COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY

SCHEME & SYLLABUS
(I – VIII Semesters)

B. TECH
IN
INFORMATION TECHNOLOGY

(2019 Admission onwards)

SEMESTER I [STREAM B]

Stream B: Computer Science and Engineering, Electronics and Communication Engineering and Information Technology

Code No.	Subject	L H/W	T H/W	P/D H/ W	C	Marks		Total
						CA	SEE	
19-200-0101B	Calculus	3	1	0	3	40	60	100
19-200-0102B	Engineering Physics	3	1	0	3	40	60	100
19-200-0103B	Engineering Mechanics	4	1	0	3	40	60	100
19-200-0104B	Basic Civil Engineering	3	0	0	3	40	60	100
19-200-0105B	Basic Mechanical Engineering	3	0	0	3	40	60	100
19-200-0106B	Soft Skills Development	2	1	0	2	50	-	50
19-200-0107B	Civil Engineering Workshop	0	0	3	1	25	25	50
19-200-0108B	Mechanical Engineering Workshop	0	0	3	1	25	25	50
19-200-0109B	Language Lab	0	0	1	1	25	25	50
19-200-0110B	NSS/Nature conservation Activities	0	0	1	0	-	-	-
	TOTAL	**18**	**4**	**8**	**20**			

CA – Continuous Assessment, SEE – Semester End Examination

SEMESTER II (STREAM B)

Code No.	Subject	L H/W	T H/W	P/D H/ W	C	Marks		Total
						CA	SEE	
19-200-0201B	Computer Programming	3	1	0	3	40	60	100
19-200-0202B	Engineering Chemistry	3	1	0	3	40	60	100
19-200-0203B	Engineering Graphics	2	1	3	3	40	60	100
19-200-0204B	Basic Electrical Engineering	3	0	0	3	40	60	100
19-200-0205B	Basic Electronics Engineering	3	0	0	3	40	60	100
19-200-0206B	Environmental Studies	3	1	0	3	40	60	100

19-200-0207B	Electrical Engineering Workshop	0	0	3	1	25	25	50
19-200-0208B	Computer Programming Laboratory	0	0	3	1	25	25	50
	TOTAL	**17**	**4**	**9**	**20**			

SEMESTER III

Code No.	Subject	L Hrs/Wk	T Hrs/Wk	P/D Hrs/Wk	C	Marks		Total
						CA	SEE	
19-200-0301	* Linear Algebra and Transform Techniques	3	1	0	3	40	60	100
19-204-0302	Digital Electronics	3	1	0	3	40	60	100
19-204-0303	**Discrete Computational Structures	3	1	0	3	40	60	100
19-204-0304	Data Base Management Systems	3	1	0	3	40	60	100
19-204-0305	Data structures and Algorithms in C	3	1	0	3	40	60	100
19-204-0306	Computer Organization & Architecture	3	1	0	3	40	60	100
19-204-0307	Hardware Design Laboratory	0	0	3	1	25	25	50
19-204-0308	Data structures Laboratory in C	0	0	3	1	25	25	50
	TOTAL	**18**	**6**	**6**	**20**			

* Common for CE/CS/EC/EE/IT/ME/SE
** Common for CS/IT

SEMESTER IV

Code No.	Subject	L Hrs/Wk	T Hrs/Wk	P/D Hrs/Wk	C	Marks		Total
						CA	SEE	
19-200-0401	*Complex Variables and Partial Differential Equations	3	1	0	3	40	60	100
19-204-0402	Data Communication & Networking	3	1	0	3	40	60	100
19-204-0403	Operating Systems	3	1	0	3	40	60	100
19-204-0404	Software Engineering	3	1	0	3	40	60	100
19-204-0405	Internet Programming	3	1	0	3	40	60	100
19-204-0406	Object Oriented Programming in c++	3	1	0	3	40	60	100
19-200-0407	*Universal Human Values	3	0	0	3	50	-	50
19-204-0408	Object Oriented Programming Laboratory in C++	0	0	3	1	25	25	50
19-204-0409	Mini Project– RDBMS based	0	0	3	1	50	-	50
	TOTAL	**21**	**6**	**6**	**23**			

* Common for CE/CS/EC/EE/IT/ME/SE

SEMESTER V

Code No.	Subject	L Hrs/Wk	T Hrs/Wk	P/D Hrs/Wk	C	Marks		Total
						CA	SEE	
19-200-0501	* Numerical and Statistical Methods	3	1	0	3	40	60	100
19-204-0502	Object Oriented Modeling & Design	3	1	0	3	40	60	100
19-204-0503	Design and Analysis of Algorithms	3	1	0	3	40	60	100
19-204-0504	Big Data Analytics	3	1	0	3	40	60	100
19-204-0505	Formal Languages and Automata Theory	3	1	0	3	40	60	100
19-204-05**	PROFESSIONAL ELECTIVE – I	3	1	0	3	40	60	100
19-204-0510	Software Systems Lab	0	0	3	1	25	25	50
19-204-0511	Software Engineering Lab	0	0	3	1	25	25	50
	TOTAL	**18**	**6**	**6**	**20**			

* Common for CE/CS/EC/EE/IT/ME/SE

19-204-0506 to 0509 : **PROFESSIONAL ELECTIVE – I**

19-204-0506 (IE) Augmented Reality

19-204-0507 Software Project Management

19-204-0508 Wireless networking

19-204-0509 Artificial Intelligence & Machine Learning

SEMESTER VI

Code No.	Subject	L Hrs/Wk	T Hrs/Wk	P/D Hrs/Wk	C	Marks		Total
						CA	SEE	
19-204-0601	Internet of Things	3	1	0	3	40	60	100
19-204-0602	*Compiler Design	3	1	0	3	40	60	100
19-204-0603	Deep Learning	3	1	0	3	40	60	100
19-204-0604	Cloud Computing	3	1	0	3	40	60	100
19-204-0605	Android Programming	3	1	0	3	40	60	100
19-204-06**	Professional Elective – II	3	1	0	3	40	60	100
19-204-0610	Cloud and Data Analytics Laboratory	0	0	3	1	25	25	50
19-204-0611	Mini Project – Android based Project	0	0	3	1	50	-	50
	TOTAL	**18**	**6**	**6**	**20**			

* Common for CS/IT

19-204-0606 to 0609: **PROFESSIONAL ELECTIVE –II**

19-204-0606 (IE) DevOps Engineering
19-204-0607 Computer Vision
19-204-0608 Soft Computing
19-204-0609 Recommender System

SEMESTER VII

Code No.	Subject	L Hrs/Wk	T Hrs/Wk	P/D Hrs/Wk	C	Marks		Total
						CA	SEE	
19-204-0701	*Principles of Management	3	1	0	3	40	60	100
19-204-0702	Data Security and Cryptography	3	1	0	3	40	60	100
19-204-0703	Computer Graphics and Visual Computing	3	1	0	3	40	60	100
19-204-07**	Professional Elective – III	3	1	0	3	40	60	100
19-204-07**	Open Elective – I	3	0	0	3	40	60	100
19-204-0712	Computer Graphics Laboratory	0	0	3	1	25	25	50
19-204-0713	Mini Project – Multimedia Project	0	0	3	1	50	-	50
19-204-0714	Entrepreneurship Development	0	0	2	1	50	-	50
19-204-0715	Project Phase I	0	0	3	1	50	-	50
19-204-0716	Industrial Internship***	0	0	-	1	50	-	50
	TOTAL	**15**	**4**	**11**	**20**			

* Common for CS/EC/EE/IT

19-204-0704 to 0707: **PROFESSIONAL ELECTIVE – III**

19-204-0704(IE) ***Mobile Computing Technology
19-204-0705(IE) High Performance Computing Architecture
19-204-0706 Quantum Computing
19-204-0707 Ethical Hacking

19-204-0708 to 0711: **OPEN ELECTIVE - I**

19-204-0708 Agile Methodology
19-204-0709 Game Design
19-204-0710 Multimedia Computing
19-204-0711 Mobile Data Management

*** Common for CS/IT

SEMESTER VIII

Code No.	Subject	L Hrs/Wk	T Hrs/Wk	P/D Hrs/Wk	C	Marks		Total
						CA	SEE	
19-204-0801	Financial Management & E-banking	3	1	0	3	40	60	100
19-204-08**	Professional Elective – IV	3	1	0	3	40	60	100
19-204-08**	Professional Elective – V	3	1	0	3	40	60	100
19-204-08**	Open Elective – II	3	0	0	3	40	60	100
19-204-0815	Seminar	0	0	3	1	50	-	50
19-204-0816	Project Phase – II	0	0	12	6	200	-	200
19-204-0817	Comprehensive Viva Voce	0	0	0	1	-	50	50
	TOTAL	**12**	**3**	**15**	**20**			

19-204-0802 to 0805: **PROFESSIONAL ELECTIVE – IV**

19-204-0802 Block Chain Technology
19-204-0803 Robotic Process Automation
19-204-0804 Service Oriented Architecture
19-204-0805 Cyber Laws and Information Security

19-204-0806 to 0809: **PROFESSIONAL ELECTIVE – V**

19-204-0806 Software Quality and Testing
19-204-0807 Electronic Business and Services
19-204-0808 Randomized Algorithms
19-204-0809 Cognitive Computing

19-204-0810 to 0814 **OPEN ELECTIVE II**

19-204-0810 Design Thinking
19-204-0811 Soft skills & Integral Development
19-204-0812 Social Computing
19-204-0813 Research Methodology
19-200-0814 Constitutional Law

Industry based Electives

Industry based Electives are offered in 5th, 6th and 7th Semesters and are listed among the Professional Electives with notation (IE) along with the subject code. A student should opt for at least one Industry based elective during the B.Tech. programme.

Open Electives:

Open Electives are offered in 7th and 8th Semesters. A student should opt for at least one Open Elective offered by any Division other than their branch of study.

Industrial Internship:

Industrial Internship of a minimum duration of 2 weeks must be completed after 4th Semester and before commencement of 7th Semester. The evaluation of internship will be conducted along with Project Phase I.

Evaluation Pattern for Theory and Practical courses

1. Theory courses

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b) ----------12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)---------- 12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)---------- 12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)---------- 12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

2. Practical courses

50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor.

3. Pass Requirements

A candidate has to obtain a minimum of 50% marks for continuous assessment and semester end examination put together, with a minimum of 40% marks in the semester end examination for a pass in theory and laboratory courses.

In the case of theory/laboratory/other courses having only continuous assessment, a candidate has to obtain a minimum of 50% marks in continuous assessment for a pass.

19-200-0101B/ 19-200-0201A CALCULUS

Course Outcomes:
On completion of this course the student will be able to:

1. Recall the methods of differentiation and integration.
2. Solve ordinary differential equations and linear differential equations of higher orders with constant coefficient and apply them in engineering problems
3. Estimate the maxima and minima of multi variable functions.
4. Evaluate area as double integrals and volume as triple integrals in engineering applications.
5. Illustrate the application and physical meaning of gradient, divergence and curl.

Module I
Ordinary differential equations:
First order differential equations - exact differential equations, Bernoulli's equations--Methods of solution and Simple applications.
Linear differential equations of higher orders with constant co-efficient-Methods of solution of these equations. Cauchy's linear differential equations. Simultaneous linear differential equations- Simple applications of linear differential equations in engineering problems –Electrical Circuits, Mechanical Systems.

Module II
Partial differentiation: Partial differentiation-Concept of partial derivative - Chain rule- Total derivative- Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables(Proof of the result not required)-Simple applications.
Co-ordinate systems: Rectangular co-ordinates-Polar co-ordinates-In plane and in Space-Cylindrical polar co-ordinates-Spherical polar co-ordinates.

Module III
Integral calculus:
Application of definite integrals: Area, Volume, Arc length, Surface area.
Multiple integral: Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals-Change of Variables in integrals.
Applications of multiple integrals. Plane Area, Surface area &Volumes of solids

Module IV
Vector calculus: scalar and vector point functions, gradient and directional derivative of a scalr point function, divergence and curl of vector point functions, their physical meaning. Evaluation of line integral, surface integral, and volume integrals, Gauss's divergence theorem, Stoke's theorem (No proofs), conservative force fields, scalar potential.

References:

1. Sastry, S.S. Engineering mathematics: Vol1. (Fourth edition).PHI Learning, New Delhi. (2008).
2. Erwin Kreyzig. Advanced engineering mathematics (Tenth edition). John Wiley& Sons, Hoboken, NJ.(2011)
3. Veerarajan, T. Engineering mathematics.(third edition). Tata McGraw Hill Publishers, New delhi. (2011)
4. Grewal, B.S. Higher engineering mathematics. (Forty third Edition). Khanna Publishers, New Delhi. (2013)

19-200-0102B/ 19-200-0202A ENGINEERING PHYSICS

Course Outcomes:
On completion of this course the student will be able to:

1. Interpret modern devices and technologies based on lasers and optical fibres.
2. Explain the basic principles of crystal physics and applications of liquid crystals.
3. Summarise the characteristics and applications of nano materials and superconducting materials
4. Explain the factors affecting the acoustics of buildings and application of ultrasonics in non-destructive testing.

Module I

Laser-introduction: properties-interaction of radiation with matter-absorption spontaneous and stimulated emission-principle of laser--Einstein coefficients- conditions for getting laser-population inversion- metastable state -Basic components of a laser-Different types of lasers- construction, working and applications of Ruby laser-Neodymium YAG laser- He-Ne laser -Applications of laser in medicine, industry, science and communication.

Holography-basic principle-Comparison with ordinary photography-Recording and reconstruction of holograms -applications.
Fibre optics - Basic structure of an optical fibre - propagation of light in an optical fibre- classifications-step-index fibre and graded index fibre- single mode and multimode- Numerical aperture of a step-index fibre, graded index fibre---acceptance angle and acceptance cone-modes of propagation - Applications.

Module II

Crystallography – Space lattice- Basis- Unit cell- Unit cell parameters- Crystal systems-Bravais lattices-Three cubic lattices-sc, bcc, and fcc- Number of atoms per unit cell- Co-ordination number- Atomic radius-Packing factor- Relation between density and crystal lattice constants- Lattice planes and Miller indices-Separation between lattice planes in sc-Bragg's law- Bragg's x-ray spectrometer.
Liquid crystals- Liquid crystals, display systems-merits and demerits- Metallic glasses-Types of metallic glasses (Metal-metalloid glasses, Metal-metal glasses) – Properties of metallic glasses (Structural, electrical, magnetic and chemical properties). Shape memory alloys- Shape memory effect.

Module III

Introduction to nanoscale science and technology- nanostructures-classifications-nanoring, nanorod, nanoparticle, nanoshells, fullerence- surface occupancy-quantum confinement effect- Properties of nanoparticles- optical, electrical, magnetic and mechanical properties-Applications of nanotechnology.
Superconductivity-Introduction--transition temperature-Meissner effect-effect of current-entropy-specific heat-isotope effect-penetration depth-.Types of superconductors-type 1 and type 2- cooper pair-BCS theory (briefly)-AC Josephsons effect- DC Jospehsons effect- Applications of super conductivity.

Module IV

Quantum mechanics-Introduction- quantum theory-black body radiation and Photoelectric effect (brief ideas only)-matter waves- de broglie wavelength-wave packet-uncertainty principle-wave function -Physical intrepretation -Time dependent Schrodinger equation for a free particle- Time independent schrodinger equation. **Ultrasonics**-production of ultrasonics -piezo electric effect-Magnetostriction effect-properties of ultrasonics- Application of ultrasonics in non-destructive testing - Acoustics of building-reverberation-Absorption Coefficient- Sabines formula for reverberation time (no derivation)-Accoustic intensity-loudness-decibel-phon-conditions for good acoustics(Qualitative study).

References:

1. S. Mani Naidu, A Text book of Engineering Physics, Pearson. (2010)
2. A.S. Vasudeva, Modern Engineering Physics, S. Chand & Co. (2013)
3. Prabir K. Vasu and Hrishikesh Dhasmana, Engineering Physics, Ane books Pvt. Ltd. (2010)
4. S.O. Pillai and Sivakami, Applied Physics, New Age International (P) Ltd., Second Edition. (2008)
5. G.S. Raghuvanshi, Engineering Physics, Prentice Hall of India.(2008)

19-200-0103B/ 19-200-0203A ENGINEERING MECHANICS

Course Outcomes: On completion of this course, a student will be able to

1. Understand the principles of mechanics (statics and dynamics), the concept of free body diagrams and resolution of forces.
2. Apply the principles of mechanics, concept of free body diagrams and resolution of forces and equations of equilibrium or motion to given engineering or physical applications.
3. Analyse given engineering or physical applications and calculate the required parameters like forces, moments, various motion parameters like, displacement, velocity, acceleration, etc.
4. Ascertain the physical and mathematical meaning of quantities, like centroid, moment of inertia and their applications in engineering and locate centroid and calculate the moment of inertia or second moment of area of typical sections used in engineering.

Module I

Introduction to Mechanics: Definition and classification of mechanics – rigid body (statics and dynamics) and deformable body mechanics.

Forces and Force systems: Force and its characteristics, Principles of statics – concept of resultant and equilibrant, Composition and resolution of forces, force systems.

Coplanar Concurrent force system: Equilibrium of two, three and more than three forces, Moment of a force, Varignon's theorem of moments, Equations of equilibrium, Friction and its effects on bodies, Engineering applications. **Coplanar Parallel force System**: Two parallel forces, General case of parallel forces in a plane, Centre of parallel forces, Centre of gravity, Centre of mass, Centroids of curves, areas and volumes – regular and composite, Pappus's theorems, Equilibrium of distributed forces in a plane, Applications of the concept of centroid in engineering practice.

Module II

Moment of Inertia: Concept of moment of inertia and second moment of area, Moment of inertia of regular and composite solids, Second moment of area of regular and irregular surfaces, Polar moment of inertia / second moment of area, Product of inertia, Principal moments of inertia and principal axes, Applications of the concepts in engineering practice.

Coplanar non-concurrent force system and Analysis of Plane trusses and frames: Resultant of a general case of force system in a plane, Equilibrium equations, Concept of load carrying mechanism in trusses and frames – internal (axial) forces, two force and multi force members, Analysis of plane trusses by Method of joints and Method of sections, Analysis of Plane frames by Method of members.

Module III

Principle of virtual work: Concept of virtual work and the principle of virtual work, Applications in engineering, Equilibrium of ideal systems, Stable and unstable equilibrium.

Introduction to Dynamics: Definitions, Units, Divisions – Kinematics, Kinetics.

Rectilinear translation: Kinematics of rectilinear motion – displacement, velocity, acceleration, Kinetics – Differential equations of motion, D'Alembert's principle in rectilinear translation and its applications, Motion of a particle due to a constant force, Motion of a particle due to a force proportional to displacement – Simple harmonic motion, Momentum and impulse, Work and energy, Conservation of energy, Collision of two bodies – direct central impact.

Module IV

Curvilinear translation: Kinematics of curvilinear translation – components of displacement, velocity and acceleration, normal and tangential acceleration, Kinetics – Differential equations of motion, Motion of a projectile – projection on horizontal and inclined surfaces, D'Alembert's principle in curvilinear motion and its applications, Moment of momentum, Work and energy in curvilinear motion.

Rotation of a rigid body: Kinematics of rotation – angular displacement, velocity and acceleration, RPM, Relations of kinematic parameters of linear and angular motions, Kinetics – Differential equations of motion of a rigid body rotating about a fixed axis, Rotation under the action of a constant moment, Rotation proportional to angular displacement – Compound pendulum, D'Alemberts principle in rotation, Resultant inertia force in rotation, Principle of angular momentum in rotation, Energy equation for rotating bodies.

References

1. Timoshenko and Young. Engineering mechanics. McGraw Hill Book Company, Singapore. (1956)
2. Beer, F. P. and Johnston, E. R. Mechanics for engineers (Vol. 1: Statics and Vol.2: Dynamics). Tata McGraw Hill, New Delhi.(2004).
3. Merriam, H. L. and Kraige, L. G. (2003). Engineering mechanics (Vol. 1: Statics and Vol.2: Dynamics*)*. John Wiley and Sons, Somerset, N.J.(2003)
4. Hibbeller, R.C. Engineering mechanics. Vol. 1: Statics, Vol. 2: Dynamics. (Twelfth edition). Pearson Education Asia Pvt. Ltd., New Delhi.
5. Rajasekaran,S. and Sankarasubramanian,.G. Fundamentals of engineering mechanics. (Third edition). Vikas Publishing House Pvt. Ltd., New Delhi.(2010)

19-200-0104B/19-200-0204A BASIC CIVIL ENGINEERING

Course outcomes

At the end of the course students will be able to

1. Summarize the types, uses and properties of various building materials
2. Explain the different components of building and types of foundations
3. Illustrate the fundamental aspects of civil engineering
4. Discuss about the surveying techniques and to solve problems related with levelling
5. Recognize the various modern services emerging in the field of civil engineering
6. Prepare site plan based up on the Kerala Municipality Building Rule

Module I

Engineering Materials: Cement - varieties and grade of cement and their uses. Cement mortar- Steel- types of steel for reinforcement bars, steel structural sections. Brick- varieties and strength, tests on bricks.
Aggregates- types & requirements. Concrete- grades of concrete as per IS code, water cement ratio, workability, mixing, batching, placing, compaction and curing.

Module II

Construction : Components of a building-Foundation- types of foundations- isolated footing, combined footing, raft, pile & well foundations- Foundation for Machinery
Super structure: Brick masonry, English bond and Flemish bond, Stone masonry-Ashlar masonry- Rubble masonry. Roofing- Steel trusses, roofing for industrial buildings

Module III

Surveying: Basic Principles of surveying, instruments, methods and measurements- linear measurements- reconnaissance, selection of survey stations.
Leveling: Leveling instruments, different types, temporary adjustments, reduced level of point, booking of field notes, and reduction of levels by height of collimation method.
Introduction to Total Station.

Module IV

Site planning and Building Rules-Selection of site-Site plan preparation for buildings-Kerala Municipal Building Rules prevailing, general provisions regarding site and building requirements-Coverage and Floor Area Ratio-Basic concepts of Intelligent Buildings and Green Buildings
Roads- Classification of Rural and urban Roads.
Sources of Water - Water Supply-Quality of Water.

References:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England (2011).
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England (1998)
3. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers (2011)
4.McKay, W. B. and McKay, J. K., Building Construction, Vol. 1 to 4, Pearson India Education Services.(2013)
5. Rangwala,S.C and Dalal,K.B.,Building Construction, Charotar Publishing House (2017).
6. Kerala Municipal Building Rules (latest revision)

19-200-0105B/19-200-0205A BASIC MECHANICAL ENGINEERING

Course Outcomes:

On completion of this course the student will be able to:

1. Understand basics of thermodynamics and working of steam turbines
2. Understand basics of internal combustion engines, refrigeration and air conditioning
3. Gain knowledge on the working of hydraulic turbines and centrifugal pumps
4. Identify manufacturing methods encountered in engineering practice and understand mechanism of power transmission

Module I

Thermodynamics: Thermodynamics systems – open, closed and isolated systems, equilibrium state of a system, property and state, process, cycle, Zeroth law of thermodynamics- concept of temperature, temperature scales. First law – internal energy, enthalpy, work and heat, Different processes (isobaric, isochoric, isothermal, adiabatic and polytropic processes). Second law – Kelvin-plank and Claussius statements and their equivalence, Carnot Cycle (Elementary problems only).

Thermodynamic properties of Steam, Steam Generator. Different types of boilers, boiler mountings and accessories. Formation of steam at constant pressure, working of steam turbines, compounding of turbines.

Module II

Internal Combustion Engines: Air standard cycles – Otto and Diesel cycles, working of two stroke and four stroke Petrol and Diesel engines, Carburetted and MPFI engines, fuel pump, fuel injector, ignition system, cooling system, lubricating system.

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapour compression cycle (Elementary problems only), Summer and winter air conditioning.

Module III

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton Wheel, Francis and Kaplan turbines, Specific speed (Definition and significance only), Classification of water pumps, working of centrifugal pumps and reciprocating pumps (Theory of working principles only)

Power plants: Hydro-electric power plants, Thermal power plants, Nuclear power plants, Diesel power plants, Wind mills, solar energy (Working principles using schematic representations only)

Module IV

Introduction to Manufacturing Systems: Welding- different types of welding, resistance welding, arc welding, gas welding, Brazing and soldering, Different welding defects. Casting- different casting processes, sand casting, casting defects, Rolling- hot rolling and cold rolling, two high, three high , cluster rolling mills, wire drawing, forging, extrusion, Heat treatment of steel, elementary ideas of annealing, hardening, normalizing, surface hardening.

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive. Length of belt open and crossed. Ratio of belt tensions (Elementary problems only). Different types of gears (Elementary ideas only). Types and functioning of clutches.

References

1. Nag, P.K. Engineering thermodynamics. (Fifth Edition). McGraw Hill Education (India) Pvt. Ltd, New Delhi.(2013).
2. Gill, J.H. Smith Jr. and Ziurys, E.J. Fundamentals of internal combustion engines, Oxford & IBH, New Delhi.(1959)
3. Stoecker, W. F. Refrigeration and air conditioning. Tata McGraw Hill, New Delhi.(1980).
4. JagadishLal. Hydraulic machines. Metropolitan Book co, New Delhi.(1994)
5. Raghavan, V. Material science and engineering, Prentice Hall of India, New Delhi.(2004)

6. Rajendar Singh.Introduction to basic manufacturing processes and workshop technology, New Age International, New Delhi. (2006).

19-200-0106B/19-200-0206A SOFT SKILLS DEVELOPMENT

Course Outcomes:

On completion of this course the student will be able to:

1. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
2. Read, comprehend and answer questions based on literary, scientific and technological texts
3. Develop self-motivation, raised aspiration, belief in one's own abilities and commitment to achieving one's goal
4. Demonstrate emotional maturity and emotional health.

Module I

Role and importance of verbal communication, Everyday active vocabulary, Common words used in transitions, enhancing vocabulary, affixes and changes in pronunciation and grammatical functions, words often confused in pronunciation and usage. Passage comprehension- skimming, scanning techniques, note making, note taking and summarizing. Deciphering meaning from contexts. Two types of meaning- literal and contextual. Constructive criticism of speeches and explanations.

Module II

Fundamental grammar, Simple structures, passivizing the active sentences, reported speech, the judicious use of tenses and moods of verbs, forming questions and conversion from questions to statements and vice versa, forming open –ended and close- ended questions. Words and style used for formal and informal communication. Practice converting informal language to formal, the diction and the style of writing. Dealing with the nuances of ambiguous constructions in language. Learning authoritative writing skills, polite writing and good netiquette. Writing for internships and scholarships.

Module III

Kinesics, Proxemics, Haptics, and other areas of non-verbal communication, fighting communication barriers, positive grooming and activities on the same.

Different types of interviews, and presentation - oral, poster, ppt. Organizing ideas for group discussions, the difference between GD and debates.

Effective listening and seeking to understand others' perspectives.Non-violent negotiation and persuasion, communicating across age groups, cultures or identity groups.

Higher order thinking and evaluation, information-seeking, research, and independent learning, synthesis, creativity, problem analysis and problem solving. Decision making, Self-reflection and learning from experience.

Module IV

Developing positive self: Understanding oneself, A realistic awareness of oneself and one's abilities, strengths and potential, Self-esteem, Self-efficacy, steps for improvement.

Intra-personal skills – Self-control, emotional regulation and self-discipline, conscientiousness, dutifulness, reliability, truthfulness, honesty and trustworthiness. Goal orientation and initiative. Time management – prioritising work.

Interpersonal skills – cross cultural competence and valuing diversity of perspectives, respecting and expressing concern for others. Empathy and ability to notice the effect of one's actions on others, tolerance for disagreement, conflict management and resolution.

Civic engagement and social responsibility – Global and local awareness (issues, challenges, priorities). Vision, ability to imagine something new or improved. Social responsibility and willingness to take constructive action.

References:

1. Duck, Steve and David T. Macmahan. Communication in Everyday Life. 3rd Ed. Sage, (2017).
2. Gamble, Kawl Teri and Michael W. Gamble. The Public Speaking Playbook. Sage, (2015).
3. Raman, Meenakshi and Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, (2015).
4. Coleman, D. Emotional intelligence: Why it can matter more than IQ, Bantam Books, New York (2006).
5. Devadas Menon. Stop sleep walking through life, Yogi Impressions Books Pvt. Ltd, Mumbai (2012).
6. Barun K Mitra. Personality Development and Softskills, Oxford University Press (2012).

ASSESSMENT

1. 'Soft Skills Development' is a practical and activity oriented course which has continuous assessment for 50 marks based on class room interaction, activities, and assignments. The activities may include 'Just a Minute' (JAM) sessions, group discussion, role play, debate, and extempore speech.

The weightages for the different components shall be as follows:

Class room interaction – 10 marks
Activities – 30 marks
Assignments (mainly from Modules I and II) – 10 marks

2. Semester End Examination is not envisaged.

3. A student should secure a minimum of 50% marks in continuous assessment for a pass in the course.

19-200-0107B/19-200-0207A CIVIL ENGINEERING WORKSHOP

Course Outcomes:
On completion of this course the student will be able to:

1. Identify simple plumbing and sanitary fittings and state its use
2. Identify the various methods used in building construction.
3. Construct brick walls using English Bond and Flemish Bond
4. Set out a building as per a given building plan using surveying instruments
5. Compute the various quantities of materials required for a building

Plumbing:
Introduction to simple plumbing and sanitary fittings.

Building Materials:
Familiarization of building materials and their testing.

Masonry:
Construction of English bond and Flemish bond – wall junction – one brick – one and a half brick –and two brick thick

Surveying:
Surveying and levelling instruments
Setting out of building (single room only) as per the given building plan using surveying instruments
Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc. (to create an awareness of measurements and units)
Demonstration of Total Station

Assignment: *Students shall collect the list of various building materials used for the construction of a building including their market rate.*

19-200-0108B/19-200-0208A MECHANICAL ENGINEERING WORKSHOP

On completion of this course the student will be able to:

1. Identify and use tools, and make different types of joints used in carpentry, fitting, and sheet metal shop.
2. Compare basic fabrication techniques of different types of welding.

Preliminary exercises for beginners in all the following shops. Specific models may be designed by the teachers.

1) Fitting Shop.
2) Sheet Metal Shop
3) Foundry Shop
4) Welding Shop
5) Carpentry Shop

19-200-0109B/19-200-0209A LANGUAGE LAB

Course Outcomes:

On completion of this course the student will be able to:

1. Test pronunciation skills through stress on word accent, intonation, and rhythm.
2. Use English language effectively for writing business letters, resume, minutes of meeting and reports.
3. Use English language effectively to face interviews, group discussions, and public speaking.

Following course content is prescribed for the **Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Preparing business letters
4. Preparing a resume
5. Conducting a meeting and writing the minutes
6. Writing a report
7. Situational Dialogues / Role Play.
8. Oral Presentations- Prepared and Extempore.
9. 'Just A Minute' Sessions (JAM).
10. Describing Objects / Situations / People.
11. Debate
12. Group discussion

19-200-0110B/19-200-0210A NSS/NATURE CONSERVATION ACTIVITIES

NATIONAL SERVICE SCHEME (NSS)

Course Outcomes:

On completion of this course the student will be able to:

1. Recognise the community in which they work
2. Utilise their knowledge in finding practical solution to individual and community problems

A student enrolling as member of NSS will have to complete 10 hours of training / social service.

NATURE CONSERVATION ACTIVITIES

Course Outcomes:

On completion of this course the student will be able to:

1. Practice and spread the message of sustainable life styles
2. Understand the importance of green plants in mitigating global environmental problems
3. Identify suitable waste management practices for the local community

A student enrolling as member of the Nature Conservation Club will have to complete 10 hours of campus cleaning and greening activities.

19-200-0101A/19-200-0201B COMPUTER PROGRAMMING

Course Outcomes:

On completion of this course the student will be able to:

1. Identify main components of a computer system and explain its working.
2. Develop flowchart and algorithms for computational problems.
3. Write the syntax of various constructs of C language.
4. Build efficient programs by choosing appropriate decision making statements, loops and data structures.
5. Illustrate simple search and sort algorithms.
6. Demonstrate how to perform I/O operations in files for solving real world problems.
7. Design modular programs using functions for larger problems.

Module I

Basics of Computer and Information Technology:

Digital Computer System (CPU, Memory, I/O devices)- Working of a digital computer-Hardware and Software : Definition - Categories of Software, Application of Computers.

Problem Solving Methodology:

Problem statement, Analysis, Design a solution, Implement/Coding the solution, Test the solution, Design tools (Algorithm, Flow-chart, Pseudo-code)- Develop algorithms for simple problems.

Programming Languages:

Types of programming languages-Compiler–Interpreter-Linker–Loader–Execution of program.

Module II

Basics of C:

Character set-Identifier- Keywords- Constants –Data Types- Variables and declaration –Operators and Expressions – Operator precedence and associativity – Expression Evaluation (Simple Examples) - Input and output functions – Simple computational problems involving the above constructs.

Control Statements: Selection, Conditional operator, Iteration (for, while, do-while), Branching (switch, break, continue, goto), Nesting of control statements- Problems using control statements.

Module III

Arrays and Strings:

1D and 2D arrays –Searching (Linear and Binary) - Sorting (Bubble, Selection) – Matrix manipulation programs – Strings and basic operations on strings – Strings functions -Programs on string manipulation.

Functions:

Definition – Calling – Declaration – Parameter Passing (by value and by reference) – Recursion –Programs based on functions.

User defined data types: Structure – Union - Enumerated data type - Programs involving structure and union.

Module IV

Pointers:

Declaration, Initialization – Operations on pointers- Pointers and arrays – Pointers and Structures- Command line arguments-Dynamic memory allocation — Programs involving the above concepts.

Files:

File concept – File pointer – File handling operations (open, close, read, write etc) on sequential and random access files. Programs on file manipulations using fgetc(), fgets(),fseek().

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming, Second Edition, Oxford University Press, (2013).
2. Byron Gottfried, Programming with C, Second edition, Tata McGraw-Hill, (2006).
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson

Education, (2001).
4. R.G. Dromey, How to solve it by Computer, Pearson Education, (2008).
5. Kanetkar Y, Let Us C, BPB Publications, (2007).

19-200-0102A/19-200-0202B ENGINEERING CHEMISTRY

Course Outcomes:
On completion of this course the student will be able to:

1. Interpret the basic principles and concepts of quantum mechanics
2. account for how spectroscopic methods can be used to determine molecular structures, with focus on the identification of characteristic groups in polyatomic molecules
3. Apply the laws of thermodynamics to engineering systems.
4. Explain the chemistry of a few important engineering materials and their industrial applications.

Module I
Quantum Chemistry: Schrodinger equation. Derivation from classical wave equation. Operator form of the equation. Application of Schrodinger equation to 1-D box solutions. Significance of wave functions, probability and energy. Application of 1-D box solutions to conjugated molecules.
Forms of hydrogen atom wave functions and the plots of these functions to explore their spatial variations.
Energy level diagrams of diatomic molecules, Pi-molecular orbitals of butadiene, and benzene and aromaticity.

Module II
Spectroscopy: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine.
Vibrational and rotational spectroscopy of diatomic molecules. Applications.
Nuclear magnetic resonance and magnetic resonance imaging.
Surface characterisation techniques. Diffraction and scattering.

Module III
Chemical Thermodynamics: Fundamentals. First law of thermodynamics. Molecular interpretation of internal energy, enthalpy and entropy. Heat of reaction. Kirchoff's equations. Dependence on pressure and temperature. Gibbs-Helmholtz equation. Free energy changes and equilibrium constant. Chemical potential and fugacity. Thermodynamics of biochemical reactions.
Phase Rule: Terms involved in phase rule and examples, Application of phase rule to one component water system, Application of phase rule to two-component systems. (Simple eutectic systems).

Module IV
Engineering materials:
Polymers- Classifications- Mechanism of polymerisation (Addition, free radical, cationic, anionic and coordination polymerisation)- Thermoplastics and thermosetting plastics-Compounding of plastics-Moulding techniques of plastics (Compression, Injection, Transfer and Extrusion moulding)-Preparation, properties and uses of PVC, PVA, PET, Nylon- Silicon polymers- Biodegradable plastics. Elastomers- structure of natural rubber- vulcanisation- synthetic rubbers (Buna-S, Butyl rubber and Neoprene).
Lubricants- Introduction-Mechanism of lubrication- solid and liquid lubricants- Properties of lubricants-Viscosity index- flash and fire point- cloud and pour point- aniline value.
Refractories: Classification – Properties of refractories.
Cement- Manufacture of Portland cement- Theory of setting and hardening of cement.

References:

1. B. H. Mahan and R. J. Meyers University Chemistry, 4th Edition, Pearson publishers. (2009).
2. Peter W. Atkins, Julio de Paula, and James Keele. Physical Chemistry, 11th Edition, Oxford publishers. (2018).
3. M. J. Sienko and R. A. Plane. Chemistry: Principles and Applications, 3rd Edition, McGraw-Hill publishers.(1980).
4. C. N. Banwell. Fundamentals of Molecular Spectroscopy, 5th Edition, McGraw-Hill publishers.(2013).

5. B.L. Tembe, M.S. Krishnan and Kamaluddin. Engineering Chemistry (NPTEL Web Course)
6. Shashi Chawla. A Text book of Engineering Chemistry. Dhanpat Rai & Co, New Delhi.(2013).

19-200-0103A/19-200-0203B ENGINEERING GRAPHICS

Course Outcomes:
On completion of this course, the students will be able to:

1. Prepare drawings as per Indian standards
2. Produce orthographic projection of straight lines and planes.
3. Draw orthographic projection of solids.
4. Understand development of surface of different geometric shapes
5. Construct isometric scale, isometric projections and views.

Module I
Introduction to engineering graphics. Drawing instruments and their use. Familiarisation with current Indian Standard Code of Practice for general engineering drawing.
Scales- plain scale, Vernier scale, diagonal scale.
Conic sections- Construction of ellipse, parabola, hyperbola - construction of cycloid, involute, Archimedian spiral and logarithmic spiral- drawing tangents and normal to these curves.
Module II
Introduction to orthographic projections- plane of projection- principles of first angle and third angle projections, projection of points in different quadrants.
Orthographic projection of straight lines parallel to one plane and inclined to the other plane- straight lines inclined to both the planes- true length and inclination of lines with reference planes- traces of lines.
Projection of plane laminae of geometrical shapes in oblique positions.
Module III
Projection of polyhedra and solids of revolution- frustum, projection of solids with axis parallel to one plane and parallel or perpendicular to other plane- projection of solids with axis inclined to both the planes- projection of solids on auxiliary planes.
Section of solids by planes inclined to horizontal or vertical planes- true shape of sections.
Module IV
Development of surface of cubes, prisms, cylinders, pyramids and cones
Intersection of surfaces- methods of determining lines of intersection - intersection of prism in prism and cylinder in cylinder.
Module V
Introduction to isometric projection- isometric scales, isometric views- isometric projections of prisms, pyramids, cylinders, cones and spheres.
Introduction to perspective projections: visual ray method and vanishing point method- perspective of circles- perspective views of prisms and pyramids.

References:

1. John, K.C. Engineering graphics. PHI Learning, New Delhi.(2013)
2. Bhat, N.D. Elementary engineering drawing. (Forty ninth edition). Charotar Publishing House, Anand.(2010)
3. Gill P.S. Geometric drawing. B.D Kataria &Sons, Ludhiana.(2012)

Type of questions for Semester End Examination
Two questions of 12 marks each from Module I with option to answer any one. (1 x 12 = 12)
Two questions of 15 marks each from Module II, Module III, Module IV and Module V with option to answer any one question from each module. (4 x 15 = 60).

19-200-0104A/19-200-0204B BASIC ELECTRICAL ENGINEERING

Course Outcomes:
On completion of this course the student will be able to:

1. Analyse and solve electric circuits
2. Understand the principles of electromagnetic induction and identify meters for measuring electrical quantities
3. Recognise the basic elements and phases in AC circuits
4. Identify the type of electrical machine for a given application

Module I
Basic principles of Electric circuits: Review of Ohm's law - Definition of Resistance, Current, Voltage and Power - Series and Parallel circuits- Constant voltage source and Constant current source.
Network Theorems: Kirchhoff's laws- Network analysis by Maxwell's circulation currents - Superposition theorem -Thevenin's theorem - Norton's theorem - simple illustrative problems on network theorems.
Review of electrostatics - Coulomb's Law- Electric field strength and electric flux density, Capacitance.

Module II
Review of electromagnetic induction -Faraday's Law- Lenz's Law - Mutually induced emf.
Magnetic circuits - Magnetic field of a coil - Ampere turns calculation - Magnetic flux - Flux density - Field strength.
Measuring instruments: Working principle of galvanometer, Ammeter, Voltmeter, Watt meter & Energy Meter (elementary concepts).

Module III
AC Fundamentals: Sinusoidal Alternating Waveforms - Sinusoidal AC Voltage characteristics and definitions — General representation of voltage or current – Phase Relations – Average value – Effective (Root mean square) value.
The Basic Elements and Phasors: Response of basic R, L and C elements to a sinusoidal voltage or current –Phasor diagrams, Frequency response of the basic elements – Average power and power factor – Complex representation of vectors (Rectangular & polar forms)
Series and Parallel ac Circuits: Series & parallel impedances and admittances, Analysis of RL, RC & RLC circuits, Resonance in series and parallel circuits- Variation of impedance and admittance in series and parallel resonant circuits. Power in ac circuits: active, reactive & apparent power.
Introduction to 3 phase Systems: Star& Delta connection, Power in three phase circuits

Module IV
Electrical Machines: Principle of operation, Types and applications of DC machines, Transformers and Induction Machines. (Only an elementary qualitative treatment is envisaged.)
Elementary Concepts of Generation, Transmission, and Distribution: Conventional sources of electrical energy: Hydro, Thermal, Nuclear and Diesel power station, Non-conventional Sources: Solar energy, wind energy & energy from oceans, Various levels of power transmission, introduction to primary and secondary distribution

References:

1. Robert L. Boylestad. Introductory circuit analysis. (Twelfth edition). Pearson Education, New Delhi. (2012)
2. Cotton, H. Electrical technology. (Seventh edition). CBS Publishers and Distributors, New Delhi. (2005)
3. Leonard S. Bobrow. Fundamentals of electrical engineering. Oxford University Press, New Delhi.(1996).
4. Rajendra Prasad. Fundamentals of electrical engineering. (Second edition). PHI Learning, New Delhi.(2009)
5. Edward Hughes. Electrical technology. Addison Wesley Longman, Boston. (1995

19-200-0105A/19-200-0205B BASIC ELECTRONICS ENGINEERING

Course Outcomes:
On successful completion of this course the student will be able to:

1. Develop an understanding of the behaviour of semiconductor junctions, diodes and BJTs
2. Familiarize with the applications of Diodes in rectification and regulation
3. Relate the role of BJTs in amplification and switching
4. Identify various measuring instruments and their functions
5. Gain knowledge on the fabrication of semiconductor devices and ICs

Module I:
Basic Semiconductor and PN Junction Theory: Atomic Theory, Conduction in Solids, Conductors, Semiconductors and Insulators, n-Type and p-Type semiconductors, Semiconductor conductivity
The p-n Junction, Biased Junctions. Junction Currents and Voltages

Module II:
Semiconductor Diodes and Applications: PN Junction Diode, Characteristics and parameters, Diode Approximations, DC Load Line Analysis, Temperature Effects, Diode AC Models, Diode Specifications, Diode Testing, Zener Diodes
Half wave rectification, Full wave rectification, RC and LC Filters, Shunt Voltage Regulators, Power supply - performance and Testing
Optoelectronic Devices-LED, LCD, Seven segment displays

Module III:
Bipolar Junction Transistors and Electronic measuring instruments: BJT Operation, BJT voltages and currents, BJT Amplification and Switching, Common Base, Common Emitter and Common Collector Characteristics, Transistor Testing
Electronic measuring instruments – Power Supply, Function Generator, CRO, Multimeter.

Module IV:
Fabrication of Semiconductor Devices and ICs: Processing of Semiconductor materials, Diode Fabrication and Packaging, Transistor construction and Performance, Transistor Fabrication, Integrated Circuits, IC components and circuits, Transistor and IC packaging, Transistor Data sheets, Power measurement in dB

References:

1. David A Bell, Electronic Devices and Circuits Oxford Higher Education, 5th Edition, (2017).

2. NN Bhargava, DC Kulshreshtha, SC Gupta, Basic Electronics and Linear circuits, Tata McGrawHill Publishing Company, 2nd Edition, (2013).

19-200-0106A/19-200-0206B ENVIRONMENTAL STUDIES

Course Outcomes:

On completion of this course the student will be able to:

1. Identify the natural resources and suitable methods for conservation and sustainable development
2. Realise the importance of eco system and biodiversity for maintaining ecological balance
3. Identify environmental pollutants and abatement mechanisms
4. Understand environmental problems arising due to developmental activities and population growth

Module I

Multidisciplinary nature of environmental studies. Definition, scope and importance, need for public awareness.

