-22

Prepared by: - Board of Studies in Computer Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Chairman – BOS

Chairman – Academic Board

Title: Course Structure

FF No. 653

Branch: Computer Year: S.Y. A.Y.: 2021-22 Module: III

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme						Total	Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)		ESE (%)	PPT/ GD (%)	Viva (%)		
S1	MD2201	Data Science	3	2	1	10	20	10		20	20	20	100	5
S2	CS2221	Internet of Things	3	2	1	10	20	10		20	20	20	100	5
S3	IT2201	Computer Organization and Architecture	3	2	1	10	20	10		20	20	20	100	5
S4	CS2207	Software Development Project-I	0	6	0	-	-	30		70	-	-	100	3
S5	CS2209	Engineering Design and Innovation-III	0	8	0	-	-	30		70	-	-	100	4
S6	CS2218	Object Oriented Programming	3	2	1	10	20	10		20	20	20	100	5
		Total	12	22	4	40	80	100		220	80	80	600	27

Title: Course Structure

FF No. 653

Branch: Computer **Year:** S.Y. **A.Y.:** 2021-22 **Module:** IV

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme						Total	Credits		
			Theory	LAB	Tut.	CA		MSA		ESA					
						HA (%)	LAB (%)	MSE (%)	ESE (%)	PPT/ GD (%)	Viva (%)				
S1	CS2202	Data Structures	3	2	1	10	20	10	20	20	20	100	5		
S2	CS2225	Theory of Computation	3	2	1	10	20	10	20	20	20	100	5		
S3	CS2226	Software Engineering	3	2	1	10	20	10	20	20	20	100	5		
S4	CS2227	Database Management Systems	3	2	1	10	20	10	20	20	20	100	5		
S5	CS2208	Software Development Project-II	0	6	0	-	-	30	-	70	-	100	3		
S6	CS2210	Engineering Design and Innovation-IV	0	8	0	-	-	30	-	70	-	100	4		
		Total	12	22	4	40	80	100	-	180	80	80	600	27	

Title: Course Structure

FF No. 653

Branch: Computer Year: T.Y. A.Y.: 2021-22 Module: V

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme						Total	Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	PPT/ GD (%)	Viva (%)		
S1	CS3205	Design and Analysis of Algorithms	3	2	1	10	20	10		20	20	20	100	5
S2	CS3203	System Software	3	2	1	10	20	10		20	20	20	100	5
S3	CS3215	Web Technology	3	2	1	10	20	10		20	20	20	100	5
S4	CS3217	Database Management Systems	3	2	1	10	20	10		20	20	20	100	5
S5	CS3223	Engineering Design and Innovation-IV	0	8	0	-	-	30	-	70	-	-	100	4
S6	CS3219	Machine Learning	3	2	1	10	20	10		20	20	20	100	5
S6	CS3220	Cyber Security	3	2	1	10	20	10		20	20	20	100	5
		Total	15	20	5	50	100	80		170	100	100	600	29

Title: Course Structure

FF No. 653

Branch: Computer Year: T.Y. A.Y.: 2021-22 Module: VI

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme						Total	Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)		
S1	CS3216	Theory of Computation	3	2	1	10	20	10		20	20	20	100	5
S2	CS3218	Software Modelling and Design	3	2	1	10	20	10		20	20	20	100	5
S3	CS3202	Artificial Intelligence	3	2	1	10	20	10		20	20	20	100	5
S4	CS3207	Compiler Design	3	2	1	10	20	10		20	20	20	100	5
S5	CS3224	Engineering Design and Innovation-VI	0	8	0	-	-	30	-	70	-	-	100	4
S6	CS3226	Machine Learning Project	3	2	1	10	20	10		20	20	20	100	5
S6	CS3228	Cyber Security Project	3	2	1	10	20	10		20	20	20	100	5
		Total	15	20	5	50	100	80		170	100	100	600	29

Title: Course Structure

FF No. 653

Branch: Computer **Year:** BTech **A.Y.:** 2020-21 **Module:** VII

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme							Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)		
S1	MD4205	Marketing Management	2	0	0	10	-	30	-	30	-	30	100	2
S2	CS4217	Human Computer Interaction	2	0	0	10	-	30	-	30	-	30	100	2
	CS4219	Internet of Things	2	0	0	10	-	30	-	30	-	30	100	2
	CS4222	Image Processing	2	0	0	10	-	30	-	30	-	30	100	2
	ET4230	Natural Language Processing	2	0	0	10	-	30	-	30	-	30	100	2
S3	CS4209	Parallel Computing	2	0	0	10	-	30	-	30	-	30	100	2
	CS4201	Cloud Computing	2	0	0	10	-	30	-	30	-	30	100	2
	ET4232	Deep Learning	2	0	0	10	-	30	-	30	-	30	100	2

S4	CS4225	Major Project	0	20	0		-	30	-	70	-	-	100	10
		Total	6	20	0	30	-	120	-	160	-	90	400	16

Branch: Computer **Year:** BTech **A.Y.:** 2021-22 **Module:** VIII

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme							Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)		
S1	CS4233	Industry Internship	0	32	0	-	-	30	-	70	-		100	16
	CS4235	International Internship	0	32	0	-	-	30	-	70	-		100	16
	CS4231	Project Internship	0	32	0	-	-	30	-	70	-		100	16
		Total	-	32	-	-	-	30	-	70	-		100	16

INDEX

SN	Particular	Page No
1	Second Year Module -III Content	03
2	Second Year Module -IV Content	45
3	Third Year Module -V Content	95
4	Third Year Module -VI Content	155
5	Final Year Module -VII Content	202
6	Final Year Module -VIII Content	238

Pattern “B21”

S. Y. B. Tech. Computer Engineering AY 2021-22

Module III Course Content

MD2201:: DATA SCIENCE**Course Prerequisites:**

1. Linear Algebra Basics
2. Central Tendency & Measures of Dispersion – Mean, Mode, Median
3. Probability
4. Some exposure to programming environment – C programming; Python

Course Objectives:

1. Understand data processing pipeline
2. Perform dimensionality reduction operations
3. Optimize the performance of functions
4. Apply descriptive statistics tools
5. Deduce meaningful statistical inferences
6. Use unsupervised classification algorithms
7. Use supervised classification algorithms
8. Utilize the data science principles for an entire project life cycle as a case study

Credits: 5**Teaching Scheme Theory: 3 Hours/Week****Tut: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:**

The course is offered in S.Y. B.Tech. to all branches of Engineering

Data Science is a multidisciplinary field. It uses scientific approaches, procedures, algorithms and frameworks to extract knowledge and insight from a huge amount of data.

Data Science uses concepts and methods which belong to fields like information technology, Mathematics, Statistics, Computer Science etc.

Data Science influences the growth and improvements of the product by providing a lot of intelligence about customers and operations, by using methods such as data mining and data analysis.

The course is relevant to all branches of Engineering and beyond, since data is generated as an obvious outcome of many processes.

SECTION-1

- Introduction to Data Science
Role of data scientist, introduction to R, R studio; introduction to univariate and multivariate systems, understanding databases, Data Processing - Data collection; Data preparation; Data visualization techniques and inferences - scatter plot, scatter matrix, histogram, box plot.
- Normal distribution, evaluating normal distribution, Binomial distribution, confidence Intervals, central limit Theorem, hypothesis testing, inference for numerical data distribution, paired data, ANOVA
- Vector norms, distances & projections, discriminants, Principal Component Analysis, Optimization: constrained and unconstrained, Gradient Descent

SECTION-2

- Supervised Learning – line fitting, residuals, correlation; line fitting by least squares regression; outliers in linear regression; Inference for linear regression; Multiple regression; Model selection; Logistic regression, Nearest Neighbor Classification – Knn; Naïve Bayes Classification – Bayesian methods, Bayes algorithm; Classification using decision trees and learners
Unsupervised Clustering - K-means clustering; Evaluation of model performance – Confusion matrices, sensitivity, specificity, kappa statistics, precision, recall, F-measure, ROC curve etc.; Methods of cross-validation, Bootstrapping; Meta-learning through ensemble approach – Bagging, boosting, Random Forests strategies.
Classifier performance measurement metrics – Training & Testing strategies – Resubstitution, Hold-out, Cross validation, Bootstrap ; Confusion matrix, Performance measures – Accuracy, Error rate, Sensitivity, Specificity, Precision, Recall, F-Measure, Receiver Operating Characteristics curves

List of Tutorials:

1. Data Visualization
2. Distances and Projections
3. Singular Value Decomposition
4. Principal Component Analysis
5. Optimization
6. Normal & Binomial Distribution
7. Hypothesis Testing
8. ANOVA test

9. Linear Regression
10. Logistic Regression
11. Nearest Neighbor Classification
12. Decision Trees based classification
13. Naive Bayes classification
14. Clustering
15. Evaluation of model performance
16. Bagging & Boosting approaches

List of Practicals: (Any Six)

1. Data visualization
2. Unconstrained Optimization
3. Hypothesis Testing
4. Linear regression
5. Logistic Regression
6. Nearest Neighbor classification
7. Naive Bayes classification
8. Clustering
9. Classifier performance using Confusion matrix and other attributes
10. Cross Validation methods

List of Course Projects:

1. Movie recommendation system
2. Customer Segmentation using Machine Learning
3. Sentiment analysis
4. Uber Data analysis
5. Loan prediction
6. HVAC needs forecasting
7. Customer relationship management
8. Clinical decision support systems
9. Development of machine learning solutions using available data sets (multiple projects)
10. Fraud detection

List of Course Seminar Topics:

1. Data wrangling
2. Predictive modeling
3. Data analytics in life science (multiple topics)
4. Ensemble modeling techniques
5. Text pre-processing
6. Feature scaling for machine learning
7. Multivariate normal distribution applications
8. Distance metrics and their applications
9. Visualization techniques such as Chernoff's faces
10. Tree based algorithms
11. Ridge regression
12. LASSO

List of Course Group Discussion Topics:

1. PCA and ICA
2. Hierarchical and nonhierarchical systems
3. Linear - Non linear regression
4. Parametric-non parametric estimation
5. Overfitting and underfitting in the context of classification
6. Linear and Quadratic discriminant analysis
7. Regression v/s classification
8. Classifier performance measures
9. Supervised and unsupervised learning
10. Various clustering approaches
11. Classifiers and classifier combinations
12. Balancing errors in hypothesis testing
13. Standard sampling practices for a successful survey for reliable sample data

List of Home Assignments:

Case Study: A very large number of resources are available for data generated out of case study. Unique Home assignments will be set up for all groups

Surveys: Principles of surveying will be implemented by groups to demonstrate use of data science principles in home assignments

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books: (As per IEEE format)

1. 'A Beginner's Guide to R' – Zuur, Leno, Meesters; Springer, 2009
2. 'Introduction to Data Science' – Igual, Segui; Springer, 2017
3. 'Mathematics for Machine Learning' – Diesenroth, Faisal, Ong; Cambridge University Press, 2017
4. 'Machine Learning with R' – Lantz, Packt Publishing, 2018

Reference Books: (As per IEEE format)

1. 'Elements of Statistical Learning' - Hastie, Tibshirani, Friedman; Springer; 2011
2. 'Data Science from Scratch' - Grus; Google Books; 2015
3. 'The art of Data Science' - Matsui, Peng; 2016
4. 'Machine Learning for absolute beginners' - Theobald; Google Books; 2017

Moocs Links and additional reading material: www.nptelvideos.in

1. <https://www.edx.org/course/machine-learning-fundamentals-2>
2. <https://www.edx.org/course/foundations-of-data-analysis-part-1-statistics-usi>
3. <https://www.coursera.org/learn/statistical-inference/home/welcome>
4. <https://www.coursera.org/learn/data-scientists-tools/home/welcome>

Course Outcomes:

Upon completion of the course, student will be able to –

1. Apply Data processing & data visualization techniques - 3
2. Implement dimensionality reduction & optimization techniques for enhancing data suitability - 5
3. Perform Descriptive and Inferential statistical analysis for building reliable predictions - 4

- | |
|---|
| 4. Implement Supervised algorithms for classification and prediction - 4
5. Implement Unsupervised classification algorithms - 3
6. Evaluate the performance metrics of supervised and unsupervised algorithms - 2
7. Demonstrate complete Data Science life cycle with case studies - 4 |
|---|

CO-PO Mapping

CO1	CO2	CO3	CO4	CO5	CO6
PO1, PO2, PO3,PO6	PO1, PO2, PO3, PO4, PO5, PO12, PSO1	PO1, PO2, PO3, PO4, PO5, PO12, PSO1	PO1, PO2, PO3, PO4, PO5, PSO1, PSO3	PO1, PO2, PO3, PO4, PSO1, PSO3	PO1, PO2, PO3
2, 2, 1, 2	3, 3, 3, 3, 2, 2, 2	3, 3, 3, 3, 2, 2, 2	3,3,3,2,2,3,2	3,3,3,2,3,2	2,2,2

Future Courses Mapping:

1. Deep Learning
2. Reinforcement Learning
3. DBMS
4. Big Data
5. Data Mining
6. Information Retrieval
7. Recommendation Systems
8. Cloud Computing – AWS
9. IOT
10. Artificial Intelligence
11. Pattern Recognition
12. Natural Language Processing
13. Computer Vision
14. Machine Vision
15. Fault Diagnosis
16. Optimization

- 17. Bioinformatics
- 18. Computational Biology
- 19. Econometrics
- 20. Supply Chain
- 21. Ergonomics
- 22. Operations Research
- 23. Nano-informatics

Job Mapping:

Job opportunities that one can get after learning this course

- 1. Data Scientist
- 2. Data Analyst
- 3. AI Engineer
- 4. Data Architect.
- 5. Data Engineer.
- 6. Statistician.
- 7. Database Administrator.
- 8. Business Analyst
- 9. Business Intelligence Developer
- 10. Infrastructure Architect
- 11. Enterprise Architect
- 12. Machine Learning Engineering
- 13. Machine Learning Scientist

CS2221::INTERNET OF THINGS**Course Prerequisites:**

Students should have a basic Understanding of the Internet, Cloud, Networking Concepts and Sensors

Course Objectives:

The student will be able to

1. Understand IoT Architecture and framework.
2. Recognize and differentiate between the various use cases of different sensors, actuators, solenoid valve etc
3. Learn about fundamental concepts of networking and protocols.
4. Understand IoT Physical, Data link and Higher layer Protocols.
5. Apply theoretical knowledge for Cloud computing.
6. Implement an IoT solution practically

Credits: 5**Teaching Scheme Theory: 3 Hours/Week****Tut: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:**

The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. Internet of Things is a system of interrelated computing and sensing devices and has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offers increasing opportunities to collect, exchange, analyse and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations. In a world which is moving towards an increasingly connected future, Internet of Things (IoT) is the next big thing. Right from our homes to our cars to our cities, everything is being connected and the technology of IoT is right in the middle of it.

SECTION-1**Introduction to IoT**

Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels & Deployment Templates, IoT and M2M
(6 Hours)

IOT Platform Design Methodology

IoT Design Methodology Steps, Home Automation Case Study, Smart Cities, Health Care, Agriculture, Manufacturing and Logistics
(7 Hours)

IoT Devices

IoT System Design Cycle, Sensors - Terminologies, Calibration, Types, Specification, Use, Actuators - Types and Use, Prototype Development Platform - Arduino / Raspberry pi / Node MCU, Interface with Embedded System
(7 Hours)

SECTION-II**Introduction to Wireless Sensor Network**

Sensor Node, Smart Sensor Network, Wireless Sensor Network, RFID - Principles and Components, Node MCU
(5 Hours)

Connectivity Technologies

Network Configuration in IoT, IoT Stack and Web Stack, IEEE 802.15.4 Standard, Zigbee, Bluetooth, Overview of IoT Protocols, MQTT, Cloud Architecture and Types, Cloud Service Providers
(10 Hours)

Case Studies (Any Three from following List to be covered ☺)

Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection, Smart Irrigation, IoT Printer, IoT in Manufacturing Industry, IoT in Process Industry, IoT in Quality, Control Applications in Industry, IoT in Material Handling System in Industry, IoT in Automobile Industry, Navigation System, Connected Vehicles, Industry 4.0
(5 Hours)

List of Practicals: (Minimum Six)

1. Setting up Arduino / Raspberry Pi/ Node MCU ESP8266 : Basic handling , programming
2. LED Interfacing
3. Sensor interface to Node MCU/Arduino / Raspberry Pi Temperature measurement using LM35
4. Actuator interface to Node MCU /Arduino / Raspberry Pi Traffic Signal Control
5. Node MCU /Arduino / Raspberry Pi wireless communication Raspberry Pi as a web server
6. Node MCU/Arduino / Raspberry Pi Cloud interfacing and programming like Thingspeak Email alert using SMTP protocol
7. Sensor data acquisition on Mobile (Mobile APP) / Developing Application (WEB APP) with Django Text transfer using MQTT protocol
8. Home Automation using Cisco Packet Tracer

List of Course Projects:

1. Smart Agriculture System
2. Weather Reporting System
3. Home Automation System
4. Face Recognition Bot
5. Smart Garage Door
6. Smart Alarm Clock
7. Air Pollution Monitoring System
8. Smart Parking System
9. Smart Traffic Management System
10. Smart Cradle System
11. Smart Gas Leakage Detector Bot
12. Streetlight Monitoring System
13. Smart Anti-Theft System
14. Liquid Level Monitoring System
15. Night Patrol Robot
16. Health Monitoring System
17. Smart Irrigation System
18. Flood Detection System
19. Mining Worker Safety Helmet
20. Smart Energy Grid

List of Course Seminar Topics:

1. IoT Architecture
2. Sensor Characteristics
3. IoT for supply chain management and inventory systems
4. IoT Ethics
5. Security in IoT
6. Cloud Computing Platform
7. IoT Best Practices
8. 5G in IoT
9. Middleware Technology
10. M2M energy efficiency routing protocol
11. IoT based Biometric Implementation
12. Complete IoT solution using AWS
13. A smart patient health monitoring system
14. IoT for intelligent traffic monitoring
15. Home automation of lights and fan using IoT

List of Group Discussion Topics:

1. Role of Internet of Things in development of India .
2. Manufacturing industries should make efforts to limit contribution to IoT.
3. Should countries put a ban on IoT for children?
4. Should IoT pay more attention to security rather than just expanding its horizon to the extremes?
5. IoT is the next big thing in technology.
6. IoT poses a huge risk to privacy, if your system is hacked.
7. IoT is the next big thing for hackers trying to have access to your intimate data.
8. Pros and cons of over-usage of IoT at homes and offices.
9. IoT at battlefields will make life of soldiers safer and easier.
10. IoT will make way for robots to rule over humans one day.
11. IoT devices are making people lazier and obese.
12. IoT needs to be regulated before it goes out of limits and poses serious threat.

List of Home Assignments:**Design:**

1. Smart City
2. Smart Transportation
3. Smart Healthcare
4. Smart Industry using IoT
5. Design of IoT framework

Case Study:

1. Open Source in IoT
2. IoT solutions for automobile
3. Cloud Computing
4. AWS
5. Microsoft Azure

Blog:

1. Network Selection for IoT
2. Need of secure protocols
3. Future of IoT
4. IIoT
5. IoT and Industry 4.0

Surveys:

1. Autonomous Vehicles
2. List of Indian companies which offer IoT solutions for agriculture and farming.
Describe the problem they are addressing and their solution.
3. Make a list of Indian companies which offer IoT solutions for healthcare. Describe the problem they are addressing and their solution.
4. Make an exhaustive list of everything inside, just outside (immediate surroundings) and on the auto body which must be “observed” for safe and comfortable driving using autonomous vehicles.
5. Compare different Cloud Service providers in the market.

Text Books: (As per IEEE format)

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", (Universities Press)
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press)

Reference Books:

1. Adrian McEwen, Hakim Cassimally “Designing the Internet of Things”, Wiley

- | |
|---|
| 2. Ovidiu Vermesan & Peter Friess "Internet of Things Applications - From Research and Innovation to Market Deployment", ISBN:987-87-93102-94-1, River Publishers |
| 3. Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron |

MOOCs Links and additional reading material:

- | |
|--|
| 1. https://proed.stanford.edu/course/view.php?id=191 |
| 2. https://nptel.ac.in/courses/106/105/106105166/ |
| 3. https://create.arduino.cc/projecthub/electropeak/getting-started-w-nodemcu-esp8266-on-arduino-ide-28184f |

Course Outcomes

- | |
|---|
| 1. Demonstrate fundamental concepts of Internet of Things (CO Attainment level: 2) |
| 2. Recognize IoT Design Methodology Steps (CO Attainment level: 3) |
| 3. Select sensors for different IoT applications (CO Attainment level: 3) |
| 4. Analyze fundamentals of networking (CO Attainment level: 4) |
| 5. Apply basic Protocols in IoT (CO Attainment level: 4) |
| 6. Provide IoT solutions practically with the help of case study (CO Attainment level: 5) |

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO3	PO5	PO7	PO9	PO10	PSO3

CO attainment levels

PO3 --3, PO5 ---3, PO7 -2, PO9 ---2, PO10---1, PSO3---3

Future Courses Mapping:

Other courses that can be taken after completion of this course

- | |
|--------------------|
| 1. Ad-Hoc Networks |
|--------------------|

- 2. Cyber Security
- 3. Wireless Networks
- 4. Industry 4.0
- 5. Big Data

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positions available as IoT Research Developer, IoT Design Engineer, IoT Product Manager, IoTSoftware Developer, IoT Solution Architect, IoT Service Manager and many more.

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

FF No.: 654

CS2218:: OBJECT ORIENTED PROGRAMMING**Course Prerequisites:**

Basic course on programming

Course Objectives:

1. Understand Object Oriented programming concepts
2. Demonstrate Object Oriented programming concepts by writing suitable Java programs
3. Model a given computational problem in Object Oriented fashion
4. To develop problem solving ability using Object Oriented programming constructs like multithreading
5. Develop effective solutions using for real world problems using the concepts such as file handling and GUI
6. Implement applications using Java I/O and event-based GUI handling principles
- 7.

Credits: 5**Teaching Scheme Theory: 3 Hours/Week****Tut: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:**

This is an important course for engineering students. It develops computational problem solving and logic building capability of students. Acquiring programming skills has a high relevance in all branches of Engineering. Once the student gains expertise in coding, this course proves to be beneficial to them to excel in industry demanding coding in specific software.

SECTION-1

Introduction:

What is Object Oriented Programming (OOP)? The need of OOP, Characteristics of OOP.

Java overview: Classes and Objects, Java object storage, Different ways to create objects in Java, Access Modifiers, this reference, main method, Static vs Instance block, Static methods vs Instance methods in Java, Object class, Static class in Java, operators, keywords in java.

Constructors: Constructors in Java, Default constructor, Parameterized constructor, Copy Constructor, Private Constructors and Singleton Classes. **Garbage Collection:** Garbage Collection, How to make object eligible for garbage collection in Java?

Input and Output: Byte Stream vs Character Stream, Command Line arguments, use of Scanner Class, Scanner vs BufferedReader Class, Formatted output, Reading input from console.

Arrays in Java: Arrays in Java, initialization, Default Array values, multi dimensional array, passing array to a function, Jagged arrays, java.util.Arrays class, string class, string buffer, string builder.

Methods in Java: Methods, Parameters passing, Returning Multiple values, Throwables fillInStackTrace() method in Java, Valid variants of main(), Variable Arguments (Varargs) method

Inheritance: Inheritance in Java, Types, Constructor in Inheritance, Using final with Inheritance, Accessing superclass member, Override private methods, Parent and Child classes having same data member, Base vs derived class reference. Polymorphism: Method Overloading, Overloading main(), Static vs Dynamic Binding, Method Hiding. Private and final methods, Passing and Returning Objects in Java

SECTION-2

Exception Handling: Exceptions, types, types of handling exception, Checked vs Unchecked Exceptions, Throw and Throws, User-defined Exception, Chained Exceptions.

Interfaces and Abstract Classes: Interface and its usage, Abstract Class and its usage, Difference between Abstract Class and Interface, Nested Interface, Nested Class, Inner class, Anonymous Inner class, Marker interface.

Java Packages: Packages Introduction, default access specifier use, dealing with package.

Collection in Java: Collections Class, Enumeration, Iterators and ListIterator, Using Iterators, Iterator vs Foreach, ArrayList, Vector, Map, Set.

Multithreading: Thread life Cycle, Thread Priority, Thread Methods, Inter-thread Communication, Synchronization, Method and Block Synchronization, Deadlock situation in threading.

File Handling & Database connectivity: File Processing, Primitive Data Processing, Object Data Processing, Wrapper classes, Connecting Java with database (JDBC/ODBC).

Java GUI: AWT, Swing, Components, design patterns. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key), Menus, Tables

List of Course Seminar Topics:

1. Introduction of Arrays and 1D Array programming examples
2. Multidimensional arrays
3. Variants of main() and command line arguments
4. Input and Output stream classes
5. String concepts and various methods of compairing strings
6. Methods in Java
7. Java String Methods
8. Passing array to a function and Jagged array examples
9. Reading input using Scanner and BufferedReader Class
10. String, String buffer and String builder
11. Types of Inheritance in Java
12. Implementation of Types using Constructor in Inheritance
13. Using final with Inheritance
14. Base vs derived class reference in Inheritance
15. Using final with Inheritance, Accessing superclass member
16. Parent and Child classes having same data member
17. Overriding, Hiding Fields & Methods
18. Static vs Dynamic Binding & Hiding Methods
19. Private and final methods
20. Passing and Returning Objects in Java
21. Java Memory Management
22. File handling in Java vs C++
23. Data types used in Java vs C++
24. Java Object Serialization and Deserialization

- 25. Operator precedence
- 26. Use of Object Class Methods
- 27. Garbage collection in JAVA
- 28. Use of Static Blocks in various applications
- 29. Keywords used in JAVA
- 30. Types of Variables In JAVA

List of Group Discussion Topics:

- 1. Checked and unchecked exception, user defined and standard exception
- 2. Abstraction in Java and different ways to achieve Abstraction
- 3. Packages in Java – Types, Advantages & Techniques to Access Packages
- 4. Inner classes, nested interfaces in Java
- 5. Difference between Interfaces and abstract classes in Java
- 6. Exception Handling in Java Vs CPP
- 7. Difference between 1) throw and throws. 2) Final, finally and finalize in Java
- 8. Discuss Exception propagation and Discuss Exception handling with method overriding in Java
- 9. Discuss Packages, Access specifiers and Encapsulation in java.
- 10. Difference between abstraction and encapsulation in Java.
- 11. Daemon Threads Vs user threads
- 12. Preemptive scheduling Vs slicing
- 13. Is it possible to call the run()method directly to start a new thread? pls comment
- 14. ArrayList Vs Vector
- 15. Arrays Vs Collections
- 16. is Iterator a class or an Interface? what is its use?
- 17. List Vs Set
- 18. BufferedWriter and BufferedReader classes in java
- 19. BufferedReader Vs Scanner class in java

20. Buffered Reader Vs FileReader in java
21. Instanceofjava
22. Difference between CPP and JAVA
23. Difference between JDBC and ODBC connectivity
24. file processing in java
25. Difference between primitive data processing and object data processing
26. Creating GUI using swing
27. comparision between Swing, SWT, AWT, SwingX, JGoodies, JavaFX, Apache Pivot
28. Introduction To JFC And GUI Programming In Java
29. Introduction to wrapper classes
30. Why java uses Unicode System?

List of Practicals:

1. Implement Student class using following Concepts
 - All types of Constructors
 - Static variables and instance variables
 - Static blocks and instance blocks
 - Static methods and instance methods
2. There is a class Adder which has two data members of type 1D int array and int variable. It has two functions: getdata and numsum. Function getdata accepts non-empty array of distinct integers from user in 1D int array data member and a targetsum in another data member. The function numsum adds any two elements from an input array which is equal to targetsum and return an array of resulting two elements, in any order. If no two numbers sum up to the target sum, the function should return an empty array. Note that the target sum is to be obtained by summing two different integers in the array; you can't add a single integer to itself in order to obtain the target sum. You can assume that there will be at most one pair of numbers summing up to the target sum. Use constructor. Use extra variables if needed

Input:
Array=[3,5,-4,8,11,1,-1,7] targetsum=15
Output: [8,7]

Input:
Array=[3,5,-4,8,11,1,-1,6] targetsum=15
Output: []
3. Write Java program to calculate area of triangle, square & circle using function overloading. Function parameter accept from user (Use function Overloading concepts and Inheritance).

4. Write a program for following exception, develop a suitable scenario in which the following exceptions occur:
 - a. divide by zero
 - b. Array index out of bounds exception
 - c. Null pointer Exception
5. Write a java program to solve producer-consumer problem where there are two producer threads and one consumer thread.
6. Implement various operations using JDBC Connectivity.
7. Display bank account information (Use interface and inheritance using java)
8. Develop a GUI in java which reads, update the file.

List of Course Projects:

Topics of Course Project would be discussed in Lab session.

List of Home Assignments:**Blog:**

1. Single and Multidimensional arrays in Java
2. Comparison Inheritance & Polymorphism
3. Need of abstract classes and interfaces in Java
4. Multithreading concept in Java
5. Signed & Unsigned arithmetic operations usin JAVA
6. Role of start() and run() methods in multithreading

Survey:

1. Strategies for Migration from C++ to Java
2. Product development using Inheritance and Polymorphism in Industry
3. on Java/OOP features popular amongst developers
4. Which other (non-JVM) languages does your application use?
5. How Java Impacted the Internet
6. How can a ArrayList be synchronised without using vector?

