COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY

SCHEME & SYLLABUS
(I – VIII Semesters)

B. TECH
IN
ELECTRONICS & COMMUNICATION ENGINEERING

(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 H/W	T H/W	P/D H/W	C	Marks		Total
						CA	SEE	
19-200-0301*	Linear Algebra & Transform Techniques	3	1	0	3	40	60	100
19-203-0302	Computational Techniques for Electronics & Communication Engineering	3	1	0	3	40	60	100
19-203-0303	Network Theory	3	1	0	3	40	60	100
19-203-0304	Digital Electronics	3	1	0	3	40	60	100
19-203-0305	Solid State Electronics	3	1	0	3	40	60	100
19-203-0306	Electronic Circuits I	3	1	0	3	40	60	100
19-203-0307	Basic Electronics Laboratory	0	0	3	1	25	25	50
19-203-0308	Digital Electronics Laboratory	0	0	3	1	25	25	50
	TOTAL	**18**	**6**	**6**	**20**			

*Common to all branches

SEMESTER IV

Code No.	Subject	L H/W	T H/W	P/D H/W	C	Marks		Total
						CA	SEE	
19-200-0401*	Complex Variables and Partial Differential Equations	3	1	0	3	40	60	100
19-203-0402	Microprocessor Architecture	3	1	0	3	40	60	100
19-203-0403	Signals & Systems	3	1	0	3	40	60	100
19-203-0404	Digital System Design	3	1	0	3	40	60	100
19-203-0405	Communication Engineering I	3	1	0	3	40	60	100
19-203-0406	Electronic Circuits II	3	1	0	3	40	60	100
19-200-0407*	Universal Human Values	2	0	0	2	50	0	50
19-203-0408	Digital Systems & Programming Laboratory	0	0	3	1	25	25	50
19-203-0409	Electronic Circuits Laboratory I	0	0	3	1	25	25	50
	TOTAL	**20**	**6**	**6**	**22**			

*Common to all branches

SEMESTER V

Code No.	Subject	L H/W	T H/W	P/D H/W	C	Marks		Total
						CA	SEE	
19-200-0501	Numerical and Statistical Methods	3	1	0	3	40	60	100
19-203-0502	Electromagnetic Theory	3	1	0	3	40	60	100
19-203-0503	Communication Engineering II	3	1	0	3	40	60	100
19-203-0504	Analog & Integrated Circuits	3	1	0	3	40	60	100
19-203-0505	Digital Signal Processing	3	1	0	3	40	60	100
19-203-050**	Professional Elective I	3	1	0	3	40	60	100
19-203-0510	Digital Signal Processing Laboratory	0	0	3	1	25	25	50
19-203-0511	Electronic Circuits Laboratory II	0	0	3	1	25	25	50
	TOTAL	**18**	**6**	**6**	**20**			

19-203-0506 to 19-203-0509 Professional Elective – I	
Code No.	**Subject**
19-203-0506(IE)	Embedded Systems
19-203-0507	Power Electronics
19-203-0508	Advanced Digital System Design
19-203-0509	Probability and Random Process

SEMESTER VI

Code No.	Subject	L H/W	T H/W	P/D H/W	C	Marks		Total
						CA	SEE	
19-203-0601	Control Systems Engineering	3	1	0	3	40	60	100
19-203-0602	Microwave Techniques & Devices	3	1	0	3	40	60	100
19-203-0603	VLSI Design	3	1	0	3	40	60	100
19-203-0604	Information Theory & Coding	3	1	0	3	40	60	100
19-203-0605	Data Structures and Algorithms	3	1	0	3	40	60	100
19-203-06**	Professional Elective – II	3	1	0	3	40	60	100
19-203-0610	Electronic Product Design Project	0	0	3	1	25	25	50
19-203-0611	Communication Lab	0	0	3	1	25	25	50
	TOTAL	**18**	**6**	**6**	**20**			

19-203-0606 to 19-203-0609 Professional Elective – II	
Code No.	**Subject**
19-203-0606(IE)	FPGA based System Design
19-203-0607	Object Oriented Programming
19-203-0608	Optical Fiber Communication
19-203-0609	Electronic Measurements & Instrumentation

SEMESTER VII

Code No.	Subject	L H/W	T H/W	P/D H/W	C	Marks		Total
						CA	SEE	
19-203-0701*	Principles of Management	3	1	0	3	40	60	100
19-203-0702	Antennas & Propagation	3	1	0	3	40	60	100
19-203-0703	Digital Image Processing	3	1	0	3	40	60	100
19-203-07**	Professional Elective – III	3	1	0	3	40	60	100
19-203-07**	Open Elective I	3	0	0	3	40	60	100
19-203-0712	Microwave Engineering Lab	0	0	3	1	25	25	50
19-203-0713	Image Processing Lab	0	0	3	1	25	25	50
19-203-0714	Entrepreneurship Development	0	0	2	1	50	-	50
19-203-0715	Project Phase I	0	0	3	1	50	-	50
19-203-0716	Industrial Internship	0	0	0	1	50	-	50
	TOTAL	**15**	**5**	**10**	**20**			

*Common for CS/EC/EE/IT

19-203-0704 to 19-203-0707 Professional Elective – III	
Code No.	Subject
19-203-0704 (IE)	IoT System Design
19-203-0705	Satellite Communication
19-203-0706	Digital Integrated Circuit Design
19-203-0707	Adaptive Signal Processing

19-203-0708 to 19-203-0711 Open Elective – I	
Code No.	Subject
19-203-0708*	Universal Human Values- Undivided Society & Human Order
19-203-0709	Advanced Computer Architecture
19-203-0710	Mechatronics
19-203-0711	Intellectual Property Rights