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module II

Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems: - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. Inida as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module III

Environmental Pollution: Definition. Cause, effects and control measures of: - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

Diaster management: floods, earthquake, cyclone and landslides.

Environmental legislation: Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation.

Module IV

Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products.

Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case Studies. Public awareness.

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

Field work: Visit to a local area to document environmental assets river/ forest/grassland/hill/mountains. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

References:

1. Rajagopalan, R. Environmental studies: From crisis to cure. Oxford University Press, New Delhi. (2005).
2. Erach Bharucha. Textbook of environmental studies and ethics. Universities Press (India), Hyderabad. (2005).
3. Jayashree A. Parikh. Balsaraf, V.M. and Dwivedi, P.B. Environmental studies. Ane Books Pvt. Ltd, New Delhi. (2010)
4. Anindita Basak. Environmental studies, Pearson, New Delhi. (2009).
5. Misra, S.P. (2011). Essential environmental studies. (Third edition). Ane Books Pvt. Ltd., New Delhi. (2011).
6. Benny Joseph. Environmental science & engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi. (2010).

19-200-0107A/19-200-0207B ELECTRICAL ENGINEERING WORKSHOP

Course Outcomes:

On completion of this course the student will be able to:

1. Apply basic electrical engineering knowledge for house wiring practice

Experiments:

1. One lamp controlled by one switch
2. Series and parallel connections of lamps.
3. Stair case wiring.
4. Hospital Wiring.
5. Godown wiring.
6. Fluorescent lamp.
7. Connection of plug socket.
8. Different kinds of joints.
9. Winding of transformers.
10. Soldering practice.
11. Familiarisation of CRO.
12. Single Phase Distribution Board Wiring.

19-200-0108A/19-200-0208B COMPUTER PROGRAMMING LABORATORY

Course Outcomes:
On completion of this course the student will be able to:

1. Solve problems efficiently by choosing loops and decision making statements in C programming.
2. Implement different operations on arrays.
3. Solve problems using functions and recursion.
4. Design and implement C programs using the concepts of structure, pointers and files.

Cycle I
Application Packages:
Text Editor
1. To create a word document like an advertisement.
Spread Sheet
2. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts.
Presentation Software
3. To create a presentation for the department using Power Point.
C Programming Basics:
4. To write a program to calculate and display areas of rectangle and triangle.
Decision Making:
5. To write a program for electricity bill preparation.
6. To write a program to find the roots of a quadratic equation.
7. To write a simple menu driven calculator program using switch statement.
8. To write a program to find the sum of digits of a given number.
Cycle II
Looping:
9. To write a program to print all the prime numbers of a given range.
10. To write a program to print the sine and cosine series.
11. To write a program to print Pascal's triangle.
Arrays:
12. To write a program to print the sum and average of elements in an array.
13. To write a program to sort the given numbers using bubble sort.
14. To write a program to perform Matrix addition and matrix multiplication.
String:
15. To write a program to perform string manipulation functions like string concatenations, comparison, find the length and string copy without using library functions.
16. To write a program to arrange names in alphabetical order.
Cycle III
Functions:
17. To write a C program to calculate the mean, variance and standard deviation using functions.
18. To write a C program to perform sequential and binary search using functions.
Recursion:
19. To write a program to print the Fibonacci series using recursive function.
20. To write a program to print the factorial of the given number using recursive function.
Structure:
21. To print the mark sheet of n students using structures.
Pointers:
22. To write a program using pointers to access the elements of an array and count the

number of occurrences of the given number in the array.

Files:

23. To write a program to count the number of characters,lines in a file.

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, (2013).
2. Smarajit Ghosh, All of C, PHI Learning Pvt. Ltd, (2009).
3. Byron Gottfried, Programming with C, 2 nd edition, Tata McGraw-Hill, (2006).
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson Education, (2001).
5. Sukhendu Dey, Debobrata Dutta, Complete Knowledge in C, Narosa PublishingHouse, New Delhi, (2009).

19-200-0301 Linear Algebra and Transform Techniques

***Course Outcomes**:*
On completion of this course, students will be able to:
1. Solve linear system of equations and to determine Eigen values and vectors of a matrix.
2. Understand the concept of vector space and sub space.
3. Determine Fourier series expansion of functions and transform.
4. Solve linear differential equation and integral equation using Laplace transform.

Module I
Linear Algebra 1: Rank of a matrix, solution of linear system of equations, existence, uniqueness, general form Eigen values and Eigen vectors, properties of Eigen values, Diagonalization of a matrix, Cayley Hamilton theorem (without proof), Verification, Finding inverse and power of a matrix using it, Quadratic form orthogonal reduction of quadratic form to Canonical form.

Module II
Linear Algebra 2: Vector space, subspace, Linear dependence and independence, Spanning of a subspace, Basis and Dimension. Inner product, Inner product spaces, Orthogonal and Orthonormal basis –Gram Schmidt Orthogonalization process. Linear Transformation.

Module III
Fourier analysis: Periodic function, Fourier series, Functions of arbitrary period, Even and odd functions, Half Range Expansion, Harmonic analysis, Complex Fourier Series, Fourier Integrals, Fourier Cosine and Sine Transform, Fourier Transform.

Module IV
Laplace Transforms: Gamma functions and Beta function Definition and properties, Laplace transforms. Inverse Laplace Transform, Shifting theorem, Transform of Derivative and Integrals, Solution of differential equation and integral equation using Laplace transform, Convolution, Unit step function, Second Shifting theorem, Laplace transform of periodic function.

References:
1. Kreyszig, E. (2011). Advanced engineering mathematics (10th ed.). John Wiley, New York
2. Grewal, B.S, & Grewal, J.S (2013). Higher engineering mathematics (43rd ed.). Khanna, Delhi.
3. Hoffman, K., &Kunze, R. (1961). Linear algebra, Prentice Hall. Englewood Cliffs, N.J.
4. Hsiung, C.Y, & Mao, G.Y (1998). Linear algebra. World Scientific, Singapore
5. Venkataraman,M.K (1999). Linear Algebra, The National Co

19-204-0302 Digital Electronics

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Represent different number systems, circuits and logic gates
2. Design Combinational and Sequential circuits
3. Analyse Logic families.
4. Familiarized with the basic principles of memory.

Module I

Number System: Binary, Decimal, Octal and HEX Conversion from one radix to another, Number Representation, Complements, Signed Binary numbers, Binary Arithmetic, Binary Codes, BCD, Excess 3, Grey Code, ASCII EBCDIC

Logic Gates: NAND and NOR Implementation of Logic Circuits, Boolean Algebra, Basic Theorems and properties, Boolean Functions, Canonical and standard forms, Karnaugh Map Simplification:Two, Three, Four and Five variables, Dont care Conditions, Quine Mc Clusky technique

Module II

Combinational Logic Circuits: Design of Adders, Subtractors, Binary Parallel Adder, Carry look ahead Adder, BCD Adder, Multiplexer, Demutiplexer, Magnitude Comparator, Decoder, Encoder

Module III

Sequential Logic Circuits: Latches, Flip Flops, SR, JK, T, D. Triggering of FF, Conversion, Master/Slave FF, Analysis of clocked sequential circuits state reduction and assignment, Design of clocked sequential circuits, Shift registers, Design of Counters, Asynchronous and Synchronous ripple counters, Ring counters, Johnson counter

Module IV

Memory and Programmable Logic: Introduction to Programmable Logic Devices, Read Only Memory, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

Logic Families: Transistor Transistor Logic(TTL), Emitter Coupled Logic(ECL), MOSFET Logic, TTL Gates.

References:

1. Mano, M. (2008). Digital logic and computer design (4th ed.). Prentice Hall, Englewood Cliffs, N.J.
2. Kumar, A. (2004). Fundamentals of digital circuits (Eastern economy ed.). Prentice Hall of India, New Delhi.
3. Taub, H., & Schilling, D. (1983). Digital integrated electronics (10. print., internat. student ed.). McGraw Hill, Auckland New Zealand.
4. Millman, J., &Halkias, C. (1998). Integrated electronics: Analog and digital circuits and systems (3rd ed.). Tata McGraw Hill, New Delhi

19-204-0303 Discrete Computational Structures

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Use logical notation to define and reason mathematically about the fundamental data types and structures used in computer algorithms.
2. Summarise mathematical notations and concepts in discrete mathematics that is essential for computing.
3. Construct proofs using direct proof, proof by contraposition, proof by contradiction and proof by resolution and by mathematical induction.
4. Familiarise mathematical reasoning and proof strategies.
5. Identify and apply the counting principle.
6. Apply graph theory to solve real world problems.
7. Interpret the conceptual background needed to be able to identify structures of algebraic nature, and discover, prove and use properties about them.

Module I

Mathematical Logic: Propositions, Connectives, Equivalences of Proposition, Algebra of Propositions, Quantifiers, Proofs: Direct, Contraposition, Contradiction, Resolution, Mathematical Induction, Sets, Relations: properties, Representation, Composition of Relations, Equivalence Relation, Functions: Types, Composition of Functions.

Module II

Algorithms: Introduction, The Growth of Functions, Complexity of Algorithms, Recursive algorithms, Counting techniques: Counting Principle, The Pigeonhole Principle, Recurrence relations, Order of Recurrence Relation, Linear Recurrence Relation with Constant Coefficients, Linear Homogeneous Recurrence Relation with Constant Coefficients.

Module III

Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homomorphism of graphs, Euler and Hamiltonian paths and graphs, Fleury's Algorithm, Shortest path in weighted graphs, Dijkstra's Algorithm.

Trees: Introduction to trees, Binary Tree, Tree Traversal, Expression Trees, Spanning Trees, Minimum Spanning Tree, Kruskal's Algorithm.

Module IV

Algebraic Structures: Semigroups and Monoids, groups, subgroups, homomorphisms, Isomorphism, Rings, Field. Posets, Hasse Diagrams, Lattice: Bounded Lattice, Sublattices, Isomorphic Lattices, Distributive Lattice.

References:

1. Veerarajan, T., Discrete Mathematics with Graph Theory and Combinatorics, McGraw Hill Education.
2. Rosen, K.H.(2011). Discrete Mathematics and its Applications, McGraw Hill, 7th Edition
3. Ralph P. Grimaldi.(2014). Discrete and Combinatorial Mathematics: An applied introduction,, Pearson Education Limited.
4. Satinder Bal Gupta, Discrete Mathematics and Structures, University science Press (Laxmi Publications (P) Ltd.), 5th Edition.

19-204-0304 Database Management Systems

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Explain database architecture and representation models.
2. Apply DDL and DML commands using SQL to retrieve data from the given table.
3. Apply normalization techniques to design a database for a given application.
4. Apply data storage techniques for a given scenario.
5. Describe concurrency control and transaction processing techniques.

Module I

Introduction, Applications, Purpose of Database Systems, View of Data, Database Languages, Database Architecture, Database Users and Administrators

Database Design: The Entity Relationship Model, Constraints, Removing Redundant Attributes Entity Sets, Entity Relationship Diagrams, Reduction to Relational Schemas, Extended E-R Features.

Module II

Relational Databases: Relational Model, Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

SQL: Introduction, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Join Expressions, Relational Algebra.

Module III

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, 2NF, 3NF, BCNF, Decomposition Using Functional Dependencies, Functional Dependency Theory. File Structure: File Organization, Organization of Records in Files. Indexing and Hashing: Basic Concepts, Ordered Indices, Static Hashing, Dynamic Hashing.

Module IV

Transaction Management: Transaction concept, Simple Transaction Model, Transaction Atomicity and Durability, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels. Concurrency Control: Lock Based Protocols, Deadlock Handling, Timestamp Based Protocols, Validation Based Protocols.

References:

1. A Silberschatz, H. F. Korth, and S Sudarshan.(2019). Database System Concepts, 7/e,Tata McGraw Hill,
2. Elmasri and Navathe.(2017).Fundamentals of Database Systems, 7/e, Addison, Wesley.
3. Peter Rob Carlos Coronel, Database Systems, Design, Implementation & Management, 5/ e,Thomson Course Technology
4. Thomas Connoly ,Carolyn Begg, Database Systems,3/e,Pearson Education.
5. C.J Date, An Introduction to Database Systems , Addison Wesley
6. Margaret.H.Dunham ,Data Mining. Introductory and advanced topics, Pearson Education,2003.

19-204-0305 Data Structures and Algorithms in C

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Implement linear data structures such as arrays, linked lists, stack and queue with their related operations.
2. Implement non linear data structures such as trees and graphs with their related operations.
3. Implement various sorting and searching techniques.
4. Identify suitable data structure and design technique for developing algorithm to solve a given problem.

Module I

Introduction to Data Structures, Types of Data Structures, Data Structure Operations, Abstract Data Type (ADT), Complexity of Algorithms. Linear Arrays: Representation, Inserting, deleting and traversing linear arrays. Searching: Linear search and Binary search in array and their complexity analysis. Sorting: Bubble sort, Selection sort, Insertion sort and their complexity analysis.

Module II

Linked List: Representation, Traversing, Searching, Insertion, Deletion. Two way lists: Representation, Traversing, Searching, Insertion, Deletion. Stack: Linked list representation of Stack, Applications of Stack: Polish Notation and Recursion. Queue: Linked list representation of queue, Priority Queue using linked list, Deque.

Module III

Trees, Binary trees, Linked list and Sequential representation of binary tree Traversing a binary tree: Preorder, Postorder and Inorder traversals. Introduction of Threaded binary tree, B Tree and Heap. Binary search tree, Inserting, deleting and searching a binary search tree AVL trees: Inserting, deleting and searching AVL tree

Module IV

Graph, Graph terminology, Graph representation: Adjacency matrix, Adjacency list, Warshall's algorithm for shortest path. Graph operations: Searching, Insertion, Deletion. Traversing a graph: DFS, BFS, Topological sorting

References:

1. Lipschutz, S. (2017). *Data structures with C*. (Schaum's Outline Series). Mcgraw Hill Education.
2. Weiss M. A. (2002). Data Structures and Algorithm Analysis in C. Pearson Education India.
3. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (2009). *Data Structures and algorithms*. Delhi: Dorling Kindersly.
4. Langsam, Y., Augenstein, M., & Tenenbaum, A. M. (2000). *Data structures using C and C++*. New Delhi: Prentice Hall of India.
5. Horowitz, E., Sahni, S., & Mehta, D. P. (2008). *Fundamentals of data structures in C*. Summit, NJ: Silicon Press.

19-204-0306 Computer Organization and Architecture

***Course Outcomes**:*
On completion of this course, students will be able to:

1. Understand the basic functional units of a computer and its operational concepts
2. Execute a complete instruction and arithmetic operations.
3. Understanding of internal organization of memory chips and different memories (static and dynamic)
4. Analyse different interrupts, buses and I/O interface circuits

Module I

Basic structure of computers: Functional units, Basic operational concepts, Bus structures Instructions & instruction sequencing. Hardware and software, Addressing modes, Assembly language, Stacks & Subroutines.

Computer arithmetic, Two's complement Number representation and arithmetic. Multiplication: Booth's algorithm, Fast multiplication, Integer division, Floating point numbers and operations.

Module II

Processing Unit Fundamental concepts –Execution of a complete instruction, Hardwired control unit, Microprogrammed control, Control signals, Micro instructions, Microprogram sequencing Emulation.

Module III

Memory organization Semiconductor RAM memories, internal organization of memory chips Static and Dynamic memories, cache memories, mapping functions, replacement algorithms, virtual memory, address translations –performance considerations. Interleaving, Secondary storage.

Module IV

Input output organizations, Interrupts Enabling & Disabling interrupts, handling multiple devices, device identification, vectored interrupts, interrupt nesting Simultaneous requests DMA, Buses, I/O interface circuits –Standard I/O interfaces.

Basic Concepts of Pipelining: Basic Concepts, Role Of Cache memory, Pipeline performance, Data Hazards, Instruction Hazards,

Multicore: Basic Concept, Interconnection: NoC

References:

1. Hamacher, V., & Vranesic, Z. (2001). Computer organization,(5^{th} ed),McGrawHill.
2. Patterson, D., & Hennessy, J. (2011). Computer Organization and Design, Revised Fourth Edition the Hardware/Software Interface. (4th ed.). Elsevier Science.
3. Stallings, W. (2000). Computer organization and architecture: Designing for performance (5th ed.). Prentice Hall. Upper Saddle River, N.J.
4. Hayes, J. (1978). Computer architecture and organization. McGraw Hill. New York

19-204-0307 Hardware Design Laboratory

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Familiarizes to Troubleshooting, Maintenance and Assembling a PC.
2. Know how to read and understand specifications of basic electronic components.
3. Understand the principles of operation of diodes, transistor switches and amplifier.
4. Simulate traditional test and measurement instruments using digital instruments connected to students' laptops.
5. Illustrate the Arduino board with a diagram and name its components

A: PC HARDWARE

1. Study of SMPS, TTL and composite type monitor circuits, Emulator, Logic state analyser, Serial port, Parallel port, Motherboard, CGA card, Floppy disk controller, Hard disk controller, Printer Interface, Keyboard Interface
2. Hard Disk drive: Partitioning, Familiarisation of disk maintenance, Software Tools. Installations.
3. Troubleshooting and maintenance: Preventive and maintenance, Common maintenance problems
4. Familiarisation: Device drivers, Motherboard components and other add on cards.
5. Assembling a PC

B: DIGITAL

1. Transfer characteristics and specifications of TTL and MOS gate.
2. Design of half adder and Full adder using NAND gates, set up R S & J K flip flops using NAND gates.
3. Asynchronous UP/DOWN counter using J K F/Fs.
4. Study of shift registers and design of Ring counter using it.
5. Study of IC counter 7490, 7492, 7493 and 74192.
6. Study of MUX IC's and DEMUX IC's (74151, 74150, 74153)
7. Design of Johnson Counter

C: ARDUINO PROGRAMMING

1. Downloading and installing Arduino
2. Operating the Arduino IDE, loading a simple program.
3. Writing a program to blink the onboard LED.
4. Traffic Light System Design

References:

1. Mano, M. (2008). Digital logic and computer design (4th ed.). Prentice Hall, Englewood Cliffs, N.J.
2. Kumar, A. (2004). Fundamentals of digital circuits (Eastern economy ed.). Prentice Hall of India, New Delhi.
3. John Nussey (2013) Arduino for Dummies,Wiley.
4. Simon Monk (2016), Programming Arduino Getting Started with Sketches, Wiley.

19-204-0308 Data Structures Laboratory in C

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Use linear and non li near data structures for a given application.
2. Perform data manipulation in a given application using searching and sorting techniques.
3. Develop application to solve the real world problem by selecting the suitable data structure.
4. Improve communication and team building skills.

Lab Schedule

1. Implementation of operations of an array: insertion, deletion, traversing and displaying.
2. Implementation of Linear Search and Binary search on an array.
3. Implementation of sorting algorithms: bubble sort, selection sort, insertion sort.
4. Implementation of Linear Linked List and its operations.
5. Implementation of Doubly Linked List and its operations.
6. Implementation of Stack and Queue using Array.
7. Implementation of Stack and Queue using Linked List.
8. Implementation of Binary Search Tree and its operations.
9. Implementation of Binary Search Tree and its traversals: preorder, inorder, postorder.
10. Implementation of Circular List and its operations.
11. Implementation of Circular Queue and its operations.
12. Assignment, Design of any real time application:
    i. Students can form a project team with around 5 members per team.
    ii. The team can select the problem(s) from societal, health, safety and legal domains. Using C programming language for application development, the team has to identify and use a suitable data structure to implement the project.
    iii. At the end of the semester, the team has to present their project, submit a hand written report in their lab record. The team is assessed through rubrics.

References:

1. Lipschutz, S. (2017). *Data structures with C*. (Schaum's Outline Series). Mcgraw Hill Education.
2. Weiss M. A. (2002). Data Structures and Algorithm Analysis in C. Pearson Education India.
3. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (2009). *Data Structures and algorithms*. Delhi: Dorling Kindersly.
4. Langsam, Y., Augenstein, M., & Tenenbaum, A. M. (2000). *Data structures using C and C++*. New Delhi: Prentice Hall of India.
5. Horowitz, E., Sahni, S., & Mehta, D. P. (2008). *Fundamentals of data structures in C*. Summit, NJ: Silicon Press.

19-200-0401 Complex Variables and Partial Differential Equations

***Course Outcomes**:*
On completion of this course, students will be able to:

1. Transform a region to another region using conformal mapping.
2. Evaluate real integrals using residue theorem.
3. Formulate and determine solution of partial differential equation.
4. Determine solution of partial differential equation for vibrating string and heat conduction.

Module I

Analytic function, Cauchy Riemann equation (Cartesian and polar) Harmonic function construction of analytic function given real or imaginary parts, Conformal mapping of standard elementary function and bilinear transformation.

Module II

Cauchy's integral theorem, Cauchy's integral formula and for derivatives Taylor's and Laurent's expansion (without proof) Singularities Residues Cauchy's Residues theorem, Contour integration involving unit circle.

Module III

Formation of partial differential equation eliminating arbitrary constants and function, Solution of first order equation four standard types, Lagrange's equation, Linear homogeneous partial differential equation with constant coefficient.

Module IV

One dimensional wave equation, D'Alembert's solution and one dimensional heat flow equation, solution by the method of separation of variables, application of Fourier series solution. Solution of Laplace's equation over a rectangular region by the method of separation of variables

References:

1. Kreyszig, E. (2011). Advanced engineering mathematics (10th ed.). John Wiley, New York.
2. Grewal, B.S, & Grewal, J.S (2013). Higher engineering mathematics (43rd ed.). Khanna, Delhi.

19-204-0402 Data Communication and Networking

***Course Outcomes**:*

On completion of this course, students will be able to:

1. Identify the requirements for a high order communication systems.
2. Learn with a solid foundation in fundamentals required to have a better understanding of the Internet.
3. Understand the working of network protocols and standards.
4. Explain the functionalities and protocols of various layers in ISO/OSI Network model.
5. Use a suitable transport/application layer protocol based on application requirements.
6. Suggest an appropriate access control, congestion control and congestion avoidance technique for a given traffic scenario.

Module I

Introduction –Data Communications, Networks, The Internet, Protocols and Standards. Network Models, ISO/OSI Reference Model, TCP/IP Reference Model.

Physical Layer and Media:, Data and Signals: Analog and Digital, Transmission Impairments, Data Rate Limits, Performance, Digital to Digital Conversion, Analog to Digital Conversion, Digital to Analog Conversion, Analog to Analog Conversion.

Module II

Data Link Layer: Error Detection And Correction Types of Errors, Redundancy, Detection Vs Correction, Forward Error Correction Vs Retransmission, Block coding, Cyclic Codes, CRC, Polynomials, Checksum.