Design:

1. Implementation of Singleton design pattern in Java
2. Notes Repository System for Academic
3. Design for employee management system
4. Design for student management system
5. Inventory Management System
6. Write a program to delete duplicate numbers from the file

Case Study:

1. Java development milestones from 1.0 to 16.0
2. Implementation of Different Methods in Polymorphism
3. Real world systems which use java for its implementation
4. Drawing a flag using java
5. Use of different methods of Class object
6. Drawing a flag using java

Assessment Scheme:

Mid Semester Examination - 10 Marks

Presentation - 15 Marks

Laboratory - 10 Marks

Course Project - 10 Marks

Home Assignment - 10 Marks

Group Discussion - 15 Marks

End Semester Examination - 10 Marks

Comprehensive Viva Voce - 20 Marks

Text Books:

Herbert Schildt, "JAVA- The Complete Reference", , 11th Edition, McGraw Hill Education

Reference Books:

1. *Bruce Eckel, "Thinking In Java – The Definitive Introduction to Object-Oriented Programming in the Language of the World-Wide Web", Fourth Edition, Pearson Education, Inc.*
2. *R. Morelli and R. Walde, "Java, java, Java – Object-Oriented Problem Solving", 3rd edition, Pearson Education, Inc.*

Moocs Links and additional reading material:

Programming using Java| Java Tutorial | By Infosys Technology

https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01304972186110361645_shared/overview

An Introduction to Programming through C++ – Prof A.G. Ranade- NPTEL- computer science and engineering – NOC <https://nptel.ac.in/courses/106/101/106101208/#>

Course Outcomes:

The student will be able to –

1. Understand object-oriented programming features
2. Develop real world applications using class, inheritance and polymorphism
3. Adapt Best Practices of Class Design by using Standard Templates Library
4. Solve computing problems by applying the knowledge of Exception handling and Multithreading
5. Design solutions by choosing suitable data structures such as Array, Vector, Map etc
6. Implement applications using Java I/O and event-based GUI handling principles

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2, PO3	PO3, PO5, PO7, PSO3	PO4, PO9	PO11	PO12, PSO1, PSO2
3	2, 3	3, 2, 2, 2	3, 1	1	2, 2, 3

Future Courses Mapping:

Advanced Data Structures, Advanced Java, Spring Frame Work, Grails Frame Work

Job Mapping:

Java Programmer, Application Developer, Design Engineer, Senior Software Developer

IT2201:: COMPUTER ORGANIZATION AND ARCHITECTURE**Course Prerequisites:**

Basics of computer system and any programming language.

Course Objectives:

1. To study the fundamental concepts of structural Computer system and Computer Arithmetic
2. To understand the basic concepts and functions of Microprocessor
3. To gain knowledge of Computer Memory System
4. To get familiar with GPU and CPU architecture
5. To identify solutions for real world design issues using processors.

Credits: 5**Teaching Scheme Theory: 3 Hours/Week****Tut: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:**

Modern computer technology requires an understanding of both hardware and software, since the interaction between the two offers a framework for mastering the fundamentals of computing.

The purpose of this course is to cultivate an understanding of modern computing technology through an in-depth study of the interface between hardware and software.

In this course, you will study the history of modern computing technology before learning about modern computer architecture and a number of its essential features, including instruction sets, processor arithmetic and control, the Von Neumann architecture, pipelining, memory management, storage, and other input/output topics.

The course will conclude with a look at the recent switch from sequential processing to parallel processing by looking at the parallel computing models and their programming implications.

SECTION I

Basic concepts of Digital Electronics, Organization and Architecture, Structure & Function, Brief History of computers, Von Neumann Architecture, Integer Representation: Fixed point & Signed numbers. Integer Arithmetic: 2's Complement arithmetic, multiplication, Booth's Algorithm, Division Restoring Algorithm, Non Restoring algorithm, Floating point representation: IEEE Standards for Floating point representations.

8086 Microprocessor Architecture, Register Organization, Instruction types, Types of operands, Instruction formats, addressing modes and address translation. Near & FAR procedure, Instruction cycles. RISC Processors: RISC- Features, CISC Features, Comparison of RISC & CISC Superscalar Processors. Case study of Processor.

Fundamental Concepts: Single Bus CPU organization, Register transfers, Performing an arithmetic/ logic operations, fetching a word from memory, storing a word in memory, Execution of a complete instruction. Micro-operations, Hardwired Control, Example-Multiplier CU. Micro-programmed Control: Microinstructions, Microinstruction-sequencing: Sequencing techniques, Micro-program sequencing

SECTION II

Need, Hierarchical memory system, Characteristics, Size, Access time, Read Cycle time and address space. Main Memory Organization: ROM, RAM, EPROM, E 2 PROM, DRAM, Design examples on DRAM, SDRAM, DDR3, Cache memory Organization: Address mapping. Basic concepts: role of cache memory, Virtual Memory concept. Pipeline and its performance, Data hazards: operand forwarding, handling data hazards in software, side effects. Instruction hazards: unconditional branches, conditional branches and branch prediction.

Parallelism in Uniprocessor system, Evolution of parallel processors, Architectural Classification, Flynn's, Fengs, Handler's Classification, Multiprocessors architecture basics, Parallel Programming Models : Shared memory, Message passing, Performance considerations : Amdahl's law, performance indications.

Parallel computing architectures (multi-core CPUs, GPUs, traditional multi-processor system, Xeon-Phi, Jetson Kit, Kilocore processor), multiprocessor and multicomputer systems, interconnection networks, Modern GPU architecture (in brief), Performance comparison: Speedup, Gain time and scalability.

List of Practical (Any Six)

1. Study of 8086 Architecture and Execution of sample programs.
2. Write 8086 ALP to access marks of 5 subjects stored in array and find overall percentage and display grade according to it.
3. Write 8086 ALP to perform block transfer operation. (Don't use string operations)
Data bytes in a block stored in one array transfer to another array. Use debugger to show execution of program.
4. Write 8086 ALP to find and count zeros, positive number and negative number from the array of signed number stored in memory and display magnitude of negative numbers.
5. Write 8086 ALP to convert 4-digit HEX number into equivalent 5-digit BCD number.
6. Write 8086 ALP to convert 5-digit BCD number into equivalent 4-digit HEX number.
7. Write 8086 ALP for following operations on the string entered by the user.
 - a. String length
 - b. Reverse of the String
 - c. Palindrome
8. Write 8086 ALP for following operations on the string entered by the user (Use Extern Far Procedure).
 - a. Concatenation of two strings
 - b. Find number of words, lines.
 - c. Find number of occurrences of substring in the given string.
9. Write 8086 ALP to initialize in graphics mode and display following object on screen.
10. Write 8086 ALP to encrypt and decrypt the given message.
11. Write 8086 ALP to perform following operations on file
 - a. Open File
 - b. Write data in the file.
 - c. Delete data in the file.
 - d. Close the file.

List of Course Projects:

1. Combinational and Sequential circuits
2. Memory Management
3. Graphics Mode
4. IOT based projects.
5. IoT based atmospheric CO₂ administration.
6. IoT based flood risk predictor.
7. Simulate modern traffic control system.
8. Online Parallel Examination.

List of Course Seminar Topics:

1. Computer Architecture VS Computer Organization
2. Evolution of Computing Devices
3. Instructions types , formats and execution
4. Interrupts in Microprocessor
5. Trends in computer architecture
6. RISC Vs CISC architecture : A Case Study
7. ARM processor architecture
8. Latest Technology in Embedded systems
9. Multiplier Control Unit
10. Booth's Encoding Pattern for Fast Scalar Point Multiplication in ECC for Wireless Sensor Networks
11. Internet of Things (IoT) in 5G Wireless Communications
12. State of the art parallel processor design.
13. Memory management in mobile OS.
14. Evolution of processors.
- 15. Ultra SPARC Processor Architecture.**

List of Course Group Discussion Topics:

1. GPU computing: CUDA
2. Memory System
3. Replacement Algorithms
4. Pipelining
5. Cache Coherence
6. Virtual Memory
7. Hazards in pipelining
8. Super Computer

- | |
|---|
| 9. Modern computer generations
10. Parallel computing models |
|---|

List of Home Assignments:**Design:**

1. Write the sequence of control steps required for the single bus organization for each of the following instructions:
 1. ADD the (immediate) number NUM to register R1
 2. ADD the contents of memory location NUM to register R1

Assume that each instruction consists of two words. The first word specifies the operation and addressing mode, and second word contains the number NUM
2. Configure a 32 Mb DRAM chip. Consider cells to be organized in 8K X 4 array. Find out the number of address lines.
3. A set associative cache consists of 64 lines, or slots, divided into four-line sets. Main memory contains 4K blocks of 128 words each. Analyze the format of main memory addresses with proper explanation.
4. A one pipeline system takes 50 ns to process a task. The same task can be processed in 6 segment pipeline with a clock cycle of 10 ns. Determine the speedup ratio of pipeline for 100 tasks. What is maximum speedup ratio?

Case Study:

1. Micro-programmed Control Unit and Hardwired Control Unit.
2. Pipeline Hazards
3. Flynn's architectural classification scheme.
4. Modern Processor units

Survey:

1. New memory technologies and their potential impact on **architecture**
2. Virtual Memory
3. Simulation of a superscalar processor and analyzing impact of design tradeoffs
4. Cache Consistency Models in Modern Microprocessors

Blog:

1. Super Computer
2. Intel Journey
3. New Arm Interconnect technologies
4. Distributed Systems and Parallel Computing

Assessment Scheme:

Mid Semester Examination - 10 Marks

Presentation - 15 Marks

Laboratory - 10 Marks

Course Project - 10 Marks

Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 7th Edition, Pearson Prentice Hall Publication, ISBN 81-7758-993-8.
2. C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill Publication, ISBN 007-120411-3.
3. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill ISBN 0-07-113342-9
4. Douglas Hall, "Microprocessors and Interfacing", 2nd Edition, Tata McGraw Hill Publications, ISBN 0-07-025742-6.
5. Peter Abel, "Assembly Language Programming," 5th Edition, Pearson Education Publications, ISBN 10:013030655.

Reference Books:

1. Hwang and Briggs, "Computer Architecture and Parallel Processing", Tata McGraw Hill Publication ISBN 13: 9780070315563.
2. A. Tanenbaum, "Structured Computer Organization", Prentice Hall Publication, ISBN 81-203-1553-7, 4th Edition.

MOOCs Links and additional reading material:

1. www.nptelvideos.in
2. <https://www.udemy.com/>
3. <https://learn.saylor.org/>
4. <https://www.coursera.org/>
5. <https://swayam.gov.in/>

Course Outcomes:

Upon completion of the course, post graduates will be able to –

1. Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. (2)
2. Illustrate the micro operations sequencing. (3)
3. Evaluate various alternatives in processor organization. (3)
4. Understand concepts related to memory & IO organization (2)
5. Adapt the knowledge based on Pipeline and its performance (3)
6. Design real world applications using processors. (4)

Future Courses Mapping:

Advance Computer Architecture, Advance Operating Systems

Job Mapping:

Application Developers, System programmer

CS2207::SOFTWARE DEVELOPMENT PROJECT-I**Course Prerequisites:** C and Python, Problem Based Learning**Course Objectives:**

1. To develop problem solving ability using programming skills by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students

Credits:3.....**Teaching Scheme Theory:.... Hours/Week****Tut: ... Hours/Week****Lab: 6 Hours/Week****Course Relevance:**

Software project development comes under the category of project based learning (PBL).

PBL 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 by using domain specific language technologies.

PBL is "learning by doing."

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.

Project based learning will also redefine the role of teacher as mentor in the learning process.

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 students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Teacher's Role in PBL :

- Teacher is not the source of solutions; rather he will act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

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 disciplinary subject frame/domain.
- 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.
- Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.
- Activities may include- Solving real life problems, investigation, /study and Writing reports of in depth study, field work.

Student's Role in PBL:

- Students must have the 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.
- 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
- Students in PBL are expected to individually.

Developing 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.
- Use the following mechanism to maintain the track of moving towards the solution.
- 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?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- 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

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

Sample Software Project Statement based on Computer Vision with OpenCV

- 1) Design and deploy a system for traffic board sign detection for moving autonomous car in all-weather conditions.
- 2) Design and deploy a system for object identification and collision avoidance for unmanned vehicles.
- 3) Design and deploy a system for real time image compression for interactive real time application.
- 4) Design and deploy a system for real-time writing Devanagari character detection and conversion in unicode format.

...not limited to.....Faculty and students are free to include other area which meets the society requirements at large.

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Higher levels of the Booms Taxonomy - analyze, apply, evaluate and create.

Text Books: (As per IEEE format)

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 Robart Capraro, Mary Margaret Capraro*

Course Outcomes:

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

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

CO2: Recognize algorithms, programming constructs and data structures in building software solutions

CO3: Analyze and synthesize the identified problem from technological perspective

CO4: Apply ethical principles in utilizing skills and knowledge to design the reliable and scalable solution to meet challenges using modern tools

CO5: Evaluate the solution based on the criteria specified

CO6: Inculcate long life learning attitude towards the societal problems

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO3, PO4	PO5, PO8	PO 6,7,9,12	PO12, PSO1, PSO2
3	3	2, 2	2, 2	2, 2, 2, 1	2, 3, 3

CO attainment levels

CO1 -4 CO2 –2 CO3-4 CO4-5 CO5 -1 CO6-3

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer

CS2209::ENGINEERING DESIGN AND INNOVATIONS-III**Course Prerequisites:** Problem Based Learning**Course Objectives:**

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

Credits:1**Teaching Scheme Theory:.... Hours/Week****Tut: ... Hours/Week****Lab: 8 Hours/Week**

Course Relevance: Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. 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. Project centric learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of “Engineering Design” are designed as a ladder to extend connectivity of software technologies to solve real world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.
- It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea .The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- 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 disciplinary subject frame/domain.
- 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.

Teacher's Role in PCL :

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PCL must be responsible for their own learning.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PCL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Developing Inquiry Skills:

- Students in PCL 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.
- Use the following mechanism to maintain the track of moving towards the solution.
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?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning

- 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

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

ED Sample Case Studies :-

With the adaptation of industry communication standards, Raspberry Pi and Sensors projects can be taken up :

- 1) Design of wireless voice controlled fire extinguisher in societies and organizations.
- 2) Design of wireless energy meter reading and sending meter readings to MSEB office.
- 3) Design of remote controlled automatic light on-off systems in societies and organizations.
- 4) Design of RFID based library management system.
- 5) Design of wireless fingerprint based college attendance system.
- 6) Design of wireless home automation system.

...not limited to.....Faculty and students are free to include other area which meets the society requirements at large.

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Higher levels of the Booms Taxonomy - analyze, apply, evaluate and create.

Text Books: (As per IEEE format)

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.*
1. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro*

Reference Books: (As per IEEE format)

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. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development. By James Shore & Shane Warden.*

Course Outcomes:

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

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

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO3	PO4, PO5, PO8	PO6, 7, 9, 11	PO12, PSO1, PSO2, PSO4
3	3	2	2, 2, 2	2, 2, 2, 1	2, 3, 2, 2

CO attainment levels

CO1 -4 CO2 –2 CO3-4 CO4-5 CO5 -1 CO6-3

Future Courses Mapping:

Mention other courses that can be taken after completion of this course

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer

Module IV Course Content

CS2202::Data Structures

Course Prerequisites: Basic programming Skills (C/C++).

Course Objectives:

1. To introduce the basic concepts of data structures and algorithms.
2. To emphasize concepts about searching and sorting techniques.
3. To construct and implement various data structures and abstract data types including lists, stacks, queues, trees, and graphs.
4. To make understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
5. To associate data structures in developing and implementing efficient algorithms.

Credits:..5.....

Teaching Scheme Theory: ...3.....

Hours/Week

Tut: ...1..... Hours/Week

Lab: ...2..... Hours/Week

Course Relevance: This is a basic Course for Computer Engineering and allied branches. This course has a high relevance in all domains of computer engineering such as in Industries; research etc. as a basic prerequisite course. Data Structures are a crucial part of computer algorithms as they allow programmers to do data management efficiently. A wise selection of data structures can improve the performance of a computer program or algorithm in a more useful way.

SECTION-I

Arrays, Stacks, Queues and Linked Lists.

Arrays: Representation and application of Single and Multidimensional arrays, Sparse Matrix.

Sorting Techniques: Merge Sort, Quick Sort, Heap sort.

Linked Lists: Dynamic memory allocation, Singly Linked Lists, Doubly linked Lists, Circular linked lists and Generalized linked lists, Applications of Linked list, introduction to

vectors and applications.

Stack: Stack representation and Implementation using arrays and Linked lists. Applications of stack in Recursion, Expression conversions and evaluations.

Queues: Representation and implementation using array and Linked lists, Types of queue. Applications of Queues: Job Scheduling, Josephus problem etc.

SECTION-II

Trees and Graphs and Hashing.

Trees:- Basic terminology, representation using array and linked lists. Tree Traversals: Recursive and Non recursive, Operations on binary tree. Binary Search trees (BST), Threaded Binary Tree.

Graphs: Terminology and representation using Adjacency Matrix and Adjacency Lists, Graph Traversals and Application: BFS and DFS, Connected graph, Bipartite Graph, Detecting Cycle in graph. Minimum Spanning tree: Prims and Kruskal's Algorithm, Shortest Path Algorithms, Union Find.

Searching techniques: Linear Search, Binary search with Analysis.

Hashing: Hashing techniques, Hash table, Hash functions. Collision handling and Collision resolution techniques.

List of Tutorials: (Any Three)

- 1) Sorting Techniques:** Insertion, Merge sort, Bubble, Shell Sort, Radix Sort.
- 2) Problem solving using stack** (Maze problem, Tower of Hanoi).
- 3) Expression conversion** like infix to prefix and postfix and vice versa.
- 4) Priority Queues and Job Scheduling Algorithm.**
- 5) Generalized Linked Lists.**
- 6) Threaded Binary tree and Stack less Traversals using TBT.**
- 7) AVL and R-B Tree.**
- 8) Applications of Graph in Network problems.**
- 9) Searching Techniques:** Ternary Search, Fibonacci Search.
- 10) Design of Hashing Functions and Collision Resolution techniques.**
- 11) Cuckoo Hashing.**

List of Practical's: (Any Six)

- 1)** Assignment based on Sorting.
- 2)** Assignment based on Stack Application (Expression conversion etc.)
- 3)** Assignment based on Queue Application (Job scheduling, resources allocation etc.)
- 4)** Assignment based on linked list.
- 5)** Assignment based on BST operations(Create, Insert, Delete and Traversals)
- 6)** Assignment based on various operations on Binary Tree (Mirror image, Height, Leaf node display, Level wise display etc.)
- 7)** Assignment based on AVL tree.
- 8)** Assignment based on DFS and BFS
- 9)** Assignment based on MST using Prim's and Kruskals Algorithm.
- 10)** Assignment based on Finding shortest path in given Graph.
- 11)** Assignment based on Hashing.

List of Projects:

- 1.** Finding Nearest Neighbors.
- 2.** Calendar Application using File handling.
- 3.** Path finder in Maze
- 4.** Word Completion Using Tire.
- 5.** Bloom Filters.
- 6.** Different Management Systems.
- 7.** Scheduling Applications and Simulation.
- 8.** Shortest Path Applications. (Kirchhoff's Circuit, TSP with Scenario.)
- 9.** Efficient Storage and Data Retrieval Systems.
- 10.** Different Gaming Application.

List of Course Seminar Topics:

- 1.** Asymptotic Notations in Data structures.
- 2.** Hash Table, Heaps and Their applications.
- 3.** Analysis of Merge Sort, Quick Sort and Bubble Sort for Best, Average and Worst Case.
- 4.** Solving N-queen and Josephus Problem using Backtracking , Stack and Queue respectively.
- 5.** Priority Queue in Job Scheduling.
- 6.** Application of Stack in Backtracking problems.
- 7.** Priority Heap and min-Max Heap.
- 8.** Data Structures for Languages and Libraries.
- 9.** Multidimensional and Special Data Structures.
- 10.** Algorithm Designing using Divide and Conquer

List of Course Group Discussion Topics:

- 1.** Application based comparison of Sorting Algorithms.
- 2.** Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?
- 3.** Advanced trees: which is the best? (AVL,RB,B,B+) when? how? why?
- 4.** Scenario Based Comparison: Kruskals vs Prims Algorithm.
- 5.** Hashing application in today's technology. Is it necessary?
- 6.** Application based comparison: Stack vs Queues.
- 7.** B- Tress VS B+ Trees: Which is to be consider? When ? Why?
- 8.** Need and Role of Different tree Traversals.
- 9.** Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?
- 10.** Linked List application in today's technology. Is it necessary?

List of Home Assignments:**Design:**

1. Design Single Source multiple destination Shortest Path Algorithm For Driving Application.
2. Expression Tree and Topological Sorting application in Problem solving.
3. Scheduling Algorithms using Queue.
4. Implementation of B and B+ trees for database management.
5. GLL application to Solve problems on Multivariable Polynomial. Consider suitable example.

Case Study:

1. Consider a Suitable Example for Hashing Application. Study its Merits, Demerits and Design.
2. Consider different real life examples where different sorting, Searching techniques have been used. Why used? How? Comparative study.
3. Why there is a need of different tree traversal algorithms? Consider different real life examples where they are used. Why? How?
4. Game Base study for data structures.
5. Compare different graph traversal algorithm by considering different real life examples where they have used.

Blog

1. Comparative Application of Prims vs Kruskals Algorithm in real life scenarios.
2. AVL Tree vs RB Tree with applications
3. Need of different Sorting techniques.
4. How Hashing is useful in recent technologies? Consider any application related to it.
5. Role of Stacks and Queues in problem Solving.

Surveys

1. How application of Graph Search Algorithms (DFS and BFS) is there in recent technologies? Consider some real life technologies.
2. How Advanced Trees Data structure plays important role in Database management?
3. Survey of Data Structures for computer Graphics applications.
4. A survey on different hashing Techniques in programming.
5. Graph algorithms in Network Application.

Suggest an assessment Scheme:

MSE, ESE, GD, Seminar, HA, CVV, Lab Assignment, Course Project.

Text Books:

1. *E. Horwitz , S. Sahani, Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, Universities Press.*
2. *Y. Langsam, M.J. Augenstein, A.M.Tenenbaum, “Data structures using C and C++ ”, Pearson Education, Second Edition.*
3. *Narasimha karumanchi, “Data Structures and Algorithm Made Easy”, Fifth Edition, CareerMonk publication.*

Reference Books:

1. *J. Tremblay, P. soresan, “An Introduction to data Structures with applications”, TMHPublication, 2nd Edition.*

Moocs Links and additional reading material:

www.nptelvideos.in, www.geeksforgeeks.org

Course Outcomes:**The student will be able to –**

- 1)To interpret and diagnose the properties of data structures with their memory representations and time complexity analysis.(1)
- 2)To use linear data structures like stacks, queues with their applications.(2)
- 3)To implement operations like searching, insertion, deletion, traversing mechanism etc. on various data structures with the help of dynamic storage representation.(3)
- 4)To demonstrate the use of binary tree traversals and to perform various operations on Non-linear data structures.(5)
- 5) To analyze the Graph data structure and to solve the applications of Graph data structures.(4)
- 6)To design the appropriate data structure by applying various hashing Techniques.(3)

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO4	PO5	PO8, PO11	PO12, PSO1, PSO2
3	2	3	2	2, 1	2, 3, 2

CO attainment levels

CO1 -1, CO2 –2, CO3-3, CO4-5, CO5 -4, CO6-3

Future Courses Mapping:

Following courses can be learned after successful completion of this course: Advanced Data Structures, Design and Analysis of Algorithms, Operating Systems, Compiler Design, Systems Programming, Data Science and similar courses.

Job Mapping: *Data Structures and Algorithm is must necessary part of any programming job. Without Data structures it is not possible to be good in Competitive coding. All Industries always looks for a strong knowledge in Data structures. Without learning this course one can't imagine a job in computer/IT related industries and research.*

Syllabus Template**CS2225::Theory of Computation**

Course Prerequisites: Discrete Mathematics, Computer Programming.

Course Objectives:

1. To introduce basic concepts such as alphabet, strings, Languages, Decision problems, etc to work with the abstract formal setup
2. To construct deterministic/nondeterministic automata for regular languages to prove non regularity of languages through application of Pumping Lemma and Myhill-Nerode theorem.
3. To understand the role of non-determinism in Automata theory
4. To design Context free grammars, Push down automata for Context Free Languages
5. To comprehend meaning of undecidability in the context of Turing Machine Model

Credits: 5**Teaching Scheme Theory: 3 Hours/Week****Tut: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:**

This is a foundational course for Computer Science and Engineering. The central theme of the course is to study what makes certain computational problems very hard and the others easy? Is there some concrete theoretical evidence for the exhibited hardness of the problems? The course explores these questions, first by introducing students to the abstract notion of computation and models of computation. Starting from very simple model of state machines to finally cumulating into the Turing machine model (which is a foundation of modern-day computers), several models in between are studied. For every model, questions such as, which computational problems can be/cannot be solved in the model? how efficiently a problem can be solved in a particular model? various closure properties of model are studied. Throughout the course emphasis is given to proving things with concrete mathematical arguments.

The course is very important for understanding the concept of computation in more abstract set-up. Wherever one wants to formally talk about underlying model, the restrictions imposed by the model, what is the power and limitations of the model, the principles learnt in this course are useful. Due to abstract nature of the course, the principles learnt have wide applicability. The course is an essential prerequisite for several advanced courses such as Computational Complexity, Advanced Algorithms, Foundation of Logic, Quantum Computation, Parallel computation, Circuit Complexity etc. On more applied side: The Automata theoretic models, concept of Context Free Grammar and Pushdown Automata studied in the course are very important for Compiler design. The models discussed during the course have direct applications to several machine learning models, Natural Language processing, Artificial Intelligence, Functional Programming.

Once the student gains expertise in thinking abstractly about underlying models of computation it facilitates in systematic study of any other domain (in computer science or otherwise) which demands logical thinking and abstraction.

This course is also relevant for students who want to pursue research career in theory of computing, computational complexity theory, Natural Language Processing, advanced algorithmic research.

SECTION-1

Topics and Contents

Finite Automata:

Introduction to Automata, Computability and Complexity theory, Automaton as a model of computation, Central Concepts of Automata Theory: Alphabets, Strings, Languages. Decision Problems Vs Languages. Finite Automata, Structural Representations, Deterministic Finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, transition table, Language of DFA, construction of DFAs for Languages and proving correctness, Product construction, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Conversion of NFA with epsilon transitions to DFA, Automata with output. Applications and Limitation of Finite Automata.

Regular and Non-Regular Languages:

Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleene's Theorem: Equivalence Regular expressions and DFAs, Closure properties of Regular Languages (union, intersection, complementation, concatenation, Kleene closure), Decision properties of Regular Languages, Applications of Regular expressions. Myhill-Nerode theorem and applications: proving non-regularity, lower bound on number of states of DFA, State Minimization algorithm, Equivalence testing of DFAs. Non-Regular Languages, Revisiting Pigeon-Hole principle, Pumping Lemma for regular Languages.

Context Free Grammars (CFG):

Context Free Grammars: Definition, Examples, Derivation, Languages of CFG, Constructing CFG, correctness proof using induction. Closure properties of CFLs (Union, Concatenation, Kleene closure, reversal). Derivation trees, Ambiguity in CFGs, Removing ambiguity, Inherent ambiguity. Simplification of CFGs, Normal forms for CFGs: CNF and GNF. Decision Properties of CFLs (Emptiness, Finiteness and Membership). Applications of CFG.

SECTION-1I

Topics and Contents

Push Down Automata:

Description and definition, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic, Non-deterministic PDAs, CFG to PDA construction (with proof). Equivalence of PDA and CFG (without proof). Intersection of CFLs and Regular language. Pumping lemma for CFLs, non-Context Free Languages, Context Sensitive Languages, Definition and Examples of Context Sensitive Grammars, Chomsky hierarchy.

Turing Machines:

Basic model, definition, and representation, Instantaneous Description, Language acceptance by TM. Robustness of Turing Machine model and equivalence with various variants: Two-way/One-way infinite tape TM, multi-tape TM, non-deterministic TM, Universal Turing Machines. TM as enumerator. Recursive and Recursively Enumerable languages and their closure properties.

Introduction to Undecidability:

Church-Turing Thesis and intuitive notion of Algorithm. Introduction to countable and uncountable sets (countability of set of natural numbers, integers, rational numbers. Uncountability of set of real numbers, points in plane, set of all binary strings), Encoding for Turing machines and countability of set of all Turing machines. Existence of Turing unrecognizable languages via Cantor's diagonalization. Undecidability of Halting problem. Examples of undecidable problems: Post Correspondence Problem, Hilbert's 10th Problem, Tiling problem (without proof). Example of Turing unrecognizable language. Decision properties of R, RE languages and Rice's theorem.

List of Tutorials: (Any Three)

- 1) Problem solving based on deterministic and non-deterministic finite automata.
- 2) Advanced problem solving based on DFA, NFA.
- 3) Problem solving based on Regular expressions.
- 4) Problem solving based on Pumping Lemma.
- 5) Understanding Myhill-Nerode theorem.
- 6) Advanced problems on Context Free Grammars.
- 7) Problem solving on Pushdown Automata.
- 8) Problem solving on Turing Machines.
- 9) Problem solving on Contability
- 10) Problem solving on undecidability

List of Practicals: (Any Six)

1. Problem Solving based on Basic Counting: Propositional logic, Introduction to proofs: direct, contraposition, contradiction, counterexamples, principle of mathematical induction, strong induction. Proving correctness of programs.

Elementary set theory, relations, functions, basic counting principles, permutations, combinations, generalized permutations and combinations (with/without repetitions, distinguishable/indistinguishable objects), Binomial coefficients and identities. Double counting, combinatorial proof technique, Pigeon-Hole Principle and some applications, Inclusion Exclusion Principle, and applications.

Recurrence relations, modeling using recurrence relations (some examples Fibonacci numbers, Catlan numbers, Derangements, Tower of Hanoi, partitions), generating functions and their application in counting.

2. Problem Solving based on Basic Discrete Probability:

Definition of probability, examples, independence of events, conditional probability, union bound, inclusion exclusion, Bayes' rule, discrete random variables, expectation, variance, linearity of expectation, sum of independent random variables, Markov and Chebyshev inequality, weak law of large numbers, standard distributions (Bernoulli, Binomial, Geometric), coupon collector problem, birthday paradox, probabilistic recurrences. Uniform generation of combinatorial structures. Indicator random variables and their role in algorithm analysis.

3. Problem Solving based on Modular Arithmetic:

Number theory – Integers, division algorithm, divisibility and congruences, gcd and Euclid's Algorithm, extended Euclid's algorithm, application to modular inversion, prime numbers, Euclid's proof for infinitude of primes, unique factorization, Fermat's little theorem, Euler's phi function, Euler's theorem, Chinese remainder theorem, Fast modular exponentiation.

4. Problem Solving based on Graph Theory:

[To be taught in combinatorial perspective] Graphs, different representations, properties of incidence and adjacency matrices, directed/undirected graphs, degree of a vertex, connected components, paths, cycles in graph, Eulerian and Hamiltonian tours, Trees, properties of trees,

Simple combinatorial problem solving based on graphs, bipartite graphs (graph with only odd cycles, 2-colorable graphs), Planar graphs, Euler's theorem for planar graph, Graph colorings, matching in bipartite graphs

List of Course Seminar Topics:

1. NFA Vs DFA
2. Pumping Lemma and Applications
3. Closure properties of Regular languages
4. Decision properties of Regular languages
5. Chomsky hierarchy
6. Application of TOC principles in compiler design
7. Hilbert's 10th problem
8. Context Free and Context sensitive grammars
9. Pumping Lemma for CFL and applications
10. Recursive and Recursively enumerable languages

List of Course Group Discussion Topics:

1. Applications of Automata theory in Compiler design
2. Applications of Automata theory in Natural language processing
3. Undecidability
4. Software testing, why it is very hard?
5. Robustness of Turing machine model
6. Godel's incompleteness theorem
7. Countable and un-countable sets
8. P Vs NP problem
9. Church Turing thesis
10. Models of computation

List of Home Assignments:**Design:**

1. Solve 5 challenging problems on NFA, DFA
2. Solve 5 challenging problems on non regular, regular languages
3. Solve 5 challenging problems on Context free grammars, PDAs
4. Solve 5 challenging problems on Turing machines
5. Solve 5 challenging problems on undecidability

Case Study:

1. Randomized algorithms for pattern matching
2. Myhill-Nerode theorem and applications
3. Chomsky-Schützenberger Theorem and Dyck languages
4. Lambda Calculus
5. Hilbert's 10th Problem

Blog

1. Finite Automata
2. Timed Automata and applications
3. Buchi Automata

4. Non-regular languages

5. Contability

Surveys

1. Pattern Matching algorithms

2. Parsers

3. Evolution of models of computations

4. Role of nondeterminism in theory of computation

5. Closure and decision properties of Context free languages

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.

MSE: 10% + ESE: 10% + Seminar: 15% Group Discussion: 15% + Home Assignments: 10% + Discrete-Maths evaluation 20% + CVV: 20%

Text Books: (As per IEEE format)

1. Hopcroft J, Motwani R, Ullman, Addison-Wesley, "Introduction to Automata Theory, Languages and Computation", Second Edition, ISBN 81-7808-347-7.

2. Michael Sipser, Course Technology, "Introduction to Theory of Computation", Third Edition, ISBN-10: 053494728X.

3.. "Discrete Mathematics and its applications" by Kenneth Rosen (William C Brown Publisher)

Reference Books: (As per IEEE format)

1. J. Martin, "Introduction to Languages and the Theory of Computation", Third edition, Tata McGraw-Hill, ISBN 0-07-049939-x, 2003.

2. Daniel I. A. Cohen, "Introduction to Computer Theory", Wiley-Second Edition, ISBN-10 : 04711377

Moocs Links and additional reading material: www.nptelvideos.in**Course Outcomes:**

The student will be able to –

1. Infer the applicability of various automata theoretic models for recognizing formal languages.
2. Discriminate the expressive powers of various automata theoretic and formal language theoretic computational models.
3. Illustrate significance of non determinism pertaining to expressive powers of various automata theoretic models.
4. Comprehend general purpose powers and computability issues related to state machines and grammars.
5. Explain the relevance of Church-Turing thesis, and the computational equivalence of Turing machine model with the general purpose computers.
6. Grasp the theoretical limit of computation (independent of software or hardware used) via the concept of undecidability.

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO4	PO9	PO12	PSO13
3	3	2	1	2	3

CO attainment levels

CO number	1	2	3	4	5	6
Attainment level	2	3	3	4	5	5

Future Courses Mapping:

Compiler design, Computational Complexity theory, Computability theory, Advanced Algorithms, Natural Language Processing, Artificial Intelligence

Job Mapping:

Wherever one wants to formally talk about underlying model, the restrictions imposed by the model, what is the power and limitations of the model, the principles learnt in this course are useful. Due to abstract nature of the course, the principles learnt have wide applicability, let it be domain of Machine learning, Natural Language processing, Compiler design, Parallel

computation, for each of them having background of Theory of Computation is very useful. If student wants to pursue higher education/ research in Computer Science, this course is must.

FF No. :654

Syllabus Template**CS2226:: Software Engineering****Course Prerequisites: Data Structures****Course Objectives:**

1. To summarize capabilities and impact of Software Development Process Models and justify process maturity through application of Software Engineering principles and practices
2. To discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model using stakeholder analysis and requirement validation.
3. To formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework
4. To compose system analysis and design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented analysis and design principles and Model Driven Engineering practices using UML-supported modeling tools.
5. To comprehend the nature of design patterns by understanding a small number of examples from different pattern categories and apply these patterns in creating a correct design using design heuristics
6. To propose multi-faceted defendable solutions demonstrating team-skills accommodating design patterns reducing the potential cost and performance impedance in order to realize system artifacts with the help of Model Driven Development practices using, scheduling, estimation and risk management activities.

Credits:5.....**Teaching Scheme Theory:...3 Hours/Week****Tut: 1 Hours/Week****Lab:...2.Hours/Week**

Course Relevance: Given that software engineering is built upon the foundations of both computer science and engineering, a software engineering curriculum can be approached from either a computer science-first or software engineering-first perspective; there clearly is merit in both approaches. Software engineering spans the entire software lifecycle - it involves creating high-quality, reliable programs in a systematic, controlled, and efficient manner using formal methods for specification, evaluation, analysis and design, implementation, testing and maintenance. any software products are among the most complex of man-made systems, requiring software development techniques and processes that successfully scale to large applications which satisfy timing, size, and security requirements all within acceptable timeframes and budgets. For these reasons, software engineering requires both the analytical and descriptive tools developed in computer science and the rigor that the engineering disciplines bring to the reliability and trustworthiness of the systems that software developers design and implement while working cohesively in a team environment.

SECTION-1

Topics and Contents

Software Engineering Paradigms: Overview of Software Engineering, Software Process Framework, Traditional Process Models, Process Models: Code-and-Fix, Waterfall Model, Rapid Application Development, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Cleanroom Methodology, Component-Based Software Engineering, CMMI, Software Engineering Principles and Practices, Requirements Engineering Tasks, Requirement Elicitation Techniques, Software Requirements: Functional, Non-Functional, Domain Engineering activities, Requirements Characteristics and Characterization, Eliminating Requirement Ambiguities, Conflict Identification and Resolution, Requirement Qualities, Requirement Specification, Requirement Traceability, Requirement Prioritization, Relationship of Requirement Engineering to other Framework Activities, System Scope Determination and Feasibility Study, Statement of Work Generation, Requirements Verification and Validation, Requirement Maturity, Technical Reviews, Stakeholder Management

Overview of Agile Methodology: Introducing Agile in Practice, Landscape of Agile and Planned Methods, Agile Challenges in Practice, Composite Agile Method and Strategy (CAMS), Composite Agile and IT: Enablement, Development, and Maintenance, Collaborative-Agile Business Management, Business Analysis and Composite Agile, CAMS Project Management and ICT Governance, Agile Adoption in Organizations. Time-Boxing, Kanban, and Theory of Constraints, Lean IT, Pair Programming, Extreme Programming, DSDM, User Requirements in the context of Agile

The Scrum: Scrum Origins: What Is Scrum? Scrum Origins, Why Scrum? Scrum Framework, Agile Principles, Overview, Variability and Uncertainty, Sprints., Requirements and User Stories, Product Backlog, Estimation and Velocity, Technical Debt, Roles: Product Owner, Scrum Master, Development Team, Scrum Team Structures, Managers, Planning: Scrum Planning Principles, Portfolio Planning, Envisioning (Product Planning), Release Planning (Longer-Term Planning), Sprinting: Sprint Planning, Sprint Execution, Sprint Review, Sprint Retrospective, Scrum and Service Industry

SECTION-1I

Topics and Contents

System Behavior Specification: Static Behavior: Use Cases, Use Case Diagram Components, Use Case Diagram, Actor Generalization, Include and Extend, Template for Use Case Narrative, Building Domain Model, and capturing system behavior in use cases, Use cases and User Stories, Dynamic Behavior: Sequence diagrams, object lifelines and message types, Modeling collections multiobjects, Refining sequence diagrams, Collaboration diagrams, States, events and actions, Nested machines and concurrency, Modifying the object model to facilitate states, Modeling methods with activity diagrams, Activity Diagrams: Decisions and Merges, Synchronization, Iteration, Partitions, Parameters and Pins, Expansion Regions, Swimlanes, concurrency and synchronization, Communication Diagram, Interaction Overview Diagrams, Timing Diagrams

Software Architecture Design and Configuration Management: Analysis Concepts, Analysis Methods, The Design Model, Design Qualities, Characteristics of Design activities, Design Principles, Cohesion and Coupling, Software Architecture Vs Software Design, Software Reuse, Design Heuristics, User Interface Design: Rules, User Interface Analysis and Steps in Interface Design, Design Evaluation, Source Code Management,

Foundations of Software Architecture, Reference Architectures, Architectural Design: Software Architecture, Data Design and Architectural Design, Views, Viewpoints, Perspectives, Conceptual Architecture View, Module Architecture View, Execution Architecture View, Code Architecture View.

Architecture styles: data-flow, object oriented, layered, data-centered, call and return, Repository, Pipe-Filter, Peer-Peer, Publish-Subscribe, Client-Server, Two-Tier, Three-Tier, N-Tier, Heterogeneity in Architecture, Categorizing classes: entity, boundary and control , Modeling associations and collections, Preserving referential integrity, Achieving reusability, Reuse through delegation, Identifying and using service packages, Improving reuse with design Packages and interfaces: Distinguishing between classes/interfaces, Exposing class and package interfaces.

Project Management Principles and Design Patterns:, Design Patterns: Introduction to Design Pattern, Describing Design Patterns, Catalogue of Design Patterns Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Structural Patterns: Adapter, Bridge, Composite, Decorator, Facade, Flyweight, Proxy, Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Antipatterns, Applications of Design Patterns, Project Management Activities, Structures and Frameworks, Teamwork, Leadership, Project Planning, Project

Scheduling, Risk Analysis, Introduction to Function Points, Empirical Estimation, COCOMO II model.

List of Tutorials: (Any Four)

1. Study of Requirement Engineering
2. Study on preparation of System Requirement Specification
3. Scrum Artifacts
4. User Stories and Use Case
5. Product Backlog Development
6. Burn-up and Burn-down chart development and management
7. Software System Analysis and Design: UML
8. Incorporation of Design patterns

List of Practical's: (Any Eight)

1. A real-world problem issue is required to be identified with manageable scope. The problem scenarios are required to be identified for target system to be developed. The scenarios are stated in the form of Statement-of-Work template. The SOW document shall address the vision, goals, and objectives of the project.
2. The initial requirements and feature set for the target system is required to be identified. The requirements are required to be synthesized with stakeholder participation. The project roles are assigned to the project team with clear indicator of responsibilities. The initial requirements summary document with adequate and minimal infrastructure is required to be developed using multiple iterations.
3. The product backlog for the project aimed at maintaining a prioritized queue of project requirements shall be created.
 - a. It should be dynamic and should be continuously groomed as the project progresses. Agile projects generally use an iceberg strategy for grooming the product backlog.
 - b. The items that are near the top of the iceberg and are closest to going into development should get the most attention.
 - c. There should typically be about two to three sprints worth of stories at the top of the backlog that are well-groomed and ready to go into development in order to avoid a situation where the project team is waiting for work to do.
4. Sprint-level planning activity accommodating story points, planning poker shall be performed. The Sprint-plan and Sprint-design indicating detailed activity planner shall be developed.
5. To decompose and organize the problem domain area into broad subject areas and identify the boundaries of problem/system. Specify the behavior of the target system and map requirements to Use cases.
 - a. The System Context Diagram depicts the overall System behavioral trace and Requirement Capture diagram depicts the hierarchical Use case Organization. The Use Case diagram should encompass
 - b. Actors (External Users)
 - c. Transactions (Use Cases)
 - d. Event responses related to transactions with external agents.
 - e. Detection of System boundaries indicating scope of system.
6. To depict the dynamic behavior of the target system using sequence diagram. The Sequence diagram should be based on the Scenarios generated by the inter-object Communication. The model should depict:
 - a. Discrete, distinguishable entities (class).
 - b. Events (Individual stimulus from one object to another).
 - c. Conditional events and relationship representation.
7. To depict the state transition with the life history of objects of a given class model. The

model should depict:

- a. Possible ways the object can respond to events from other objects.
 - b. Determine of start, end, and transition states.
8. To depict the dynamic behavior using detailed Activity diagram. Activity is a parameterized behavior represented as coordinated flow of actions. The flow of execution is modeled as activity nodes connected by activity edges.
 - a. A node can be the execution of a subordinate behavior, such as an arithmetic computation, a call to an operation, or manipulation of object contents.
 - b. Activities may form invocation hierarchies invoking other activities, ultimately resolving to individual actions.
 9. To develop logical static structure of target system with Software Class diagram. To prepare Class Collaboration-Responsibility (CRC) cards for the Conceptual classes traced from System analysis phase. The design model should depict
 - a. Relationship between classes: inheritance, Assertion, Aggregation, Instantiation
 - b. Identification of objects and their purpose.
 - c. Roles / responsibilities entities that determine system behavior.
 10. To enhance Software Class diagram to Architecture diagram with appropriate design patterns. The patterns selected shall be justifiable and applied to individual and distinct hierarchies. Suitable Architectural Styles shall be selected and the structural elements shall be well-documented.

To represent physical module that provides occurrence of classes or other logical elements identified during analysis and design of system using Component diagram. The model should depict allocation of classes to modules. To narrate precise Program Design Language constructs separating computation from interface. To represent deployment view of the system through Architecture Diagram.

List of Projects:

1. Automated Parking lot identifier
2. Health Care Software's
3. Financial Domain
4. Appraisal Systems
5. Automate Project Administration System

6. Translator for Agriculture System
7. Development of applications manageable by Agile
8. Development of SMART applications

List of Course Seminar Topics:

1. Agile software development
2. AI and software engineering
3. Apps and app store analysis
4. Automated reasoning techniques
5. Autonomic and (self-)adaptive systems
6. Big data
7. Cloud computing
8. Component-based software engineering
9. Computer-supported cooperative work
10. Configuration management and deployment
11. Crowd sourced software engineering
12. Cyber physical systems
13. Data-driven software engineering
14. Debugging
15. Dependability, safety, and reliability

List of Course Group Discussion Topics:

1. Distributed and collaborative software engineering
2. Domain modelling and meta-modelling
3. Education
4. Embedded software
5. Emerging domains of software
6. Empirical software engineering
7. End-user software engineering
8. Fault localization
9. Formal methods
10. Green and sustainable technologies
11. Human and social aspects of software engineering
12. Human-computer interaction
13. Knowledge acquisition and management
14. Machine learning for software engineering
15. Middleware, frameworks, and API

List of Home Assignments:**Design:**

1. Software visualization

- 2. Specification and modeling languages
- 3. Tools and environments
- 4. Traceability
- 5. Ubiquitous and pervasive software systems
- 6. Validation and verification

Case Study:

- 1. Software economics and metrics
- 2. Software engineering for machine learning
- 3. Software evolution and maintenance
- 4. Software modeling and design
- 5. Software process
- 6. Software product lines

Blog

- 1. Mining software engineering repositories
- 2. Mobile applications
- 3. Model-driven engineering
- 4. Parallel, distributed, and concurrent systems
- 5. Performance
- 6. Program analysis
- 7. Program comprehension
- 8. Program repair
- 9. Program synthesis
- 10. Programming languages
- 11. Recommendation systems
- 12. Refactoring

Surveys

- 1. Requirements engineering
- 2. Reverse engineering
- 3. Safety-critical systems
- 4. Scientific computing
- 5. Search-based software engineering
- 6. Security, privacy and trust
- 7. Software architecture
- 8. Software reuse
- 9. Software services
- 10. Software testing

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.

MSE+ESE+HA+LAB+CP+CVV+SEMINAR+GD

Text Books: (As per IEEE format)

1. Ian Sommerville, 'Software Engineering', Addison-Wesley, 9th Edition, 2010, ISBN-13: 978-0137035151.
2. Kenneth S. Rubin, Essential SCRUM: A Practical Guide To The Most Popular Agile Process, Addison-Wesley, ISBN-13: 978-0-13-704329-3, 2012
3. Tom Pender, "UML Bible", John Wiley & sons, ISBN – 0764526049

Reference Books: (As per IEEE format)

1. SorenLauesen, Software requirements: Styles and techniques, Addison Wesley, ISBN 0201745704, 2002
2. Dean Leffingwell, Agile Software Requirements, Addison-Wesley, ISBN-13: 978-0-321-63584-6, 2011
3. Charles G. Cobb, The Project Manager's Guide To Mastering Agile: Principles and Practices for an Adaptive Approach, Wiley Publications, ISBN: 978-1-118-99104-6 (paperback), ISBN 978-1-118-99177-0 (epdf), 2015
4. Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language Users Guide", 2nd Edition, Addison- Wesley, ISBN – 0321267974
5. Erich Gamma, Richard Helm, Ralph Johnson, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, ISBN-10: 0201633612 ISBN-13: 978-0201633610
6. Paul Clements, Felix Bachmann, Len Bass, David Garlan, Documenting Software Architectures: Views and Beyond Addison-Wesley Professional 2003, ISBN-10:0201703726, ISBN-13: 9780201703726

Moocs Links and additional reading material: www.nptelvideos.in

www.nptelvideos.in

www.coursera.com

www.udemy.com

Course Outcomes:

1. Summarize capabilities and impact of Software Development Process Models and justify process maturity through application of Software Engineering principles and practices focusing tailored processes that best fit the technical and market demands of a modern software project.
2. Discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model using stakeholder analysis and requirement validation.
3. Formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework along with Propose and demonstrate realistic solutions supported by well-formed documentation with application of agile roles, sprint management, and agile architecture focusing project backlogs and velocity monitoring.
4. Compose system analysis and design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented analysis and design principles and Model Driven Engineering practices using UML-supported modeling tools.
5. Comprehend the nature of design patterns by understanding a small number of examples from different pattern categories and apply these patterns in creating a correct design using design heuristics, published guidance, applicability, reasonableness, and relation to other design criteria resulting in well-documented system profiles to the engineering and social community.
6. Propose multi-faceted defendable solutions demonstrating team-skills accommodating design patterns reducing the potential cost and performance impedance in order to realize system artifacts with the help of Model Driven Development practices using, scheduling, estimation and risk management activities.

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO4	PO8	PO11	PSO3
2	3	3	2	1	3

CO attainment levels

CO1	CO2	CO3	CO4	CO5	CO6
PO2	PO3	PO4	PO8	PO11	PSO3
1	5	2	3	3	4

Future Courses Mapping:

Software testing and Quality Assurance, Service-oriented Software

Job Mapping:

Application Architect, Project Designer, SCRUM Role Players

CS2227 ::Database Management Systems**Course Prerequisites:** Data structures, Discrete Mathematics**Course Objectives:**

1. To introduce the fundamentals of different data modeling techniques.
2. To design and development of relational database management systems.
3. To Study the theory behind database systems, the issues that affect their functionality and performance
4. To design of query languages and the use of semantics for query optimization.
5. To understand the latest trends of data management systems.

Credits: 4**Teaching Scheme Theory: 3 Hours/Week****Tut: NA****Lab: 2 Hours/Week**

Course Relevance: The course emphasizes on the fundamentals of database modeling and design, the languages and models provided by the database management systems, and database system implementation techniques. The goal is to provide an in-depth and up-to-date presentation of the most important aspects of database systems and applications, and related technologies.

SECTION-I**Topics and Contents**

Introduction: Need of Database Management Systems, Evolution, Database System Concepts and Architecture, Database Design Process

Data Modeling: Entity Relationship (ER) Model, Extended ER Model, Relational Model, Codd's Rules;

Database Design: Need of Normalization, Functional Dependencies, Inference Rules, Functional Dependency Closure, Minimal Cover, Decomposition Properties, Normal Forms: 1NF, 2NF, 3NF and BCNF, Multi-valued Dependency, 4NF, Relational Synthesis Algorithms

Query Languages: Relational Algebra, SQL: DDL, DML, Select Queries, Set, String, Date and Numerical Functions, Aggregate Functions ,Group by and Having Clause, Join Queries, Nested queries, DCL, TCL, PL/SQL: Procedure, Function, Trigger, Mapping of Relational Algebra to SQL

SECTION-II

Topics and Contents

Storage and Querying: Storage and File structures, Indexed Files, Single Level and Multi Level Indexes; Query Processing, Query Optimization

Transaction Management: Basic concept of a Transaction, ACID Properties, State diagram, Concept of Schedule, Serializability – Conflict and View, Concurrency Control Protocols, Recovery techniques

Parallel and Distributed Databases: Architecture, I/O Parallelism, Interquery, Intraquery, Intraoperation and Interoperation Parallelism, Types of **Distributed** Database Systems, Distributed Data Storage, Distributed Query Processing

NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Databases, Types of NOSQL Databases, BASE properties, CAP theorem, Big Data, HADOOP: HDFS, MapReduce.

Data Warehousing: Architecture and Components of Data Warehouse, Warehouse Schemas, OLAP

List of Practicals: (Any Six)

- 1) Create a database with appropriate constraints using DDL and populate/modify it with the help of DML.
- 2) Design and Execute "SELECT" queries using conditional, logical, like/not like, in/not in, between...and, is null/is not null operators in where clause, order by, group by, aggregate functions, having clause, and set operators. Use SQL single row functions for date, time, string etc.
- 3) Write equijoin, non equijoin, self join and outer join queries. Write queries containing single row / multiple row / correlated sub queries using operators like =, in, any, all, exists etc. Write DML queries containing sub queries. Study a set of query processing strategies.
- 4) Write PL/SQL blocks to implement all types of cursor.
- 5) Write useful stored procedures and functions in PL/SQL to perform complex computation.
- 6) Write and execute all types of database triggers in PL/SQL.
- 7) Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
- 8) Create a database with suitable example using MongoDB and implement Inserting and saving document, Removing document, Updating document
- 9) Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques:find and findOne, Query criteria, Type-specific queries
- 10) Implement Map Reduce operation with suitable example using MongoDB.

List of Tutorial (Any 6)

- 1) Draw ER Diagram for any information system application
- 2) Draw Extended ER Diagram for any information system application
- 3) Convert ER Diagram to Relational Model
- 4) Convert EER Diagram to Relational Model
- 5) Solving the Queries using Relational Algebra
- 6) Normalization using Minimal Cover,
- 7) Normalization using Synthesis Algorithm
- 8) Creation of Data warehouse for any organisation.
- 9) OLAP & OLTP
- 10) Advanced SQL

List of Projects:

Designing and Implementing a Small-scale Relational DBMS

Phase 1: SQL interpreter

Phase 2: Persistent data management

Phase 3: Relational Operations

List of Course Seminar Topics:

1. Object and Object-Relational Databases
2. XML data model, XML documents and associated languages
3. Database Security
4. Modern Storage Architectures
5. Google Cloud- SQL Databases
6. Google Cloud- NOSQL Databases
7. Amazon Databases
8. Oracle NoSQL Database
9. Cassandra DB
10. Data Center Engineering

List of Course Group Discussion Topics:

1. RDBMS Vs NOSQL
2. ER model Vs UML diagrams
3. Normalized vs unnormalized database
4. OLTP Vs OLAP
5. Data Warehouse Vs Data Lake
6. RDBMS and OODBMS
7. Neo4J and GraphBase
8. DynamoDB Vs Voldemort
9. Google File System (GFS) Vs HDFS (Hadoop Distributed File System)
10. Hive SQL Vs Pig Latin

List of Home Assignments:**Design:**

1. Suppose you want to build a video site similar to YouTube. Identify disadvantages of keeping data in a file-processing system. Discuss the relevance of each of these points to the storage of actual video data, and to metadata about the video, such as title, the user who uploaded it, tags, and which users viewed it.
2. Illustrate data model that might be used to store information in a social-networking system such as Facebook
3. Describe the circumstances in which you would choose to use embedded SQL rather than SQL alone or only a general-purpose programming language.
4. Give the DTD and XML Schema for Library Management System. Give a small example of data corresponding to this DTD and XML. Write ten queries in Xpath and XQuery
5. If you were designing a Web-based system to make airline reservations and sell airline tickets, which DBMS architecture would you choose? Why? Why would the other architectures not be a good choice? Design a schema and show a sample database for that application. What types of additional information and constraints would you like to represent in the schema? Think of several users of your database, and design a view for each.

Case Study:

1. PostgreSQL
2. Oracle
3. IBM DB2 Universal Database
4. Microsoft SQL Server
5. SQLite database

Blog

1. OLAP tools from Microsoft Corp. and SAP
2. Views in database
3. Dynamic SQL and Embedded SQL
4. Active databases and Triggers
5. SQL injection attack

Surveys

1. Keyword queries used in Web search are quite different from database queries. List key differences between the two, in terms of the way the queries are specified, and in terms of what is the result of a query.
2. List responsibilities of a database-management system. For each responsibility, explain the problems that would arise if the responsibility were not discharged
3. List reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a library of C or C++ functions to carry out data manipulation
4. Consider a bank that has a collection of sites, each running a database system. Suppose the only way the databases interact is by electronic transfer of money between themselves, using persistent messaging. Would such a system qualify as a distributed database? Why?
5. Data warehousing products coupled with database systems

Suggest an assessment Scheme:

MSE:10 ESE:10 HA:10 CP:10 Lab:10 Seminar:15 GD: 15 CVV:20

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan; "Database System Concepts"; 6th Edition, McGraw-Hill Education
2. Ramez Elmasri, Shamkant B. Navathe; "Fundamentals of Database Systems"; 7th Edition, Pearson

Reference Books:

1. Thomas M. Connolly, Carolyn E. Begg," Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition ;Pearson
2. Raghu Ramakrishnan, Johannes Gehrke; "Database Management Systems", 3rd Edition; McGraw Hill Education
3. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.
4. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
5. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
6. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.
8. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.
9. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

Moocs Links and additional reading material:

<https://nptel.ac.in/courses/106/105/106105175/>
https://onlinecourses.nptel.ac.in/noc21_cs04/preview
<https://www.datacamp.com/courses/introduction-to-sql>
[Oracle MOOC: PL/SQL Fundamentals - Oracle APEX](#)

Course Outcomes:

- 1)Design and draw ER and EER diagrams for real life applications.
- 2)Transform conceptual schema of high level data model into implementation data model
- 3)Apply the concepts of normalization to develop the quality relational data model
- 4)Formulate queries in relational algebra, SQL and write PL/SQL blocks.
- 5)Acquaint with physical database file structures
- 6)Identify the use of database techniques such as NOSQL

CO PO Map

CO1: PO2 CO2:PO3 CO3:PO5 CO4:PO9 CO5:PO10 CO6:PSO15

CO attainment levels

CO1:1 CO2:4 CO3:2 CO4:4 CO5:3 Co6:5

Future Courses Mapping:

Advanced databases
Big Data Management
Cloud Databases
Database Administrator

Job Mapping:

Database Engineer
SQL developer
PL/SQL developer

FF No. : 654

CS2208::SOFTWARE DEVELOPMENT PROJECT –II**Course Prerequisites: C++ and JAVA****Course Objectives:**

1. To develop problem solving ability using programming skills by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students

Credits:3.....**Teaching Scheme Theory:.... Hours/Week****Tut: Hours/Week****Lab:..6..Hours/Week**

Course Relevance: Software project development comes under the category of project based learning (PBL). PBL 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 by using domain specific language technologies. PBL is "learning by doing."

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. Project based learning will also redefine the role of teacher as mentor in the learning process.

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 students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Teacher's Role in PBL :

- Teacher is not the source of solutions; rather he will act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

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 disciplinary subject frame/domain.
- 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.
- Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.
- Activities may include- Solving real life problems, investigation, /study and Writing reports of in depth study, field work.

Student's Role in PBL:

- Students must have the 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.
- . 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
- Students in PBL are expected to individually.

Developing 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.
- Use the following mechanism to maintain the track of moving towards the solution.
 - 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?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- 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

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

Sample Software Project Statement based on Java and Mobile Application Development

- 1) Design and deploy an android app for real time criminal detection on the basis of database provided by the police department.
- 2) Design and deploy an android app for real time health alarm generation like Aarogya Setu.
- 3) Design and deploy a system for real time home kitchen accidents and appliances control.

...not limited to.....Faculty and students are free to include other area which meets the society requirements at large.

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Higher levels of the Booms Taxonomy - analyze, apply, evaluate and create.