Data Link Control: Framing, Flow and Error Control, Protocols, Noiseless and Noisy channel, Point to Point Protocols. Wired LANs Ethernet, Wireless LANs IEEE 802.11, Bluetooth

Module III

Introduction to Network Layer Logical Addressing, Internet Protocol, IPV4, IPV6, Address Mapping, Routing Algorithms –Distance Vector Routing, Link State Routing. Unicast Routing Protocols.

Module IV

Transport Layer: Process to Process Delivery– Port Addressing, TCP & UDP Segment Format, TCP Connection, Congestion Control and Quality of service.

Application Layer Services: Domain Name System, Electronic Mail, File transfer, WWW & HTTP, Network Management: SNMP.

References:

1. Forouzan, B., & Fegan, S. (2007). Data communications and networking (4th ed.). McGraw Hill Higher Education. Boston.
2. Kurose, J., & Ross, K. (2013). Computer networking: A top down approach (6th ed.). Pearson. Boston.
3. Tanenbaum, A., & Wetherall, D. (2011). Computer networks (5th ed.). Pearson Prentice Hall. Boston.
4. Comer, D. (2009). Computer networks and internets (5th ed.). Pearson/Prentice Hall. Upper Saddle River, N.J
5. Stallings, W. (2000). Data and computer communications (6th ed.). Prentice Hall. Upper Saddle River, N.J.

19-204-0403 Operating Systems

***Course Outcomes*:**

On completion of the course, students will be able to:

1. Design various scheduling algorithms.
2. Apply the principles of concurrency.
3. Design deadlock, prevention and avoidance algorithms.
4. Compare and contrast various memory management schemes.
5. Design and Implement a prototype file system.
6. Attain basic knowledge about Real time operating systems.

Module I

Introduction to Operating Systems: Operating system concepts, System calls, Operating System Structure. Processes: Process Concept, Process Scheduling, Inter process Communication; Process Synchronization: Race Conditions, Critical Sections, Mutual Exclusion, Busy Waiting, Sleep And Wakeup Semaphores. CPU Scheduling: Scheduling Criteria, Scheduling Algorithms: First come First Served, Shortest Job First, Priority scheduling, Round Robin Scheduling, Multiple queues scheduling, Guaranteed scheduling, Two level scheduling.

Module II

Memory management. Multiprogramming and memory usage, Swapping, multiprogramming with fixed and variable partitions, Memory management with bitmaps, linked lists, Buddy system, Allocation of swap space. Virtual memory: paging and page tables, Associative memory, Inverted page tables; Page replacement algorithms, Segmentation.

Module III

Deadlock: Conditions for deadlock, Deadlock Characterization, Methods for handling deadlock, Deadlock prevention, Deadlock avoidance: resource trajectories, safe and unsafe state, Banker's algorithm. Deadlock detection and recovery, Two phase locking, Non resource deadlocks, Starvation.

Module IV

File systems and Input/output: Files, Directories, File system implementation, Directory Implementation, Security and Protection mechanisms. Principles of I/O hardware, I/O devices, Device controllers, DMA. Principles of I/O software, Interrupt handlers, Device drivers, Disk scheduling, Clocks and terminals. I/O Buffering, RAID, Disk Cache.

Real time Operating Systems: Introduction, Types of RTOS, Characteristics, Functions, Applications of Real Time Systems Scheduling in RTOS, Resource allocation in RTOS, Other issues in RTOS. Case Study: UNIX / LINUX operating system.

References:

1. Silberschatz, A., & Galvin, P. (2012). Operating system concepts (9th ed.). John Wiley and Sons.
2. Tanenbaum, A. (2014). Modern operating systems (4th ed.). Pearson Education.
3. Stallings, W. (2014). Operating systems: Internals and design principles (8th ed.). Pearson Education.
4. Dhamdhere, D. (2012). Operating systems: A concept based approach (3rd ed.). New Delhi: Tata McGraw Hill Pub.
5. Mall, R. (2008). Real time systems theory and practice. New Delhi, India: Dorling Kindersley.

19-204-0404 Software Engineering

Course Outcomes:

On completion of this course the student will be able to:

1. Apply engineering aspects required for building software in a systematic way.
2. Formally specify the requirements and choose an appropriate life cycle model.
3. Apply various design concepts and UML notations in their academic projects.
4. Explain fundamental elements of Software Project Management
5. Estimate software project effort, cost, and schedule for an intermediate size project.
6. Identify and manage software project risks.
7. Develop various test plans and apply in the academic projects.

Module I

Software Engineering: Definition, The Evolution of Software Engineering, Software Process, Agile process Extreme programming.

Software Life Cycle: Waterfall model, Prototyping, Spiral model pros and cons of each model.

Requirements analysis and specification: Levels of requirements; Requirements characteristics; Eliciting requirements, sources and techniques; Req. Documentation, IEEE format of SRS; Requirements validation.

Module II

Software Design: Design concepts: Design principles (information hiding, cohesion, and coupling), Interactions between design and requirements.

Design strategies: Function oriented design, Object oriented design, Data structure centered design, Aspect oriented design.

Architectural design: Architectural styles, patterns, and frameworks.

Human computer Interaction design: General HCI design principles, Design modalities, Coding techniques and visual design, Localization and internationalization, Interface modalities, Psychology of HCI.

Detailed design: Design patterns, Database design, Design notations, UML Diagrams.

Module III

Software Quality Management: Definitions of quality, The costs and impacts of bad quality, Quality attributes for software. Software Quality Assurance: Elements of SQA, SQA Tasks.

Quality Standards: Six Sigma in SE , ISO9000 and CMM.

Software Testing: Objectives of testing Functional(Black box) and Structural(White box) testing, Generation of test data, Test Plan, Unit testing Integration testing, Validation testing, System testing, Test reporting.

Software configuration management: Revision control, Release management, Configuration management tools, Software configuration management processes, Maintenance issues, Distribution and backup.

Module IV

Software Project Management: Planning, Organizing, Staffing, Directing and Controlling.

Software Project Cost Estimation: LOC and FP Based Estimation, COCOMO.

Software Project Scheduling: Basic Principles, Task Network, Gantt chart, Program Evaluation and Review Technique (PERT) and the Critical Path Method (CPM). Evolution Processes: Working with legacy systems, Refactoring.

Risk Management: Reactive and Proactive Risk Strategies, Software Risk, Seven Principles of Risk Management, RMMM Plan.

References:

1. Pressman, R. (2014). Software engineering: A practitioner's approach (8th ed.). McGraw Hill Education.
2. Mall, R. (2014). Fundamentals of software engineering. Prentice Hall Of India.
3. Jalote, P. (2008). A concise introduction to software engineering. Springer. London
4. Limaye, M. (2011). Software quality assurance. Tata McGraw Hill Education. New Delhi
5. Limaye, M. (2009). Software testing: Principles, techniques and tools. New Delhi: Tata McGraw Hill Education Private

19-204-0405 Internet Programming

Course Outcomes:

On completion of this course the student will be able to:

1. Illustrate the essentials of web and application servers.
2. Design interactive web page(s) using HTML and JavaScript.
3. Transfer XML documents using schemas and Query languages
4. Develop Dynamic web site using Client side/server side scripting languages.
5. Demonstrate internet application with AJAX Programming and Ruby on Rails.

Module I

Fundamentals of Web: Internet, WWW, W3C, Web 2.0, web servers.

HTML 5: Basic syntax, Standard document structure, Basic text mark up, Images, Hypertext Links, Lists, Tables, Forms, Frames. –XML, HTML Vs. XML Creating XML documents – XML: Structuring data, XML namespaces, DTD, XML Schema.

Module II

JavaScript: Overview of JavaScript, Screen output and keyboard input, Input with Dialogs, Memory concepts, operators, decision making, control statements, counter controlled repetition, Arrays, Functions, objects, events. Document Object Model (DOM): DOM nodes and trees, DOM tree, DOM Collections, dynamic styles.

Module III

PHP: PHP basics, string processing, regular expressions, Handling HTML form with PHP, connecting to database, using cookies, dynamic content.

Module IV

Introduction to AJAX Programming, PHP with AJAX, working with Database.

Ruby on Rails: Ruby introduction, Rails framework, Database driven web application

References:

1. Deitel, H., & Deitel, P. (2014). Internet and World Wide Web: How to program (5th ed.). Pearson Education.
2. Duckett, J. (2011). HTML & CSS: Design and build websites. Wiley. Indianapolis, IN
3. Sebesta, R. (2005). Programming the World Wide Web (3rd ed.). Pearson/Addison Wesley.Boston
4. Bates, C. (2006). Web programming: Building Internet applications (3rd ed.). Wiley. Chichester, England
5. Bai, X. (2003). The web warrior guide to Web programming. Thomson/Course Technology. Australia

19-204-0406 Object Oriented Programming in C++

Course Outcomes:

On completion of this course the student will be able to:

1. Understand the basic concepts of Object Oriented Programming
2. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
3. Implement object oriented programming constructs like encapsulation, inheritance and polymorphism.
4. Understand dynamic memory management techniques using pointers, constructors, destructors, etc.

Module I

Procedure oriented programming, Object oriented programming paradigm, Basic concepts of object oriented programming, Benefits of OOP –console I/O operations formatted and unformatted –managing output with manipulators. Functions in C++:call and return by reference, inline functions, default arguments, const arguments function overloading –friend functions.

Module II

Classes and objects, Specifying a class, Defining member functions, Memory allocation for objects Static data members, Static member functions, Arrays of objects, const member functions Constructors and Destructors: Constructors: default, parameterised, with default arguments, copy constructor, destructors, operator overloading: overloading unary operators, overloading binary operators, overloading binary operators using friends, manipulation of strings using operators, Type conversions: basic to class, class to basic, class to class.

Module III

Inheritance: Defining derived classes, Single inheritance, Multilevel inheritance, multiple inheritance, Hierarchical inheritance, Hybrid inheritance virtual base classes, Abstract classes Constructors in derived classes ,pointers, pointers to objects, this pointer, pointers to derived classes, virtual functions, pure virtual functions.

Module IV

Working with files: classes for fstream operations, opening and closing of file, detecting end of file, file modes, file pointers and manipulators, sequential input and output operations, random access, Templates, Exception handling, Manipulating strings

References:

1. Balagurusamy, E. (2013). Object oriented programming with C++ (6th ed.). Tata McGraw Hill. New Delhi.
2. Lafore, R., & Lafore, R. (2002). Object oriented programming in C++ (4th ed.). Sams Pub.Indianapolis, Ind.
3. Stroustrup, B. (2013). The C++ programming language (4th ed.). Reading, Mass.: Addison Wesley.
4. Kamthane, A. (2003). Object oriented programming with ANSI and Turbo C++. Pearson Education.Delhi, India.
5. Schildt, H. (2012). C++ the complete reference (5th ed.). Osborne McGraw Hill. Berkeley.

19-200-0407 UNIVERSAL HUMAN VALUES

Course Outcomes:

On completion of this course the student will be able to:

1. More aware of themselves and their surroundings (family, society, nature).
2. More responsible in life in handling problems with sustainable solutions
3. Keep human relationships and human nature in mind.
4. Having better critical ability and would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Apply what they have learnt to their real life.

Module I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I
Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module II: Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
Understanding the meaning of Trust; Difference between intention and competence
Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature
Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module V: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems
Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
Sum up.

Include practice exercises and case studies to discuss the conduct as an engineer or scientist etc.

References:

1. Human Values and Professional Ethics (2nd revised edition) by R R Gaur, R Asthana, G P Bagaria, Excel Books,New Delhi, 2019.
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

19-204-0408 Object Oriented Programming Laboratory in C++

Course Outcomes:

On completion of this course the student will be able to:

1. Identify classes including data, methods and the relationship among the classes for a given application.
2. Implement object oriented constructs using C++ for the given application.
3. Develop application for real time problems using object oriented programming.
4. Improve communication and team building skills.

Lab Schedule

1. Introduction to C++ programming, data types, variables, control statements (if, if else, switch), iteration (for, while, do...while).
2. Implementation of classes and objects.
3. Implementation of constructors and constructor overloading.
4. Implementation of methods and method overloading.
5. Implementation of inheritance types: Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance.
6. Implementation of inheritance types: Multiple Inheritance, Hybrid Inheritance through Interface.
7. Implementation of polymorphism.
8. Implementation of File handling
9. Assignment, Design of any real time application using object oriented concepts :
    i. Students can form a project team with around 5 members per team.
    ii. The team can select the problem(s) from societal, health, safety and legal domains. Use C++programming language for application development.
    iii. At the end of the semester, the team has to present their project, submit a hand written report in their lab record. The team will be assessed through rubrics.

References

1. Balagurusamy, E. (2013). Object oriented programming with C++ (6th ed.). Tata McGraw Hill. New Delhi
2. Lafore, R., & Lafore, R. (2002). Object oriented programming in C++ (4th ed.). Sams Pub.Indianapolis, Ind.
3. Stroustrup, B. (2013). The C++ programming language (4th ed.). Reading, Mass.: Addison Wesley.
4. Kamthane, A. (2003). Object oriented programming with ANSI and Turbo C++. Pearson Education.Delhi, India
5. Schildt, H. (2012). C++ the complete reference (5th ed.). Osborne McGraw Hill. Berkeley

19-204-0409 Mini Project – RDBMS based

Course Outcomes:

On completion of this course the student will be able to:

1. Design database with integrity constraints and appropriate normal forms.
2. Implement SQL data model for a given application.
3. Use PL/SQL constructs to add programming extension to SQL.
4. Use database connectivity mechanism for a real time application.

PART A

Students will complete the following experiments in lab to get an introduction to SQL queries and establishing database connectivity with the front end and back end. (2 lab sessions)

1. Program to demonstrate various SQL commands.
   a. DDL commands including Create database, Drop database
   b. DML commands including Create Table, Insert, Delete, Update, Select, Join
2. Design and implementation of payroll processing system with database connectivity. The program will accept input using a front end user interface and insert to back end database. The application will support insert, delete, modify and display operations. (UI can be created using HTML, PHP and back end can be MySQL.)

PART B

Project Description

It is required to design and develop a RDBMS prototype that implements the concepts and basic functionalities of a typical RDBMS. The RDBMS will have capabilities of creating schemas and tables, inserting and manipulating data, and conducting queries. A basic web application/desktop application will be created with your DBMS as the back end. The project is developed in 5 manageable increments:

1. Increment 1: Design of Database
   Design and define database, create schema and tables, with necessary attributes. Each of these attributes will have a name and a data type. Implementation of primary keys and foreign keys is required. Normalize the tables.
2. Increment 2: Data Definition
   Implement the above database design into the database software of your choice. The interface may be web based or otherwise (ease of use & presentation will contribute towards grade).
3. Increment 3: Data Manipulation
   Develop data input and manipulation capabilities into your DBMS. External software (e.g. web application) will be able to use the functions provided by you to insert and manipulate data into particular tables of a particular schema. Data entered will be checked for compatibility with the data type of the attributes. Checking primary keys and foreign keys for consistency is optional (bonus).
4. Increment 4: Querying

Your DBMS will be enhanced to support querying. Embedded queries are optional (bonus). The input can be SQL or any other self defined method, and the output will be shown on the interface or returned to the calling function in an appropriate format

(e.g. two dimensional array). Primitive querying such as the following will be supported: Complex joins may be supported.
SELECT X.x, Y.y FROM X, Y WHERE X.x = Y.y AND Y.y = 10;

5. Increment 5: Web Application/Desktop Application

Create a website/ desktop application that is able to interact with the database in the back end. The design and functionalities of the website/ desktop application will also be evaluated.

Presentation

You will be required to present your project. Your presentation will include a description of your design (e.g. using diagrams) in each increment, difficulties encountered and solved in the design and implementation processes, tools used, advanced techniques supported by your DBMS, and a demonstration of your web application that is based on your DBMS. A full report will be submitted at this time. The report will include in detail (i.e. diagrams and explanation) your design of each increment, tools used, difficulties encountered, and testing mechanisms. An ER diagram for your web application will also be given. Design details of your web application are not required.

Notes

All modules developed will have an extensible design for further additions.
All code will be fully documented.
You may use any programming language that you wish.

Guideline for Evaluation:

1. Intermediate assessment:	***20 marks.***
2. End Semester assessment:	***20 marks.***
3. Documentation/Report:	***10 marks***

19-200-0501 Numerical and Statistical Methods

Course Outcomes:

On completion of this course the student will be able to:

1. Solve algebraic and transcendental equations by numerical methods
2. Perform numerical differentiation and integration
3. Find the mean and variance of a probability distribution including the binomial distribution.
4. Use statistical tests in testing hypotheses on data

Module I

Numerical solution of algebraic and transcendental equation by Regula falsi method, Newton Raphson's method. Gauss Seidal iteration method to solve a system of equations and convergence (without proof), Newton's forward and backward interpolation formula. Lagrange interpolation, Newton's divided difference and central differences

Module II

Numerical differentiation at the tabulated points with forward, backward and central differences. Numerical integration with trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Taylor series method. Euler method, Modified Euler method, Runge –Kutta method of second and fourth order for solving 1st order ordinary differential equation.

Module III

Random variable (discrete and continuous) Expectation mean and variance of probability distribution. Binomial, Poisson and Normal distribution and Fitting of this Distribution to the given data. Curve fitting fitting of straight line, parabola, exponential.

Module IV

Population and Sample Sampling Distribution (of mean and variance) Testing of Hypothesis level of significance, Ztest statistic, Chi square test for variance, for goodness of fit and F test

References:

1. Kreyszig, E. (2011). Advanced engineering mathematics (10th ed.). John Wiley, New York
2. Grewal, B.S, & Grewal, J.S (2013). Higher engineering mathematics (43rd ed.). Khanna, Delhi.
3. Kandasamy, P., &Thilagavathy, K. (2003). Numerical methods. New Delhi: S. Chand & Company.
4. Johnson, R., & Miller, I. (2014). Miller and Freund's probability and statistics for engineers (8th ed., Pearson new international ed.). Pearson.

19-204-0502 Object Oriented Modeling and Design

Course Outcomes:

On completion of this course the student will be able to:

1. Represent basic Object-Oriented design entities using UML notations.
2. Distinguish various UML diagrams and their purpose
3. Identify actors and use cases from a context and draw use case diagrams.
4. Identify the structural and behavioural aspects of a system and draw corresponding UML diagrams.

Module I

Introduction to UML and Unified Process. Use case modeling: Actors and Use cases, Use case specification, Actor generalization, Use case generalization. Objects and classes, Relationships, Inheritance and Polymorphism, Packages.

Module II

Use case realization: Interactions, Sequence diagrams, Communication diagrams, Interaction occurrences. Activity diagrams: Activity semantics, activity partitions, Sending signals and accepting events, Interaction overview diagrams.

Module III

Design: Design workflow, well formed design classes, Refining analysis relationships. Interfaces and components. State machine diagrams, Composite states, sub machine states.

Module IV

Implementation workflow, Deployment, Introduction to OCL: Need of OCL, OCL expression syntax, Types of OCL expressions. Introduction to Software Architecture, Architecture description language (ADL)

References:

1. Arlow, J., & Neustadt, I. (2005). UML 2 and the unified process: Practical object oriented analysis and design (2nd ed.). Addison Wesley.
2. Blaha, M., & Rumbaugh, J. (2005). Object oriented modeling and design with UML (2nd ed.). Pearson Education.Upper Saddle River, NJ
3. Larman, C. (2005). Applying UML and patterns: An introduction to object oriented analysis and design and iterative development (3rd ed.). Prentice Hall PTR. Upper Saddle River, N.J.
4. Booch, G., & Rumbaugh, J. (1999). The unified modeling language user guide. Addison Wesley. Reading, Mass.
5. Bruegge, B., &Dutoit, A. (2003). Object oriented software engineering: Using UML, patterns and Java (2nd ed.). Prentice Hall. Upper Saddle River, NJ
6. Jacobson, I., &Booch, G. (1999). The unified software development process. Addison Wesley. Reading, Mass

19-204-0503 Design and Analysis of Algorithms

Course Outcomes:

On completion of this course the student will be able to:

1. Construct algorithms for various computing problems.
2. Explain the different asymptotic notations. Demonstrate the algorithms of various types such as Brute force, Divide and Conquer, Dynamic programming, Greedy, Backtracking and, Branch and bound.
3. Analyse the time and space complexity of an algorithm.
4. Examine the type of problem (NP hard, NP complete) for the given scenario.

Module I

Analyzing Algorithms and problems. Classifying functions by their asymptotic growth rate. Recursive procedures. Recurrence equations, Substitution Method, Changing variables, Recursion Tree, Master Theorem. Design Techniques: Divide and Conquer, Dynamic Programming, Greedy, Backtracking.

Module II

Analysis of searching and sorting. Insertion sort, Quick sort, Merge sort and Heap sort. Binomial Heaps and Fibonacci Heaps, Lower bounds for sorting by comparison of keys. Comparison of sorting algorithms. Amortized Time Analysis. Red Black Trees Insertion & Deletion.

Module III

Graphs and graph traversals. Strongly connected components of a Directed graph. Biconnected components of an undirected graph. Transitive closure of a Binary relation. Warshall's algorithm for Transitive closure. All pair shortest path in graphs. Dynamic programming. Constructing optimal binary search trees.

Module IV

Complexity Theory, Introduction. P and NP. NP Complete problems. Approximation algorithms. Bin packing, Graph coloring. Travelling salesperson Problem.

References :

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). *Introduction to algorithms*. MIT Press
2. Levitin, A. (2012). *Introduction to the design & analysis of algorithms*. Pearson.
3. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (1983). *Data structures and algorithms*. Reading, MA: Addison Wesley. Pearson.
4. Goodrich, M. T., & Tamassia, R. (2001). *Algorithm design: Foundations, analysis, and Internet examples*. John Wiley & sons.

19-204-0504 Big Data Analytics

Course Outcomes:

On completion of this course the student will be able to:

1 Appraise the business areas where big data technologies.
2 Demonstrate the ideas to integrate big data with cloud service.
3 Provide solutions for big data Applications using different Ecosystem tools.
4 Implement the MapReduce algorithms in Hadoop framework.

Module I

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem.