Text Books: (As per IEEE format)

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 Robart Capraro, Mary Margaret Capraro*

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

- 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

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1, PO3	PO2, PO8, PO11, PO12, PSO3, PSO4	PO3, PO4, PSO1	PO5, PO8	PO6,7,9,12	PO12, PSO1, PSO2
3, 3	3, 2, 2, 2, 3, 3	2, 2, 1	2, 2	2, 2, 2, 1	2, 3, 3

CO attainment levels

CO1 -4 CO2 –2 CO3-4 CO4-5 CO5 -1 CO6-3

Future Courses Mapping:

Mention other courses that can be taken after completion of this course

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer

CS2210::ENGINEERING DESIGN AND INNOVATIONS-IV**Course Prerequisites:** Problem Based Learning**Course Objectives:**

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

Credits:4.....**Teaching Scheme Theory:.... Hours/Week****Tut: Hours/Week****Lab:..8.Hours/Week**

Course Relevance: Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. 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. Project based learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of “Engineering Design” are designed as a ladder to extend connectivity of software technologies to solve real word problem using interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.
- It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea .The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- 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 disciplinary subject frame/domain.
- 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.

Teacher's Role in PCL :

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PCL must be responsible for their own learning.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PCL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Developing Inquiry Skills:

- Students in PCL 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.
- Use the following mechanism to maintain the track of moving towards the solution.
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?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- 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

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

EDI Sample Case Studies :-

With the adaptation of industry communication standards, Raspberry Pi and Sensors, following projects can be taken up:

- 1) Design a deployable product for soil moisture detection
- 2) Design a deployable product for temperature detection
- 3) Design a deployable product for pressure detection
- 4) Design a deployable product smoke detection
- 5) Design a deployable product for motion detection
- 6) Design a deployable product for sound detection

...not limited to.....Faculty and students are free to include other areas which meet the society requirements at large.

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

To focus on the higher levels of the Booms Taxonomy analyze, apply, evaluate and create.

Text Books: (As per IEEE format)

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.*
2. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro*

Reference Books: (As per IEEE format)

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. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development. By James Shore & Shane Warden.*

Moocs Links and additional reading material: www.nptelvideos.in

<https://worldwide.espacenet.com/>

Course Outcomes:

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

- 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

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2, PO8	PO3	PO4, PO5, PO8	PO6, PO7, PO9, PO12	PO12, PSO1, PSO2, PSO4
3	3, 1	2	2, 2, 2	2, 2, 2, 1	2, 3, 2, 2

CO attainment levels

CO1 -4 CO2 –2 CO3-4 CO4-5 CO5 -1 CO6-3

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer



Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus

B.Tech. (Computer Engineering)

Effective from Academic Year 2022-23

Prepared by: - Board of Studies in Computer Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Chairman – BOS

Chairman – Academic Board

Title: Course Structure

FF No. 653

Branch: Computer Year: S.Y. A.Y.: 2022-23 Module: III

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme									Credits
			Th	Lab	Tut	CA	MSA	ESA					Total		
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)		
S1	MD2201	Data Science	2	2	1	-	20	-	20	20	20	20	100	4	
S2	CS2221	Internet of Things	2	2	1	-	20	-	20	20	20	20	100	4	
S3	CS2218	Object Oriented Programming	2	2	1	10	40	10	-	20	20	100	4		
S4	CS2227	Database Management System	2	2	1	-	20	-	20	20	20	20	100	4	
S5	CS2229	Design Thinking	-	-	-	-	-	-	-	-	-	-	100	1	
S6	CS2230	Engineering Design and Innovation-III	-	12	-	-	30	-	-	-	-	70	100	6	
		Total	8	20	4	10	30	60	40	70	60	80	150	600	23

Title: Course Structure

FF No. 653

Branch: Computer **Year:** S.Y. **A.Y.:** 2022-23 **Module:** IV

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme							Total	Credits	
			Th	Lab	Tut	CA	MSA	ESA							
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)		
S1	CS2202	Data Structures	2	2	1	10	-	-	40	10	-	20	20	100	4
S2	CS2225	Theory of Computation	2	2	1	-	-	20	-	20	20	20	20	100	4
S3	CS2228	Operating Systems	2	2	1	-	-	20	-	20	20	20	20	100	4
S4	CS2235	Computer Organization and Architecture	2	2	1	-	-	20	-	20	20	20	20	100	4
S5	CS2229	Design Thinking	-	-	-	-	-	-	-	-	-	-	-	100	1
S6	CS2230	Engineering Design and Innovation-III	-	12	-	-	30	-	-	-	-	-	70	100	6
		Total	8	20	4	10	30	60	40	70	60	80	150	600	23

Title: Course Structure

FF No. 653

Branch: Computer **Year:** T.Y. **A.Y.:** 2022-23 **Module:** V

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme								Total	Credits		
			Th	Lab	Tut	CA	MSA	ESA									
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)				
S1	CS3051	Operating System	2	2	1	10	-	-	40	10	-	20	20	100	4		
S2	CS3052	Computer Networks	2	2	1	-	-	20	-	20	20	20	20	100	4		
S3	CS3205	Design and Analysis of Algorithms	2	2	1	-	-	20	-	20	20	20	20	100	4		
S4	CS3215	Web Technology	2	2	1	10	-	-	40	10	-	20	20	100	4		
S5	CS3055	Design Thinking - I	-	-	-	-	-	-	-	-	-	-	-	100	1		
S6	CS 3057	Engineering Design and Innovation - V	-	12	-	-	30	-	-	-	-	-	70	100	6		
		Total	8	20	4	20	30	40	80	60	40	80	150	600	23		

Title: Course Structure

FF No. 653

Branch: Computer Year: T.Y. A.Y.: 2022-23 Module: VI

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme									Credits
			Th	Lab	Tut	CA	MSA	ESA					Total		
						Lab (%)	MSE (%)	HA (%)	LAB (%)	Course Project (%)	PPT /GD (%)	CVV (%)	ESE (%)		
S1	CS3207	Compiler Design	2	2	1	-	-	20	-	20	20	20	20	100	4
S2	CS3226	Cloud Computing	2	2	1	-	-	20	-	20	20	20	20	100	4
S3	CS3202	Artificial Intelligence	2	2	1	-	-	20	-	20	20	20	20	100	4
S4	CS3220	Cyber Security	2	2	1	-	-	20	-	20	20	20	20	100	4
S5	CS3055	Design Thinking - I	-	-	-	-	-	-	-	-	-	-	-	100	1
S6	CS 3057	Engineering Design and Innovation - V	-	12	-	-	30	-	-	-	-	-	70	100	6
		Total	8	20	4	-	30	80	-	80-	80	80	150	600	23

1.

Title: Course Structure

FF No. 653

Branch: Computer **Year:** BTech **A.Y.:** 2022-23 **Module:** VII

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme						Total	Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)		
OE1	MD4205	Marketing Management	2	0	0	10	-	30	-	30	-	30	100	2
OE2	CS4217	Human Computer Interaction	2	0	0	10	-	30	-	30	-	30	100	2
	CS4219	Internet of Things	2	0	0	10	-	30	-	30	-	30	100	2
	CS4222	Image Processing	2	0	0	10	-	30	-	30	-	30	100	2
	ET4230	Natural Language Processing	2	0	0	10	-	30	-	30	-	30	100	2
OE3	CS4272	Neural Networks	2	0	0	10	-	30	-	30	-	30	100	2
	CS4201	Cloud Computing	2	0	0	10	-	30	-	30	-	30	100	2
	ET4232	Deep Learning	2	0	0	10	-	30	-	30	-	30	100	2

	CS4271	Magic XPA/XPI	2	0	0	10	-	30	-	30	-	30	100	2
S4	CS4225	Major Project	0	22	0		-	30	-	70	-	-	100	11
		Total	6	22	0	30	-	120	-	160	-	90	400	17

Branch: Computer **Year:** BTech **A.Y.:** 2022-23 **Module:** VIII

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme						Total	Credits	
			Theory	LAB	Tut.	CA		MSA		ESA				
						HA (%)	LAB (%)	MSE (%)	PPT (%)	ESE (%)	GD (%)	Viva (%)		
S1	CS4232	Industry Internship	0	32	0	-	-	30	-	70	-		100	17
	CS4234	International Internship	0	32	0	-	-	30	-	70	-		100	17
	CS4202	Research Internship	0	32	0	-	-	30	-	70	-		100	17
		Total	-	32	-	-	-	30	-	70	-		100	17

INDEX

SN	Particular	Page No
1	Second Year Module -III Content	03
2	Second Year Module -IV Content	45
3	Third Year Module -V Content	95
4	Third Year Module -VI Content	155
5	Final Year Module -VII Content	202
6	Final Year Module -VIII Content	238

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

T.Y. B. Tech. (Computer Engineering)

Effective from Academic Year 2022-23

Prepared by: - Board of Studies in Computer Engineering

Pattern “C21”

T. Y. B. Tech. Computer

Engineering AY 2022-23

Module V courses

COURSE CODE: CS3051**COURSE NAME: OPERATING SYSTEM****Course Prerequisites:** Computer Architecture & organization, Data Structure**Course Objectives:**

1. To learn functions of Operating System
2. To learn the importance of concurrency and how to implement concurrent abstractions correctly in an OS.
3. To learn OS scheduling policies and mechanisms.
4. To deal with deadlock
5. To learn memory management schemes in various ways to improve performance, and how this impacts system complexity
6. To learn design & develop the Operating system from a scratch.

Credits: 4.....**Teaching Scheme Theory: 2 Hours/Week****Tutorial: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:** Every digital device we use runs on an operating system. This course is a fundamental course in computer engineering curriculum & used as a prerequisite to study advanced courses like distributed systems, parallel computing, etc.**SECTION-I****Topics and Contents:**

Unit-I Operating Systems Overview: An introduction to the operating system, functions of OS, OS Services, System Calls, Types of system calls. [CO1] [PO1]

Unit-II Title: Process Management: -Process Concept, Process States: 2, 5, 7 state models, Process Control. Threads: Multithreading models, Thread implementations. Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: S/W approach, Semaphores, Mutex and Monitors. Readers-Writer's problem, Producer Consumer problem, Dining Philosopher problem. [CO2] [PO1, PO2, PO4]

Unit-III : CPU Scheduling : - Uniprocessor Scheduling : Preemptive, Non preemptive, Long-term, Medium-term, Short term scheduling. Scheduling Algorithms: FCFS, SJF, RR, Priority. [CO3] [

SECTION-II

Topics and Contents:

Unit-IV: Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery. [CO4] [PO1, PO2]

Unit-VMemory Management: Memory Management requirements, Memory Partitioning: Fixed, Dynamic Partitioning, Fragmentation, Buddy Systems, Paging, Segmentation, Address translation. Virtual Memory: Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Lookaside Buffer, VM with Segmentation with combined paging and segmentation. Thrashing. [CO5][PO1, PO2, PO4]

Unit-VI File Management: Concepts, File Organization, File Directories, File Sharing. Record Blocking, Secondary Storage Management, Free Space management, Security. [CO6] [PO1, PO9, PO12]

Tutorials:

List of Tutorials (Any Thirteen)

Tut 01 Statement: Linux Commands [CO1] [PO1]

Tut 02 Statement: Shell Script [CO1] [PO2]

Tut 03 Statement: Types of OS [CO1] [PO1]

Tut 04 Statement: System Call[CO1] [PO1]

Tut 05 Statement: Synchronization Problems[CO2] [PO2]

Tut 06 Statement: Problems on CPU Scheduling[CO3] [PO2]

Tut 07 Statement: Problems of Deadlock detection, avoidance [CO4] [PO2]

Tut 08 Statement: Problems on Placement Strategies[CO5] [PO2]

Tut 09 Statement: Problems on page Replacement Algorithms[CO5] [PO2]

Tut 10 Statement: Problems on address translation in paging & segmentation CO5] [PO2]

Tut 11 Statement: Problems on Disk scheduling algorithm[CO5] [PO2]

Tut 12 Statement: iOS -Case Study[CO1] [PO]

Tut 13 Statement: Android OS -Case Study[CO1] [PO1]

Practical's:

List of Practical's (Any Six)

Lab 01 Statement : Execution of Basic & Advanced Linux Commands. [CO1] [PO1]

Lab 02 Statement : Write shell script covering – basic arithmetic, control structures, loops, execution of Linux command in shell, command line arguments, functions and arrays.[CO1] [PO1]

Lab 03 Statement:Solve synchronization problems – Reader writer problem, Producer consumer problem & dinning philosopher problem using mutex & semaphore.[CO2] PO2]

Lab 04 Statement:Implement CPU scheduling algorithms[CO3] [PO2]

Lab 05 Statement : Implement Banker's algorithm[CO4] [PO1]

Lab 06 Statement:Implement deadlock detection algorithm[CO4] [PO1]

Lab 07 Statement:Implement placement strategies.[CO5] [PO4]

Lab 08 Statement:Implement buddy system.[CO5 , CO6] [PO4]

Lab 09 Statement:Implement page replacement algorithm[CO5, CO6] [PO4]

Lab 10 Statement:Implement disk scheduling algorithm[CO5, CO6] [PO1, PO10]

Course Projects:

List of Course Project Topics

1.Design and implementation of a

i. CPU/ Machine Simulation

ii. Supervisor Call through interrupt

Design multi programming operating system phase 1

2.Design and implementation of a Multiprogramming Operating System: Stage II

i. Paging

ii. Error Handling

iii. Interrupt Generation and Servicing

iv. Process Data Structure

3.Design and implementation of a Multiprogramming Operating System: Stage III

i. I/O Channels& I/O buffering

- ii. Multiprogramming
 - iii. I/O Spooling
4. Design multi programming operating system phase 1 with arithmetic & logical instructions
5.Design multi programming operating system phase 3 with swapping

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Text Books: (As per IEEE format)

1. Stalling William; "Operating Systems", 6th Edition, Pearson Education.
2. Silberschatz A., Galvin P., GagneG.; "Operating System Concepts", 9th Edition, John Wiley and Sons.
3. D M Dhamdhere; "Systems Programming & Operating Systems"; Tata McGraw Hill Publications, ISBN – 0074635794
4. John J Donovan; " Systems Programming " ; Tata Mc-Graw Hill edition , ISBN-13978-0-07-460482-3

Reference Books: (As per IEEE format)

1. Silberschatz A., Galvin P., Gagne G ; "Operating System Principles" 7th Edition John Wiley and Sons.
2. YashavantKanetkar; "Unix Shell Programming", 2 nd Edition, BPB Publications.
3. Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming", 1 st Edition, Australia Thomson Brooks Cole.
4. Achyut S. Godbole ,AtulKahate; "Operating Systems", 3 rd Edition, McGraw Hill.

MOOCs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:**On the completion of course, student will able to**

1. Discuss the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve.
2. Implement concurrent abstractions correctly in an OS to solve real world problems.
3. Use various CPU scheduling algorithms to construct solutions to real world problems.

4. Corelate the mechanisms related to deadlock handling in real life situations.
5. Distinguish memory management schemes & file management systems in various ways to improve performance, and analyze the impact of it on system complexity.
6. Design & develop the Operating system from a scratch.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	2															
2	2	2		1												
3	2	5		1												2
4	2	3														3
5	2	2		1												
6	2								2				3			
Avg	2	3		1					2				3			2.5

CO attainment levels:

CO1- 2

CO2 - 3

CO3 -3

CO4 - 3

CO5 - 4

CO6 - 5

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Distributed Operating System, Parallel Computing

Job Mapping:

What are the Job opportunities that one can get after learning this course

System Analyst, System Administrator, System Engineer

COURSE CODE: CS3052**COURSE NAME: COMPUTER NETWORKS****Course Prerequisites:** Operating System, Theory of Computer Science**Course (Learning) Objectives:**

1. To learn the data communication model, signal generation, data encoding, digital modulation and demodulation required for wired and wireless communication networks.
2. To learn the physical layer which includes transmission mediums, physical layer devices, transmission modes and topologies, performance issues for intranet and internetworks.
3. To learn multiple access schemes and wide area network connectivity for intranet and internetworks.
4. To learn IP protocol and routing algorithms for packet switching service framework used in intranet and internetworks.
5. To learn TCP and UDP protocol to provide quality of service over packet switching service framework used for intranet and internetworks.
6. To learn to select, design, develop, analyze and evaluate client server solutions for societal requirements at large.

Credits: 4.....**Teaching Scheme Theory: 2 Hours/Week****Tutorial: 1 Hours/Week****Lab: 2 Hours/Week**

Course Relevance: The key technology of the information age is communications. Data communications and networking is a truly global area of study, both because the technology enables global communication over telephone lines and Internet. Data communication and networking is the backbone of all IT infrastructures in the world. These technologies and applications often emerge in communication within countries of countries and spread rapidly around the world.

SECTION-I**Topics and Contents:**

**Unit-I Data Communication Networking Fundamentals and Physical Layer:
[CO1 → PO1, PO2, PO5 – CO Strength - 3,2,2]**

Communication Model: Source, Transmitter, Transmission System, Receiver, Destination, Data

Terminal Equipment (DTE), Data Communication Equipment (DCE). **Transmission Configurations:** Point to Point and Multipoint. **Transmission Modes:** Synchronous and Asynchronous. **Transmission Methods:** Serial and Parallel. Communication. **Communication Modes:** Simplex, Half Duplex, and Full Duplex. **Line Coding:** Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding, Differential Manchester Encoding. **Modulation:** Analog Modulation: Amplitude, Frequency, Phase. Pulse Modulation Techniques: PCM, PAM, PWM, PPM. **Digital Modulation:** ASK, FSK, MSK, GMSK, PSK, BPSK, PSK, QAM, CPM, OFDM and multicarrier modulations. [3 Hrs]

Networking Fundamentals: **Types of Computer Networks:** LAN, MAN, WAN, PAN, Internet, internet and Intranet. **Network Architectures:** Client-Server; Peer To Peer. **Network Architecture Modes:** Infrastructure and Ad-hoc mode. **Network Topologies:** Mesh, Star and Hierarchical. **Reference Models:** OSI, TCP/IP. Design Issues for Layers. Is ATM still used? Is ISDN dying? Is Frame Relay outdated? Is SNA still present in the Market? [3 Hrs]

Physical Layer: **Transmission Mediums:** Air, Water, Vacuum, Coaxial, Cat5, Cat5e, Cat6, Cat6a, Cat7, Cat8, OFC - Single and Multicore. **Networking Devices Wired and Wireless:** NIC, Repeater, Bridge, Switch, Modem, Router, Gateways and Access Point. [2 Hrs]

Unit-II Logical Link Control

[CO2 → PO1, PO2, PO3, PO5, PO12, PSO01 –CO Strength -3,2,2,2,3,3]

Logical Link Control: **Design Issues:** Services to Network Layer, **Framing**, **Error Control:** Parity Bits, Hamming Codes and CRC. **Flow Control Protocols:** Unrestricted Simplex, Stop and Wait, Sliding Window Protocol, **WAN Connectivity:** PPP and HDLC. PPPoE, PPPoA. Is DOCSIS used in 2022? Do we use DSL line in 2022? Do we use coaxial cable in 2022? Is PPP still used? [4 Hrs]

Unit-III Medium Access Control:

[CO3 → PO1, PO2, PO3, PO4, PO6, PO7, PSO04 – CO Strength 2,3,2,1,1,3,2]

Medium Access Control: **Channel Allocation:** Static and Dynamic, **Multiple Access Protocols:** Pure and Slotted ALOHA, CSMA, WDMA. **Legacy Standard :** 10 Mbps IEEE 802.3 Standard(Ethernet), Wiring Schemes and Frame Formats, CSMA/CD, Binary Exponential Back-off Algorithm. **High Speed Ethernet Standards:** Fast, Gigabit and 10Gigabit. **Wireless Standards:** Radio Spectrum, Frequency Hopping (FHSS) and Direct Sequence (DSSS), IEEE 802.11a/b/g/n/ac, IEEE 802.15, IEEE 802.15.4 and IEEE 802.16 Standards, CSMA/CA [4 Hrs]

SECTION-II

Topics and Contents:

Unit-IV Network Layer:

[CO4 → PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PSO01, PSO2, PSO3 – CO Strength 3,3,3,2,1,2,3,3,3,3,1]

Network Layer: **Switching Techniques:** Circuit, Message and Packet Switching. **Logical**

Addressing: IPv4 and IPv6, Subnetting, NAT, CIDR. **Network Layer Protocols:** IP, ICMP, Routing Protocols: Distance Vector, Link State, and Path Vector. **Routing in Internet:** RIP, OSPF, BGP, **Congestion control and QoS**, MPLS, Mobile IP, **Routing in MANET** : AODV, DSR [6 Hrs]

Unit-V Transport Layer

[CO5 → PO1, PO2, PO4, PO5, PSO02 – CO Strength -3,3,2,3,3]

Transport Layer: **Services:** Berkeley Sockets, Addressing, Connection Establishment, Connection Release, Flow control and Buffering, Multiplexing. **HTH Layer Protocols:** TCP, TCP, TCP Timer management, UDP. Quality of Service: **TCP Congestion Control**. **Traffic Shaping:** AIMD. **Real Time Support Protocols:** Real Time Transport protocol(RTP), Stream Control Transmission Protocol (SCTP), Quality of Service (QoS), **Differentiated services**, **TCP and UDP for Wireless** [4 Hrs]

Unit-VI Application Layer:

[CO6→ PO1, PO2, PO4, PO10, PO12, PSO04 – CO Strength 3,3,2,3,3,2]

Application Layer: Address Resolution: Domain Name System (DNS). WWW: Hyper Text Transfer Protocol (HTTP) and HTTPS with SSL. Web Service. Email: SMTP, MIME, POP3 and Webmail. File Transfer: FTP, Dynamic Logical Addressing: Dynamic Host Control Protocol (DHCP), Design, development and evaluation of scalable enterprise application using communication and service frameworks. [4 Hrs]

Tutorials:

List of Tutorials (Any Thirteen)

List of Tutorials:

Unit-I Data Communication Networking Fundamentals and Physical Layer: [CO1,CO2]

- 1) **Examples and analysis of Encoding Methods:** Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding, Differential Manchester Encoding
- 2) **Line coding, Channel Encoding and modulations Techniques:** used in IEEE 802.3 standard and its extensions, IEEE 802.11 standards and its extensions for 100 Mbps, 1 GbE, 1 Gbps, 2.5 Gbps, 5 Gbps, 10 Gbps, 25Gbps, 40 Gbps, 100 Gbps networks. Chanel Encodings in 3G, 4G and 5G Mobile Networks

Unit-II Logical Link Control [CO2]

- 3) **Examples on Network Performance parameters:** RTT, Delay, Bandwidth, Throughput and efficiency

Unit-III Medium Access Control: [CO3]

4) **PHY and MAC Layer IEEE 802.3 Standards For Copper:** Overview of 10 Mbps Ethernet, Fast Ethernet, GbE -Gigabit Ethernet, 2.5 Gigabit Ethernet, 5 Gigabit Ethernet, 10 Gigabit Ethernet, 25 Gigabit Ethernet, 40 Gigabit Ethernet, 100 Gigabit Ethernet

5) **PHY and MAC Layer IEEE 802.3 Standards For Optical Fiber:** 100 Mbps Fast Ethernet, GbE -Gigabit Ethernet, 2.5 Gigabit Ethernet, 5 Gigabit Ethernet, 10 Gigabit Ethernet, 25 Gigabit Ethernet, 40 Gigabit Ethernet, 100 Gigabit Ethernet

6) **PHY and MAC Layer IEEE 802.11 Wireless LAN Standards:** IEEE 802.11, Wi-Fi 1/IEEE 802.11a, Wi-Fi 2/IEEE 802.11b, Wi-Fi 3/IEEE 802.11g, Wi-Fi 4/IEEE 802.11n, Wi-Fi 5/IEEE 802.11ac, IEEE 802.11ad (WiGig), IEEE 802.11ah (HaLow), Wi-Fi 6/IEEE 802.11ax, Wi-Fi 6/IEEE 802.11ay, Wi-Fi 6/IEEE 802.11by, Wi-Fi 7/IEEE 802.11be

Unit-IV Network Layer: [CO4]

7) Examples of Network Layer Logical Addressing

- (a) Classful IP and CIDR : Subnetting, IP Prefixes
- (b) NAT Mapping: Public to Private IP and Port Mapping
- (c) Packet Delivery in Internetwork : Packets traversing through different subnetworks with different MTU and Speeds
- (d) Packet Dropping Probabilities of Routers

8) Examples of Network Layer Routing

- (a) Shortest Path and Spanning Tree
- (b) Dijkstra's Algorithm
- (c) Distance Vector Routing
- (d) Link State Routing
- (e) ECMP

Unit-V Transport Layer [CO5]

9) Examples of Transport Layer

- (a) TCP Connection Establishment: SYN and ACK, Normal Packets
- (b) Flow Control : Calculating Optimal Size of Sliding Window
- (c) Cumulative ACK scheme

- (d) Smoothed RTT
- (e) Slow Start and Additive Increase

Unit-VI Application Layer: [CO6]**10) Examples of Application Layer**

- (a) DNS: URL Domain Processing
- (b) Performance of HTTP1.0 and HTTP1.1
- (c) CDN

Practical's:**List of Practical's (Any Six)****Unit-I Data Communication Networking Fundamentals and Physical Layer: [CO1]**

1) Write a program in C++/JAVA to implement - Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding and Differential Manchester Encoding.

2) Setting up small computer networks and Hands on networking commands:

Set up a small wired and wireless network of 2 to 4 computers using Hub/Switch/Access point. It includes installation of LAN Cards, Preparation of Cables/ Installation and Configuration of Access Point, Assigning unique IP addresses and use of ping utility. Hands on for network commands - ping, pathping, ipconfig/ifconfig, arp, netstat, nbtstat, nslookup, route, traceroute/tracert, nmap.

Unit-II MAC and Logical Link Layer [CO2, CO3]

3) Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC. Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.(50% students will perform Hamming Code and others will perform CRC). Further extend it to real implementation of CRC over Ethernet standard.

4) Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer to peer mode and demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode. Further extend it to real implementation of Flow Control over TCP protocol.

Unit-IV Network Layer: [CO2,CO3,CO4]

5) Write a program to find the shortest path using Dijkstra Equation for Link State Routing Protocol which is used by Open Shortest Path First Protocol (OSPF) in the Internet for the network flow provided by instructor.

Unit-V Transport Layer [CO4,CO5]

6) Write a program using TCP Berkeley socket primitives for wired /wireless network for following

- a. Say Hello to Each other (For all students)
- b. File transfer (For all students)
- c. Calculator (Arithmetic) (50% students)
- d. Calculator (Trigonometry) (50% students)

Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.

7) Write a program using UDP Berkeley Sockets for wired/wireless network to enable file transfer (Script, Text, Audio and Video one file each) between two machines. Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer to peer mode.

Unit-VI Application Layer: [CO3,CO4,CO5,CO6]

8) Understanding protocol stack of Intranet

Analyze packet formats of Ethernet, IP, TCP and UDP captured through Wireshark for wired networks.

9) Develop a client-server to demonstrate the behavior of HTTP1.0, HTTP1.1, HTTP1.2 and HTTP2.0 protocols.

CO-PO-PSO Mapping For Course Projects, Seminars, Home Assignments

All course projects, Seminars, Home Assignments should be a mixed blend of:

Communication Framework [Encoding, Modulation, Physical, MAC and Logical Link Control] and Service Framework TCP/IP [HTTP,FTP,SMTP,TCP,UDP,IP,ICMP,PPP] and Use of front end, Server side and backend Technologies [HTML5, CSS#, JavaScript, JQuery, PHP, MySQL]

In each category problem statement, backward and forward compatibility or support or obsolete or current in terms of communication framework, Service Framework and Technological Frameworks must be correlated

For example: For the course project “Simulation of modulation and demodulation for 100 Mbps Ethernet Network”, major focus is on Communication framework but students must extent their work to relate whether it supports to Service Framework and Technological Frameworks.