Data Analytics Lifecycle: Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize

Module II

Clustering, Overview of Clustering, K means, Additional Algorithms

Association Rules: Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, Validation and Testing

Module III

Regression: Linear Regression, Logistic Regression, Additional Regression Models

Classification: Decision Trees, Decision Tree Algorithms, Naïve Bayes, Bayes' Theorem, Diagnostics of Classifiers

Module IV

MapReduce and Hadoop: Analytics for Unstructured Data, MapReduce, Apache Hadoop, Hadoop Ecosystem, Pig, Hive, HBase, Mahout, NoSQL

References:

1. EMC Education Services.(2015). Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley.
2. Michael Minelli, Michele Chambers, Ambiga Dhiraj. (2013). Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses. Wiley.
3. Bart Baesens. (2014). Analytics in a Big Data World", The Essential Guide to Data Science and its Applications, Wiley, First edition.
4. Thomas H. Davenport, Jeanne G. Harris. (2007). Competing on Analytics: The New Science of Winning. Harvard Business Review Press, First edition.
5. Paul C. Zikopoulos, Chris Eaton. (2012). Understanding Big Data. McGraw Hill.
6. Tom White. (2015). Hadoop: The Definitive Guide. Third Edition, O'Reilley.

19-204-0505 Formal Languages and Automata Theory

Course Outcomes:

On completion of this course the student will be able to:

1 Develop a formal notation for strings, languages and machines.
2 Design finite automata to accept a set of strings of a language.
3 Prove that a given language is regular and apply the closure properties of languages.
4 Design context free grammars to generate strings from a context free language and convert them into normal forms.
5 Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars
6 Identify the hierarchy of formal languages, grammars and machines.
7 Distinguish between computability and non computability and Decidability and undecidability.

Module I

Finite Automata and Regular Expression: NFA, DFA, Equivalence of NFA and DFA, Equivalence of NFA and NFA with epsilon moves, regular expression, Equivalence of regular expression and finite automata, Finite automata with output, Equivalence of finite automata with output (Moore and Mealy Machines), Equivalence of Moore and Mealy machines, Applications of Finite automata.

Properties of Regular sets: Pumping Lemma, closure properties, My Hill Nerode theorem

Module II

Context Free Grammars and languages: Definitions, Derivations parse Trees, Ambiguity, Simplification of CFG, Normal forms of CFG, Chomsky Normal form, Greibach Normal Form.

Push Down Automata: Definition of PDA & DPDA, Languages of PDA, Equivalence of PDA and CFL, Applications of CFG, pumping lemma for CFL, Closure Properties, and Decision algorithms.

Module III

Turing machine: TM model, Computational Languages and Functions, Techniques for construction of TM, NDTM.

Undecidability: Decidable & undecidable problems, properties of recursive and recursively enumerable languages, UniversalTM and an undecidable problem

Module IV

Chomsky Hierarchy: Regular Grammars, equivalence of regular grammar and FA, Unrestricted Grammars, equivalence of unrestricted grammar and TM, Context Sensitive Languages (CSL) and Linear Bounded Automaton(LBA), Equivalence of LBA and CSL, Relation between languages.

References

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.(2001).Introduction to Automata Theory, Languages, and Computation. Pearson Education Asia.

2. Harry R. Lewis and Christos H. Papadimitriou.(1997).Elements of the Theory of Computation. Pearson Education Asia.
3. Dexter C. Kozen.(1997).Automata and Computability.Undergraduate Texts in Computer Science.Springer.
4. Michael Sipser.(2012).Introduction to the Theory of Computation.PWS Publishing.
5. John Martin.(2010).Introduction to Languages and The Theory of Computation.Tata McGraw Hill.

19-204-0506(IE) Augmented Reality

Course Outcomes:

On completion of this course the student will be able to:

1. Identify different types of AR experiences.
2. Use tools and platforms used in the AR landscape.
3. Create an AR use flow.
4. Building an AR experience using AR Core and other tools

Module I

Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.

Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner Output -- Visual /Auditory / Haptic Devices.

Module II

Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

Module III

Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc.

Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

Module IV

Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Text Books :

1. Kelly S. Hale (Editor), Kay M. Stanney (Editor). 2014. Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition (Human Factors and Ergonomics) ISBN-13: 978-1466511842

2.Jason Jerald. 2015. The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool Publishers.

3. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

4. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.

19-204-0507 Software Project Management

Course Outcomes:

On completion of this course the student will be able to

1. Understand the principles behind the agile approach to software development.
2. Enable them to positively contribute as an agile team member with a better understanding of various phases.
3. Develop a more advanced, applied level of knowledge to gain an understanding of Agile and the ability to apply relevant project management methods, leading to successful Agile projects.
4. Learn the different management styles needed for successful Agile projects compared to traditional projects.

Module I

The Agile Revolution, Agile Business Objectives, Agility Defined, Agile Leadership Values, Agile Performance Measurement, Iterative, Feature Based Delivery Teams over Tasks, Leading Teams, Building Self Organizing (Self Disciplined) Teams, Participatory Decision Making.

Module II

An Agile Project Management Model, An Agile Enterprise Framework, An Agile Delivery Framework The Envision Phase, Product Vision, Project Objectives and Constraints, Project Community.

Module III

The Speculate Phase, Speculating on Product and Project, Product Backlog, Release Planning Advanced Release Planning, Release (Project) Planning, Wish based Planning (Balancing Capacity and Demand), Capabilities, Value Point Analysis.

Module IV

The Explore Phase, Agile Project Leadership, Iteration Planning and Monitoring, Coaching and Team Development, Collaboration and Coordination, The Adapt and Close Phases, Adapt, Product, Project, and Team Review and Adaptive Action.

References:

1. Highsmith, J. (2010). Agile project management: Creating innovative products (2nd ed.).Addison Wesley.
2. Shore, J., & Warden, S. (2008). The art of agile development. O'Reilly Media.
3. Martin, R. (2003). Agile software development: Principles, patterns, and practices. Prentice Hall.
4. Cohn, M. (2010). Succeeding with agile: Software development using Scrum. Addison Wesley.
5. Cockburn, A. (2006). Agile software development (2nd ed.). Addison Wesley.

19-204-0508 Wireless Networking

Course Outcomes:

On completion of this course the student will be able to:

1. Understand the basic wireless communication techniques.
2. Analyse the Satellite and cellular wireless networks
3. Learn an overview of wireless LAN
4. Differentiate between various wireless system standards and their basic operation cases.

Module I

Introduction: Cellular Revolution: 1G, 2G, 3G, 4G(LTE)

Wireless Communication Technology: Antennas: Radiation Pattern and Antenna Types, Propagation Modes, Line of Sight Transmission

Signal Encoding Techniques: Digital and Analog Data and Signals, Spread Spectrum: Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum

Module II

Wireless Networking: Satellite Communications: Satellite Orbits, Frequency Bands, Transmission Impairments, Satellite Network Configurations

Mobile IP: Operation of Mobile IP, Discovery, Registration and Tunneling

Module III

Wireless Application Protocol: Architectural Overview, Wireless Application Environment, Wireless Session Protocol, Wireless Transaction Protocol, Wireless Transport Layer Security, Wireless Datagram Protocol

Wireless LAN Technology: Wireless LAN Applications, Wireless LAN Requirements, Wireless LAN technology

Module IV

Wi Fi and IEEE 802.11 Wireless LAN standard: IEEE 802 Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical layer, Wi Fi Protected Access

Bluetooth: Overview, Radio Specifications, Baseband Specifications, Link Manager Specifications, Logical Link Control and Adaptation Protocol

References:

1. Stallings, W. (2009). Wireless communications & networks (2nd ed.). Pearson.
2. Kurose, J., & Ross, K. (2013). Computer networking: A top down approach (6th ed.). Pearson. Boston
3. Muller, N. (2001). Bluetooth demystified. McGraw Hill.
4. Umar, A. (2004). Mobile computing and wireless communications: Applications, networks, platforms, architectures, and security. NGE Solutions.
5. Tse, D. & Viswanath, P. (2005). Fundamentals of wireless communication. Cambridge University Press.

19-204-0509 Artificial Intelligence & Machine Learning

Course Outcomes:

On completion of this course the student will be able to:

1. Explain different Problem Solving strategies
2. Apply the First Order Logic approach to the fundamentals of computational intelligence.
3. Analyse the structures and algorithms of a selection of techniques related to searching, reasoning and machine learning.
4. To understand and solve complex problems in Machine Learning Applications for image, video, & text.

Module I

Computational Intelligence: Introduction, Overview, Definition

Problem solving strategies, Classical approach for problem solving, Generate and Test Search strategies, Uninformed search: Depth First Search, Breadth First Search, Branch and Bound. Informed search: Best First search, Greedy search, A* algorithm Iterative search: Hill Climbing

Adversarial search: MIN MAX algorithm, Alpha Beta pruning

Module II

Knowledge Representation and Reasoning, Propositional logic, First order Logic, Resolution in Propositional logic and First order logic

Probability Theory, Classical Probability Theory, Bayes' Rules, Bayesian Reasoning, Bayesian Networks

Module III

Introduction to machine learning - different forms of learning; Basics of probability theory, linear algebra and optimization. Linear regression, ridge regression, Lasso, Bayesian regression, regression with basis functions Linear Discriminant Analysis, Logistic regression, Perceptrons, Large margin classification

Module IV

Kernel methods, Support Vector Machines, Classification and Regression Trees, Multilayer Perceptrons and Back propagation. Bayesian Belief Networks, Markov Random Fields, Exact inference methods, approximate inference methods.

References:

1. Crina Grosan and Ajith Abraham.(2011). Intelligent Systems A Modern Approach. Springer
2. Elaine Rich, Kevin Knight, & Shivashankar B Nair.(2009). Artificial Intelligence. McGraw Hill, 3rd ed.
3. Russel Eberhart, Yuhui Shi. (2007). Computational Intelligence Concepts to Implementations. MK Publishers.
   Andries P. Engelbrecht.(2007). Computational Intelligence: An Introduction. Second Edition, Wiley.

19-204-0510 Software Systems Lab

Course Outcomes:

On completion of this course the student will be able to:

1. Apply basic knowledge in UNIX/LINUX shell scripts and execute various shell programs.
2. Analyse and evaluate different process scheduling techniques.
3. Develop Port programming, Routing algorithms.
4. Handle common network troubleshooting techniques.

Part A: OS Lab

1. UNIX programming
2. Shell Scripting
3. System commands like fork, join, pipe, getpid() etc
4. File attributes using stat system call
5. IPC using shared memory, semaphores and message queues.
6. UNIX command simulation eg. ls, mvetc
7. Operating System programming
8. Process Scheduling FCFS, SJF, Priority etc
9. Memory Management Schemes MVT and MFT
10. Deadlock Detection and Avoidance
11. File Management

Part B: Computer Network Lab

12. Familiarisation/Introduction to:
    (a) Network components such as Modem, Gateways, Routers, Switches, and Cables etc.
    (b) Various network softwares, services and applications.
    (c) Network trouble shooting Techniques.
13. Serial Port Programming
14. Parallel Port Programming
15. TCP socket Programming
16. UDP socket Programming
17. TCP Chatting
18. UDP Chatting
19. Implementation of Routing Algorithms
20. RPC Programming

References :

1. Silberschatz, A., & Galvin, P. (2012). Operating system concepts (9th ed.). John Wiley and Sons.
2. Tanenbaum, A. (2014). Modern operating systems (4th ed.). Pearson Education.
3. Forouzan, B., & Fegan, S. (2007). Data communications and networking (4th ed.). McGraw Hill Higher Education. Boston
4. Kurose, J., & Ross, K. (2013). Computer networking: A top down approach (6th ed.). Pearson. Boston

19-204-0511 Software Engineering Lab

Course Outcomes:

On completion of this course the student will be able to:

1. Perform Object Oriented analysis and design for a given problem specification.
2. Identify and map basic software requirements in UML mapping.
3. Improve the software quality using design patterns and to explain the rationale behind applying specific design patterns.
4. Test the compliance of the software with the SRS.
5. Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture.
6. Test the developed code and validate whether the SRS is satisfied.

Instructions:

1. Suggested domains from mini project (RDBMS BASED)
2. Identify a software system that needs to be developed.
3. Document the Software Requirements Specification (SRS) for the identified system.
4. Identify use cases and develop the Use Case model.
5. Identify the conceptual classes and develop a Domain Model and also draw a Class Diagram from that.
6. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagram. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

References:

1. Arlow, J., & Neustadt, I. (2005). UML 2 and the unified process: Practical object oriented analysis and design (2nd ed.). Addison Wesley.
2. Blaha, M., & Rumbaugh, J. (2005). Object oriented modeling and design with UML (2nd ed.). Pearson Education.Upper Saddle River, NJ
3. Larman, C. (2005). Applying UML and patterns: An introduction to object oriented analysis and design and iterative development (3rd ed.). Prentice Hall PTR. Upper Saddle River, N.J.

19-204-0601 Internet of Things

Course Outcomes:

On completion of this course the student will be able to:

1. Understand the concepts of IoT and its underlying architecture.
2. Apply IoT concepts to real world issues.
3. Analyse the tools and technologies that are used to create new IoT solutions.
4. Evaluate virtualization frameworks available in the industry.
5. Evaluate the IoT security and privacy issues.

Module I

Internet of Things Definition Evolution, IoT Architectures, Resource Management, IoT Data Management and Analytics, Communication Protocols, Internet of Things Applications, Security, Privacy, Standardization and Regulatory Limitations.

Module II

OpenIoT Architecture for IoT/Cloud Convergence, Scheduling Process and IoT Services Lifecycle, Scheduling and Resource Management, Validating Applications and Use Cases, Device/Cloud Collaboration Framework, Applications of Device/Cloud Collaboration

Module III

Embedded Device Programming Languages, Message Passing in Devices, Coordination Languages, Polyglot Programming, Survey of IoT Programming Frameworks

Module IV

ARM Virtualization Extensions, XEN ARM Virtualization, KVM ARM Virtualization, Container Based Virtualization, Virtualization and Real Time

IoT Reference Model, IoT Security Overview, Security Frameworks for IoT, Privacy in IoT Networks, IoT Governance

References

1. Rajkumar Buyya, Amir Vahid Dastjerdi., Internet of Things, Principles and Paradigms, Morgan Kaufmann.,2016.
2. Zhou, H., The Internet of Things in the Cloud: A Middleware Perspective. CRC Press.,2012.
3. Bahga, A., & Madisetti, V., Internet of things: A hands on approach. VPT., 2014.
4. Dr. Vermesan, O., & Dr. Friess, P.; Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems. River Publishers., 2013
5. McEwen, A., & Cassimally, H., Designing the internet of things. Chichester: Wiley.,2014.
6. Velte, T., Velte, A., & Elsenpeter, R., Cloud Computing, A Practical Approach. McGraw Hill Professional.,2009.

19-204-0602 Compiler Design

Course Outcomes:

On completion of this course the student will be able to:

1. Summarize the functionality of each phase involved in compilation process.
2. Develop scanner and parser using Lex and Yacc tools.
3. Design top down parsers including recursive descent parser and non recursive predictive parser for CFGs.
4. Design bottom up parsers including shift reduce, operator precedence and LR parsers (SLR, CLR and LALR).
5. Explain Syntax directed translation using S attributed definition and L attributed definition.
6. Familiarize specification for a type checker and run time environment.
7. Comprehend different representations of intermediate code.,
8. Describe various code optimization techniques to improve the performance of a program and learn code generation techniques.

Module I

Compiler: Introduction, Analysis of the source program, phases of a compiler, Lexical analysis: Role of the lexical analyser, Input Buffering, Specification of tokens, Recognition of tokens, Lexical analyser generators.

Module II

Syntax Analysis: Role of the parser, Context free grammars, Top down parsing, Bottom up parsing –Operator precedence parsing, LR parsers (SLR, Canonical LR, LALR) Parser generators.

Module III

Syntax directed translation, Syntax directed definitions, S attributed definitions, L attributed definition, Top down and bottom up translation, Type checking, Type systems, Specification of a type checker. Run time environment, Source language issues, Storage organization, Storage allocation strategies, Access to non local names, Symbol tables.

Module IV

Intermediate code generation, Intermediate languages, Declarations, Assignment, Statement. Boolean Expression, Procedure calls, Code optimization: Introduction, Sources of optimization, Introduction to data flow analysis. Code generator Issues in the design of a code generator, the target machine, A simple code generator.

References:

1. Alfred V. Aho, Ravi Sethi & Jeffrey D. Ullman, Compilers Principles, Techniques & Tools, Pearson.
2. Kenneth C. Louden, Compiler Construction: Principles and Practice, Thomson Learning, India.
3. Keith D. Cooper & Linda Torczon, Engineering a Compiler, 2nd Edition, Elsevier, New Delhi.
4. Muchnick, S.S., Harcourt Asra, Advanced Compiler Design implementation, Morgan Kaufman.
5. Alan Holub, Compiler Design in C, PHI.

19-204-0603 Deep Learning

Course Outcomes:

On completion of this course the student will be able to:

1. Understand the fundamental principles, theory and approaches for learning with deep neural networks
2. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
3. Fit within the context of other ML approaches and what learning tasks it is considered to be suited and not well suited to perform.
4. Implement deep learning algorithms and solve real world problems

Module I

Neural Networks: The Biological Neuron, The Perceptron, Multilayer Feed Forward Networks, Training Neural Networks, Backpropagation Learning, Activation Functions, Linear, Sigmoid, Tanh Hard, Tanh Softmax, Rectified Linear Loss Functions, Loss Function Notation, Loss Functions for Regression, Loss Functions for Classification, Loss Functions for Reconstruction, Hyper parameters, Learning Rate, Regularization, Momentum, Sparsity.

Module II

Deep Networks: Deep Learning, Common Architectural Principles of Deep Networks, Parameters, Layers, Activation Functions, Loss Functions, Optimization Algorithms, Hyper parameters, Summary, Building Blocks of Deep Networks, RBMs Autoencoders, Variational Autoencoders

Module III

Unsupervised Pretrained Networks: Deep Belief Networks, Generative Adversarial Networks. Convolutional Neural Networks (CNNs): Biological Inspiration, Intuition, CNN Architecture Overview, Input Layers, Convolutional Layers, Pooling Layers, Fully Connected Layers, Other Applications of CNNs.

Module IV

Recurrent Neural Networks, Modeling the Time Dimension, 3D Volumetric Input, Why Not Markov Models? General Recurrent Neural Network Architecture, LSTM Networks, Domain Specific Applications and Blended Networks. Recursive Neural Networks, Network Architecture, Varieties of Recursive Neural Networks, Applications of Recursive Neural Networks

References

1. Josh Patterson and Adam Gibson," Deep Learning, A Practitioner's Approach" ,O'REILLY
2. Nikhil Buduma,"Fundamentals of Deep Learning " , O'REILLY
3. Goodfellow, I., Bengio,Y., and Courville, A., (2016) Deep Learning, MIT Press,.
4. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009

19-204-0604 Cloud Computing

Course Outcomes:

On completion of this course the student will be able to:

1. Identify the key technologies in cloud architecture and Models.
2. Choose appropriate Virtualization tools by knowing its importance (including Virtualization of CPU, Memory, I/O Devices.)
3. Solve the core issues of cloud computing infrastructure such as resource provisioning, managing the SLAs.
4. Implement the appropriate programming model (such as Hadoop, Google App Engine, etc.) in the cloud computing driven systems.

Module I

Cloud Computing: Defining a Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Historical Developments, Computing Platforms and Technologies. Elements of Parallel Computing: Parallel Processing, Hardware Architectures for Parallel Processing, Approaches to Parallel Programming, Levels of Parallelism

Module II

Elements of Distributed Computing: General Concepts, Components of a Distributed System, Architectural Styles for Distributed Computing, Models for Inter Process Communication, Technologies for Distributed Computing. Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation

Module III

Cloud Computing Architecture: Cloud Reference Model, IaaS, PaaS, SaaS, Types of Clouds, Economics of the Cloud, Open Challenges. Inter cloud Resource Management, Extended Cloud Computing Services, Resource Provisioning and Platform Deployment, Virtual Machine Creation and Management, Global Exchange of Cloud Resources, Cloud Security and Trust Management, Cloud Security Defence Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation Guided Protection of Data Centers.

Module IV

Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, Thread APIs, Techniques for Parallel Computation with Threads

High Throughput Computing: Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Workflow Applications with Task Dependencies. Data Intensive Computing: Map Reduce Programming, Characterizing Data Intensive Computations, Data clouds and Big Data, Technologies for Data Intensive Computing, Storage Systems, Programming Platforms

References

1. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi. (2013). Mastering Cloud Computing. Tata McGraw Hill Education
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Morgan Kaufmann. (2012). Distributed and Cloud Computing: From Parallel Processing to the Internet of Things.
3. Thomas Erl, Ricardo Puttini, Zaigham Mahmood. (2013). Cloud Computing: Concepts, Technology & Architecture. The Prentice Hall Service Technology Series from Thomas Erl.
4. Borko Furht, Armando Escalante(2010). Handbook of Cloud Computing, Springer Science & Business Media.
5. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski. (2010). Cloud Computing: Principles and Paradigms. John Wiley & Sons.

19-204-0605 Android Programming

Course Outcomes:

On completion of this course the student will be able to:

1. Install and configure Android application development tools.
2. Apply mobile application models/architectures and patterns to the development of a mobile software application.
3. Describe the components and structure of a mobile development framework (Google's Android Studio).
4. Apply a mobile development framework to the development of a mobile application.
5. Demonstrate advanced Java programming competency by developing a maintainable and efficient cloud based mobile application.

Module I

Introduction to Java Programming: Features of Java, Data types, Variables, Class, Objects, Constructors, Methods, Organizing Classes and Interfaces with Packages, Inheritance, Organizing Object Behaviour with Interfaces, Polymorphism, Abstract classes. Implementation of method overloading and overriding.

Multithreaded Programming: Creating a Thread, Synchronization, Inter thread communication.

Module II

An Overview of the Android Architecture, The Anatomy of an Android Studio Android Application Setting up Android Studio Development Environment, Creating and Configuring an Android Virtual Device (AVD) and Android Debug Bridge (ADB)

Understanding Android Application and Activity Lifecycles, Handling Android Activity State Changes: The Activity Class, Dynamic State vs. Persistent State, The Android Activity Lifecycle Methods, Activity Lifetimes

Saving and Restoring Activity State: Default Saving of User Interface State, The Bundle Class, Saving the State, Restoring the State

Module III

Understanding Android Views, View Groups and Layouts, Android Constraint Layout, Designing a User Interface, Android Event Handling, Android Touch and Multi touch Event Handling, Detecting Common Gestures using the Android Gesture Detector Class, An Overview of Intents, Broadcast Intents and Broadcast Receivers, Android Threads and Thread Handlers

Module IV

Understanding Android Started and Bound Services, Implementing an Android Started Service, Android Local Bound Services, An Overview of Android SQLite Databases, Understanding Android Content Providers. Case Study: Develop an Android Application addressing a real world problem.