Use of Communication Frameworks Fundamentals of Data Communication, Physical Layer, Logical Link Control and Medium Access Control			Use of TCP/IP Framework and Technological frameworks at front end, Server Side and Backend Use of socket programming to understand Enterprise Application using frameworks at front end and Server Side and Backend		
CO1	CO2	CO3	CO4	CO5	CO6
18	16	16	18	16	16

Course Projects:

List of Course Project Topics

- 1.. Simulation of modulation and demodulation for digital telephone lines
2. Simulation of modulation and demodulation for 100 Mbps Ethernet Network
3. Simulation of modulation and demodulation for Gigabit Ethernet Network
4. Simulation of modulation and demodulation for 10Gigabit Ethernet Networks
5. Simulation of modulation and demodulation for 3G for mobile networks
6. Simulation of modulation and demodulation for 4G mobile networks
7. Develop a tool fox for line encoding methods
8. Develop a tool fox for modulation and demodulation methods
9. Design and deploy TCP based Multithreaded HTTP client server for accessing student activity data in the institute.
10. Design and deploy TCP based Multithreaded FTP client server to share institute level notices.
11. Design and deploy UDP based Multithreaded TFTP client server for your class
12. Design and deploy TCP based Multithreaded SMTP and POP3 mail client server for your campus.
13. Design and deploy TCP based Multithreaded Chat client server for your class.
14. Design and deploy UDP based Multithreaded Chat client server for your class.
15. Design and deploy UDP based Multithreaded Audio Conferencing client server for computer engineering department.
16. Design and deploy UDP based Multithreaded Video Conferencing client server for computer

17. Implementation of RIP/OSPF/BGP using Packet Tracer
18. Simulation of AODV routing protocol using Packet Tracer/ NS3/OMNet

Seminars:

List of Course Seminar Topics

1. MIMO Technology For Wi-Fi
2. Underground and underwater data Communications
3. Transmission technologies for 4G mobile networks
4. Transmission technologies for 5G mobile networks
5. Autonomous systems in the Internet
6. IP Addressing using IPv6
7. RIP implementation for campus network
8. OSPF implementation in Internet
9. BGP implementation in Internet
10. Simple Network Management Protocol implementation in Internet

Group Discussion:

List of Group Discussion Topics

1. Energy-Efficient Architectures For Communication System
2. Satellite Communication System
3. Data Communication in Software Defined Networks
4. Cognitive Radios for Future Communication Frameworks

5. Fast Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)
6. Gigabit Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)
7. 10G Ethernet (Encoding Framing, Modulation, Multiplexing, Diameter etc)
8. IEEE 802.11b protocol based on HR-DSSS for wireless physical layer standard
9. IEEE 802.11g protocol based on ERP-OFDM for wireless physical layer standard
10. IEEE 802.11n protocol based on HT-OFDM for wireless physical layer standard
11. IEEE 802.11ac protocol based on VHT-OFDM for wireless physical layer standard

List of Home Assignments:**List of Design Based Home Assignments**

1. Design a communication framework for irrigation system
2. Design a communication framework for automated car
3. Design a communication framework for smart city applications
4. RIP Routing Protocol for Intranet in VIT campus
5. OSPF Routing Protocol for Internet on India
6. BGP Routing Protocol for Asia continent

List of Case Study Based Home Assignments

1. WiTricity technology for industrial applications
2. Multiple access schemes implemented in 4G mobile networks
3. RFCs for wired TCP based reliable communication
4. RFCs for wireless TCP based reliable communication
5. RFCs for SSL Certificates

List of Blog Based Home Assignment

- 1.Journey of line encoding methods
2. Journey of modulation techniques
3. Internet Logical Addressing
- 4 Internet Routing Protocols
5. Applications Layer Protocols

List of Survey Based Home Assignments

- 1.Analogy to digital transformations on communication systems
2. Routing protocols for MANET
3. IEEE 802.1 Physical layer standard for Internet
4. IEEE 802.15.4 standard for IoT applications
5. IEEE 802.11 Wireless Standards for Wi-FI

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

PPT(Seminar/Group Discussion)-(MSE 30M+ ESE 70M =20M), Home Assignments-(ESE 100M-20M), Course Project- (100M-20M), ESE Theory Exam -(60M-20M), Comprehensive Viva Voce -(100M-20M)20

Text Books: (As per IEEE format)

1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, PHI, ISBN 81-203-2175-8.
2. Kurose, Ross "Computer Networking a Top Down Approach Featuring the Internet", Pearson; 6th edition (March 5, 2012), ISBN-10: 0132856204
3. Fourauzan B., "Data Communications and Networking", 5th edition, Tata McGraw- Hill, Publications, 2006

Reference Books: (As per IEEE format)

1. Matthew S. Gast "802.11 Wireless Networks", O'Reilly publications; 2nd Edition.

2. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols" Prentice Hall, 2004

3. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, ISBN: 0-470-09510-5

MOOCs Links and additional reading material:

www.nptelvideos.in, www.coursera.com, www.udemy.com

Course Outcomes:

On the completion of course, student will able to

1. Select line encoding, modulation, topology, essential components of physical layer, data transmission rates to design computer networks.
2. Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency.
3. Propose mechanisms for server channel allocation in wired and wireless computer networks
4. Develop Client-Server architectures and prototypes by the means of correct standards, protocols and technologies
5. Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols
6. Compare sustainable engineering practice indicating the scientific purpose and utility of communication frameworks and standards.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	3	2			2											
2	3	2	2		2								3			
3	2	3	3	2		2	3									2
4	3	3	3	2	1	2	3	3	3				3	3	1	
5	3	3		2	3										3	
6	3	3		2						3		3				
Avg	2.84	2.67	2.67	2.67	2.67	2	3	3	3	3	0	3	3	3	1	2

CO attainment levels:

Attainment Levels: 1, 5, 3, 4, 2, 4

Future Course Mapping:

Mention other courses that can be taken after completion of this course

High Speed Networks, Wireless Networks, Mobile Networks, Network Security, Cyber Security

Job Mapping:

What are the Job opportunities that one can get after learning this course

Network Engineer, Network Stack Developers, Application Developer

CS: CS3205**COURSE NAME: DESIGN AND ANALYSIS OF ALGORITHMS**

Course Prerequisites: Basic courses on programming, data structures, discrete structures, theory of computing.

Course Objectives:

1. Students will gain understanding of asymptotic notations and will be able to apply suitable mathematical techniques to find asymptotic time and space complexities of algorithms.
2. Students will develop the ability to formulate computational problems in the abstract and mathematically precise manner.
3. Student will gain understanding of different algorithm design paradigms such as divide and conquer, dynamic programming, greedy, backtracking and will apply suitable paradigm for designing algorithms for computational problems
4. Students will develop understanding of notions of NP-hardness and NP-completeness and their relationship with the intractability of decision problems.
5. Students will design randomized, approximation algorithms for some computational problems.
6. Students will be able to incorporate algorithm design principles, data structures and provide efficient solutions for complex computational problems.

Credits: 4.....**Teaching Scheme Theory: 2 Hours/Week****Tutorial: 1 Hours/Week****Lab: 2 Hours/Week**

Course Relevance: This is a foundational course for Computer science and Engineering. This course develops algorithmic thinking capability of students. Designing algorithms using suitable paradigm and analysing the algorithms for computational problems has a high relevance in all domains where computer science plays a crucial role (equally in Industry as well as research). This course is also an essential pre-requisite for advanced domain specific algorithmic courses such as Algorithmic Graph Theory, Algorithmic Number Theory, Computational Geometry, Motion planning and Robotics, etc, to give a few examples.

Once the student gains expertise in Algorithm design and in general gains ability of Algorithmic thinking, it facilitates in systematic study of any other domain (in computer science or otherwise) which demands logical thinking.

This course is also relevant for students who want to pursue research career in theory of computing, computational complexity theory, advanced algorithmic research.

SECTION-I

Topics and Contents:

Unit-I: Basic introduction and time and space complexity analysis: [COs Mapped: 3] [POs Mapped: 2, 3]

Asymptotic notations (Big Oh, small oh, Big Omega, Theta notations). Best case, average case, and worst-case time and space complexity of algorithms. Overview of searching, sorting algorithms. Adversary lower bounds (for the comparison-based sorting algorithms). Using Recurrence relations and Mathematical Induction to get asymptotic bounds on time complexity. Master's theorem and applications. **[4 Hrs]**

Unit-II Divide and Conquer: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

General strategy, Analyzing Quick sort, Merge sort, Finding a majority element, Order statistics (randomized and deterministic algorithms), Efficient algorithms for Integer arithmetic (Euclid's algorithm, Karatsuba's algorithm for integer multiplication, fast exponentiation). **[4 Hrs]**

Unit-III Dynamic Programming: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

General strategy, simple dynamic programming-based algorithms to compute Fibonacci numbers, binomial coefficients, Matrix Chain multiplication, Coin change problem, 0-1 Knapsack, Traveling Salesperson Problem, All pair shortest path algorithm, Longest increasing subsequence problem, Largest independent set for trees. **[6 Hrs]**

SECTION-II

Topics and Contents:

Unit-IV Greedy and Backtracking strategy: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

Greedy: General strategy, Analysis and correctness proof of minimum spanning tree and shortest path algorithms, fractional knapsack problem, conflict free scheduling.

Backtracking: General strategy, n-queen problem, backtracking strategy for some NP-

complete problems (e.g. graph coloring, subset sum problem, SUDOKU) **[4 Hrs]**

Unit-V Introduction to complexity classes and NP-completeness: [COs Mapped: 3, 4] [POs Mapped: 2, 3, 6]

Complexity classes P, NP, coNP, and their interrelation, Notion of polynomial time many one reductions reduction, Notion of NP-hardness and NP-completeness, Cook-Levin theorem and implication to P versus NP question, NP-hardness of halting problem. NP-Complete problems (some selected examples from - Satisfiability problem, Circuit-SAT, 3-CNF SAT, vertex cover problem, independent set problem, clique problem, Hamiltonian-circuit problem, subset sum problem, Integer Linear Programming) **[6 Hrs]**

Unit-VI Introduction to Randomized and Approximation algorithms: [COs Mapped: 3, 5] [POs Mapped: 2, 3, 12]

Introduction to randomness in computation, Las-Vegas and Monte-Carlo algorithms, Abundance of witnesses/solutions and application of randomization, solving SAT for formulas with “many” satisfying assignments, randomized quick sort, Karger’s Min-cut algorithm, coupon collector problem,

Introduction to Approximation algorithms for NP-optimization problems, Approximation algorithm for Vertex Cover, metric Traveling-Sales-Person Problem (metric-TSP), Hardness of approximation for TSP. **[4 Hrs]**

Tutorials:

List of Tutorials (Any Thirteen)

Unit I: [COs Mapped: 3] [POs Mapped: 2, 3]

1. Problem solving based on asymptotic notations, solution of recurrences
2. Proving correctness of algorithms: some techniques

Unit II, III, IV: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]

3. Problem solving based on Divide and Conquer strategy (Binary search interesting applications, counting inversions)
4. Advanced problem solving based on Divide and Conquer strategy (Discrete Ham-Sandwich theorem, efficient algorithm for Josephus problem)
5. Problem solving based on Dynamic Programming strategy (Largest sum contiguous block and generalizations, Optimal binary search tree (OBST) construction)
6. Advanced problem solving based on Dynamic Programming strategy (Winning strategy for two player games, Variants of shortest path algorithms)

7. Problem solving based on Greedy strategy with emphasis on proof of correctness
8. Problem solving based on Backtracking strategy

Unit V: [COs Mapped: 3, 4] [POs Mapped: 2, 3, 6]

9. reducing NP problems to Integer Linear Programming.
10. Problem solving based on complexity classes, NP-completeness.

Unit VI: [COs Mapped: 3, 5] [POs Mapped: 2, 3, 12]

11. Problem solving based on Randomized Algorithms
12. Problem solving based on Approximation Algorithms

Practical's:**List of Practical's (Any Six)****Unit II, III, IV: [COs Mapped: 1, 2, 3, 6] [POs Mapped: 1, 2, 3, 4, 13]**

1. Assignment based on some simple coding problems on numbers, graphs, matrices
2. Assignment based on Divide and Conquer strategy (e.g. majority element search, finding kth rank element in an array)
3. Assignment based on Divide and Conquer strategy (e.g. efficient algorithm for Josephus problem using recurrence relations, fast modular exponentiation)
4. Assignment based on Dynamic Programming strategy (e.g. Matrix chain multiplication, Longest increasing subsequence)
5. Assignment based on Dynamic Programming strategy (e.g. All pair shortest path, Traveling Sales Person problem)
6. Assignment based on Greedy strategy (e.g. Huffman encoding)
7. Assignment based on Backtracking (e.g. graph coloring, n-queen problem)

Unit VI: [COs Mapped: 3, 5] [POs Mapped: 2, 3, 12]

8. Assignment based on analysis of quick sort (deterministic and randomized variant)
9. Assignment based on Las-Vegas and Monte-Carlo algorithm for majority element search
10. Assignment based on factor-2 approximation algorithm for metric-TSP

Course Projects:

List of Course Project Topics

1. Applications of A* algorithm in gaming
2. Pac-Man game
3. File compression techniques
4. Solution of Maze (comparing the backtracking based solution and Dijkstra's algorithm)
5. Different exact and approximation algorithms for Travelling-Sales-Person Problem
6. Creation of Maze using backtracking
7. Knight tour algorithms
8. Network flow optimization and maximum matching
9. AI for different games such as minesweeper, shooting games, Hex, connect-4, sokoban, etc
10. SUDOKU solver
11. Graph theoretic algorithms
12. Computational Geometry Algorithms
13. AKS primality testing
14. Algorithms for factoring large integers
15. Randomized algorithms for primality testing (Miller-Rabin, Solovay-Strassen)
16. Slider puzzle game

Seminars:

List of Course Seminar Topics

1. Divide and Conquer Vs Dynamic Programming
2. Greedy strategy
3. NP-hardness
4. Backtracking strategy
5. Dynamic Programming Vs Greedy
6. Computational Complexity
7. Philosophical relevance of P Vs NP question
8. Complexity classes
9. Space complexity
10. Compression Techniques
11. Real world applications of Graph theoretic algorithms
12. Approximation algorithms
13. Hardness of approximation
14. Pseudorandom number generators

Group Discussion:**List of Group Discussion Topics**

1. Greedy Algorithms
2. Dynamic Programming strategy
3. Dynamic Programming Vs Greedy
4. NP-completeness
5. P Vs NP question
6. Algorithm design paradigms
7. Different Searching techniques
8. Backtracking strategy
9. Relevance of Cook-Levin theorem
10. Randomness in computation
11. Approximation Algorithms
12. Application of Recursion

List of Home Assignments:**List of Design Based Home Assignments**

1. Problem solving based on Divide and Conquer strategy
2. Problem solving based on Dynamic Programming strategy
3. Problem solving based on Greedy strategy
4. Problem solving based on Backtracking strategy
5. Problems on Randomized Algorithms
6. Problems on Approximation Algorithms
7. Problems on NP completeness

List of Case Study Based Home Assignments

1. AKS primality test
2. Quadratic sieve factoring algorithm
3. Huffman Encoding, LZW encoding
4. Network flow optimization algorithms
5. Approximation algorithms for TSP
6. Cook-Levin theorem and its relationship with intractability of computational problems
7. Sorting techniques

List of Blog Based Home Assignment

1. Approximation Algorithms
2. Randomized Algorithms
3. Computational Geometry Algorithms
4. Number Theoretic Algorithms
5. Graph Theoretic Algorithms
6. P Vs NP Problem
7. Complexity classes
8. Greedy Algorithms
9. Divide and Conquer Vs Dynamic Programming

List of Survey Based Home Assignments

1. Primality Testing Algorithms
2. Integer Factoring Algorithms
3. NP-complete problems
4. Compression Techniques
5. Shortest Path Algorithms
6. Algorithms for finding Minimum Weight Spanning Tree

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Text Books: (As per IEEE format)

4. Cormen, Leiserson, Rivest and Stein "Introduction to Algorithms" ,PHI 3rd edition, 2009. ISBN 81-203-2141-

5. *Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson, 1st edition, 2005. ISBN 978-81-317-0310-6*
6. *Dasgupta, Papadimitriou, Vazirani "Algorithms" McGraw-Hill Education; 1 edition (September 13, 2006), ISBN-10: 9780073523408, ISBN-13: 978-0073523408*

Reference Books: (As per IEEE format)

5. *Motwani, Raghavan "Randomized Algorithms", Cambridge University Press; 1 edition (August 25, 1995), ISBN-10: 0521474655, ISBN-13: 978-0521474658*
6. *Vazirani, "Approximation Algorithms", Springer (December 8, 2010), ISBN-10: 3642084699, ISBN-13: 978-3642084690 Gerd Keiser, MC Graw Hill International edition, optical fiber communication , third edition*

MOOCs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:

Course Outcomes:

On the completion of course, student will able to

1. To formulate computational problems in abstract and mathematically precise manner
2. To design efficient algorithms for computational problems using appropriate algorithmic paradigm
3. To analyze asymptotic complexity of the algorithm for a complex computational problem using suitable mathematical techniques.
4. To establish NP-completeness of some decision problems, grasp the significance of the notion of NP-completeness and its relationship with intractability of the decision problems.
5. To understand significance of randomness, approximability in computation and design randomized algorithms for simple computational problems and design efficient approximation algorithms for standard NP-optimization problems.
6. To incorporate appropriate data structures, algorithmic paradigms to craft innovative scientific solutions for complex computing problems.

CO-PO Map:

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO3,PO4	PO2,PO3	PO6	PO12	PSO1
3	2,3	2,3	2	2	3

CO attainment levels:

CO No.	1	2	3	4	5	6
Attainment level	1	3	2	3	4	5

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Advanced Algorithms, Computational Complexity, Computational Geometry, Algorithmic Number Theory, Algorithmic Graph Theory

Job Mapping:

What are the Job opportunities that one can get after learning this course

Algorithm design lie at heart of any Computer Science/Engineering application. Once the student gains expertise in Algorithm design and in general gains ability of Algorithmic thinking, it facilitates in systematic studying any other domain (in computer science or otherwise) which demands logical thinking. Algorithm design is an essential component of any job based on programming. All Industries in computer Engineering always look for a strong knowledge in Algorithm design and Data structures. If student wants to pursue higher education/ research in Computer Science, this course is must.

COURSE CODE:CS3215**COURSE NAME:WEB TECHNOLOGY**

Course Prerequisites: Computer Networks

Course Objectives:

1. To describe most commonly used HTML5 and CSS3 tags and attributes for website development.
2. To associate event handling with HTML5 forms and CSS3 using javascript as a front-end technology for website development.
3. To extend HTML5 and CSS3 and javascript front end technologies with PHP and Mysql as a serverside and backend technologies for website development.
4. To simplify website development using REST API and Spring boot as server-side technologies.
5. To build single page applications using REACT as a reusable UI component technology as client-side technology
6. To assemble REACT as a front-end technology and Node js as a server-side technology to develop enterprise applications

Credits: 4.....

Teaching Scheme Theory: 2 Hours/Week

Tutorial: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: The key technology of the information age is global communication. Web technology is a truly global area of study as it enables global communication with the help of web sites. Web technologies are the backbone of all IT infrastructures and their applications in the world. These technologies and applications often emerge in communication within countries of countries and spread rapidly around the world. The main objective of the course is present the basic web technology concepts that are required for developing web applications. The key technology components are descriptive languages, server-side program elements and client-side program elements. In addition, the course gives specific contents that are beneficial for developing web-based solutions, like relational data-base communication basics and information security principles and approaches. Most of the jobs available in the IT industries are web technology related.

SECTION-I**Topics and Contents:****Unit-I Front End Tools [CO1→PO1, PO2, PO5 – CO Strength 3,2,2]**

Introduction to web technology, internet and www, Web site planning and design issues. HTML5: structure of html document, HTML elements: headings, paragraphs, line break, styles, colors, fonts,

links, frames, lists, tables, images and forms, CSS, Bootstrap, XML, JSON. [4 Hrs]

Unit-II Client-Side Technologies [CO2→PO1, PO2, PO3, PO5, PO12 – CO Strength 3,2,2,1,3]

JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, HTML5 forms Validation, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM. JQuery: Introduction to JQuery, Loading JQuery, selecting elements, changing styles, creating elements, appending elements, removing elements, handling events. [6 Hrs]

Unit-III Server-Side Technologies**[CO3→ PO1, PO2, PO3, PO4, PO6 - CO Strength 2,3,3,2,3]**

PHP: Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, File Handling, Exception Handling, E-mail validations, MySQL with PHP [4 Hrs]

SECTION-II**Topics and Contents:****Unit-IV Spring Boot [CO4→PO1, PO2, PO3, PO7, PO10, PSO4 – CO Strength 3, 2, 3, 3, 3, 3]**

Overview of Spring Boot, Spring Framework, Installing Spring Boot, Build Tool Maven/Gradle/Ant, Core Features, Spring Security, Web Applications, JPA for database connectivity, working with SQL and NoSQL, Messaging, Testing, Deploying Spring Boot Applications, Monitoring. [6 Hrs]

Unit-V React [CO5→ PO1, PO2, PO4, PO5, PO8, PO11, PSO1, PSO3–CO Strength 3, 3, 2, 3, 3, 3, 3]

Introduction to React, React component, JSX, Render function, Component API, Component lifecycle, State, Props, Mixins, Component composition, Pass data from parent to child, Pass data from child to parent, Component styling, Forms, Events, Refs, Keys, Router, Flux. [4 Hrs]

Unit-VI Node JS [CO6→PO1, PO2 PO4 PO9 – CO Strength 3, 2, 2, 3]

Introduction to Node JS, Installation of Node JS, Node JS Modules, Node Package Manager (npm), Creating Web server, File System, Express JS, Serving Static Resources, Database connectivity. [4 Hrs]

Tutorials:**List of Tutorials (Any Thirteen)****Unit-I Front End Tools [CO1, CO2]**

- 1) Examples of html and CSS
- 2) Examples of Bootstrap and XML

Unit-II Client-Side Technologies [CO2]

- 3) Examples of html form validation (a)Email Validation (b)Mob No Validation
- 4) Examples of JavaScript and JQuery

Unit-III Server-Side Technologies [CO3]

- 5) Examples of PHP

Unit-IV Spring Boot [CO4]

- 6) Examples of MySQL
- 7) Examples of Springboot

Unit-V React [CO5]

- 8) Examples of React

Unit-VI Node JS [CO6]

- 9) Examples of Node js

Practical's:**List of Practical's (Any Six)****Unit-I Front End Tools [CO1, CO2]**

- 1) Installation and configuration and testing working of XAMPP server for local host.
- 2) Develop a basic web page using the HTML tags you learned in class. (Develop a responsive web page for your CV using multiple column layout.)

Unit-II Client-Side Technologies [CO1, CO2, CO3]

- 3) Create an admission Template form for VIT admission Process? Perform the validation for email and phone no fields (Develop a responsive web site for your CV having video background for first page and perform the validation using email or mobile number as username and a password of min length 11 consisting at least one uppercase letter one digit and one special character.)

4) Create an one IT company Template with video in Background (The Web Page must be Responsive and the page contains video in Background)

5) Write a JavaScript program to reverse the elements of a given array.

6) Develop a website using toggleable or dynamic tabs or pills with bootstrap and JQuery

Unit-III Server-Side Technologies [CO1, CO2, CO3]

7) Assume we have a file named "webtech.txt", write the correct syntax to open and read the file content.

8) Write a program to calculate Electricity bill in PHP
(a) You need to write a PHP program to calculate electricity bill using if-else conditions.
(b) Conditions For first 50 units – Rs. 3.50/unit For next 100 units – Rs. 4.00/unit For next 100 units – Rs. 5.20/unit for units above 250 – Rs. 6.50/unit
You can use conditional statements.

Unit-IV Spring Boot [CO1, CO3CO4, CO5]

9) Create three MySQL database tables and write php scripts to read, insert & delete data through web interface.

10) Design and implement a website using REST API and Spring Boot.

Unit-V React [CO1, CO4, CO5]

11) Design and implement a website using REST API, Spring Boot and MySQL/Oracle.

12) Design and implement a website using REACT, Spring Boot and MySQL/Oracle.

Unit-VI Node JS [CO1, CO4, CO5, CO6]

13) Design and implement a website using REACT, Node Js and MySQL/Oracle.

Course Projects:

List of Course Project Topics

1. Develop a Website with NLP as a backend
2. Student Grievance System
3. Workflow Management System for MNC
4. Browser-based Game Website using HTML, CSS, JavaScript, Bootstrap

5. Develop an web application that help to farmers to solve their farming problems
6. GST Billing Software for Small Business
7. Online Crime Reporting System using PHP
8. Develop an Online College Voting System
9. Develop an Online Loan Processing System for Farmers.

Seminars:**List of Course Seminar Topics**

- 1.Evolution of Web Technology
2. CSS and Bootstrap
3. JavaScript and JQuery
4. JSON and AJAX
5. Cookies & Sessions
- 6.PHP and MySQL
7. Angular JS
8. Java Servlets
9. Java Server Pages (JSP)
10. JSP and Servlets
11. JavaBeans
12. Model-View_Controller (MVC) Paradigm
13. Web Services
14. Strut
15. SOAP

Group Discussion:**List of Group Discussion Topics**

1. Evolution of web technologies
2. HTML v/s XML
3. JavaScript and PHP
4. 21st Century Web Technologies
5. SQL Vs MongoDB[
6. Internet Privacy
7. Ruby
8. Rails
9. Groovy
10. Grails
11. EJB

List of Home Assignments:**List of Design Based Home Assignments**

- 1) Website for restaurant
- 2) Website for e-book shop
- 3) Website for on-line music store
- 4) Website for guest visiting your society
- 5) Website for web search engine

List of Case Study Based Home Assignments

- 1) Emerging Web Technologies
- 2) Databases for Servers
- 3) A case study of JQuery used in any real-time healthcare web application

- 4) SOAP
- 5) Angular versions

List of Blog Based Home Assignment

- 1) Front End Technologies
- 2) Client-Side Technologies
- 3) Server-Side Technologies
- 4) Web Services
- 5) EJB Applications

List of Survey Based Home Assignments

- 1) Survey on Front End Technologies
- 2) Survey on Client-Side Technologies
- 3) Survey on Server-Side Technologies
- 4) Component based technologies

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360-degree assessment and check if it covers all aspects of Bloom's Taxonomy.

MSE, ESE, Seminar, Group Discussion, Home Assignments, Course Project, Lab evaluation, CVV

Text Books: (As per IEEE format)

1. Kumar, A., *Web technologies*, CRC press, 2019
2. Gupta, R., *Internet & Web Technologies*, Engineering Handbook, 2019
3. Martin, M.G., *Programming for Beginners: 6 Books in 1 – Swift+PHP+Java+Javascript+Html+CSS: Basic Fundamental Guide for Beginners*, independently published, 2018
4. *Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5*, O'Reilly Media; 5th edition, 2018
5. Kohli, S., *Web Technologies*, PPB Publications, 2015
6. Adam Bretz& Colin J Ihrig, “*Full Stack Javascript Development with MEAN*”, SPD, First Edition 2015, Indian Reprint September 2015
7. GiulioZambon, “*Beginning JSP, JSF and Tomcat*”, Apress Publication, Second Edition, 2013
8. Jeremy McPeak& Paul Wilton, ”*Beginning JavaScript*”, Wrox Publication, Fifth Edition, 2015
9. Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", Second Edition,

Pearson Education, 2007, ISBN 978-0131856035.

10. *Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson education, 2008*

Reference Books: (As per IEEE format)

7. *Marty Hall, Larry Brown, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.*
8. *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.*
9. *Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.*
10. *Xue Bai et al: The web Warrior Guide to Web Programming, Thomson, 2003*

MOOCs Links and additional reading material:

2. <https://www.w3.org/html>
3. HTML, The Complete Reference
4. <http://www.htmlref.com/>
5. <http://w3schools.org/>
6. <http://php.net/> <https://jquery.com/>
7. <https://developer.mozilla.org/en-US/docs/AJAX>
8. <http://www.tutorialspoint.com/css/>

Course Outcomes:

On the completion of course, student will able to

1. Create front end web pages using HTML5 and CSS3 tags and attributes
2. Provide validation mechanism and event handling in a website using javascript as a front end technology
3. Integrate front end with serverside and backend technologies for commercial websites using PHP and Mysql
4. Write Web API/RESTful API application programming interface to communicate with Spring boot as a serverside technology.
5. Build single page applications using REACT as a reusable UI component technology as client side technology and Spring boot and Node Js as server side technologies
6. Design and develop three tier enterprise application using client side, server side and back end

CO-PO Map:

	Program Outcomes (PO)												PSO			
	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CS3215.1	3	2			3											
CS3215.2	3	2	2		1							3				
CS3215.3	2	3	3	2		3										
CS3215.4	3	2	3				3			3						3
CS3215.5	3	3		2	3			3			3		3		3	
CS3215.6	3	2		2					3							
Average	2.8	2.3	2.7	2.0	2.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

CO attainment levels:

Attainment Levels: 1, 2, 3, 4, 4, 5

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Mobile Application Development

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Web Developer, IT Engineer, UI Developer

Module VI Courses

COURSE CODE: CS3226**COURSE NAME: CLOUD COMPUTING****Course Prerequisites:** Operating Systems, Computer Networks, Database Management System**Course Objectives:**

1. To become familiar with cloud computing and its ecosystem
2. To acquire basics of virtualization and its importance
3. To evaluate in-depth analysis of Cloud Computing capabilities and its services.
4. To configure and implement storage services.
5. To analyze different cloud-based services to meet a set of given requirements.
6. To design security aspects for cloud computing

Credits: 4.....**Teaching Scheme Theory: 2 Hours/Week****Tutorial: 1 Hours/Week****Lab: 2 Hours/Week****Course Relevance:** Cloud computing to enable transformation, business development and agility in an organization.**SECTION-I****Topics and Contents:****Unit-I Introduction to Cloud Computing
[CO1 → PO1, PO2, PO5 – CO Strength - 2,1,1]**

Recent trends in computing, Cluster computing, Distributed computing ,Evolution of cloud computing, Cloud versus traditional architecture, Cloud Computing Architecture, Google Cloud architecture, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Public cloud, Private cloud, Hybrid cloud, Community cloud **[4 Hrs]**

**Unit-II Virtualization
[CO2→ PO1, PO2, PO3, PO4, PO5- CO Strength -2,2,1,1,1]**

Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with auto scaling, Basics of virtualization and implementation challenges. System virtualization technologies-architectures and internals. KVM, Xen, VMware.

Memory virtualization-virtualization techniques, ballooning, deduplication and sharing. Network

and storage virtualization, Virtual machine migration and replication techniques pre-copy and post-copy techniques, applicability to system availability. **[6 Hrs]**

Unit-III Cloud Services**[CO3→] [PO1, PO2, PO3, PO4, PO5, PO7, PO8, PSO4 – Strength - 3,2,2,2,2,3,3,2]**

Service Oriented Architecture (SOA), Web services, Web 2.0, Web OS. Introduction to IaaS, PaaS, SaaS. Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine Software as a Service (SaaS) Docker flow, orchestration with Docker, dynamic linking and legacy linking of containers. The GCP Console, understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs. **[4 Hrs]**

SECTION-II**Topics and Contents:****Unit-IV Cloud Storage****[CO4→PO1, PO2, PO3, PO4, PO5, PO6, PO9- Strength 3,2,2,2,3,3,3]**

Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option. OpenStack: NOVA, Neutron, Keystone Cinder, Swift and Glances, VMware Suit, Apache Cloud Stack **[4 Hrs]**

Unit-V Service Management**[CO5 → PO1,PO2,PO3,PO4,PO5,PO9,PO11,PSO2-Strength 3,3,1,3,3,1,2,3]**

Service Level Agreements (SLAs), Billing and accounting, Billing in GCP Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM., Introduction to configuration and management tools Ansible, Architecture of DevOps. **[4 Hrs]**

Unit-VI Cloud Network and Security**[CO6→ PO1, PO2, PO3, PO4, PO5, PO10, PO12 - Strength 2,2,1,3,1,3]**

Introduction to networking in the cloud, defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing. Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM. **[6 Hrs]**

Tutorials:

List of Tutorials (Any Thirteen)**List of Tutorials:****Unit-I Introduction to Cloud Computing [CO1] [CO2]**

- 1) Install VirtualBox/VMware Workstation with different Linux or Windows Operating Systems.
- 2) Study Google Cloud Architecture.

Unit-II Virtualization [CO2]

- 3) Find a procedure to launch virtual machine
- 4) Find a procedure to transfer the files from one virtual machine to another virtual machine.

Unit-III Cloud Services [CO3]

- 5) Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
- 6) Install Google App Engine. Create hello world app and other simple web applications using python/java.

Unit-IV Cloud Storage [CO4]

- 7) Launch the Web Applications using GAE launcher.
- 8) Install Hadoop single node cluster and run simple applications like wordcount.

Unit-V Service Management [CO5]

- 9) Use AWS Pricing Calculator: Create estimate for EC2 Compute cost for VM instance. Use region closest to you. Find On demand cost and compare the pricing for other regions.

Unit-VI Cloud Network and Security [CO6]

- 9) Launch EC2instane and explore Public/Private/Elastic IP

Practical's:**List of Practical's (Any Six)****Unit-I Introduction to Cloud Computing [CO1] [CO2]**

- 1) To setup AWS accounts and launch instances.

Unit-II Virtualization [CO2]

- 2) To install an OS using VirtualBox/ VMWare Workstation. Add Storage to create new virtual disk.
- 3) To Deploy Virtual Machine on hypervisor such as KVM, ESXi. Take Backup and Migrate them.

Unit-III Cloud Services [CO3]

- 4) To use Infrastructure as a Service to facilitates for creating and deleting compute resources. Create network and attach volumes to run instances.
- 5) To install docker on window/linux and build docker image from docker hub.
- 6) Deploy a stateless/stateful application on Kubernetes cluster.

Unit-IV Cloud Storage [CO4]

- 7) To work on different Cloud Storage Services.

Unit-V Service Management [CO5]

- 8)To create login into AWS and use S3 Bucket Service for storage.

Unit-VI Cloud Network and Security [CO6]

- 9) Develop elastic services for dynamic load scenario using AWS APIs. Build load balancer and explore on scalability, fault detection and performance.

Course Projects:**List of Course Project Topics**

1. Creating Google Account to store files and programs.
2. Creating Account to Store Images.
3. Creating a Warehouse Application in SalesForce.com
4. Creating an Application in SalesForce.com using Apex programming Language.
5. To study and implement Web services in SOAP for JAVA Applications.
6. Implementation of Para-Virtualization using VMWare ‘s Workstation/ Oracle’s Virtual Box and Guest Operator System.
7. Installation and Configuration of Hadoop.
8. AWS Case Study: Amazon.com.
9. Case Study of Google App Engine.

10. Case Study of Face book.

Seminars:**List of Course Seminar Topics**

1. Storage Cost Optimization on Cloud.
2. Cloud Security and Cryptography
3. Infrastructure As A Code (IAC)
4. Cloud Computing in Healthcare
5. Serverless
6. Deployment of Microservices in Kubernetes Engine
7. RPA Using AWS Cloud
8. Cloud Trends In Supporting Ubiquitous Computing
9. Mobile Cloud Computing
10. Modern Data Center Architecture

Group Discussion:**List of Group Discussion Topics**

1. Data Storage Security in Cloud
2. Cloud Services for SMB's.
3. Monitoring Services Provided by GCP and AWS.
4. Docker and Kubernetes.
5. SaaS vs FaaS (Function as a service).
6. Hybrid Cloud.
7. GCP Vs AWS Web Service Architecture.

8. Cloud based security issues and threats.
9. Authentication and identity.
10. Future of Cloud-Based Smart Devices.

List of Home Assignments:**List of Design Based Home Assignments**

1. Serverless Web App to order taxi rides using AWS lambda.
2. Deploying App on Kubernetes.
3. Serverless web Application (GCP Cloud Functions).
4. Demonstration of EBS, Snapshot, Volumes.
5. Single Node Cluster Implementation (Hadoop).

List of Case Study Based Home Assignments

1. PayU Migration to AWS.
2. Cloud object storage.
3. Deployment and Configuration options in AWS.
4. Deployment and Configuration options in Microsoft Azure.
5. Deployment and Configuration options in GCP.

List of Blog Based Home Assignment

1. Comparing design of various cloud computing platforms.
2. AWS EKS and Google Cloud Functions.
3. App Engine.

4. Cloud Endpoints.

5. Cloud Pub/Sub.

List of Survey Based Home Assignments

1. Disaster Recovery in Cloud Computing.

2. Cloud Economics.

3. Data archiving solutions.

4. Salesforce.

5. Dropbox.

Suggest an assessment Scheme:

MSE, ESE, GD, Seminar, HA

Text Books: (As per IEEE format)

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley,India.
2. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India
3. Gautam Shroff. "Enterprise Cloud Computing", Cambridge

Reference Books: (As per IEEE format)

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley India
2. Antohy T Velte, et.al, "Cloud Computing : A Practical Approach", McGraw Hill.
3. Michael Miller, "Cloud Computing", Que Publishing.
4. Tim Malhar, S.Kumaraswamy, S.Latif, "Cloud Security & Privacy", SPD,O'REILLY
5. Scott Granneman, "Google Apps", Pearson

MOOCs Links and additional reading material:

<https://nptel.ac.in/courses/106/105/106105167/>

https://swayam.gov.in/nd1_noc20_cs55/preview

<https://www.coursera.org/specializations/cloud-computing>

<https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/>

<https://aws.amazon.com/what-is-cloud-computing/>

<https://www.ibm.com/in-en/cloud/learn/cloud-computing>

Course Outcomes:

Course Outcomes:

On the completion of course, student will able to

1. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Display new ideas and innovations in cloud computing.
6. Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing.

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CS3226.1	2	1			1											
CS3226.2	2	2	1	1	1											
CS3226.3	3	2	2	2	2		3	3								2
CS3226.4	3	2	2	2	3	3			3							
CS3226.5	3	3	1	3	3				1		2			3		

CS3226.6	2	2	1	3	1					3		3			
Average	2.50	2.00	1.40	2.20	1.83	3.00	3.00	3.00	2.00	3.00	2.00	3.00		3.00	2.00

CO attainment levels:**Attainment Levels:1,2,3,5,4,3****Future Course Mapping:**

After completing this course different certifications courses in cloud be taken such as AWS, Azure, Google cloud certifications. One can go for higher studies in specialization of cloud computing and allied subjects

Job Mapping:

Cloud Architect, Cloud Engineer, Cloud Administrator, Solutions Architect - Cloud Computing - AWS / Kubernetes, Cloud Computing Technical Consultant, Associate Cloud Computing Engineer, Cloud Computing Trainer

COURSE CODE:CS3202 COURSE NAME: ARTIFICIAL INTELLIGENCE**Course Prerequisites:**

- A course on “Computer Programming and Data Structures”
- A course on “Mathematical Foundations of Computer Science”
- Some background in linear algebra, data structures and algorithms, and probability will be helpful

Course Objectives:

1. To learn the distinction between optimal reasoning Vs. human like reasoning
2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Credits: 4.....**Teaching Scheme Theory: 2 Hours/Week****Tutorial: 1 Hours/Week****Lab: 2 Hours/Week**

Course Relevance: Technologies driven by artificial intelligence (AI) have transformed industries and everyday life. The possibilities for AI applications are virtually unlimited and sought after in practically every industry segment. That's why global organizations are actively recruiting professionals with specialized skills and proficiencies needed to develop future AI technological innovations.

SECTION-I**Topics and Contents:****Unit-I Title: Fundamentals of Artificial Intelligence**

Introduction: A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, Types of production systems, Turing Test. **Intelligent Agents:** Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. **Formulation of problems:** Vacuum world, 8 queens, Route finding, robot navigation.[

CO1, CO2] [PO1, PO2]

Unit-II Title: Uninformed Search Strategies

Uninformed Search Methods: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies. [CO3] [PO3, PSO1]

Unit-III Title: Informed Search Methods:

Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means Ends Analysis, **Game playing:** Minimax Search, Alpha-Beta Cut offs, Waiting for Quiescence. [CO3, CO6] [PO3]

SECTION-II

Topics and Contents:

Unit-IV Title: Logical Agents:

Knowledge based agents, Wumpus world. **Propositional Logic:** Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. **First order Logic:** Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. [CO4] [PO2]

Unit-V Title: Basics of PROLOG:

Representation, Structure, Backtracking. **Expert System:** Design, Implementation, Case study of Expert System in PROLOG. [CO4] [PO2]

Unit-VI Title: Planning:

Blocks world, STRIPS, Implementation using goal stack, **Planning with state space search:** Forward state space search, Backward state space search, Heuristics for state space search. Partial Order Planning, Planning Graphs, Hierarchical planning, Least commitment strategy.

Conditional Planning, Continuous Planning. [CO5] [PO4]

Tutorials:

List of Tutorials

[CO1] [PO1]

1. AI problem formulation [CO1] [PO1]
2. Task Environment [CO1] [PO1]

3. AI Problem Characteristics [CO1] [PO1]
4. Missionaries and Cannibals Problem [CO2] [PO2]
5. Water Jug Problem [CO2] [PO2]
6. Monkey Banana problem [CO2] [PO2]
7. 8 Puzzle Problem [CO2] [PO2]
8. Magic Square problem [CO2] [PO2]
9. Tic-Tac Toe Problem [CO3] [PO3]
10. Robot Navigation [CO5] [PO4]
11. Propositional Logic Examples [CO5] [PO4]
12. Predicate Logic Examples [CO5] [PO4]
13. Mini Expert system examples [CO5] [PO4]

Practicals:**List of Practical's**

1. Implementation of AI and Non-AI technique by implementing any two player game [CO1,CO2] [PO1,PO2]
2. Implementation of Uninformed strategies [CO1,CO2] [PO1,PO2]
3. Implementation of Informed strategies[CO2,CO3] [PO2,PO3]
4. Implementation of CSP Problem [CO3] [PO3]
5. Implementation predicate logic using PROLOG[CO5] [PO4]
6. Implementation of Expert system using PROLOG[CO5] [PO4]

Course Projects:**List of Course Project Topics (Sample topics)**

Course Project 01 Statement: ----- [CO's Mapped] [PO Mapped]

1. Inventory management E Commerce [CO1] [PO1]
2. stock market price prediction [CO1] [PO1]
3. Object Identification / detection [CO2] [PO2]
4. Product Delivery Drones [CO3] [PO3]
5. Pick and drop robotic arm [CO4] [PO2]
6. Arrangement of blocks [CO2] [PO2]
7. Smart city water / light management system [CO2] [PO2]
8. Human Tracking system [CO2] [PO2]
9. Automatic Interview Conduction system [CO3] [PO3]
10. Student Information Chatbot Project. [CO3] [PO3]
11. Product Review Analysis For Genuine Rating. [CO3] [PO3]
12. Customer Targeted E-Commerce [CO4] [PO2]
13. College Enquiry Chat Bot [CO2] [PO2]
14. Artificial Intelligence HealthCare Chatbot System [CO3] [PO3]

15. Intelligent Tourist System Project [CO3] [PO3]

Seminars:

List of Course Seminar Topics

Seminar 01 Statement: ----- [CO's Mapped] [PO Mapped]

1. Fundamentals of Artificial Intelligence [CO1] [PO1]
2. Intelligent Agents [CO1] [PO1]
3. Uninformed searching Techniques [CO2] [PO2]
4. Informed searching Techniques [CO2] [PO2]
5. Gaming Techniques [CO2] [PO2]
6. Planning Techniques [CO5] [PO4]
7. Applications of AI [CO6] [PO3]
8. Predicate Logic [CO4] [PO2]
9. Propositional Logic [CO4] [PO2]
10. Adversarial Search Techniques [CO4] [PO2]

List of Home Assignments:

List of Design Based Home Assignments

1. Design of intelligent algorithm for AI Accessibility [CO3] [PO3]
2. Design of AI algorithm for Robot Navigation. [CO3] [PO3]
3. Design of AI algorithm for Customer Experience [CO3] [PO3]
4. Design of AI algorithm for Data-Informed Design [CO3] [PO3]
5. Design of AI algorithm for AI Decision Making [CO3] [PO3]
6. Design of AI algorithm for any application for Children [CO3] [PO3]
7. Design of AI algorithm for problems of Senior Citizens [CO3] [PO3]
8. Design of AI algorithm for ecommerce Applications [CO3] [PO3]
9. Design of AI algorithm for Enterprise UX Design [CO3] [PO3]
10. Design of AI algorithm as Teaching Aid for teachers [CO3] [PO3]

List of Case Study Based Home Assignments

HA_CS[CO's Mapped] [PO Mapped]

1. How Automobile Sector Is Preparing For The 4th Industrial Revolution using AI [CO3] [PO3]
2. How Indian Retail Giant Is Using AI And Robots To Prepare For The 4th Industrial Revolution [CO3] [PO3]
3. Rolls-Royce And Google Partner To Create Smarter, Autonomous Ships Based On AI [CO3] [PO3]
4. The Amazing Ways Tesla Is Using Artificial Intelligence And Big Data [CO3] [PO3]
5. The Incredible Ways John Deere Is Using Artificial Intelligence To Transform Farming[CO3] [PO3]
6. Challenges/Issues in AI applications [CO3] [PO3]
7. Research problems in AI [CO3] [PO3]
8. AI in Search Engine [CO3] [PO3]
9. Future of AI [CO3] [PO3]
10. AI in Agriculture [CO3] [PO3]

List of Blog Based Home Assignment

1. AI Trends [CO3] [PO3]
2. AI Research [CO3] [PO3]
3. AI Chatbot [CO3] [PO3]
4. Chatbot Magazine [CO3] [PO3]
5. AI Medical / Agriculture [CO3] [PO3]
6. AI Challenges [CO3] [PO3]
7. Knowledge based Inference Engine [CO3] [PO3]
8. Rule based inference Engine [CO3] [PO3]
9. Truth maintenance system[CO3] [PO3]
10. AI in CSP problems [CO3] [PO3]

List of Survey Based Home Assignments

1. Adaption of AI in 2020 [CO3] [PO3]
2. AI in Industry [CO3] [PO3]
3. AI in Digital Marketing [CO3] [PO3]
4. AI in Gaming [CO3] [PO3]
5. AI after Covid-19 [CO3] [PO3]
6. AI in rule based systems [CO3] [PO3]
7. Analysis of Search Engines : AI perspective [CO3] [PO3]
8. Page rank algorithms in AI [CO3] [PO3]
9. AI in Ecommerce [CO3] [PO3]
10. Analysis of Expert systems in medical diagnosis [CO3] [PO3]

Suggest an assessment Scheme:

HA, Seminar, MSE, ESE, Lab, CVV

Text Books: (As per IEEE format)

1. *Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill*
2. *Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.*
3. *Deepak Khemani: "A First Course in Artificial Intelligence", Mc Graw Hill*
4. *Saroj Kaushik: "Artificial Intelligence" Cengage Publication*

Reference Books: (As per IEEE format)

1. *Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley, 1990.*
2. *Eugene, Charniak, Drew McDermott: "Introduction to Artificial Intelligence.", Addison Wesley*
3. *Patterson: "Introduction to AI and Expert Systems", PHI*
4. *Nilsson: "Principles of Artificial Intelligence", Morgan Kaufmann.*
5. *Carl Townsend, "Introduction to turbo Prolog", Paperback, 1987*

MOOCs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:**On the completion of course, student will able to**

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
2. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
3. Evaluation of different uninformed and informed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.
4. Formulate and solve a given problem using Propositional and First order logic.
5. Analyze the AI problem using different planning techniques.
6. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

CO-PO Map:															
CO	Program Outcomes (PO)												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS3202.1	2														
CS3202.2		2													
CS3202.3			2										1		
CS3202.4		1													
CS3202.5				3											
CS3202.6			1												
Average	2	3	3	3								1			

CO attainment levels:

CO-Number	1	2	3	4	5	6
Attainment Level	2	2	3	1	3	1

Future Course Mapping:

Mention other courses that can be taken after completion of this course

Machine Learning

Job Mapping:

What are the Job opportunities that one can get after learning this course

AI Data Analyst, Data Scientist

COURSE CODE: 3220**COURSE NAME: CYBER SECURITY**

Course Prerequisites: Computer Networks

Course Objectives:

1. Learners must be able to discover the programming bugs that will be malicious code, they also must be able to explain various attacks and resolve the bugs to mitigate the threats.
2. Learners must be able to apply various cryptographic techniques to secure the systems developed.
3. Discover and explain various authentication and authorization methods with the access control
4. Articulate the use of various standard security protocols for the layered architecture.
5. Articulate the urgent need for cyber security in critical computer systems, networks, and World Wide Web, and explain various threat scenarios
6. Articulate the cyber threats to critical infrastructures

Credits: 4

Teaching Scheme Theory: 3 Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance:**SECTION-I****Topics and Contents**

Introduction to Security : Key security properties - Confidentiality, Integrity, Availability. Risk Management, Understanding Governance- Policies, Framework, Laws, Regulations, Guidelines and Compliance, Risk based Management

Cryptography:

Private key cryptography: Role of random numbers & nonce in security, Importance of prime numbers

Data Encryption Standard: Block cipher, Stream cipher, Feistel structure, round function, block cipher modes of operation, S-DES, Attacks on DES, S-AES, AES.

Public key cryptography: RSA: RSA algorithm, Key generation in RSA, attacks on RSA. Elliptic Curve Cryptography (ECC): Elliptic Curve over real numbers, Elliptic Curve over Z_p , Elliptic Curve arithmetic.

Data Integrity: Certificates, Introduction to Hashing, Properties of Hash function, HASH + SALT, hashing algorithms (SHA1, SHA2)

Authentication and Authorization: Network Access Control: SHA-512, Kerberos, Multifactor authentication

Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application, IPsec.

Introduction to Security Attacks and Hacking: Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, countermeasures - Avoiding attacks, Security services. Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, IP spoofing, Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing.

SECTION-II

Introduction to Digital Forensics, Data Recovery and OS Forensics, Email Crimes and Violations, Cyber Forensics.

IoT Security: Definitions of OT, IoT, IIoT, & ICS), Introduction to most widely used protocols in IoT environment - MQTT and CoAP.

Blockchain: Introduction to Blockchain, Decentralized System & Distributed Ledger Technology, Blockchain Computing Power, Hash & Merkle Tree with Hands on Examples, Multiple Use-Cases of Blockchain, Different Types of Blockchain, Public Blockchain, Private Blockchain, Consensus and Types of Consensus with examples Smart Contracts in Blockchain, Need of Smart Contracts, Developing Smart Contracts, Programming basics of Solidity (Data Types) and Advanced Solidity, EVM in relation with Smart Contracts and Gas Price, Running and Debugging Smart Contracts in Remix (Detailed), Deploy and Debug Smart Contract with Truffle

Smart Contracts in Ethereum Blockchain, Crypto-Economics and Cryptocurrency, Types of Cryptocurrency and Cryptography, Valid and Invalid Transactions, Permissioned Blockchain(RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Blockchain for Enterprise – Overview, Blockchain Components and Concepts, Hyperledger Fabric – Transaction Flow

Hyperledger Fabric Details, Fabric – Membership and Identity Management, Hyperledger Fabric Network Setup, Hyperledger Composer, Use cases.

List of Tutorials:

1. Mathematical background for cryptography: modulo arithmetic, GCD (Euclid's algorithm), algebraic structures (Groups, Rings, Fields, Polynomial Field).
2. Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack.
3. Chinese remainder theorem.
4. hashing algorithms MD5

5. Email security: PGP and SMIME
6. Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic
7. Study of Snort
8. Nessus: a Security Vulnerability scanning tool
9. OWASP Zed Attack Proxy (ZAP).
10. Source Code Analysis Tools
11. Metasploit/Ollydbg
12. Testing SSL
13. Testing for Brute Force Password
14. Testing for SQL Injection

List of Practicals: (Any Six)

- 1) Acquisition of System Information/ RAM/Volume Shadow Copy/Detecting Encryption in information.
- 2) Forensic of Disc Image/ Registry/ Meta data/ RAM
- 3) Simplified DES implementation
- 4) Simplified AES implementation
- 5) Encryption and Decryption by RSA algorithm
- 6) Implementation of ECC over Diffie Hellman Key Exchange Protocol
- 7) Implementation of authentication algorithms
- 8) Digital forensic of images
- 9) Forensics of Video alteration
- 10) Vulnerabilities finding in Mobile/ computer/ digital devices

List of Projects:

1. Design a System to develop a analyzer which will differentiate between different vulnerability and packets entered using it. This system will detect the intrusions coming through the vulnerabilities.
2. Securing Video Conferencing App for online meetings
3. Steganography for Image/Video/Files
4. Secure Image display on online social media.
5. Secure transfer of government subsidies to farmers/BPL people/ students etc
6. Authentication of users for various applications for integrity, availability, confidentiality.
7. Implementing a system for detecting the modification of videos/images on social media
8. Secure App for online exams detecting Keystroke and camera movements.
9. A system to detect the difference between the voice edited in the audio/video
10. A System to check the vulnerabilities in the websites.

List of Course Seminar Topics:

1. Blockchain architecture and its implementation
2. Cloud Security
3. Mobile Security
4. IoT and Security Issues/ Security Models for IoT
5. Darkweb
6. Docker Security
7. Access control methods for online social media and various organizations
8. Security of Android Vs IOS
9. Machine learning and SCADA Security
10. Security Applications for Smart Cities

List of Course Group Discussion Topics:

1. Security Issues in Android and IOS devices
2. Industry 4.0 and security
3. Blockchain and E-voting system
4. Security of Aadhar Card and other digital cards
5. Automated Home Appliances and Security
6. Programming Bugs and Malicious code in information security
7. Indian Cyber laws and Deficiencies
8. Social Media and Cyber Security
9. Child abuse on online social media and security
10. Need of cyber crime and security in school education.

List of Home Assignments:**Design:**

1. Design a secure system using cryptography techniques for security of multimedia files.
2. Design a secure system using steganography for hiding data files in image/video
3. Design a system for educational institutes using authentication and authorization techniques, also give details about the access control policies that must be implemented for the design of system by various places.
4. Design a secure system using SSL/TLS/IPSec for the various organizations
5. Design a system for the analysis of cyber crime using various cyber forensic techniques and compare each technique with respect to integrity, confidentiality, availability

Case Study:

1. How to improve the security of social media? Write a detail case study
2. Find out the vulnerability issues in educational institutes websites/online systems and give solutions to these problem. Perform a detailed case study of the various issues.

3. Write a detail case study about the banking security flows and solutions to these flows.
4. Give a detail case study of the antivirus system giving the flows and solutions to it.
5. Perform the detail case study of various operating systems used for mobile devices and give a secure solution to one for widely used OS.

Blog

1. Dark Web
2. Crypto currency and Economy
3. Cyber crime and solutions
4. Authentication and Access control for social media
5. Cyber forensic and Cyber laws

Surveys

1. Survey on various blockchain related issues/ cryptocurrency/ application systems developed using blockchain
2. Survey on various authentication and access control methods for different applications
3. Steganography and Biometric Systems for authentication
4. Survey of various attacks and its effect on Indian economy and its analysis
5. Problems over Integer Lattices: A Study

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.

Text Books: (As per IEEE format)

1. William Stallings; “Cryptography and Network Security-Principles and Practices” 6th Edition , Pearson Education, 2014, ISBN13:9780133354690.
2. Bernard Menezes, “Network Security and Cryptography”, 1st Edition, Cengage Learning, 2010, ISBN 81-315-1349-1.
3. Raef Meeuwisse, “Cybersecurity for Beginners”, 2nd Edition, Cyber Simplicity, 2017, ISBN-9781911452157

Reference Books: (As per IEEE format)

1. M. Speciner, R. Perlman, C. Kaufman, “Network Security: Private Communications in a Public World”, Prentice Hall, 2002
2. Michael Gregg, “The Network Security Test Lab: A Step-By-Step Guide”, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

3. Matt Bishop, "Computer Security: Art and Science", 1st Edition, Pearson Education, 2002, ISBN 0201440997.
4. Charlie Kaufman, Radia Perlman and Mike Spencer, "Network security, private communication in a public world", 2nd Edition, Prentice Hall, 2002, ISBN 9780130460196.
5. V.K. Pachghare, "Cryptography and Information Security", 2nd Edition, PHI, 2015, ISBN-978-81-203-5082-3.

Moocs Links and additional reading material:www.nptelvideos.in

Course Outcomes:

- 1) . Analyze cryptographic techniques using a mathematical approach by examining nature of attack.
- 2) Identify and establish different attacks on the system
- 3) Justify various methods of authentication and access control for application of technologies to various sections of industry and society.
- 4) Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization
- 5) Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.
- 6) Analyze various types of cyber crime by detecting the crime

CO PO Map

CO	Program Outcomes (PO)													PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO 1	PO 1	PO 1	PS O1	PS O2	PS O3	PS O4
CS3201.1	3	3		3	2	2		3	1					3		1	3
CS3201.2	2	3	3		1	2		3	1							1	3
CS3201.3	3	3	1	3	3	3	3	3	1				3		3	1	3
CS3201.4	3	2	3	2			2	3	3	3	2	1					2
CS3201.5	3	2	1	1	3	3	3	3			3	2		3	3	3	
CS3201.6	2	2	3	2	1		2		3	3	3	3					
Average	2.6	7	2.5	2.2	2.2	2	2.5	2.5	3	1.8	3	2.67	2.25	3	3	1.5	2.8

CO attainment levels

Future Courses Mapping:

Blockchain Technologies

Ethical Hacking and Network Defense

Cloud and Data Security

Job Mapping:

Security Engineer/Network Security Engineer

Information Security Analyst

Cyber Security Analyst

Cyber Security Associate

Manager-Information Security Services

Security Consultant

Penetration Testing Engineer

CS:CS3257**COURSE NAME: ENGINEERING DESIGN AND INNOVATIONS-V****Course Prerequisites:** Problem Based Learning**Course Objectives:**

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

Credits:4.....**Teaching Scheme Theory:.... Hours/Week****Tut: Hours/Week****Lab:8.Hours/Week**

Course Relevance: Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. 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. Project based learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of “Trends in Engineering Technology” are designed as a ladder to extend connectivity of software technologies to solve real word problem using interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

- There should be a team/group of 4-5 students.
- A supervisor/mentor teacher assigned to individual groups.
- It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

- Students must focus to initiate the task/idea .The idea inception and consideration shall be from following areas as a real world problem:
- Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.
- This is the sample list to start with. Faculty and students are free to include other areas which meet the society requirements at large.
- 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 disciplinary subject frame/domain.
- 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.

Teacher’s Role in PCL :

- Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
- To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
- To aware the group about time management.
- Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PCL must be responsible for their own learning.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PCL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Developing Inquiry Skills:

- Students in PCL 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.
- Use the following mechanism to maintain the track of moving towards the solution.
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?

Literature Survey – To avoid reinvention of wheel:

- It is integral part of self- directed learning
- 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

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

EDI Sample Case Studies :-

- 1) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis
- 2) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for SAM and BAM processing and analysis
- 3) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for Gnome NGS processing and analysis
- 4) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for population genetics simulation
- 5) Design of bioinformatics library using CPython for Next-generation Sequencing processing and analysis for proteomics processing and analysis

...not limited to.....Faculty and students are free to include other area which meets the society requirements at large.

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Higher levels of the Booms Taxonomy - analyze, apply, evaluate and create.

Text Books: (As per IEEE format)

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.

Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robert Capraro, Mary Margaret Capraro

Reference Books: (As per IEEE format)

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. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development.* By James Shore & Shane Warden.

Course Outcomes:

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

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

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2, PO4	PO3, PO5	PO4, PO5, PO8	PO6, PO7, PO9, PO11	PO12, PSO2, PSO3, PSO4
3	3, 3	2, 3	2, 2, 2	2, 2, 2, 1	2,3,2,2

CO attainment levels

CO1 -4 CO2 –2 CO3-4 CO4-5 CO5 -1 CO6-3

Job Mapping:

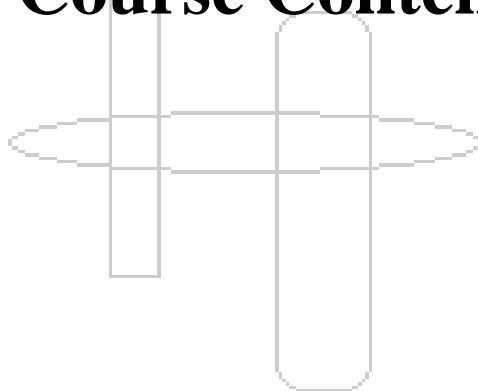
What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer

Job Mapping: Compiler Engineer

B. Tech. Final Year Computer Engineering AY 2023-24

Module VII and VIII Course Content



MD4202::Project Management

Credits: 2

Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites:

Production Systems, Basics of Industrial Engineering

Course Objectives:

1. Understand the Project Management Basics
2. Learn & Apply Project Management principles in Manufacturing and Service Sector
3. Learn Modern Tools like MS-Project for managing projects
4. Understand Project Management principles usage in the entrepreneurship

Section 1: Topics / Contents

Introduction:

Definition & Characteristics of Project, Performance Parameters: Time, Cost & Quality. Difference with respect to Standard Routine Production. Classification of Projects: Sector based, Investment based, Technology based, Causation based, Need based (BMERD) - Balancing, Modernization, Replacement, Expansion & Diversification Project Life Cycle Phases – Concept/Initiation Phase: Parameters Involved in Project Identification. Sources of New Project Ideas. Governmental Framework for Identification of Opportunities, Incentives from state & central govt.; Import-substitution projects

Project Conceptualization & Feasibility Analysis

Project Definition Phase: Project Formulation & Feasibility. Types of Feasibility Studies – Pre-feasibility, Support/Functional, Feasibility Study. Preparation of Project Feasibility Report

Project Planning, Implementation & Control

Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Network Analysis & Duration Estimating Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Project Crashing.