References:

1. Neil Smyth.(2019). Android Studio 3.2 Development Essentials, Android 9 Edition. Payload Media
2. Schildt, H. (2017). *Java 2: The Complete Reference* (10th ed.). Oracle Press.
3. Ted Hagos. (2018). Learn Android Studio 3: Efficient Android App Development. Apress.
4. Reto Meier. ( ). Professional Android 4 Application Development (Wrox Programmer to Programmer). Wiley India
5. J.F. DiMarzio. (2010). Android: A Programmer's Guide. Tata McGraw Hill.
6. Chris Haseman. (2008).Android Essentials. Apress.

19-204-0606 (IE) DevOps Engineering

Course Outcomes:

On the successful completion of the course, students will be able to:

1. Understand the key concepts and principles of DevOps.
2. Explain the benefits of DevOps practices in the Software Delivery Lifecycle (SDLC) such as test, infrastructure, and build and deployment automation.
3. Describe how DevOps utilises Lean and Agile methodologies to drive product-focused development.
4. Recall specific DevOps methodologies and frameworks.

Module 1

Introduction to DevOps: What is Devops, Benefits of DevOps, Principles of DevOps, Relationship with Agile and DevOps, Challenges with the Traditional Approach, DevOps Approach to the challenges, CI/CD Pipeline

Module II

Overview of Modern Application Development: Micro services, Monoliths, API, Pros & Cons of Micro services. Software and Automation Testing Framework: Test-Driven Development Approach, Behavior Driven Development Approach.

Module III

Overview of Containerization: Introduction to Docker Containers, Development of Containerized Application, Benefits and overheads of Containerization. Overview of Virtualization, Docker installation on Multiple OS

Module IV

Cloud in DevOps : Cloud Services and Models, Case study Using AWS in DevOps

Information Security: Ethical hacking, Cyber security and information Security, Service Development Life Cycle, Threat Modeling and Risk Management.

Text Books :

1. The DevOps Handbook:(2016 How to Create World-Class Agility, Reliability, and Security in Technology Organizations October 6, 2016, Gene Kim
2. Effective DevOps,(2016) by Jennifer Davis, Ryn Daniels, Released June 2016,Publisher(s): O'Reilly Media, Inc.,ISBN: 9781491926307
3. The Phoenix Project(2018) A Novel about IT, DevOps, and Helping Your Business Win, February 27, 2018, Gene Kim
4. Infrastructure as Code: (2016) Managing Servers in the Cloud, Kief Morris, O'Reilly Media, Inc, ISBN: 9781491924358

19-204-0607 Computer Vision

Course Objectives:

On completion of this course the student will be able to:

1. Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
2. Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.
3. Develop and apply computer vision techniques for solving practical problems.
4. Identify appropriate image processing methods for image filtering, image restoration, image reconstruction, segmentation, classification and representation.

Module I

Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projectiv; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

Module II

Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Image Segmentation: Region Growing, Edge Based approaches to segmentation Graph-Cut, Mean-Shift, MRFs.

Module III

Texture Segmentation; Object detection. Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection. Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods

Module IV

Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation. Shape from X: Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Textbooks

1. Digital Image Processing, 4th Edition Rafael C. Gonzalez, University of Tennessee
2. Richard E. Woods, MedData Interactive Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
4. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

19-204-0608 Soft Computing

Course Outcomes:

On completion of this course the student will be able to:

1. Learn fuzzy set theory, fuzzy rules and inference systems.
2. Learn on neural networks and supervised and unsupervised learning networks.
3. Comprehend neuron fuzzy modelling.
4. Get an introduction to Genetic Algorithms.
5. Able to develop applications using soft computing methods.

Module I

Introduction: Neuro Fuzzy and Soft Computing, Fuzzy Set Theory**:** Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.

Module II

Regression and optimization**:** Least Squares Methods for System Identification, Derivative Based Optimization, Derivative Free Optimization.

Neural networks**:** Adaptive Networks, Supervised Learning Neural Networks, Learning from Reinforcement, Unsupervised learning and other Neural Networks.

Module III

Neuro fuzzy modeling**:** ANFIS: Adaptive Networks based Fuzzy Inference Systems –Co active Neuro Fuzzy Modeling: Towards Generalized ANFIS.

Advanced neuro fuzzy modeling**:** Classification and Regression Trees, Data Clustering Algorithms, Rule base Structure Identification.

Module IV

Neuro fuzzy control: Neuro Fuzzy Control I, Neuro Fuzzy Control II

Advanced applications**:** ANFIS Application, Fuzzy Filtered Neural Networks

Fuzzy Theory and Genetic Algorithms in Game Playing Soft Computing for Color Recipe Prediction.

References:

1. Jang, J., & Sun, C. (1997). Neuro fuzzy and soft computing: A computational approach to learning and machine intelligence. Prentice Hall.
2. Yen, J., &Langari, R. (2003). Fuzzy logic: Intelligence, control, and information. Pearson Education.
3. Kosko, B. (1997). Neural networks and fuzzy systems: A dynamical systems approach to machine intelligence. Prentice Hall.

19-204-0609 Recommender System

Course Outcomes:

On completion of this course the student will be able to:

1. Understand the concept of recommender systems in online platforms.
2. Apply data mining and machine learning concepts for recommender system design.
3. Analyze and evaluate recommendation accuracy.
4. Evaluate various recommendation algorithms.
5. Identify the various security aspects of recommender systems.

Module I

Introduction to basic concepts, Need for recommender systems, Prediction vs Recommendations. Collaborative Recommendations: user based nearest neighbor recommendation, item based nearest neighbor recommendation, model based and preprocessing based approach, types of ratings, data sparsity, cold start problem, advantages and disadvantages of collaborative filtering. Case Study: Amazon Recommender System.

Module II

Content Based Recommendation: content representation and content similarity, similarity-based retrieval, other text classification methods.

Case Study: Movie Recommender System.

Knowledge based recommendation: Knowledge representation and reasoning, Interacting with constraint based recommenders, Interacting with case based recommenders

Case Study: Entree Restaurant Recommendation

System

Module III

Hybrid recommendation approaches: Opportunities for hybridization, Monolithic hybridization design, Parallelized hybridization design, Pipelined hybridization design.

Explanations in recommender systems: Explanations in constraint based recommenders, Explanations in case based recommenders, Explanations in collaborative filtering recommenders.

Module IV

Evaluating recommender systems: General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets,

Case study: Personalized game recommendations on the mobile Internet.

Attacks on Collaborative Recommender Systems: Types of attacks, evaluation of effectiveness and countermeasures. Recommendations in ubiquitous environments.

References:

1. Jannach, D., & Zanker, M. (2010). Recommender Systems an Introduction. Cambridge University Press. Leiden.
2. Bhasker B., & Srikumar, K. (2010). Recommender Systems In E Commerce. Tata McGraw Hill Education Pvt.
3. Santos, O., & Boticario, J. (2011). Educational recommender systems and technologies practices and challenges. IGI Global, USA.
4. Robillard, M., Maalej, W., & Walker, R. (2014). Recommendation systems in software engineering. Springer
5. Aggarwal, C. Charu. (2016). Recommender Systems: The Textbook. Springer.

19-204-0610 Cloud and Data Analytics Laboratory

Course Outcomes:

On completion of this course the student will be able to:

1. Learn the basics of Linux OS commands
2. Appreciate cloud architecture
3. Create and run virtual machines on open source OS
4. Implement Infrastructure, storage as a Service.
5. Install and appreciate security features for cloud

Part A:

Students will complete the following set of experiments in lab to get familiarised to Python language:

1. Programs to demonstrate Variables, Data Types, I/O and Import and Operators.
2. Programs to demonstrate flow control using if else and looping statements.
3. Program to demonstrate functions in python, arguments, recursion and anonymous functions.
4. Program to demonstrate modules and packages in python.
5. Program to demonstrate file handling operations and exception handling.
6. Program to demonstrate multi threaded programming using Python.

Part B:

1. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
2. Install Virtualbox/VMware Workstation with different flavours of Linux or Windows OS on top of windows7 or 8.
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
4. Install Google App Engine. Create hello worldapp and other simple web applications using python/Java.
5. Use GAE launcher to launch the web applications.
6. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
7. Find a procedure to transfer the files from one virtual machine to another virtual machine.
8. Install Hadoop single node cluster and run simple applications like word count.

Part C: Programming in Distributed environment. Implementations may be done using Python, Scala or Java.

1. Resilient Distributed Dataset operations and passing functions
2. Working with Key/Value Pairs and transformations
3. Broadcast Variables and Piping to External Programs
4. Using Spark SQL in Applications'
5. Installing Message Passing Interface (MPI) for demonstrating Distributed computing.

6. Demonstrating Distributed applications using Pyro or Python RQ.

References :

1. White, T. (2009). Hadoop the definitive guide. O'Reilly Media. Sebastopol, Calif.
2. Grover, M., &Malaska, T. (2015). Hadoop application architectures. O'Reilly.
3. Karau, H., &Konwinski, A. (2015). Learning Spark: Lightening fast data analysis (3rd release. ed.). O'Reilly. Beijing.
4. Ryza, S., &Laserson, U. (2015). Advanced analytics with Spark.
5. Francesco Pierfederici.(2016).Distributed Computing with Python.Packt Publishing Limited.

19-204-0611 Mini Project-Android based Project

Course Outcomes:

On completion of this course the student will be able to:

1. Develop an android application with a good understanding of the Android services that they have used in their project.
2. Install and configure Android application development tools.
3. Apply mobile application models/architectures and patterns to the development of a mobile software application
4. Describe the components and structure of a mobile development framework (Google's Android Studio).
5. Apply a mobile development framework to the development of a mobile application.

Part A

Students will complete the following set of experiments in lab to get familiarised to Android Studio and Android Programming:

1. Setting up Android Studio, Android Virtual Device and implementing "Hello World" application.
2. An application to demonstrate the activity life cycle.
3. An application to demonstrate saving and restoring the state of an Android Activity.
4. An application to demonstrate Interaction in an UI Interface using Button, Textbox and Text view.
5. An application to demonstrate Android Event Handling
6. An application to demonstrate Fragments and Overflow Menus in Android.
7. An application to demonstrate Intents (Explicit, Implicit, Broadcast) in Android.
8. An application demonstrating the use of Android SQLite Databases.

Part B

Students shall develop an Android application making use of **minimum of three services** from the following list**:**

Multimedia Animations, Audio Capture, Audio Manager, Camera, Image Effects, Image Switcher, Media Player, Jet Player,
Networking Bluetooth, Network Connection, SIP Protocol, Wi Fi
Social Services Facebook Integration, Google Maps LinkedIn Integration, Twitter Integration
User Interface Auto Complete, Multitouch, Clipboard, Custom Fonts, Gestures, UI Design, UI Patterns, UI Testing
Database, PHP/MySQL, Data Backup, SQLite Database, Internal
Storage Sensors,

Increment 1: Determine the Objective

Perform and document System requirement analysis and Software requirement analysis activities.

Description of the expected software features, constraints, interfaces and other attributes.
Prepare the Software Requirements Specifications (SRS) to document the agreed requirements; to provide the basis for design; to provide the basis for system test

Increment 2: Design the application

Description of how the software will meet the requirements. Also describes the rationale for design decisions taken.
Design document including database design, UI design, Data definition, Manifest file as appropriate to the work.
Prepare the Software Design Description (SDD) to document the design and design decisions in order to provide the basis for implementation and unit test.
Description of the plan and specifications to verify and validate the software and the results.
Prepare the Software Test Documentation (STD) to document how the software will be tested, and record the results.

Increment 3: Develop and refine the application

Create the application using the chosen languages, databases and platform.
Test the application using the test document
Demonstrate the application.

References:

1. Hohensee, B., & Dharma, A. (2014). Android for beginners: Developing apps using Android Studio. Babelcube.
2. Gerber, A., & Craig, C. (2015). Learn Android Studio build Android apps quickly and effectively. Apress.
3. Phillips, B., & Hardy, B. (2013). Android programming: The Big Nerd Ranch guide (2nd ed.). Addison Wesley Professional.

19-204-0701 Principles of Management

Course Outcomes:

On completion of this course, students will be able to:

1. Understand the basic principles underlying in the management of organizations.
2. Familiarize with all Industrial management functions.
3. Analyse the financial statements and ratios.
4. Understand the basic concept of economics and Intellectual property rights.

Module I

Basic concept of Management: Introduction, definitions of managements, characteristics of management, levels of management, management skills, Scientific management, Contributions of Gilbreth and Gantt.

Functions of Management: Planning, forecasting, organizing, staffing, directing, motivating, controlling, co-coordinating, communicating, decision making.

Organization: Introduction, definition of organization, elements of organization, process of organization, principles of organization, formal and informal organization, organization structure, types of organization structure.

Forms of Business Organization: Concept of ownership organization, types of ownership, Individual ownership, partnership, joint stock company, private and limited company, co-operative organizations, state ownership, public corporation.

Module II

Production planning and control: Objectives and functions.

Production management: Structure, objectives, productivity index, modern productivity improvement techniques.

Inventory Management: Functions, classifications of inventory, basic inventory models, inventory costs, Economic order quantity (EOQ).

Materials Requirement Planning: Objectives, Functions and methods.

Project Management: Functions, Characteristics, Feasibility studies, Project network analysis-PERT / CPM.

Module III

Human Resource Management: Introduction, definition, objectives, characteristics, functions, principles and organization of HR management, Recruitment, selection process and training methods, Wages and incentives, Job evaluation and merit rating, Industrial accidents causes and related issues.

Marketing Management: Introduction, Functions and objectives, Marketing environment and Information, Market segmentation, Distribution channels, Consumer and Industrial markets, Consumer behaviour, Pricing methods, Sales promotion and Advertisement. Market research: Objectives and methods.

Module IV

Financial Management: Basic functions, Capital classifications, Sources of funds, Financial accounts types, basic concepts and importance, Financial ratios and its significance, Types of budgets and budgetary controls, Overheads, Standard costing, Marginal costing.

Economics: Principles of economics, problem of scarcity, demand, supply, utility, time value of money, inflation and deflation, Consumer Demand Curve.
IPR Aspects: General introduction to IPR, eligibility for patent, patent information and prior art search, procedure for filing patent application, rights of patent owner and duration, ownership of patent and commercialization.

References:

1. Fraidoon Mazda. (1997). Engineering Management. Addison Wesley,
2. Koontz and O'Donnell. (1978). Essentials of Management. McGraw Hill
3. Kotler P.(2011). Marketing Management. Prentice Hall.
4. Prasanna Chandra. (2008). Finance Management. Tata McGraw Hill.
5. Monks, J. G.(1982). Operations Management. McGraw Hill.
6. Production and Operations Management. PHI(2010)

19-204-0702 Data Security and Cryptography

Course Outcomes

On the completion of the course, students will be able to:

1. Explain the information security terminologies like confidentiality, integrity, authentication, and access control.
2. Perform Encryption and Decryption of text using symmetric and asymmetric crypto algorithms to provide confidentiality.
3. Compute hash and digital signature for the given message to provide integrity and non-repudiation.
4. Examine the strength of any cryptographic algorithm by crypt analysis.

Module I

Introduction: Security basics, Aspects of network security, Attacks Different types, Security attacks.

Cryptography: Basic Encryption and Decryption, Classical encryption techniques, symmetric encryption, substitution ciphers, Caesar cipher, Monoalphabetic Cipher, Playfair Cipher, Polyalphabetic cipher, Vigenère Cipher, Transposition ciphers

Module II

Modern Block Ciphers, Feistel Networks, DES Algorithm, Avalanche Effect.

Introduction to Number Theory, Prime Factorisation, Fermat's Theorem, Euler's Theorem, Primitive Roots, Discrete Logarithms.

Public key Cryptography, Principles of Public key Cryptography Systems, RSA algorithms

Module III

Key Management: General aspects of key management, key distribution for asymmetrical systems, Diffie Hellman Key Exchange. Message Authentication Requirements, Authentication functions, Message authentication codes, Hash functions, Secure Hash Algorithm

Module IV

Digital signatures protocols: Digital signature standards, Digital Certificates

System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Counter measure.

References:

1. William Stallings. (2006). Cryptography and Network Security Principles and Practices. Pearson Education.
2. Charles P. Pflieger. (2005). Security in Computing. Pearson Education.
3. Behrouz A. Forouzan, Dedeep Mukhopadhyay. (2010.) Cryptography & Network Security, Second Edition, Tata McGraw Hill, New Delhi,
4. Jan C A, “Basic Methods of Cryptography”,Cambridge University Press.
5. Thomas Calabrese, “Information Security Intelligence: Cryptographic Principles & Applications”. Thomson Learning,

19-204-0703 Computer Graphics and Visual Computing

Course Outcomes:

On completion of this course the student will be able to :

1. Understand the fundamental principles that underline the computer graphics algorithms.
2. Develop and implement two and three dimensional graphical structures.
3. Design two and three dimensional graphical structures.
4. Implement graphics programming using OpenGL.
5. Understand computer animation.

Module I

Overview of graphic systems: Computer-Aided Design, Virtual Reality Environments, Data Visualization, Computer art, Entertainment, Education and Training, Visualization, Image Processing, Graphical User Interfaces.

Points and Lines, Line drawing algorithms, Circle Generation algorithms, Ellipse generating algorithms, Parallel curve algorithms, Attributes of output primitives.

Module II

Basic transformations, Matrix representations and homogeneous co-ordinates, Composite transformations, Raster methods for transformations.

The viewing Pipe Line, Viewing Co-ordinate reference frame, Window to viewport co-ordinate transformation, 2D viewing functions, Clipping operations.

Module III

Transformation, Rotation scaling, Other transformations, composite Transformations, 3D Transformation functions, Modeling and co-ordinate transformations, 3D Viewing concepts. 3D Display methods, 3D Graphics packages.

Polygon surfaces, Curved lines and surfaces, spline representations, Bezier curves and surfaces, B spline curves and surfaces, Beta splines, Relational splines, Conversion between spline representations, Displaying spline curves, Sweep representations.

Module IV

Constructive Solid Geometry Methods, Octrees, BSP trees, Fractal Geometry methods. OpenGL primitives Functions, pipeline, event handling and view manipulations

Classification of visible surface detection algorithms, Back face detection, Depth Buffer method, A-Buffer method, Scan Line method, Depth Sorting method, BSP Tree method, Area subdivision method, Octree methods, Ray Casting methods, Curved surfaces, Wireframe methods, Visibility Detection functions, Illumination models and surface rendering methods, colour applications, Computer Animation.

Graphics Card: Processing on the Graphics Card, Graphics Pipeline, NVDIA CUDA Libraries

References:

1. Hearn, D., & Baker, M. (2011). "Computer graphics with OpenGL (4th ed., International ed.). Upper Saddle River, N.J.: Pearson Education.
2. Hughes, J. (2013). Computer graphics: Principles and practice (3rd ed.). Addison Wesley.
3. Foley, van Dam, Feiner & Hughes, Computer Graphics Principles & Practice.
4. Hill, F., & Kelley, S. (2007). Computer graphics: Using OpenGL (3rd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

19-204-0704(IE) Mobile Computing Technology

Course Outcomes:

On completion of this course the student will be able to:

1. Learn the basics of mobile communications and evolution of different generations of cellular networks.
2. Understand the different architectures of mobile computing and their applications.
3. Analyse the working of mobile IP, mobile web services and mobile data management.
4. Learn about wireless security in WLAN and mobile networks.

Module I

Mobile communication basics: Antenna, Modulation, Multiplexing, Spread Spectrums. Cellular network- First Generation Networks-Second generation (2G): GSM-CDMA network, data over cellular network-2.5G network-GPRS, Third generation network (3G) network, introduction to 4G and 5G systems

Module II

Emerging wireless networks: MANET, Wireless sensor networks-OFDM and Flash OFDM
Mobile computing architecture: Wireless LANs, WAP, Wireless Personal Area Network, Pervasive computing, Mobile Devices, cards and sensors, Mobile computing applications

Module III

Mobile IP, wireless web-Web services and mobile web services- Wireless middleware-wireless gateway and mobile application servers, Mobile database management, Smart Client, Data Store, Application.

Module IV

Wireless security-WLAN security-cellular wireless network security-Mobile ad-hoc network security-Internet security protocols: VPNs and IPSec-Wireless middleware security-SSL for wireless web security-WAP security and WTLS.

References:

1. Kamal, R. (2012). Mobile computing (2nd ed.). Oxford University Press.
2. Stallings, W. (2009). Wireless communications & networks (2nd ed.). Pearson.

19-204-0705(IE) High Performance Computing Architecture

Course Outcomes:

On completion of this course, students will be able to

1. Learn about Modern Processors and concepts.
2. Understand the concepts of Optimizations.
3. Learn about Parallel Computers and Programming.
4. Apply Memory Parallel Programming using OpenMP.

Module I

Modern Processors: Stored Program Computer Architecture, General purpose cache based microprocessor architecture, Memory Hierarchies, Multicore processors, Mutithreaded processors, Vector Processors

Module II

Basic Optimization Techniques for Serial Code: Scalar profiling, Common sense optimizations, Elimination of common subexpressions, Avoiding branches Using SIMD instruction sets, The role of compilers ++ optimizations

Module III

Parallel Computers: Taxonomy of parallel computing paradigms, Shared memory computers, Distributed memory computers, Hierarchical systems Networks. Basics of parallelization Data parallelism, Functional parallelism, Parallel scalability

Module IV

Shared and Distributed Memory Parallel Programming with OpenMP: Introduction to OpenMP, Parallel execution, Data scoping, OpenMP work sharing for loops, Synchronization, Reductions, Loop Scheduling Tasking. Distributed memory parallel programming with MPI, Message passing, Introduction to MPI

References :

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
2. Charles Severance, Kevin Dowd, "High Performance Computing", O'Reilly Media, 2nd Edition, 1998.
3. Kai Hwang, Faye Alaye Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1984.

19-204-0706 Quantum Computing

Course Outcomes:

On completion of this course, students will be able to:

1. Learn the framework of quantum computation.
2. Apply for future quantum technologies.
3. Understand Quantum algorithms.
4. Apply quantum algorithms to real world problems.

Module I

Introduction to Quantum Computing: Quantum Mechanics, Church–Turing Thesis, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation.

Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation

Module II

Quantum Computation: Fundamentals of Quantumness, no cloning theorem, quantum entanglement, Bell states and Bell inequalities. Quantum Circuits, Pauli, Hadamard, phase, CNOT, Toffoli gates quantum teleportation universality of two qubit gates reversible computing

Module III

Quantum Algorithms: Probabilistic Versus Quantum Algorithms , Phase Kick Back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm, Quantum Phase Estimation and the Quantum Fourier Transform, Grover's Quantum Search Algorithm, Shor's period finding algorithm

Module IV

Quantum Information: Quantum, Error Correction, Shannon Entropy, Von Neuman Entropy, Classical Cryptography, RSA Algorithm, Quantum Cryptography, BB 84 protocol, B 92 and Eckart protocol

References :

1. Phillip Kaye, Raymond Laflamme, and Michele Mosca (2007). An Introduction to Quantum Computing. Oxford University Press.
2. Michael A. Nielsen and Isaac L. Chuang (2000). Quantum Computation and Quantum Information. Cambridge University Press.
3. Yanofsky, Noson S. and Mirco A. Mannucci (2008). Quantum Computing for Computer Scientists. Cambridge University Press.
4. McMahon, David (2008). Quantum Computing Explained. John Wiley & Sons, Inc.
5. Mermin, N. David (2007). Quantum Computer Science: An Introduction. Cambridge University Press.

19-204-0707 Ethical Hacking

Course Outcomes:

On completion of this course, students will be able to

1. Understand steps in hacking.
2. Analyse Information security threats and countermeasures.
3. Illustrate the issues relating to ethical hacking.
4. Analyse session Hijacking, SQL Injection and security in various aspects.

Module I

Ethical Hacking Overview & Vulnerabilities: Evolution of hacking, Ethical Hacker Code of Conduct and Ethics, Hacking Methodologies, Incident Response Ethics and the Law Introduction to steps in Ethical Hacking

Module II

Footprinting and Scanning: Footprinting, Need and Goals of footprinting, Terminologies, Threats, The Footprinting Process. Scanning, Introduction, Types of scans, Checking the Status of Ports, The Family Tree of Scans, OS Fingerprinting.

Module III

Enumeration and System Hacking: Enumeration, Enumeration in different OS, SMTP Enumeration. System Hacking: Password Cracking, Authentication on Microsoft Platforms, Executing Applications, Covering tracks

Module IV

Session Hijacking and Sql Injection : Session Hijacking, Spoofing, Hijacking, Application Level and Network Session Hijacking, Defensive Strategies.

SQL Injection, Results and Anatomy of a SQL Injection, Attack Altering Data, Injecting Blind Information Gathering Evading, Detection Mechanisms, Counter measures. Hacking Wi-Fi and Bluetooth, Mobile Device Security

References

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands on Ethical Hacking & Network Defense", Course Technology, 2010
3. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006
4. Ramachandran V, "BackTrack 5 Wireless Penetration Testing Beginner's Guide" (3rd ed.). Packt Publishing, 2011
5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

19-204-0708 Agile Methodology

Course Outcomes:

On completion of this course the student will be able to

1. Learn the principles behind the agile approach to software development
2. Enable them to positively contribute as an agile team member with a better understanding of various phases.
3. Develop a more advanced, applied level of knowledge to gain an understanding of Agile and the ability to apply relevant project management methods, leading to successful Agile projects.
4. Learn the different management styles needed for successful Agile projects compared to traditional projects.

Module I

The Agile Revolution, Agile Business Objectives , Agility Defined , Agile Leadership Values, Agile Performance Measurement, Iterative, Feature-Based Delivery Teams over Tasks , Leading Teams , Building Self-Organizing (Self-Disciplined) Teams , Participatory Decision Making

Module II

An Agile Project Management Model , An Agile Enterprise Framework , An Agile Delivery Framework The Envision Phase, Product Vision , Project Objectives and Constraints , Project Community

Module III

The Speculate Phase , Speculating on Product and Project , Product Backlog , Release Planning Advanced Release Planning , Release (Project) Planning , Wish-based Planning (Balancing Capacity and Demand) , Capabilities , Value Point Analysis

Module IV

The Explore Phase , Agile Project Leadership , Iteration Planning and Monitoring , Coaching and Team Development, Collaboration and Coordination, The Adapt and Close Phases ,Adapt , Product, Project, and Team Review and Adaptive Action

References:

1. Highsmith, J. (2010). Agile project management: Creating innovative products (2nd ed.). Addison-Wesley.
2. Shore, J., & Warden, S. (2008). The art of agile development. O'Reilly Media.
3. Martin, R. (2003). Agile software development: Principles, patterns, and practices. Prentice Hall.
4. Cohn, M. (2010). Succeeding with agile: Software development using Scrum. Addison-Wesley.
5. Cockburn, A. (2006). Agile software development (2nd ed.). Addison-Wesley

19-204-0709 Game Design

Course Outcomes:

On completion of the course, students will be able to:

1. Understanding of game programming, game design principles, gaming engine design and gaming frameworks.
2. Apply on basic gaming platforms and frameworks.
3. Design 3D graphics principles and animation techniques
4. Create interactive games.

Module I

3D Graphics for game programming: Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics based Simulation

Module II

Game design principles: Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding

Module III

Gaming engine design: Renderers, Software Rendering, Hardware Rendering, and Controller based animation,Spatial Sorting, Level of detail, collision detection, standard objects, and physics

Module IV

Gaming platforms and frameworks: Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines, Adventure Game Studio, DXStudio, Unity GAME DEVELOPMENT Developing 2D and 3D interactive games using OpenGL, DirectX Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

References:

1. Eberly, D. (2006). 3D game engine architecture engineering real time applications with Wild Magic (2nd ed.). Morgan Kaufman.
2. Han, J. (2011). 3D graphics for game programming. Chapman and Hall/CRC.
3. McShaffry, M. (2009). Game coding complete (3rd ed.). Course Technology Cengage Learning.
4. Adams, E., &Rollings, A. (2010). Fundamentals of game design (2nd ed.). New Riders.
5. Pedersen, R. (2009). Game design foundations.(2nd ed.) Wordware Pub.
6. Rogers, S. (2014). Level up! the guide to great video game design (2nd ed.). Hoboken: Wiley.
7. Gregory, J. (2009). Game engine architecture. Wellesley, Mass.: A K Peters.
8. Novak, J. (2005). Game development essentials: An introduction. Thomson/Delmar Learning.

19-204-0710 Multimedia Computing

Course Outcomes:

On completion of this course the student will be able to:

1. Familiarize with the common computing fundamentals employed in a variety of multimedia applications.
2. Learn different compression principles, different compression techniques, different multimedia compression standard.
3. Learn the characteristics of multimedia database and how to manage it.
4. Design and develop multimedia systems according to the requirements of multimedia applications

Module I

Introduction to Multimedia media and Data streams properties of a multimedia system, Data streams characteristics information unit,s Multimedia Hardware platforms Memory and storage devices, Input and output devices, Multimedia software tools.

Module II

Multimedia Building blocks Audio: Basic sound concepts, Music speech audio file formats, Images and graphics: Basic concepts, computer image processing, Video and Animation: Basic concepts, Animation techniques.

Module III

Data compression: Storage space and coding requirements, source entropy and Hybrid coding Basic compression techniques, JPEG, H.261, MPEG, DVI, Multimedia Database systems, Characteristics of Multimedia Database Management system, data analysis, Data structure operations on data, Integration in a database Model.

Module IV

Multimedia Documents, Hypertext and Hypermedia document architecture, SGML, Document architecture, ODA, MHEG. Multimedia applications: Introduction Media, Preparation Media, composition Media, Integration Media, communication Media, consumption Media entertainment trends

References:

1. Steinmetz, R., &Nahrstedt, K. (1995). Multimedia: Computing, communications, and applications. Prentice Hall.
2. Parekh, R. (2006). Principles of multimedia. Tata McGraw Hill. New Delhi.
3. Buford, J. (1994). Multimedia systems/Ed.[by] J.F.K. Buford. Addison Wesley.
4. Vaughan, T. (1996). Multimedia: Making it work (3rd ed.). Osborne/McGraw Hill

19-204-0711 Mobile Data Management

Course Outcomes:

On completion of this course, students will be able to

1. Learn basics of mobility, location and handoff management.
2. Design database technologies in mobile data management.
3. Apply transaction management in database systems.
4. Illustrate mobile database recovery and information broadcast.

Module I

Mobile Database System Introduction, Types of Mobility. Wireless Network Communication Introduction, Continuous Connectivity. Location and Handoff Management.

Module II

Fundamentals of Database Technology, Conventional Database, Architecture Database, Processing Serialization of Transactions, Advanced Transaction Models. Effect of Mobility on the management of Data

Module III

Mobile Transaction, Model Execution, Model Based on ACID Transaction Framework, Pre write Transaction Execution Model, Data Consistency in Intermittent Connectivity, The Consistency Model, Weak Connectivity Operation, A Consistency Restoration Schema, Concurrency Control Mechanism, Commitment of Transactions.

Module IV

Mobile Database Recovery, Introduction, Log Management in Database Systems, Mobile Database Recovery Schemes. Wireless Information Broadcast, Introduction, Broadcast Disk, Broadcast Infrastructure, Exponential Index, Location Based Indexing on Demand Data Scheduling, Data Dissemination System.

References:

1. Mobile Database Systems by Vijay Kumar, Wiley Publication.
2. Data Management for Mobile Computing by Evaggelia Pitoura, George Samaras, Kluwer Academic Publishers.

19-204-0712 Computer Graphics Laboratory

Course Outcomes:

On completion of this course the student will be able to :

1. Implement image manipulation and enhancement.
2. Create animations.
3. Develop applications using GPU.
4. Create 3D graphical scenes using open graphics library suites.

A: Implement the Exercises Using C / OpenGL / Java

1. Implementation of Algorithms for drawing 2D Primitives
    a. Line (DDA, Bresenham) all slopes
    b. Circle (Midpoint)
2. 2D Geometric transformations
    a. Translation
    b. Rotation
    c. Scaling
    d. Reflection
    e. Shear
    f. Window Viewport
3. Clipping

B: Implement the Exercises Using OpenGL

4. 3D Transformations, Translation, Rotation, Scaling
5. 3D Projections Parallel, Perspective
6. Creating 3D Scenes
7. 2D Animation To create Interactive animation using any authoring tool

C: Develop Applications Using GP GPU

8. Load the GP GPU processor device with 10,000 random numbers, sort them using CUDA program and, get the sorted output on the host machine and print the output.

References :

1. Hearn, D., & Baker, M. (2011). Computer graphics with OpenGL (4th ed., International ed.). Upper Saddle River, N.J.: Pearson Education.
2. Hughes, J. (2013). Computer graphics: Principles and practice (3rd ed.). Addison Wesley.
3. Hill, F., & Kelley, S. (2007). Computer graphics: Using OpenGL (3rd ed.). Upper Saddle River, NJ: Pearson Prentice Hall

19-204-0713 Mini Project - Multimedia Project

Course Outcomes:

On completion of this course the student will be able to :

1. Use current techniques, skill and tools necessary for animation, Frame and Video Capturing and special Effects Authoring and Presentation and will be able to work in a team in the atmosphere of a professional industry.
2. Implement Multimedia project involving Interactive Computer Graphics technology, working with audio and video capturing.

Projects can be done using software's like Blender with Python scripting, OpenCV, Kinect, OpenGL, DirectX etc.

The projects can be of any of the following type.

1. Development of Augmented Reality in the areas like education, marketing, advertisement in magazines, movies, astronomy, map, navigator, 3D games, weather condition, Healthcare etc.
2. Development of Virtual Reality in the areas like Military, Education, Healthcare, Entertainment, Fashion, Business, Scientific visualization, Construction, Film, Telecommunication etc.
3. Motion Capturing in Interactive Graphics
4. Lossless and Lossy Media Encoding and Compression
5. Development of media player in multimedia framework like gstreamer, ffmpegetc
6. Real Time communication using media and IP streaming

Increment 1: Determine the Objective

- Perform and document System requirement analysis and Software requirement analysis activities.
- Description of the expected software features, constraints, interfaces and other attributes.
- Prepare the Software Requirements Specifications (SRS) to document the agreed requirements; to provide the basis for design; to provide the basis for system test

Increment2: Design the application

- Description of how the software will meet the requirements. Also describes the rationale for design decisions taken.
- Design document including database design, UI design, Data definition, Manifest file as appropriate to the work.
- Prepare the Software Design Description (SDD) to document the design and design decisions in order to provide the basis for implementation and unit test.
- Description of the plan and specifications to verify and validate the software and the results.
- Prepare the Software Test Documentation (STD) to document how the software will be tested, and record the results.

Increment 3: Develop and refine the application

- Create the application using the chosen languages, databases and platform.
- Test the application using the test document
- Demonstrate the application.

19-204-0714 Entrepreneurship Development

Course Outcomes:

On completion of this course, students will be able to :

1. Develop awareness about the importance of entrepreneurship opportunities available in the society
2. Get acquainted with the challenges faced by the entrepreneur

Exercises:

1. To study the types of entrepreneurs and the factors affecting entrepreneurial growth.
2. To make an assessment of the major motives influencing an entrepreneur
3. To make an overview of the various stress management techniques
4. How to identify and select a good business opportunity?
5. Preparation of a techno economic feasibility report for a given project
6. Preparation of a preliminary project report for a given project
7. To identify the various sources of finance and management of working capital
8. Carry out the costing and break even analysis of a proposed project
9. Preparation of a PERT / CPM chart for the various activities involved in a project
10. To make a study of the various causes and consequences of sickness in small business and identify corrective measures.

References:

1. Roy, R. (2011). Entrepreneurship (2nd ed.) Oxford University Press. Oxford.
2. Gordon, E., & Natarajan, K. (2009). Entrepreneurship development. Himalaya Pub. House. India.
3. Coulter, M. (2001). Entrepreneurship in action. Prentice Hall. Upper Saddle River, N.J.
4. Jain, P. (1998). Handbook for new entrepreneurs. Oxford University Press. Delhi.
5. Khanka, S. (2010). Entrepreneurial development S.S. Khanka. S.Chand&.Co, New Delhi, India.

19-204-0715 Project Phase I

Course Outcomes:

On completion of this course a student will be able to:

1. Conduct literature survey in a relevant area of one's course of study and finally identify and concentrate on a particular problem.
2. Formulate a project proposal through extensive study of literature and / or discussion with learned resource persons in industry and around.
3. Generate a proper execution plan of the project work to be carried out in Phase II through thorough deliberations and improve presentation skills
4. The major project work shall commence in the seventh semester and completed by the end of eighth semester. Students are expected to identify a suitable project and complete the analysis and design phases by the end of seventh semester.

Each batch comprising of 3 to 5 students shall identify a project related to the curriculum of study. At the end of the semester, each student shall submit a project synopsis comprising of the following.

1. Application and feasibility of the project
2. Complete and detailed design specifications.
3. Block level design documentation
4. Detailed design documentation including circuit diagrams and algorithms / circuits
5. Bill of materials in standard format and cost model, if applicable
6. Project implementation action plan using standard presentation tools

Guidelines for evaluation:

1. Attendance and Regularity	10
2. Quality and adequacy of design documentation	10
3. Concepts and completeness of design	10
4. Theoretical knowledge and individual involvement	10
5. Quality and contents of project synopsis	10
Total	50 Marks

Note:

Points (1)-(2) to be evaluated by the respective project guides and project coordinator based on continuous evaluation.

Points (3)-(5) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.

19-204-0716 Industrial Internship

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

1. Acquire insights into tasks and problems which are usually not experienced in an academic environment.
2. Get an exposure to real world professional activities, which will help them to gain better understanding of their academic curriculum contents.
3. Work with various groups of professionals, managers, technicians etc.
4. Polish their engineering skills by applying knowledge in trouble shooting, software development, software maintenance etc.
5. Building relations with academic institutions and industry that will help mutual cooperation in long term.
6. Appreciate their social and ethical responsibilities.

Every student shall undergo an internship programme of minimum 2 weeks duration in an IT industry / Public Sector Organization.

Industrial Internship of a minimum duration of 2 weeks must be completed after 4th Semester and before commencement of 7th Semester. The evaluation of internship will be conducted along with Project Phase I.

19-204-0801 Financial Management and E-banking

Course Outcomes:

On completion of this course the student will be able to:

1. Acquire the knowledge of Accounting concepts and Conventions; Preparation of Journal, Ledger, Trial Balance and Balance sheet
2. Acquire the knowledge of Cost Accounting, Classification of Cost, Material Pricing like LIFO, FIFO etc, and Marginal Costing.
3. Acquire the meaning, importance of Funds Flow Statement, changes in working Capital.
4. Acquire knowledge in E banking – changing dynamics in Banking industry

Module I

The basic Accounting concepts, Accounting terms, Book keeping, difference between Book keeping and accounting Double entry system, Preparation of Journal entries, thorough American Approach(modern Approach), Preparation of Ledger Accounts, Balancing of Ledger Accounts. Preparation of Final Accounts, Trading, Profit and Cost Accounts and Balance sheet. Adjustments in Final Accounts regarding outstanding expenses, Depreciation, Prepaid expenses, accrued incomes, Treatment of Bad debts and provision for Bad debts, Closing stock etc.

Module II,

Cost Accounting, Concepts, meaning, Classification of Cost, Preparation of Cost sheet, Material Pricing: LIFO, FIFO, Marginal Costing and Break Even Analysis

Module III

Funds Flow Statement–Meaning, importance, Definition of Funds and Flow, Sources and uses of Funds, Schedule of changes in Working Capital, Funds from operation and its calculation, preparation of Funds flow statement

Module IV

E-banking changing Dynamics in banking industry Home Banking meaning, Home Banking implementation, Approaches, Banking via PC using Dial up Software, Banking via online services, Banking via the web: Security First Network Bank. Management issues in online banking, Pricing issues in online banking, Marketing issues in online banking.

References:

1. Dhameja, N., Sastry, K., &Dhameja, K. (2014). Finance and accounting for managerial competitiveness (Revised and enlarged ed.). S. Chand & Company. New Delhi
2. Brigham, E., & Houston, J. (2004). Fundamentals of financial management (10th ed.).Thomson/South Western. Mason, Ohio.
3. Shukla, M., & Grewal, T. (1967). Advanced accounts, (6th rev. and enl. ed.).S. Chand. Delhi.
4. Kalakota, R., &Whinston, A. (1997). Electronic commerce: A manager's guide. Addison Wesley.Reading, Mass.
5. Khan, M., & Jain, P. (2000). Theory and problems in financial management (2nd ed.). Tata McGraw Hill. New Delhi.

19-204-0802 Block Chain Technology

Course Outcomes:

On completion of this course the student will be able to:

1. Understand emerging abstract models for Block chain Technology
2. Familiarise the functional/operational aspects of cryptocurrency
3. Understanding of the function of Block chain as a method of securing distributed ledgers,
4. Apply Hyperledger Fabric and Ethereum platform to implement the Block chain Application.

Module 1

Introduction to Blockchain: Brief History of Blockchain, Decentralization, Ledgers, Distributed Ledgers and Consensus, Public and Private Ledgers.

Algorithms & Techniques:Cryptography, Hash Functions, Public Key Cryptography and Digital Signing, Blocks and Blockchain, Chain, Nodes and Network.

Module II

Blockchain Design Principles: Blockchain Structure, Basic Operations, Networked Integrity, Distributed Power, Security, Privacy, Rights Preserved, Inclusion.

Trust Framework and Consensus Mechanisms, Public, Consortium, Private Blockchains, Blockchain Interoperability

Module III

Ethereum Blockchain: Ethereum Structure, Ethereum Operations, Smart Contracts. Crypto currency Tokens, Wallets and the Marketplaces, Implications on Traditional Businesses.

Module IV

Blockchain-Recent Trends – Hyperledger, Corda. Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems and Agriculture sectors

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

2. Mastering Blockchain: Deeper Insights Into Decentralization, Cryptography, Bitcoin, And Popular Blockchain Frameworks,

3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

4. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048)

5. 3 R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017

19-204-0803 Robotic Process Automation

Course Outcomes:

On completion of this course the student will be able to:

1. Understand Robotic Process Automation technology.
2. Apply UiPath programming techniques to deploy robot configurations.
3. Learn Robotic Process Automation with Blue Prism.
4. Apply different technologies to Robotic Processing.

Module I

What is Robotic Process, Automation Scope and techniques of automation, Lifecycle of RPA, Robotic process automation, RPA platform,s Advantages of Robotic Process Automation, Myths of RPA, Desktop RPA, Introduction to RPA tools: I path, Blue Prism,Work Fusion

Module II

UiPath Record and Play UiPath stack, Learning UiPath Studio Sequence, Flowchart, and Control Flow. Sequencing the workflow Activities Control flow, various types of loops, and decision making, Examples

Module III

Data Manipulation Variables and scope, Collections Arguments Purpose and use, Data table usage with examples, Clipboard management, File operation with example.

Taking Control of the Controls, Finding and attaching windows, Finding the control Techniques for waiting for a control, Act on controls, mouse and keyboard activities, Working with UiExplorer Handling events, Recorder Screen Scarping, OCR.

Tame the Application with Plugins and Extensions, Terminal plugin, SAP automation, Java plugin, Citrix automation, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management, Extensions Java, Chrome, Firefox, and Silverlight

Module IV

Robotic Process Automation with Blue Prism, An Overview of Blue Prism, The Technology of Blue Prism, Creating Blue Prism Applications: Business Objects, Creating Blue Prism Applications: Processes, Deploying Blue Prism Applications, Managing Blue Prism Applications, Securing Blue Prism Applications.

References:

1. Alok Mani Tripathi, “Learning Robotic Process Automation”
2. Frank Casale, “Introduction to Robotic Process Automation”
3. Vaibhav Jain, “Crisper Learning: For Blue Prism”
4. Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide”

19-204-0804 Service Oriented Architecture

Course Outcomes:

On completion of this course the student will be able to

1. Design, develop and test Web services.
2. Learn standards related to Web services: Web Services Description Language (WSDL)
3. Learn basic principles of Service Oriented Architecture and apply these concepts to develop a sample application
4. Learn and evaluate emerging and proposed standards for the main components of Web services architecture.

Module I

SOA basics: Roots of SOA Characteristics of SOA, Comparing SOA to client server and distributed internet architectures Anatomy of SOA How components in an SOA interrelate, Principles of service orientation Service Layers.

Module II

XML and web services: XML structure Elements Creating Well formed XML, Namespaces Schema Elements, Types, Attributes XSL Transformations Parser, Web Services Overview Architecture.

Module III

WSDL, SOAP and UDDI: WSDL, Overview Of SOAP, HTTP, XML, RPC, SOAP: Protocol Message, Structure Intermediaries, Actors Design, Patterns And Faults, SOAP With Attachments, UDDI.

Module IV

SOA in J2EE and .NET: SOA platform basics, SOA support in J2EE, Java API for XML based web services (JAX WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR), Java API for XML based RPC (JAX RPC), JAX RS, SOA support in .NET ASP.NET web services.