Section 2: Topics / Contents

Topics and Contents

Project Human Resource

Project Organization & Management. Project Organization Structure, Role of Project Manager, Resource Levelling, Resource Smoothening,

Project Cost Management

Project Cost Estimation: Need, Causes of Cost & Time Overruns. Nature of Cost Estimates, Types of Project Cost Estimates

Project Implementation & Control

Implementation Phase: Activities Involved: Erection & Commissioning, Installation, Trial Runs & Commencement of Commercial Production. Cleanup / Shutdown Phase

List of Home Assignments:

On following topics any type of (**Design, Case Study, Blog, Survey**) Home Assignment can be done in a group.

1. HA Based on Project Planning by using MS- Project
2. HA Based on CPM with or without using MS- Project (On actual projects)
3. HA Based on PERT with or without using MS- Project (On actual projects)
4. HA Based on Project Crashing (Cost Optimization)
5. HA Based on Resource Optimization - Resource Levelling and Smoothening
6. Survey based on PM Softwares and its applicability
7. Study based on Project Cost Management
8. Analysis based on Earned Value Management of any project
9. Blog based on Best practices in Project Management
10. Blog based on Project Management Softwares and its usage
11. Use of MS Project in Construction / IT/ Techonology/ NPD Projects
12. Use of Project Management in Instrumentation & Control Engg fields
13. Use of PM in Education (From student's perspective)
14. Feasibility study of any project or Business plan
15. Blog on Scope of Project Management domain in India
16. Blog on Challenges in Project Management for IT / Construction / Govt sector
17. Survey based on Project Manager's experience about Challenges/ Benefits in the PM domain
18. Study of Project Life Cycle Management
19. Study of Cost or Time or Quality aspects of Project Management
20. Study of Industry 4.O feasibility in Project Management

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.

MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks

Home Assignment - End of Semester 100 Marks converted to 10 equivalent Marks

MCQ Exam – Section II - End of Semester 30 Marks converted to 30 equivalent Marks

Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books: (As per IEEE format)

1. Project Management- Harrold Kerzner, Wiley Publisher, 13th Edition, 2022
2. Project Management by Dennis Lock, 10th Edition, Gower Publishing Company, 2013
3. Project Management by Nagarajan, 2nd Edition, K, New Age International (P) Ltd Publishers, 2004

Reference Books: (As per IEEE format)

1. Project Management - Body of Knowledge (BOK) Guide by PMI – Sixth Edition, 2021

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

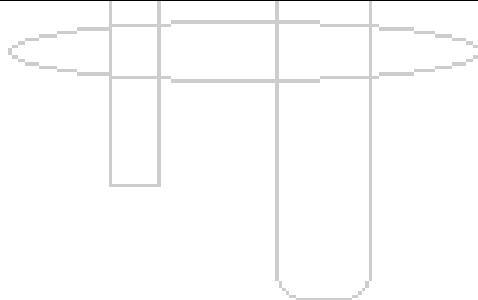
1. Learn the basic concepts of project and project management.
2. Ascertain the feasibility of small and medium projects with respect to managerial, marketing, operational, financial and socio-economic perspectives
3. Plan and schedule small and medium projects to achieve the triple constraint of time, cost and quality using software package
4. Understand the concept of earned value management system and critical chain in managing projects
5. Understand the concepts of project risk management and critical chain project management
6. Monitor the progress of projects to determine variances and recommend corrective actions

CO PO Map

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									1	1	3	1				3
CO2									1	1	3	1				3
CO3	2				3				2	1	3	1		2		3
CO4		1									3	1				3
CO5		2									3	1				3
CO6						1	1				3	1				3
Average	2.0	1.5			3.0	1.0	1.0		1.33	1.0	3.0	1.0		2.0		3.0

CO Attainment Levels

CO-1 : 3
 CO-2 : 3
 CO-3 : 3
 CO-4 : 3
 CO-5 : 3
 CO-6 : 3



Future Courses Mapping:

Industry Internship or Capstone Project

Job Mapping:

Project Manager, Project Executive, CFT member, Program Manager, Entrepreneurship

LL4001: Generative AI

Credits: 2

Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites:

Statistical Mathematics, Artificial Intelligence

LinkedIn Course: For this course, each student will have to complete following six modular courses mentioned in six units. **Other guidelines related to examination and assessment will be given by course coordinator.**

Unit-I: Processing Text with Python Essential Training

In the world of big data, more and more information is consumed and analyzed in text form. Websites, social media, emails, and chats have become the key sources for data and insights. If you work with data, then understanding how to deal with unstructured text data is essential. In this course, instructor Kumaran Ponnambalam helps you build your text mining skill set, covering key techniques for extracting, cleansing, and processing text in Python. Kumaran reviews key text processing concepts like tokenization and stemming. He also looks at techniques for converting text into analytics-ready form, including n-grams and TF-IDF. Along the way, he provides examples of these techniques using Python and the NLTK library.

Unit-II: Hands-On Natural Language Processing

Dexterity at deriving insight from text data is a competitive edge for businesses and individual contributors. This course with instructor Wuraola Oyewusi is designed to help developers make sense of text data and increase their relevance. This is a hands-on course teaching practical application of major natural language processing tasks. Learn how to replicate the knowledge gained into the data that you work with. This course includes a background of each task's process flow, use cases, and a coding demo. Some of the topics covered are named entity recognition, text summarization, topic modeling, and sentiment analysis.

Unit-III: Advanced NLP with Python for Machine Learning

An incredible amount of unstructured text data is generated every day by social media, web pages, and a variety of other sources. But without the ability to tame and harness that data, you'll be unable to glean any value from it. In this course, learn how to translate messy text data into powerful insights using Python. Instructor Derek Jedamski begins with a quick review of foundational NLP concepts, including how to clean text data and build a model on top of vectorized text. He then jumps into more complex topics such as word2vec, doc2vec, and recurrent neural networks. To wrap up the

course, he lends these concepts a real-world context by applying them to a machine learning problem.

Unit-IV Deep Learning Foundations: Natural Language Processing with Tensor Flow

There is a growing demand to harness the power of natural language processing (NLP) and deep learning models to be able to make sense of textual data and reduce the emotional intervention of humans in order to make better decisions. In this course, instructor Harshit Tyagi provides a complete guide to understanding NLP using recurrent neural networks (RNNs). Harshit begins by introducing you to word encodings and using TensorFlow for tokenization. He describes the important concept of word embeddings and shows you how to use TensorFlow to classify movie reviews and project vectors. Harshit discusses RNNs and long short-term memory (LSTM), then shows you how to improve the movie review classifier from earlier in the course. He concludes with a discussion of how you can train RNNs to predict the next word in a sentence, which in turn allows you to generate some original text.

Unit-V Recurrent Neural Networks

Get started with recurrent neural network (RNN) concepts in a simplified way and build simple applications with RNNs and Keras. RNN is a fast-growing domain within the AI world. Popular groundbreaking applications like language translation, speech synthesis, question answering, and text generation use RNNs as their base technology. Studying this technology, however, has several challenges. Most learning resources are math heavy and are difficult to navigate without good math skills. IT professionals from varying backgrounds need a simplified resource to learn the concepts and build models quickly. In this course, Kumaran Ponnambalam provides a simplified path to studying the basics of recurrent neural networks, allowing you to become productive quickly. Kumaran starts with a simplified introduction of RNN before walking through the process of building a model. He then covers the popular building blocks of RNN with GRUs, LSTMs, word embeddings, and transformers.

Unit VI Generative AI: Working with Large Language Models

Transformers have quickly become the go-to architecture for natural language processing (NLP). As a result, knowing how to use them is now a business-critical skill in your AI toolbox. In this course, instructor Jonathan Fernandes walks you through many of the key large language models developed since GPT-3. He presents a high-level overview of GLaM, Megatron-Turing NLG, Gopher, Chinchilla, PaLM, OPT, and BLOOM, relaying some of the most important insights from each model. Get a high-level overview of large language models, where and how they are used in production, and why they are so important to NLP. Additionally, discover the basics of transfer learning and transformer training to optimize your AI models as you go. By the end of this course, you'll be up to speed with what's happened since OpenAI first released GPT-3 as well as the key contributions of each of these large language models.

Syllabus Template

FF No. : 654

CS4217:: Human-Computer Interaction (HCI)

Credits: 02

Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites: NA

Course Objectives:

1. To categorize IT applications based on measurable human factors,
2. To study the user community through user survey and/or field visit,
3. To design user-friendly user interfaces with due consideration of interface theory and principles,
4. To apply usability evaluation methods to identify the usability issues with IT applications,
5. To understand the kind of documentation required for IT applications,
6. To integrate web and mobile app design approaches as per user requirements.

Course Relevance:

Human-Computer Interaction (HCI) is a multi-disciplinary socio-technical course, with a goal of bringing the power of computers and communication systems to users, customers or people. It aims to make all computing and communications systems more accessible, maintainable and useful in working, learning and recreational life of their users. It helps every computing, web or mobile application to become really user-centered, increasing its number of users as well as related sales.

Section 1: Topics / Contents

Unit-I Fundamentals of Human Computer Interaction: 05 Hours
Definition of HCI, Interdisciplinary Nature, Related Disciplines, Usability, Types of Usability, User Interface (UI), Measurable Human Factors, Accessibility, Differently-abled Users.

Unit-II Interaction Concepts and Models: 05 Hours
User Persona, User Categorization, Golden Rules of Interface Design, Miller's Principle, Task Analysis - GOMS, Contextual Inquiry, Work Models, Interaction Styles.

Unit-III Design Process: 04 Hours
Design Concept, Three Pillars of Design, Process of Design, Ethnographic Observations, Participatory Design, Internationalization.

Section 2: Topics/Contents

Unit-IV Usability Evaluation: 05 Hours

Expert-based Evaluation, User-based Evaluation, Formative Evaluation, Summative Evaluation, Heuristic Evaluation, Cognitive Walkthrough, Semiotic Analysis, Icon Categorization, User Surveys, Interviews, Usability Testing.

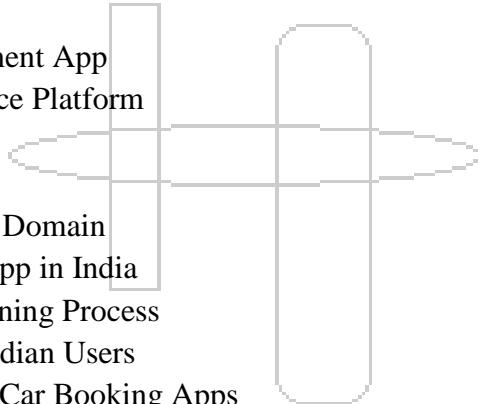
Unit-V Documentation and Groupware: **05 Hours**
Classification of Documents, Reading from Displays, Online Help, Tutorials, Error / Warning Messages, Groupware, Computer Supported Cooperative Work (CSCW), Dimensions of Cooperation, Challenges with Online Communications.

Unit-VI Website and Mobile App Design: **04 Hours**
Content Design, Interaction and Navigation Design, Presentation Design, Differences in Design Approaches, Design and Evaluation Tools.

List of Home Assignments:

Design:

- 6. Social Network for Spiritual Users
- 7. App for Alzheimer's disease
- 8. Health Tracking App
- 9. Ration Card Management App
- 10. Innovative e-Commerce Platform



Case Study:

- 6. Chatbot in Healthcare Domain
- 7. Best Food Ordering App in India
- 8. Online Teaching-Learning Process
- 9. Use of Twitter with Indian Users
- 10. User Experience with Car Booking Apps

Blog

- 6. Noise of Notifications
- 7. Challenges in Food Delivery Service
- 8. Need for Accessibility Guidelines
- 9. Usability of Autonomous Vehicles
- 10. Failure of Usability Testing

Surveys

- 7. User Experience with Video-Conferencing Apps
- 8. User Errors on Social Networking Sites (SNS)
- 9. Challenges for Hearing Impaired Users with IT Applications
- 10. Most Popular Indian Mobile Apps (Made In/By India)

11. Impact of Ban on Chinese Apps in India

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.

MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks

Home Assignment - End of Semester 100 Marks converted to 10 equivalent Marks

MCQ Exam – Section II - End of Semester 30 Marks converted to 30 equivalent Marks

Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books: (As per IEEE format)

1. Ben Shneiderman, "Designing the User Interface", Third Edition, Pearson Education, ISBN 81-7808-262-4.

2. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, "Human-Computer Interaction", Third Edition, Pearson Education, ISBN 81- 297-0409-9.

Reference Books: (As per IEEE format)

1. Donald Norman, "The Design of Everyday Things", 2002 Edition, Basic Books, ISBN 100-465-06710-7.

2. Wilbert Galitz, "The Essential Guide to User Interface Design", Second Edition, Wiley-Dreamtech India (P) Ltd., ISBN 81-265-0280-0.

3. John Carroll, "Human-Computer Interaction in the New Millennium", Pearson Education, ISBN 81-7808- 549-6.

MOOCs Links and additional reading material:

www.nptelvideos.in, www.coursera.com, www.udemy.com

Course Outcomes: Students will be able to

1. Appreciate the differences among IT applications and their categories based on measurable human factors.
- 2 Study the user community through user survey and/or field visit.
3. Design user-friendly user interfaces as per user requirements and UI design principles.
4. Apply a suitable usability evaluation method to identify the usability issues.
5. Understand the kind of documentation required for IT applications.
6. Enhance UI designs as per desired web or mobile app design approach.

	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CS4217.1	2	3	-	-	-	-	-	-	-	-	-	2	-	-	-	2
CS4217.2	2	3	-	2	-	-	-	-	-	-	-	2	-	-	-	2
CS4217.3	3	2	3	-	2	3	2	2	2	-	-	2	-	-	3	2
CS4217.4	2	3	3	2	-	-	-		-	-	-	2	-	-	2	2
CS4217.5	3	-	-	-	-	-	-	-	-	2	1	-	-	-	2	2
CS4217.6	3	2	3	2	2	3	2	2	2	-	-	-	-	-	3	2
Average	2.5	2.6	3.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0	1.0	2.0	-	-	2.5	2.0

CO Attainment levels:

Weights for attainment levels: L1 - Easy- 0.75 L2 - Comfortable - 0.7 L3 – Medium – 0.65
L4 – Somewhat difficult – 0.6 L5 – Difficult – 0.55

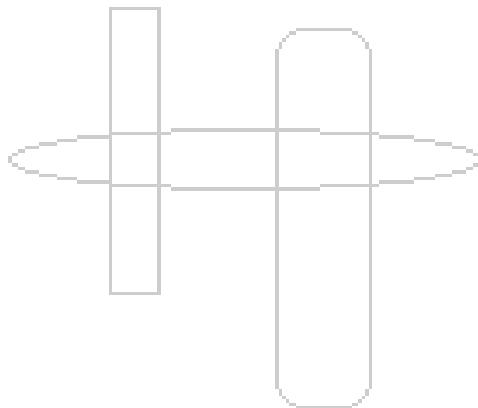
CO1 – L3, CO2 – L3, CO3 – L2, CO4 – L2, CO5 – L1 and CO6 – L3

Future Course Mapping:

User Interface Design, Usable Security & Intelligent User Interfaces

Job Mapping:

UI Designer, Product Designer, Software Engineer, Mobile App Developer and Other Jobs



CS4272:: Neural Networks

Credits: 02

Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites: Fundamentals of Mathematics, Python Programming.

Course Objectives: In this course, we will study the following topics

1. To Study the neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function, multilayer perceptron.
2. To understand the basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.
3. To Study the delta learning rule, the backpropagation delta learning rule, self-organization learning, and the r4-rule.
4. To Understand the importance of tolerance of imprecision and uncertainty for the design of robust and low-cost intelligent machines.
5. To apply basic principles of Artificial Neural networks in solutions that requires problem-solving, inference, perception, knowledge representation, and learning.
6. To build Neural Network models and implement them in real-life scenarios for different applications like detection and classification.

Course Relevance: Neural networks reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning. Artificial neural networks (ANNs) are comprised of node layers, containing an input layer, one or more hidden layers, and an output layer. Each node, or artificial neuron, connects to another and has an associated weight and threshold. If the output of any individual node is above the specified threshold value, that node is activated, sending data to the next layer of the network. Otherwise, no data is passed along to the next layer of the network.

SECTION-I: Topics and Contents:

Unit-I Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Mc_Culloch_Pitts, Hebbnet, Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks, Backpropagation algorithm

Unit-II Learning Techniques: Supervised, Unsupervised, Reinforcement Learning. Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem

Unit-III Supervised Learning: Perceptron learning and Non Separable sets, α -Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ -LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Genetic Algorithm, Regression analysis

SECTION-II :

Topics and Contents:

Unit-IV Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition

Unit-V Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory

Unit-VI Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

List of Home Assignments:

List of Design Based Home Assignments

- HA_D1.Based on Integrate-and-Fire Neurons
- HA_D 2. Based on Mac_Culloch_PittsNeuronsmodel
- HA_D 3. Based on Heb Net
- HA_D 4. Based on the Backpropagation algorithm.
- HA_D 5. Based on Support Vector Machine
- HA_D 6. Based on Linear and nonlinear models.
- HA_D 7. Based on K means Clustering algorithm.
- HA_D 8. Based on Boltzmann Machine.
- HA_D 9. Based on a self-organizing feature map.
- HA_D 10. Based on Integrate-and-Fire Neurons

List of Case Study Based Home Assignments

HA_CS 01 A case study of using artificial neural networks for classifying causes of death from verbal autopsy.

HA_CS 02A a case study of using artificial neural networks for wind energy

HA_CS 03A case study of using artificial neural networks for medical diagnostics.

HA_CS 04A case study of using artificial neural networks for the banking sector.

HA_CS 05A case study of using artificial neural networks for Industry.

HA_CS 06A case study of using artificial neural networks for the Film industry.

HA_CS 07A case study of using artificial neural networks for the agriculture sector.

HA_CS 08A case study of using artificial neural networks for Education system or teaching-learning process.

HA_CS 09A case study of using artificial neural networks for safety and security.

HA_CS 10A case study of using artificial neural networks for rainfall prediction.]

List of Blog Based Home Assignment

HA_Blog 01: Two Dimensional Feature Extraction and Blog Classification using Artificial Neural Network

HA_Blog 02: An intelligent personalized web blog searching technique using neural networks

HA_Blog 03: An author gender detection method using whale optimization algorithm and artificial neural network

HA_Blog 04: A comparative study of machine learning techniques in blog comments spam filtering

HA_Blog 05: A document-level sentiment analysis approach using artificial neural network and sentiment lexicons

HA_Blog 06: Automatic classification of unstructured text

HA_Blog 07: Product related information sentiment-content analysis based on neural networks

HA_Blog 08: Customer segmentation and classification by using data mining: an example of VOIP phone

HA_Blog 09: Travel blogs and the implications for destination marketing

HA_Blog 10: An event driven neural network system for evaluating public moods from online users' comments

List of Survey Based Home Assignments

HA_Survey 01: State-of-the-art in artificial neural network applications: A survey

HA_Survey 02: -Personality traits analysis using Artificial Neural Networks: A survey

HA_Survey 03: Artificial neural networks in accounting and finance: Modeling issues

HA_Survey 04: Neural networks for control systems—a survey

HA_Survey 05: Student's success prediction model based on artificial neural networks (ANN) and a combination of feature selection methods

HA_Survey 06: Reusability in artificial neural networks: An empirical study

HA_Survey 07: Survey on neural networks used for medical image processing

HA_Survey 08: Artificial neural networks: A powerful tool for cognitive science, A Survey

HA_Survey 09: A model selection approach to real-time macroeconomic forecasting using linear models and artificial neural networks

HA_Survey10: Predicting students' performance based on learning style by using artificial neural networks

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.

MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks

Home Assignment - End of Semester 100 Marks converted to 10 equivalent Marks

MCQ Exam – Section II - End of Semester 30 Marks converted to 30 equivalent Marks

Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books: (As per IEEE format)

1. *Introduction to Artificial Neural Systems* Jacek M. Zurada, JAICO Publishing House Ed. 2006.
2. *Neural Networks A Classroom Approach* —Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.
3. *Neural Networks a Comprehensive Foundations*, Simon S Haykin, PHI Ed.

Reference Books: (As per IEEE format)

1. *Neural Networks A Classroom Approach* —Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.
2. *Neural Networks in Computer Inteligance*, Li Min Fu TMH 2003
3. *Neural Networks* -James A Freeman David M S Kapura Pearson Ed., 2004.
4. *Artificial Neural Networks* – B. Vegganarayana Prentice Hall of India P Ltd 2005

MOOCs Links and additional reading material:

1. www.nptelvideos.com
2. www.coursera.com

Course Outcomes: On the completion of course, student will able to

1. Understand the concepts, techniques, and building blocks of neural network models like Mac_Culloch_Pitts, Hebnet and Artificial Neural Networks.
2. distinguish between supervised, unsupervised and reinforcement learning techniques.
3. Apply basic principles of Artificial Neural networks in solutions that require problem-solving, inference, perception, knowledge representation, and learning.
4. Implement neural network models to solve real-world problems.
5. Evaluate different most appropriate parameters for performance calculation.
6. Build Neural Network models and implement them in real-life scenarios for different applications.

Syllabus Template

FF No.: 654

CS4222:Image Processing

Credits: 2

Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites: Digital logic Design, Microprocessor, Computer Organization.

Course Objectives:

1. To describe different color models and image processing techniques.
2. To analyze image condition and deduce enhancement algorithms.
3. To apply image segmentation to identify the region of interest
4. To develop an algorithm to recognize the specified objects in the given image.
5. To study different image morphological operation.
6. To learn different image compression techniques.

Course Relevance:

Vision sense is the most powerful human sense organ. In the world where intelligent automation is taking place, image processing is a vital domain for research and development. In Industry 4.0, image processing systems built around industrial cameras are an essential component in automated production. Throughout all steps of production, from the inspection of raw materials and production monitoring (i.e., flaw detection) to final inspections and quality assurance, they are an indispensable part of achieving high efficiency and quality standards. In the Entertainment Industry, latest trends such as 4K video streaming requires high quality compression that can provide limited/no loss image quality with high fps. In social networking, sharing images has been a vital part. Creating innovative effects and overall manipulating the images will be explored

Section 1: Topics/Contents

Unit-I Introduction

4 Hours

Elements of image processing system, Scenes and Images, Vector Algebra, Human Visual System, color vision color model: RGB, HVS, YUV, CMYK, YCbCr and some basic relationships between pixels, linear and nonlinear operations, Image sampling and quantization.

Unit-II Image Enhancements

5 Hours

Memory-less operations, Spatial domain image enhancements: Denoising filters, Smoothing Operation, Sharpening Operation, and Contrast stretching /enhancement, histogram and histogram equalization.

Unit-III Image segmentation

5 Hours

Classification of image segmentation techniques: Edge-based Segmentation, Region based techniques. Binarization: Global Thresholding, Adaptive thresholding. Types of Edge detector: derivative filters, Sobel, Canny. Edge linking. Feature Extraction.

Section2:Topics/Contents

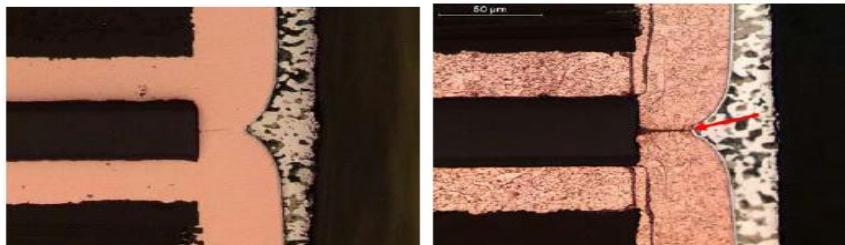
Unit-IV Morphological Operation **4 Hours**
Binary Morphology, Erosion Dilation, Opening and Closing.

Unit-V Feature Extraction and Object Recognition **5 Hours**
Feature points and feature detection (Line, circle and corner). Line detection: RANSAC, Hough Transform. Corner detection: Harris Corner Detector. Feature descriptors, Descriptor matching. SIFT, Boundary representation (Chain code), Boundary detection-based techniques.

Unit-VI Image Compression **5 Hours**
Introduction and need, Coding redundancy, classification of compression techniques (Lossy and lossless- JPEG, Run Length Coding, Huffman Coding, Shannon Fano coding).

List of Design based Home Assignments:

1.Design an algorithm to identify fault in a “PCB inspection system” as shown below



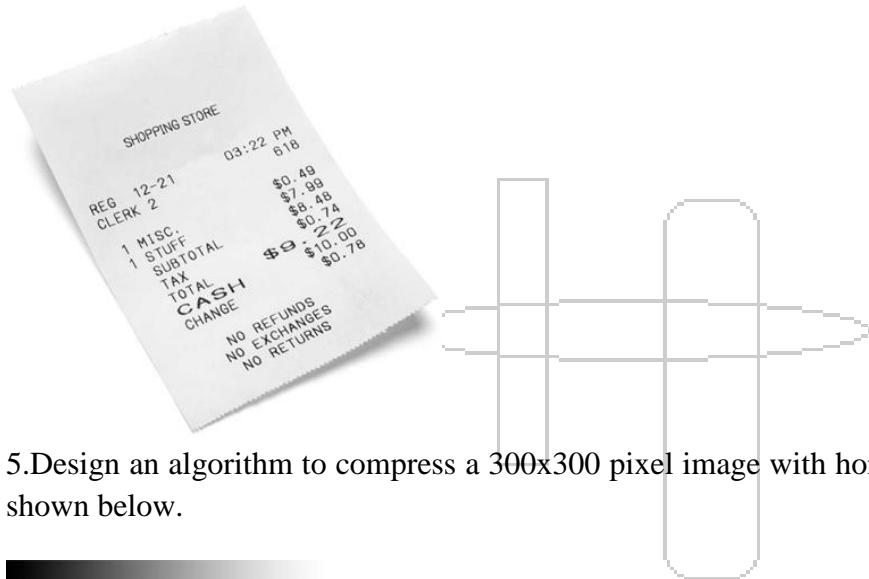
2.Design an algorithm to perform segmentation of the image below to extract the mango from its background.



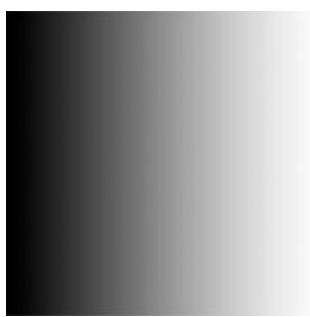
3.Design an algorithm to get from image 1 to image 2.



4.Design an algorithm to recognize character “0” in the image below.



5.Design an algorithm to compress a 300x300 pixel image with horizontal black to white gradient as shown below.



List of Case Study based Home Assignments:

1. Cam-scanner: Document scanning app
2. Tesseract OCR library
3. Instagram filters
4. OpenCV
5. Google Street View

List of Blog based Home Assignments:

1. Image processing on Embedded platforms
2. Face recognition system security analysis for authentication
3. Image processing in MSME for effective automation
4. H.264 codec for image streaming
5. Role of mathematics in image processing

List of Survey based Home Assignments:

1. Image quality metrics
2. Vision based self-driving car safety
3. Compression techniques & codecs
4. State of the art applications such as AR/ XR
5. Human recognition in social networking apps like Facebook

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.

MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks

Home Assignment - End of Semester 100 Marks converted to 10 equivalent Marks

MCQ Exam – Section II - End of Semester 30 Marks converted to 30 equivalent Marks

Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books: (As per IEEE format)

1. Rafael Gonzalez & Richard Woods, "Digital Image Processing," 3rd Edition, Pearson publications, ISBN 0132345633.
2. Anil K. Jain, "Fundamental of Digital Image Processing," 5th Edition, PHI publication, ISBN 13: 9780133361650.

Reference Books: (As per IEEE format)

1. Pratt, "Digital Image Processing," Wiley Publication, 3rd Edition, ISBN 0-471- 37407-5.
2. K.R. Castleman, "Digital Image Processing," 3rd Edition, Prentice Hall: Upper Saddle River, NJ, 3, ISBN 0-13-211467 -4.

MOOCs Links and additional reading material:

1. <https://nptel.ac.in/courses/117/105/117105135/>
2. <https://nptel.ac.in/courses/106/105/106105032/>
3. <https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs58/>
4. <https://www.coursera.org/learn/computer-vision-basics>

Course Outcomes:

The student will be able to –

1. Recognize different color models and image processing techniques. (1)
2. Select image enhancement algorithm to improve the quality of image. (2)

3. Build image segmentation techniques to identify region of interest. (4)
4. Predict image morphological techniques to resize the image. (3)
5. Construct an algorithm to recognize the specified objects in the given image. (5)
6. Identify different image compression techniques to reduce the size of image. (3)

CO-PO Map:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	-	-	-	-	-	-	-	2	2	2	3	3
CO2	3	2	2	1	3	-	-	2	-	-	-	2	2	2	3	3
CO3	2	2	3	2	3	-	-	-	1	-	-	2	2	2	3	3
CO4	3	3	3	2	3	2	-	-	-	-	-	2	2	2	3	3
CO5	3	2		2	3	2	-	-	1	1	2	2	2	2	3	3
CO6	3	2		2	3	2	2	2		1	2	2	2	2	3	3
Average	2.8	2.16	2.7	1.88	3	2.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0	2.0	3.0	3.0

CO Attainment levels:

Weights for attainment levels: L1 - Easy-0.75 L2 - Comfortable-0.7 L3 – Medium – 0.65

L4 – Somewhat difficult – 0.6 L5 – Difficult – 0.55

CO1 – L2, CO2 – L2, CO3 – L4, CO4 – L3, CO5 – L5 and CO6 – L3

Future Course Mapping:

1. Augmented Reality
2. Multimedia Processing

Job Mapping:

1. Augmented Reality Experience Designer
2. Automation Engineer
3. Embedded Software Developer
4. Image Processing Expert

ET4230 : Natural Language Processing

Credits: 2

Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites: Theory of Computer Science, Compiler Design

Course Objectives:

1. To understand morphology for given natural language
2. To learn how to design lexical analyzer for given natural language
3. To learn how to design Syntactic Analyzer for given natural language
4. To learn how to design type dependency parser using pragmatic approach for given natural language
5. To understand the scientific process for machine transliteration, machine translation and information retrieval for given natural language using statistical approach

Course Relevance: Although Natural Language Processing (NLP) has been with us for quite some time, it has only recently gained industry-wide attention, thanks to Deep Learning. Today, NLP is a core competence area in Data Science and IT, with applications spanning across sectors that rely on harnessing language data's potential. Essentially, NLP applications are designed to extract relevant and meaningful information from natural human language data and impart machines with the ability to interact with humans.

SECTION 1: TOPICS/CONTENTS

Unit-I Introduction

[5 Hours]

What is natural language processing? Applications of NLP, Origins of NLP, Challenges of NLP, Language and Knowledge, Language and Grammar, Processing Indian Languages. Grammar-based language models, lexical functional Grammar(LFG), Government and Binding (GB), Lexical functional Grammar Model, Generative grammars, Statistical Language Model.

Unit-II Regular Expressions and Automata

[5 Hours]

Formal Language Theory: Basic Notions, Basic Regular Expression Patterns, Disjunction, Grouping and Precedence, Advanced Operators, Substitution, Finite State Automata, NFSA. Words and Transducers, Morphology, Inflectional Morphology, Derivational Morphology, Finite State

Morphological Parsing, Construction of Finite State Lexicon, Finite State Transducers, FST for Morphological Parsing.

Unit-III Theory of parsing / Syntactic Analysis

[4 Hours]

Context Free Grammar, parsing, Top-down Parsing, Bottom-up parsing, Probabilistic parsing, Indian Languages parsing Semantic Analysis: Meaning Representation, Lexical Semantic, Ambiguity, Word Sense Disambiguation, Discourse processing, Natural Language Generation.

SECTION2: TOPICS/CONTENTS

Unit-IV Computer Linguistics

[5 Hours]

Machine Transliteration using Statistical Language modeling: N-gram model, Machine Transliteration: Rule-based, Phonology and Stress Analysis based and Statistical based, Support vector machine, Memory Entropy Model, Hidden Markov Model, Conditional Random Fields, Evaluation Metrics

Unit-V Machine Translation

[5 Hours]

Introduction, Problems in MT, Characteristics of Indian Languages, Machine Translation Approaches, Direct Machine Translation, Rule-Based MT, Corpus Based Machine Translation, Semantic/Knowledge based MT Systems, Translation involving Indian Languages, Statistical-Based using MT Tools - GIZA++, SRTLM and Moses, Evaluation Metrics

Unit-VI Information Retrieval

[4 Hours]

Designing features for IR Systems, IR Models, Classical IR Models, Non Classical IR Models. Evaluation of IR Systems, NLP in IR, Relation Mapping, and Knowledge based Approaches, Conceptual Graphs in IR, Cross Language Information Retrieval, Evaluation Metrics.

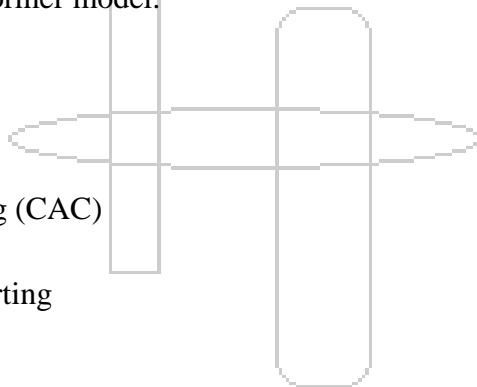
List of Course Project Areas:

1. Biomedical Text Mining.
2. Computer Vision and also NLP.
3. Deep Linguistic Processing.
4. Controlled Natural Language.
5. Language Resources and also Architectures for NLP.
6. Sentiment Analysis and also Opinion Mining.
7. Recognizing Similar Texts
8. Inappropriate Comments Scanner
9. Language Identifier
10. Image-Caption Generator

List of Design based Home Assignments:

Design:

1. Use a simple method to classify positive or negative sentiment in tweets
2. Use a more advanced model for sentiment analysis
3. Use vector space models to discover relationships between words and use principal component analysis (PCA) to reduce the dimensionality of the vector space and visualize those relationships
4. Write a simple English-to-French translation algorithm using pre-computed word embeddings and locality sensitive hashing to relate words via approximate k-nearest neighbors search
5. Create a simple auto-correct algorithm using minimum edit distance and dynamic programming
6. Write a better auto-complete algorithm using an N-gram model (similar models are used for translation, determining the author of a text, and speech recognition)
7. Write your own Word2Vec model that uses a neural network to compute word embeddings using a continuous bag-of-words model
8. Train a neural network with GLoVe word embeddings to perform sentiment analysis of tweets
9. Translate complete English sentences into French using an encoder/decoder attention model
10. Build a transformer model to summarize text
11. Build a chatbot using a reformer model.



Case Study:

1. Clinical Documentation
2. Speech Recognition
3. Computer-Assisted Coding (CAC)
4. Data Mining Research
5. Automated Registry Reporting
6. Clinical Decision Support
7. Clinical Trial Matching
8. Prior Authorization

Blog:

1. Machine Translation: Rule-Based
2. Machine Translation: Statistical-Based
3. MT Tools - GIZA++, SRTLM and Moses
4. GIZA++, SRTLM and Moses
5. Natural Language Resources for Beginners
6. Natural Language Resources for Practitioners
7. Biomedical Text Mining
8. Computer Vision and also NLP
9. Deep Linguistic Processing
10. Controlled Natural Language.

11. Language Resources and Architectures for NLP
12. Sentiment Analysis and also Opinion Mining
13. NLP includes Artificial Intelligence

Survey:

1. Language Models
2. Top-down Parsing
3. Bottom-up parsing
4. Probabilistic parsing
5. Indian Languages parsing

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.

MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks

Home Assignment - End of Semester 100 Marks converted to 10 equivalent Marks

MCQ Exam – Section II - End of Semester 30 Marks converted to 30 equivalent Marks

Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books:

1. *Tanveer Siddiqui and U S Tiwary, "Natural Language Processing and Information Retrieval"* Fourth Impression, Oxford, ISBN-13:978-019-569232-7.
2. *Daniel Jurafsky and James H Martin, "Speech and Language Processing"*, 2nd edition, Pearson, Second Impression-2014,ISBN: 978-93-325-1841-43.
3. *Christopher D.Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing"* , MIT Press, 1999.

Reference Books:

1. *Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor), "The Handbook of Computational Linguistics and Natural Language Processing"*.
2. *Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit*, Steven Bird, Ewan Klein, and Edward Loper, O'Reilly Publication
3. *Natural Language Processing with Python CookBook*, Krishna Bhavsar, Naresh Kumar, Pratap Dangeti, Packt Publication.
4. *Ralph Grishman, " Computational Linguistics: An Introduction (Studies in Natural Language Processing)"*, Cambridge University Press, ASIN : B01MQYCTOB.

MOOCs Links and additional reading material:

- www.nptelvideos.in
- www.nfnlp.com
- <https://www.mooc-list.com/tags/nlp>
- <https://www.my-mooc.com/en/mooc/natural-language-processing-nlp/>
- <https://huggingface.co/learn/nlp-course/>
- <https://www.coursera.org/learn/attention-models-in-nlp>

Course Outcomes:

The student will be able to:

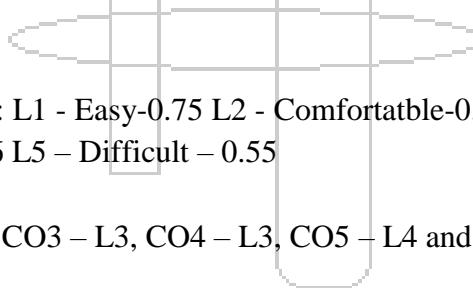
1. Interpret morphology for given natural language (2)
2. Construct shallow depth lexical analyzer and syntactic analyzer for given natural language(3)

3. Develop shallow depth type dependency parser for given natural language(3)
4. Develop shallow depth machine transliteration, machine translation, information retrieval for given natural language using either linguistic or statistical approach (3)
5. Correlate shallow depth machine transliteration, machine translation, information for given natural language (4)
6. Evaluate machine transliteration, machine translation and information retrieval results using standard evaluation metrics (5)

CO-PO Map:

CO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	3	2											2			
2	3	2	3	2									3	3		
3	3	2	3	2										3	3	
4	3	2	3	3	3				1					3	3	
5	3	3	3	3	3	2			1		3			2	3	
6	3	2	3	3	3	2						2		2	3	3
Avg	3	2.16	3	2.6	3	2			1		3	2	2.5	2.6	3	3

CO Attainment levels:



Weights for attainment levels: L1 - Easy-0.75 L2 - Comfortable-0.7 L3 – Medium – 0.65
L4 – Somewhat difficult – 0.6 L5 – Difficult – 0.55

CO1 – L2, CO2 – L3, CO3 – L3, CO4 – L3, CO5 – L4 and CO6 – L5

Future Course Mapping:

Computational Linguistics, ANN, RNN, Deep Learning

Job Mapping:

Application Developers, System programmer.

CS4274: Machine Learning

(To be completed from NPTEL/SWAYAM)

Credits: 3

Course Prerequisites:

Statistical Mathematics, Artificial Intelligence

Course Relevance:

With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. In this course we intend to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. We will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms..

All students have to complete this course from NPTEL-SWAYAM under the guidelines provided by dean academics and to be coordinated by department coordinator assigned for this course.

CS4275: Deep Learning
(To be completed from NPTEL/SWAYAM)

Credits: 3

Course Prerequisites:

Statistical Mathematics, Artificial Intelligence, Machine Learning

Course Relevance:

The availability of huge volume of Image and Video data over the internet has made the problem of data analysis and interpretation a really challenging task. Deep Learning has proved itself to be a possible solution to such Computer Vision tasks. Not only in Computer Vision, Deep Learning techniques are also widely applied in Natural Language Processing tasks. In this course we will start with traditional Machine Learning approaches, e.g. Bayesian Classification, Multilayer Perceptron etc. and then move to modern Deep Learning architectures like Convolutional Neural Networks, Auto encoders etc. On completion of the course students will acquire the knowledge of applying Deep Learning techniques to solve various real life problems.

All students have to complete this course from NPTEL-SWAYAM under the guidelines provided by dean academics and to be coordinated by department coordinator assigned for this course.

Course Prerequisites: Project Based Learning

Aim

This course addresses the issues associated with the successful management of a project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and working with peers to create desired outcomes. The Project Work can lead to:

- Transform existing Ideas into conceptual models.
- Transform conceptual models into determinable models.
- Use determinable models to obtain system specifications.
- Select optimum specifications and create physical models.
- Apply the results from physical models to create real target systems.

Project Group and Topic Selection and Synopsis:

The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members. The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.

Overview of the Course:

1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students

must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.

3. The project must be based on a Fresh Idea or Implementation of a Theoretical Problem – meaning that there is not a known Solution to the design problem Or Create a Better Solution.
4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.
5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting , Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. Upon project completion, the Student Project Group will prepare a detailed Project Report consisting Semester I Preliminary Project document along with Detailed System Design Document, Implementation and Testing Document with conclusion and future scope of the Project Work. All the documents indicated will have a prescribed format. The Project Report ideally should consist of following documents : (Exceptions may be there based on the nature of the project, especially if some of the following documents are not applicable to a particular project as determined by the project guide, coordinator and head of department).

Sr.	Project Item
1	Project Cover Front Page
2	Project Completion Certificate [Institute]
3	Project Completion Letter [In case of Sponsored Projects]
4	Acknowledgments
5	Table of Contents
6	List of Figures
7	List of Tables
8	Project Synopsis [Problem Background, Existing System Details, Proposed Solution]
9	Feasibility Study Report
10	Project Plan
11	System Requirement Specification
12	System Analysis Document: UML Use Case Diagrams
13	System Analysis Document: UML Sequence Diagrams
14	System Analysis Document: UML State Diagrams

15	System Design Document with Module Specifications
16	System Implementation
17	System Testing and Experimental Findings
18	Conclusion
19	References

7. The Project Work will be assessed jointly by a panel of examiners consisting faculty and industry experts. The Project Groups will deliver the presentation and demonstration of the Project Work which will be assessed by the panel.
8. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work and overall development effort taken by the candidates.

Note:

The student needs to design and develop solution for the identified technological problem in the area of Computer Engineering or Information Technology of their choice. The Project Implementation needs to be completed using best possible use of available technologies as applicable to deal with the complexity of the project. The Project Group will prepare a detailed report of the project work which will be approved by the concerned faculty member. The Project Report need to be submitted both in Hard form and Soft form in CD. The Soft Copy of the Project Report must accompany other project deliverables as well.

Assessment: MSE and ESE

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, latest technology and modern tools used /to be used	10
TOTAL		50

End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem statement	10
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
TOTAL		100

Course Outcomes:

Upon completion of the course, graduates will be able to -

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

CO2: Prepare the requirement engineering, feasibility analysis documents

CO3: Form the teams and share responsibilities according to individual skill strengths

CO4: Create design documents to build software solutions

CO5: Develop software solutions based on standard engineering specifications

CO6: Perform the verification and validation up to the mark

CO PO Map

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2					3			3				3
CO2	2	3	3	2	2				3	3	2	3	3		3	3
CO3	2	-	-	-	-				3		2	3	3			3
CO4	2	3	3	2	2	3	3.0	2.0	3	3	2	3	3	3	3	3
CO5	2	3	3	2	2				3	3	2	3	3	3	3	3
CO6	2	2	2	3	2				3	2	2	3	3	2	3	3
Average	2.0	2.8	2.75	2.83	2.0	3.0	3.0	2.0	3.0	2.75	2.0	3.0	3.0	1.75	3.0	3.0

CO attainment levels

CO1 -4 CO2 –2 CO3-4 CO4-5 CO5 -1 CO6-3

CS4232, CS4234, CS4202: Industry Internship, International Internship, Research Internship

Credits:.20.....

Teaching Scheme Theory: ...32... Hours/Week

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 theoretical knowledge from academics to the realities of the field work/training.

The following guidelines are proposed to give academic credits for the internship undergone as a part of the B.Tech. Engineering curriculum.

Duration:

Industry Internship will be started at the beginning of the semester 7 or semester 8 or yearlong for the duration 6 months or 12 months.

Identification of Internship work:

Student may choose to undergo Internship at Industry/Govt./NGO/MSME/ Innovation/IPR/Entrepreneurship. Contacting various companies for Internship and Internship work identification process should be initiated at the end of 6th semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Students can take internship work in the form of online/onsite work from any of the following but not limited to:

- Working for consultancy/ research project
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ start-ups cells of institute
- 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

Internship Documents Submission:

Students must submit internship offer letter, internship completion letter, FF 1029 (Students feedback form), FF 1030 (Industry feedback about interns).

Students must present their internship progress time to time to faculty mentors. Faculty mentors and industry mentors both can evaluate the progress of the intern combiningly.

Internship Work Evaluation:

In-semester and end semester internship evaluation and assessment will be done by internal (Faculty mentor) and external examiners - a supervisor from industry.

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the internship/training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report.

If the student remain absent without prior intimation to the department/institute/concern authority/T & P Cell, his entire training can be cancelled and he will fail.

Course Outcomes: Industry Internship

On the completion of course, students will able to-

1. Understand real-world applications, workplace environment and operating procedures
2. Adapt skill for learning and applying modern tools and technologies
3. Apply professional values and ethical standards
4. Perform as an individual and as a team member effectively to changing conditions
5. Encompass improved writing, verbal communication and documentation skills
6. Learn about career positions and occupations along with the qualities and training required to obtain those positions

CO-PO Map: Industry Internship

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2					3			3				2
CO2	2	3	3	2	3	2	3	2	3		2	3	3	3	3	3
CO3	2	3	3	2				2	3		2	3	3	3	3	3
CO4	2								3			3				
CO5	2		2		3			2	3	3	2	3			3	
CO6	2					2			3			3				
Average	2.0	3.0	2.66	2.0	3.0	2.0	3.0	2.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.66

CO attainment levels:

CO1 – 2, CO2 – 1, CO3 – 4, CO4 – 4, CO5 – 5, CO6 – 3

Course Outcomes: Research Internship

On the completion of course, students will able to-

1. Develop an ecosystem to promote entrepreneurship and research culture among the students.
2. Learn first-hand to apply techniques, resources, modern engineering tools for prediction modelling to complex engineering activities.
3. Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and consequent responsibilities.
4. Perform as an individual and as a team member.
5. Understand Engineering and Management Principles.
6. Exercise R & D aptitude focusing on the knowledge creation and dissemination through engineering artifacts creation, construction and presentation.

CO-PO Map: Research Internship

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2											3				3
CO2	3	3	3	2	3	2	2	2				3	3	3	3	3
CO3	3	3	3	2		3						3	3	3	3	3
CO4									3			3				3
CO5	3	2	3	2								3	3	3	3	3
CO6	3	3	2	3			3	2.0		3.0	2.0	3			3	3
Average	2.8	2.75	2.75	2.33	3.0	2.5	2.5	2.0	3.0	2.75	2.0	3.0	3.0	3.0	3.0	3.0



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Academic Year 2023 – 24, Semester I

Assessment Details – S.Y., T.Y. and Final year B.Tech.

I. Courses with Theory, Lab and Tutorial

Sr. No.	Type of Assessment	Conduction	Marks
1	Presentation / Group Discussion / Home Assignment	Week 4,5,6, and 7	30 Marks assessment (Part A)
2	Presentation / Group Discussion / Home Assignment	End Semester Assessment	70 Marks assessment (Part B) Total 100 Marks (Part A + Part B) converted to 20 equivalent Marks
3	Laboratory Experiments	During Laboratory turns	100 Marks converted to 10 equivalent Marks
4	Course Project	End Semester Assessment	100 Marks converted to 20 equivalent Marks
5	Written Examination / Multiple Choice Questions	End Semester Assessment	60 Marks converted to 30 equivalent Marks
6	Comprehensive Viva Voce	End Semester Assessment	100 Marks converted to 20 equivalent Marks

II. Courses with Practical Examination activity

Sr. No.	Type of Assessment	Conduction	Marks
1	Laboratory work	During laboratory turns	100 Marks converted to 10 equivalent Marks
2	Course Project	End Semester Assessment	100 Marks converted to 20 equivalent Marks
3	Practical	End Semester Assessment	100 Marks converted to 50 Marks
4	Comprehensive Viva Voce	End Semester Assessment	100 Marks converted to 20 equivalent Marks

Note: Department wise list of courses is given separately in this document in Part IX.

III. Final year B.Tech. Courses

Sr. No.	Type of Assessment	Conduction	Marks
1	MCQ Exam – Section I	Mid Semester	30 Marks converted to 30 equivalent Marks
2	Home Assignment	End of Semester	100 Marks converted to 10 equivalent Marks
3	MCQ Exam – Section II	End of Semester	30 Marks converted to 30 equivalent Marks
4	Comprehensive Viva Voce	End of Semester	100 Marks converted to 30 equivalent Marks

IV. S.Y. B. Tech. 2 Credit Theory Courses

Sr. No.	Type of Assessment	Conduction	Marks
1	Written Examination	End of Semester	100 Marks converted to 100 equivalent Marks

V. EDI, Major Project & Semester Internship

Sr. No.	Type of Assessment	Conduction	Marks
1	Project / Internship activity Presentation	Mid Semester	50 Marks converted to 30 equivalent Marks
2	Project/ Internship activity Presentation & Demonstration	End Semester	100 Marks converted to 70 equivalent Marks



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Assessment Rubrics

I. Presentation Assessment

Details of Assessment – 100 Marks to be converted to 20 Marks.

Partial assessment to be conducted during the 4th, 5th, 6th, and 7th week of the Academic Semester for 50 marks

Format for Assessment

Sr. No.	Parameter	Marks
1	Survey about the topic	15
2	Contents of slides	15
3	Technical content coverage & Presentation Skills	20
	TOTAL	50

50 marks to be converted to 30

AND

Summative assessment to be conducted during End of the Academic Semester for 100 marks

Format for Assessment

Sr. No.	Parameter	Marks
1	Contents of slides	25
2	Understanding of concepts	25
3	Presentation Skills	25
4	Performance in Question-and-Answer Session	25
	TOTAL	100

100 Marks to be converted to 70 marks

NSQF Compliance:

Compatibility and Assurance of imparting Level 6 and Level 7 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

II. Group Discussion

Details of Assessment – 100 Marks to be converted to 20 Marks.

Partial assessment to be conducted during the 4th, 5th, 6th, and 7th week of the Academic Semester for 50 marks

Format for Assessment

Sr. No.	Parameter	Marks
1	Survey about the topic	15
2	Technical content coverage during discussion	20
3	Ability to express technical views	15
	TOTAL	50

50 Marks to be converted to 30 marks

AND

Summative assessment to be conducted during End of the Academic Semester for 100 marks

Sr. No.	Parameter	Marks
1	Level of Participation	25
2	Knowledge of the Topic	15
3	Communication skill and Vocabulary	25
4	Critical Thinking	25
5	Overall Impression of Examiner	10
	TOTAL	100

100 Marks to be converted to 70 marks

Guidelines for assessment:

- a. Level of Participation: The student has enthusiastically demonstrated that the knowledge of the topic acquired from Theory, Tutorial, Laboratory, Project, Supplementary reading is reflected in the statements and arguments made during the Group Discussions. Has been an active orator and a passive listener at appropriate times during the course of the Group Discussion
- b. Knowledge of the Topic: The student is thorough in the content and concepts associated with the fundamental and applied aspects of the Topic. The participant contributed to clarify or synthesize other Group Discussion members' ideas. If disagreeing with other Group Discussion members' ideas, the student stated disagreement or objections consistent with the underlying technical concept clearly, yet politely.
- c. Communication skill and vocabulary: The student effectively and politely communicated with the peers and the Moderator faculty, articulating the thoughts using appropriate Academic and Technical words. The student avoided the use of mixed or non-English vocabulary
- d. Critical Thinking: The student is able to think clearly, and rationally and is able to logically connect various aspects of the topic being discussed. The student retained the ability to reason and stay focused, despite distractions, clutter and diversion experienced, if any, during the progress of the Group discussion. The student was able to think about the facts that emerged during the Group Discussion spontaneously. This ability is not the ability acquired by accumulation of facts and knowledge learned once in the past and used for ever.

Overall impression of the moderator faculty: The moderator faculty would quantify their impression on the basis of parameters such as, but not limited to - Time management, response and respect to peers and moderator faculty, ethics followed, arguments and counter arguments losing the decorum of the activity etc.

NSQF Compliance:

Compatibility and Assurance of imparting Level 6 and Level 7 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

III. EDI Assessment

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Format for Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, technology and tools being used	10
	TOTAL	50

Format for End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem statement	10
2	Design & Testing	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Timely Completion of Project work	10
	TOTAL	100

NSQF Compliance:

Compatibility and Assurance of imparting Level 8 and Level 9 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

IV. Final Year B.Tech. Major Project

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Format for Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, latest technology and modern tools being used	10
	TOTAL	50

Format for End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem statement	10
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
	TOTAL	100

NSQF Compliance:

Compatibility and Assurance of imparting Level 8,9 and Level 10 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

V. Final Year Semester Internship

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Format for Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Clarity about the objectives of Internship activity	10
4	Requirement Analysis, Internship Planning	10
5	Knowledge of domain, Latest technology and modern tools being used	10
	TOTAL	50

Format for End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of Internship as per problem statement	10
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
	TOTAL	100

Note: For the End Semester Assessment, it is expected that the Internship company guide is also involved. The Department is required to set up communication with the Internship company guide regarding the End Semester Assessment, requesting their availability, in the interest of fair and rigorous assessment. No remuneration is to be paid to Internal company guide. They are expected to be involved along with Examiner/s in the finalization of Marks. The participation from the Internship company guide is voluntary. If the company guide opts not to join the assessment activity, it may then be done by the appointed examiner/s only.

NSQF Compliance:

Compatibility and Assurance of imparting Level 8,9 and Level 10 skills as per National Skills Quality Framework (NSQF) Guidelines.



**Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37**

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

VI. Home Assignment

1. End Semester Assessment – 100 Marks to be converted to 20 Marks.

Format for End Semester Assessment

Home Assignment Type: Design

Sr. No.	Parameter	Marks
1	Design Statement: Novelty, Originality and concreteness	15
2	Understanding of Design	30
3	Engineering approach towards design	25
4	Communication and presentation skills	10
5	Design report, writeup, conclusion of Assignment	20
	TOTAL	100

Home Assignment Type: Survey

Sr. No.	Parameter	Marks
1	Comprehensiveness of the survey	15
2	Understanding of survey topic	20
3	Significance and relevance of survey findings	25
4	Communication and presentation skills	10
5	References, Bibliography, literature survey	10
6	Survey report, writeup, conclusion of Assignment	20
	TOTAL	100

Home Assignment Type: Blog

Sr. No.	Parameter	Marks
1	Comprehensiveness and overall coverage of the blog	20
2	Understanding of the blog topic	20
3	Ease of understanding of the blog for the reader	25
4	Aesthetic elements of blog and Originality of blog content	25
5	References, Bibliography, literature survey	10
	TOTAL	100

Home Assignment Type: Case Study

Sr. No.	Parameter	Marks
1	Clarity in definition of case study problem statement	10
2	Understanding of Case handled, tools and technology used	30
3	Approach of analysis of case	25
4	Significance and relevance of findings	25
5	References, Bibliography, literature survey	10
	TOTAL	100

NSQF Compliance:

Compatibility and Assurance of imparting Level 6 and Level 7 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

VII. Comprehensive Viva Voce

1. End Semester Assessment – 100 Marks to be converted to 20 Marks.

Guidelines for assessment:

- The CVV enables a dialectic communication between the examiner/s and the student, providing invaluable experience for career interviews in future.
- The Comprehensive Viva Voce is a summative assessment. It is based on verbal interaction between Examiner/s and the students, covering the entire course contents.
- The student may be encouraged to explain the applicable concepts, ideas, views with the help of pen and paper/ Whiteboard screen/ Paint etc. if required.
- A balanced set of questions invoking diverse abilities such as analysis, synthesis, application, comparison, correlation, summary, classification, explanation, illustration, description etc. be set up, while covering entire course contents.
- Sufficient time is to be given for every student during the Viva Voce, to demonstrate the requisite abilities before arriving at the summative assessment score.

NSQF Compliance:

Compatibility and Assurance of imparting Level 7 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

VIII. Design Thinking

Scope:

Applicable for S.Y. B.Tech. and T.Y. B.Tech. students as group activity

Objective:

To provide ecosystem to students for paper publication and patent filing

Outcome:

Publication of paper or filing of patent

Assessment and Grading:

Students will be assessed on the basis of the outcome, i.e., published paper or status of patent.
Grades to be awarded at the end of the Semester will be on the following basis –

Grade	Basis for Grade allocation
A+	Paper published in High impact Journals (Top 50 journal list will be given) / Patent Granted
A	Paper published in any SCI/Scopus/Web of science Journal/conference or Patent Published
B+	Paper Accepted for publication in SCI/Scopus/Web of science Journal/conference or patent filed
B	Paper published in UGC Listed Journal
C+	International Conference Paper Publication (Non-Scopus and Non-SCI)
C	National Conference Paper Publication (Non-Scopus and Non-SCI)
D	Paper submitted to any Journal / Conference
F	No publication / No patent

NSQF Compliance:

Compatibility and Assurance of imparting Level 8,9 and Level 10 skills as per National Skills Quality Framework (NSQF) Guidelines.



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

IX. Courses with Practical Examination activity

Program	Course Code	Course Name
IT	IT 2265	Advanced Data Structures
	IT 2266	Computer Networks
	IT 3221	Operating System
	IT 3218	Artificial Intelligence
AI & DS	AI 2003	Computer Network
	AI 2001	Advanced Data Structures
	AI 3001	Artificial Intelligence
	AI 3002	Operating System
Computer	CS 2041	Advanced Data Structures
	CS 2008	Operating System
	CS 3215	Web technology
	CS 3202	Artificial Intelligence
E & TC	ET 2270	Advanced Data Structure
	ET 3272	Design and Analysis of Algorithm
	ET 3221	Computer Vision
	ET 3271	Embedded System Design
	ET 3273	Web Technology
CS – AI	CI 2001	Advanced Data Structures
	CI 2003	Operating Systems
CS – AIML	ML 2006	Advanced Data Structures
	ML 2008	Operating Systems
IPED	Nil	Nil
Mechanical	Nil	Nil
Instrumentation	IC 2222	Advanced Data Structure
	IC 3232	Web Technologies
Chemical	Nil	Nil
SY Common (DOME)	CS 2218	Object Oriented Programming Systems

NSQF Compliance:

Compatibility and Assurance of imparting Level 7 in the domain of Process, Professional Knowledge, Professional Skill and Core Skill as per National Skills Quality Framework (NSQF) Guidelines.


Prof. (Dr.) Ashutosh Marathe
Dean - Academics