References:

1. Erl, T. (2006). Service oriented architecture: Concepts, technology, and design. Pearson Education.
2. Bieberstein, N., Bose, S., Fiammante, M., Jones, K., & Shah, R. (2006). Service oriented architecture compass business value, planning, and enterprise roadmap. IBM Press.
3. Carter, S. (2007). The new language of business: SOA & Web 2.0. IBM Press/Pearson.
4. Erl, T. (2004). Service oriented architecture: A field guide to integrating XML and Web services. Prentice Hall Professional Technical Reference.
5. Chappell, D. (2004). Enterprise service bus. O'Reilly.
6. Weerawarana, S., Curbera, F., Leymann, F., Storey, T., & Ferguson, D. (2005). Web services platform architecture: SOAP, WSDL, WS Policy, WS Addressing, WS BPEL, WS Reliable Messaging, and more. Prentice Hall PTR.
7. Newcomer, E., &Lomow, G. (2005). Understanding SOA with Web services. Addison Wesley.

19-204-0805 Cyber Laws & Information Security

Course Outcomes:

On completion of this course the student will be able to:

1. Make aware of various security threats in computing, database, network etc.
2. Get an idea on various Cryptographic techniques to secure the data.
3. Understand the basic security measures in networking.
4. Make aware of the existing Cyber laws and Acts on information security.

Module I

Security Problem in Computing: Characteristics of computer intrusion, Attacks, Computer Criminals

Program Security: Viruses and Other Malicious Code, Targeted Malicious Code, Controls against Program Threats

Module II

Cryptography: Terminology and Background, Substitution Ciphers, Transpositions, Characteristics of good Encryption Algorithms, Data Encryption Standard, AES Encryption Algorithm, Public Key Encryption, The Uses of Encryption

Module III

Data and Networking Security: Security Requirements, Reliability and Integrity, Sensitive Data, Inference

Security in Networks: Threats in Networks, Network Security Controls,
Firewalls

Module IV

Security Policies and Cyber Laws: Need for an Information Security Policy, Information Security Standards, ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the IT Act 2000, Intellectual Property Issues, Overview of Intellectual Property Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License

References:

1. Pfleeger, C. (2006). Security in computing (4th ed.). Prentice Hall PTR.
2. Tripathi,S. Goel,R. & Shukla,P. Introduction to Information Security and Cyber Laws.Wiley India.
3. Pachghare, V.(2008). Cryptography and Information Security Prentice Hall India.
4. Stallings, W. (1999). Cryptography and network security: Principles and practice (2nd ed.). Prentice Hall.
5. Chander, H. (2012). Cyber Laws And It Protection. PHI Learning Pvt. Ltd

19-204-0806 Software Quality and Testing

Course Outcomes:

On completion of this course the student will be able to

1. Understand the fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
2. Understand about software quality management.
3. Analysis different types of testing.
4. Evaluate the techniques and skills on how to use modern software testing tools to support software testing projects.

Module I

Quality Assurance Basics: Definition of Quality, Total Quality management. Four Dimensions of Quality: Specification Quality, Design Quality, Development Quality, Conformance Quality, Software Product Quality: white box standpoint vs functionality standpoint, Program Quality

Module II

Quality Assurance department: Role, position, organisation and staffing. Software Verification: walkthrough, inspections, audits, process. Validation: Definition, software designs, product specification, software product. Familiarization with testing tools like Selenium.

Module III

Principles of Testing, Software Development Life Cycle Models. Types of Testing: White Box Testing, Black Box Testing, Integration Testing, System and Acceptance Testing, Performance Testing, Regression Testing, Internationalization (I18n) Testing, Ad hoc Testing, Usability and Accessibility Testing

Module IV

People and organizational issues in testing: Common People Issues, Organization Structures for Testing Teams, Test Planning, Management, Execution, and Reporting. Test Management and automation: Software Test Automation, Test Metrics and Measurements

References:

1. Murali Chemuturi J. (2010). Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers. Ross Publishing.
2. Srinivasan Desikan, Gopalaswamy Ramesh. (2006). Software Testing: Principles and Practices. Addison Wesley Professional.
3. Dorothy Graham, Erik Van Veenendaal, Isabel Evans. (2008). Foundations of Software Testing: ISTQB Certification. Cengage Learning EMEA.
4. Boris Beizer .(2003). Software Testing Techniques. Dreamtech Press.
5. Glenford J. Myers, Corey Sandler, Tom Badgett, Todd M. Thomas. (2004). The Art of Software Testing. John Wiley & Sons.
6. Jeff Tian.(2009). Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement. John Wiley & Sons.
7. Stephen H. Kan. (2003). Metrics and Models in Software Quality Engineering. Addison Wesley Professional,.

19-204-0807 Electronic Business and Services

Course Outcomes:

On completion of this course the student will be able to:

1. Explain the various E-business models, trends and practices
2. Acquire knowledge in e Marketplaces.
3. Discuss modern computing infrastructures from the perspective of the internet and organisations
4. Discuss and explain theoretical and practical issues of conducting business over the internet and the Web

Module I

E-Commerceto E-Business: Defining E-business, development of new economy, Types of e business. E-business markets and models, E-business environment, market places, models, Types of E-business models, Framework for analyzing E-business.

E-Business Trend Spotting: Increase Speed of Service, Self Service, Provide Integrated Solutions, Integrate Sales and Service, Customization and Integration, Customer Service Consistent and Reliable, Service Delivery, Contract Manufacturing, Increase Process Visibility, Employee Retention, Integrated Enterprise Applications, Multichannel Integration

Module II

E-Business Design: Technology, Constructing an E-Business Design, Self Diagnosis, Reversing the Value Chain, Choosing a Narrow Focus, Case Study

E- Business Architecture: Functional Integrated Apps, Integrating Application Clusters into an E- Business Architecture, Aligning the E- Business Design with Application Integration.

Module III

Customer Relationship Management: Integrating Processes to Build Relationships, Customer Relationship Management, Definition, Organizing around the Customer, CRM Architecture, CRM Infrastructure, Implementing CRM, CRM Trends, Building a CRM Infrastructure

Selling Chain Management: Transforming Sales into Interactive Order Acquisition, Defining Selling Chain Management, Business Forces Driving the Need for Selling, Technology Forces Driving the Need for Selling, Managing the Order Acquisition Process. Enterprise Resource Planning: The E-Business Backbone, ERP Decision, Enterprise Architecture Planning, ERP Implementation.

Module IV

Supply Chain Management: Inter enterprise Fusion, Defining Supply Chain Management, Basics of Internet Enabled SCM, E-Supply Chain Fusion, Management Issues.

E Procurement: The Next Wave of Cost Reduction, Isolated Purchasing to Real Time Process Integration, Operating Resource Procurement, Lack of Process Integration. Business Intelligence: Introduction to Knowledge Management Applications and BI.

References:

1. Kalakota, R., & Robinson, M. (2001). E business 2.0: Roadmap for success.Addison Wesley. Boston, MA.

2. Combe, C. (2006). Introduction to e business management and strategy. Butterworth Heinemann. Amsterdam.

3. Almeida, V. (2000). Scaling for e business: Technologies, models, performance, and capacity planning. Prentice Hall PTR.
4. Deitel, H., & Deitel, P. (2001). The complete e business & e commerce programming training course. Prentice Hall.

19-204-0808 Randomized Algorithms

Course Outcomes:

On completion of this course the student will be able to

1. Understand randomized algorithms.
2. Cover: moments and deviations; randomized graph algorithms; Chernoff bounds and their applications; randomized data structures; hashing; martingales; the probabilistic method; Markov chains and random walks
3. Explain the difference between a randomized algorithm and an algorithm with probabilistic inputs
4. Apply randomized algorithms to graph theory.

Module I

Tools and Techniques: Introduction: Min cut algorithm, Binary Planar partitions, Probabilistic Recurrence, Computation Model and Complexity. Game theoretic techniques: Game tree evaluation, Minimax principle, randomness and non uniformity

Module II

Moments and deviations: Occupancy problems, Markov and Chebyshev inequalities, Randomized selection, two point sampling, Stable marriage problem, coupon collector's problem. Tail inequalities: Chernoff bound, Routing in parallel computer

Module III

The probabilistic method: maximum stability, expanding graphs, Lovasz Local Lemma, Conditional probabilities. Markov chains and random walks: Markov chains, Random walk in graphs, graph connectivity, expanders and rapidly mixing random walks

Module IV

Applications: Data structures: Heaps

Graph algorithm: all pairs shortest paths, min cut problem, minimum spanning trees

References:

1. Rajeev Motwani, Prabhakar Raghavan.(1995). Randomized Algorithms. Cambridge University Press.
2. Michael,M., Upfal,E. (2005). Probability and Computing: Randomized Algorithms and Probabilistic Analysis. Cambridge University Press.
3. Hromkovic,J. (2006). Design and Analysis of Randomized Algorithms: Introduction to Design Paradigms Springer Science & Business Media.
4. Cormen,T.H. (2009). Introduction to Algorithms. MIT Press.
5. Oleg Granichin, Zeev Vladimir Volkovich, Dvora Toledano Kitai. (2014).Randomized Algorithms in Automatic Control and Data Mining. Springer.

19-204-0809 Cognitive Computing

Course Outcomes:

On completion of this course, students will be able to:

1. Understand the fundamentals of human cognition and machine cognition.
2. Analyze the different design principles of cognitive systems.
3. Understanding how advanced technologies integrated with cognitive systems
4. Understand the basics of cognitive analytics

Module I

Introduction**:** Artificial Intelligence and Cognitive Computing. Understanding cognition, Two systems of Judgement and choice Automatic thinking: Intuition and Biases, Controlled Rule–Centric and concentrated effort. Understanding complex relationship between systems, Elements of Cognitive Systems. Cognitive Applications.

Module II

Design Principles: Components of Cognitive Systems. Bringing Data into Cognitive Systems, Leveraging Internal and External Data Sources, Data access and Feature extraction services. Machine Learning: Finding Patterns in the Data, Hypothesis Generation and Scoring.

Module III

Cognitive Systems: Natural Language Processing and Cognitive Systems, Role of NLP in Cognitive Systems, Semantic Web. Relationship between Big Data and Cognitive Computing. Role of Cloud and Distributed Computing in Cognitive Computing.

Module IV

Cognitive Analytics: Applying advanced analytics to cognitive computing, Key capabilities in advanced analytics, Relationship between Statistics, Data Mining and Machine Learning. Machine Learning in Analytics process. Predictive analytics, Text analytics, Image analytics, Speech analytics. Using Advanced analytics to create Value, Building Value with in memory capabilities. Impact of Open Source Tools on Advanced Analytics.

References :

1. David Vernon.(2014). Artificial Cognitive Systems: A Primer. The MIT Press.
2. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles. Cognitive Computing and Big Data Analytics.
3. Mark Watson. (2017). Introduction to Cognitive Computing: A Guide for Individuals and Small Organizations.
4. Vijay V Raghavan, Venkat N. Gudivada. Cognitive Computing: Theory and Applications

19-204-0810 Design Thinking

Course Outcomes:

On completion of this course, students will be able to:

1. Develop a thorough, hands on understanding of the design thinking innovation an experimentation approach.
2. Understand how design integrates with strategy, architecture and agile to develop a complementary learn fast and scale fast set of toolkits and skills that can be used in any part of the organization
3. Apply Design Thinking techniques when starting a new product or service
4. Identify the Design Thinking stages: Comprehension, Ideation, Prototyping, Evaluation

Module I

Overall approach to Design Thinking**:** Definitions of Design Thinking, "Design" in Design Thinking, The 3 phases of Design Thinking.

Module II

Data Collection: Introduction to “How Might We?” question, The challenge definition and its scope, Type of data, Value Analysis, Qualitative and primary data collection.

Module III

Data Analysis: Formatting the data: Journey mapping and personas, Insight Emergence, Synthesis of the inspiration phase, Design personae, Examples of Personae and Journey maps, Identify extreme users, Criteria for insights .

Module IV

Ideation: Ideas generation, rules for ideas generation, tips for ideas generation and fixation effect. Implementation: Assumptions Identification, Principles for prototyping. Organizational setting for Design Thinking: Diffusion of Design Thinking, Diffusion of Design Thinking, A cognitive explanation, Diffusion of Design Thinking, A team perspective, How Design Thinking is adopted in firms, Where Design Thinking is hosted within firms, Performance indicators, Key Success Factor.

References:

1. Nigel Cross.(2011).Design Thinking: Understanding How Designers Think and Work. Bloomsbury Academic
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Value.(2009).
3. Roger L. Martin.(2009). The Design of Business: Why Design Thinking is the Next Competitive Advantage. Harvard Business Review Press
4. TimBrown. (2009). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation.

19-204-0811 Soft Skills and Integral Development

Course Outcomes:

On completion of this course, students will be able to

1. Develop realistic perspective of work and work expectations.
2. Formulate problem solving skills, to guide students in making appropriate and responsible decisions.
3. Create a desire to fulfill individual goals
4. Develop productive thinking, self defeating emotional impulses, and self defeating behaviors.

Module I

Introduction, Need for Communication, Process of Communication, Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication Intercultural, Intra cultural, Cross cultural and International communication Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

Module II

Individual Interaction and skills, Basic Interaction Skills –Within family, Society Personal and interpersonal intrapersonal skills, Types of skills; conceptual, supervisory, technical, managerial and decision making skills, Problem Solving, Lateral Thinking Self Awareness and Self Esteem Group Influence on Interaction Skills, Human relations examples through role –play and cases

Module III

Leadership Skills Working individually and in a team Leadership skills: Leadership Lessons through Literature Teamwork & Team building Interpersonal skills –Conversation, Feedback, Feed forward Interpersonal skills –Delegation, Humour, Trust, Expectations, Values, Status, Compatibility and their role in building team –work Conflict Management –Types of conflicts, how to cope with them Small cases including role –plays will be used as teaching methodology.

Module IV

Negotiation Skills: Types of Negotiation, Negotiation Strategies, Selling skills –Selling to customers, Selling to Superiors, Selling to peer groups, team mates & subordinates, Conceptual selling, Strategic selling, Selling skills –Body language

References:

1. Goleman, D. (1995). Emotional intelligence: Why it can matter more than IQ, New York: Bantam Books
2. Stephen R Covey. (2001). 7 habits of highly effective people. Simon & Schuster Australia,
3. Devadas Menon. (2004). Stop sleep walking through life. Yogi Impressions,
4. Barun K Mitra. (2012). Personality Development and Soft Skills. Oxford University Press.
5. Carnegie, Dale. (2009). How To Win Friends and Influence People. New York: Simon & Schuster.
6. Subroto Bagchi. (2009) . Go kiss the world: Life lessons for the young professionals. Penguin Books India.

19-204-0812 Social Computing

Course Outcomes:

On completion of this course the student will be able to

1. Analyze computational models underlying social computing.
2. Understand social learning aspects of knowledge management, agents and social interaction.
3. Analyse security and identity in cyberspace.
4. Evaluate the services provided by social networks.

Module I

Social Influence and Human Interaction with Technology, Social and Human Elements of Information Security: A Case Study, Computer Mediated Communication, Learning Environments, Online Communities and Social Networking, IT and the Social Construction of Knowledge.

Module II

Social Learning Aspects of Knowledge Management, Agents and Social Interaction: Insights from Social Psychology Social Perception, Agent Based Modelling and Social Psychological Theory.

Module III

Cyber identities and Social Life in Cyberspace, Online Learning, Social Presence, Social Networking, Social Networking Analysis, Social Networking Services. Social Networks in information Systems: Tools and Services.

Module IV

Mobile Social Networks and Services, Social Software, Self Organization in Social Software for Learning, Mailing Lists and Social Semantic Web.

References:

1. Dasgupta, S. (2010). Social computing concepts, methodologies, tools and applications. Information Science Reference.
2. HLiu, H., Salerno, J., & Young, M. (2010). Social computing, behavioral modeling, and prediction. Springer.
3. Kamal, R. (2012). Mobile computing (2nd ed.). Oxford University Press.
4. Talukder, A., & Yavagal, R. (2007). Mobile computing: Technology, applications, and service creation. McGraw Hill.

19-204-0813 Research Methodology

Course Outcomes:

On completion of this course, students will be able to:

1. Get introduced to research philosophy and processes in general.
2. Formulate the problem statement and prepare research plan for the problem under investigation.
3. Apply various numerical /quantitative techniques for data analysis.
4. Communicate the research findings effectively.

Module I

Introduction: Concepts of Research, Meaning and Objectives of Research, Research Process, Types of Research, Criteria of Good Research, Research Problem Identifying and Defining, Research Proposals Types, contents, Sponsoring agency's requirements, Ethical aspects, IPR issues like patenting, copyrights etc.

Module II

Research Design Meaning, Need and Types of research design, Literature Survey and Review, Research Design Process, Measurement and scaling techniques, Data Collection concept, types and methods, Processing and analysis of data, Design of Experiments.

Module III

Quantitative Techniques Sampling fundamentals, Testing of hypothesis using various tests like ANOVA, Chi square test, Multivariate analysis, Applications of various statistical softwares.

Module IV

Computer Applications Pre writing considerations, Principles of Thesis Writing, Formats of Report Writing & Publication in Research Journals, Documentation and presentation tools LATEX, Microsoft Office with basic presentations skills, Use of Internet and advanced search techniques.

References :

1. Research Methodology: An Introduction for Science & Engineering Students', by Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
3. 'Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar, 2nd Edition
4. Research Methodology: Methods and Techniques', by Dr. C. R. Kothari, New Age International Publisher
5. Research Methodology, G.C. Ramamurthy, Dream Tech Press, New Delhi
6. 'Management Research Methodology' by K. N. Krishnaswamy, Appa Iyer Sivakumar & M. Mathirajan, Pearson Education.
7. Research Methodology: Methods and Techniques', by Dr. C. R. Kothari, New Age International Publisher
8. Research Methodology, G.C. Ramamurthy, Dream Tech Press, New Delhi
9. 'Management Research Methodology' by K. N. Krishnaswamy, Appa Iyer Sivakumar & Mathirajan, Pearson Education.

19-200-0814 CONSTITUTIONAL LAW

Course Outcomes:
On completion of this course the student will be able to:
1. Configure the preamble and fundamental rights.
2. Actuate the governance and functioning of constitutional functionaries.
3. Describe the functions of legislative bodies.
4. Decipher the judiciary system and its role in governance.

Module I: Introduction

Constitution Law – Constitutional Assembly Debates – Constitution of India – Basic Features of Indian Constitution – Preamble – Structure and Content of Indian Constitution

Module II: Fundamental Rights

Rights – Fundamental Rights – Definition of State – Fundamental Rights under Indian Constitution – Right to Equality – Untouchability – Title – Right to Life Cultural and Educational Rights of Minorities - Enforcement of Fundamental Rights

Module III: Directive Principles of State Policy & Fundamental Duties

DPSP's – Relationship between DPSP and Fundamental Rights – Conversion of DPSP into Fundamental Rights – Role of Judiciary – Judicial Activism – PIL - Fundamental Duties

Module IV: Constitutional Organs

Legislative Organs – Parliament – Lok Sabha, Rajya Sabha - State Legislatures - Executive Organs - President, Vice President, Council of Ministers - Judicial Organs – Supreme Court and High Courts – Other Constitutional Bodies – Election Commission - Comptroller and Auditor General of India, etc.

References:

1. Durga Das Basu, Introduction to the Constitution of India, 24th Edition. Prentice – Hall of India Pvt. Ltd. New Delhi, 2019.
2. D.C. Gupta, Indian Government and Politics, 8th Edition. Vikas Publishing House, 2018.
3. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes. Universal Law Publication, 2015.

19-204-0815 Seminar

Course Outcomes:

On completion of this course the student will be able to

1. Identify and familiarize with some of the good publications and journals in their field of study.
2. Acquaint oneself with preparation of independent reports, name them based on a central theme and write abstracts, main body, conclusions, and reference identifying their intended meaning and style.
3. Understand effective use of tools of presentation, generate confidence in presenting a report before an audience and improve their skills in the same.
4. Develop skills like time management, leadership quality and rapport with an audience.

Instructions

- Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Information Technology and trends.
- The references shall include standard journals, conference proceedings, reputed, magazines, and textbooks, technical reports, and URLs.
- The references shall be incorporated in the report following IEEE standards reflecting the state of the art in the topic selected.
- Each student shall present a seminar for about 30 minutes duration on the selected topic.
- The report and presentation shall be evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

19-204-0816 Project Phase II

Course Outcomes:

On completion of this course the student will be able to

1. Apply required theory and experiments on the problem related to industry/research identified in phase I and solve it.
2. Realize various steps involved in conducting a project work, like literature survey, methodology adopted field study / survey / experiments / numerical work, analysis of the data to arrive at final results and conclusions, etc.
3. Initiate a habit of proper report writing with all of its major components, proper style of writing and preparation of a distinct abstract and carved out conclusions.
4. Conceive the pros and cons of working in a team and the wonderful results which could evolve through team work.
5. Present and defend self prepared and corrected report (with the help of project guide) of a self created work to a peer audience

The project work commencing from the VII semester shall be completed and the project report shall be submitted by each student by the end of VIII semester. There shall be an internal examination of the project that includes a presentation, demonstration and oral examination of the project work.

Each batch of students shall develop the project designed during the VII semester. The implementation phase shall proceed as follows:

- A detailed algorithm level implementation, test data selection, validation, analysis of outputs and necessary trial run shall be done.
- Integration of hardware and software, if applicable, shall be carried out.
- A detailed project report in the prescribed format shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report.
- The work shall be reviewed and evaluated periodically.
- A committee consisting of the Project Coordinator (appointed by the Head of the Department/Division), Project guide and at least one senior faculty member will carry out the assessment based on at least one interim review and a final review just before the submission of the project report.
- The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide and shall include the following.
    1. Presentation of the work
    2. Oral examination
    3. Demonstration of the project against design specifications
    4. Quality and content of the project report

Guidelines for evaluation:

1. Attendance and Regularity	40
2. Work knowledge and Involvement	40
3. Semester End presentation and oral examination of completion and demonstration	40
4. Level of functionality/specifications	40
5. Project Report – Presentation style and content	40
Total	200 Marks

Note:
Points (1)-(2) to be evaluated by the respective project guides and project coordinator based on continuous evaluation.
Points (3)-(5) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.

19-204-0817 Comprehensive Viva Voce

Course Outcomes:

On completion of this course the student will be able to

1. Review all the subjects covered during the programme.
2. Gain good knowledge of theory and practice.
3. Develop oral communication skills and positive attitude.
4. Attend technical interviews with confidence.

Each student is required to appear for a viva voce examination at the end of the complete course work. The examination panel shall comprise of a minimum of one internal examiner and one external examiner, both appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field.