*Common to EE/EC

SEMESTER VIII

Code No.	Subject	L H/W	T H/W	P/D H/W	C	Marks		Total
						CA	SEE	
19-203-0801	Wireless Communication	3	1	0	3	40	60	100
19-203-08**	Professional Elective IV	3	1	0	3	40	60	100
19-203-08**	Professional Elective V	3	1	0	3	40	60	100
19-203-08**	Open Elective II	3	0	0	3	40	60	100
19-203-0814	Seminar	0	0	3	1	50	-	50
19-203-0815	Project Phase II	0	0	12	6	200	-	200
19-203-0816	Comprehensive Viva Voce	-	-	0	1	-	50	50
	TOTAL	**12**	**4**	**14**	**20**			

19-203-0802 to 19-203-0805 Professional Elective – IV	
Code No.	Subject
19-203-0802	Computer Communication and Networking
19-203-0803	Radar Systems
19-203-0804	Neuro-Fuzzy Systems
19-203-0805	Low Power VLSI Design

19-203-0806 to 19-203-0809 Professional Elective – V	
Code No.	Subject
19-203-0806	Multimedia Communication System
19-203-0807	Electromagnetic Interference and Compatibility
19-203-0808	ASIC Design
19-203-0809	Industrial Electronics

19-203-0810 to 19-203-0813 Open Elective – II	
Code No.	Subject
19-203-0810	Memory and interconnects
19-203-0811	Introduction to Machine Learning
19-203-0812	Non-Conventional Sources of Energy
19-203-0813*	Self-awareness and Integral Development
19-200-0814	Constitutional Law

*Common to EE/EC

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.

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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 & TRANSFORM TECHNIQUES

Course Outcomes:

On completion of this course the student will be able to

1. Solve linear system of equations and to determine Eigen values and vectors of a matrix.
2. Exemplify 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. Erwin Kreyzig. (2010). *Advanced engineering mathematics*. (tenth edition). John Wiley & Sons, Hoboken, N.J
2. Grewal, B.S. (2013). *Higher engineering mathematics*. (forty third edition). Khanna Publishers, New Delhi.
3. Hsiung,C.Y and Mao, G. Y. (1999). *Linear algebra*. World Scientific, New Jersey.
4. Hoffman, K. and Kunze, R. (1971). *Linear algebra*. Prentice Hall of India, New Delhi.
5. Venkataraman, M. K. (1999). *Linear algebra*. The National Publishing Co, Chennai.

19-203-0302 COMPUTATIONAL TECHNIQUES FOR ELECTRONICS & COMMUNICATION ENGINEERING

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To learn graph theory and its representation.
2. To explain the concepts of expectation and conditional expectation and describe their properties.
3. To Formulate and solve the engineering problems involving random processes.
4. To understand the concepts of queueing theory.

Module I

Graph Theory: Finite and infinite graphs, paths and circuits. Trees and fundamental circuits, Cut- sets and Cut vertices Planar and Dual Graphs, Matrix representation of graphs, Applications.

Module II

Probability Theory Joint and Conditional probability, Bayes theorem. Random Variable - Definition, discrete and continuous, probability distribution and density, mass functions, Joint and conditional distributions Random variables, Multiple Random variables, Sum of Random variables

Module III

Expectation, Moments and moment generating functions, Inequalities, union bound, Markov, Chebyshev. Limit theorems, random vectors, mean and covariance. Random Processes - Stationary Processes, Ergodicity, linear systems, and correlation and power spectrum.

Module IV

Queuing theory: Introduction to Queues and Queueing Theory. Stochastic Processes, Markov Processes and Markov Chains, Birth-Death Process. Basic Queuing Theory (M/M/-/- Type Queues. Departure Process from M/M/-/- Queue, Time Reversibility, Method of Stages, Queues with Bulk Arrivals.

References:

1. Narsingh Deo, *Graph theory with applications to Engineering and computer science,* PHI (1994)
2. Stark, Woods, `` *Probability, Random Process*", PHI 2002
3. Sanjay K. Bose, *An Introduction to Queueing Systems,* Springer 2002.
4. Donald Gross, James M. Thompson, John F. Shortle and Carl W. Harris, *Fundamentals of Queueing Thoery*, Wiley 2008.

19-203-0303 NETWORK THEORY

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. Familiarize with the various signals, theorems and techniques associated with analysis of networks
2. Apply Laplace transforms to find out the steady state response and frequency response of linear circuits and systems.
3. Perform network characterization using various network parameters
4. Classify and design different filters
5. Synthesize different passive networks

Module I

Basic Circuit concepts: Circuit elements, Energy sources, Kirchhoff's Laws, Circuit Analysis - Source Transformation, Star-Delta Transformation, Mesh analysis, Nodal analysis; Network Theorems- Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer; Single Phase AC circuits – Sine Wave, R-L, R-C R-L-C circuits, Steady State AC analysis – Mesh, Nodal, Theorems, Resonance- Series and Parallel, Q Factor, Bandwidth, Magnification.

Module II

Transient Analysis: Initial conditions, DC response of RL, RC and RLC circuits, Rise and decay of current, Time constant. Laplace Transforms and its applications – Laplace transform of important Network functions, The transformed circuit in the S domain, Circuit Analysis using Laplace Transforms – RC, RL and RLC circuits with impulse, step, exponential, pulse and sinusoidal inputs. Network Functions: Driving Point Functions and Transfer function; S domain analysis - complex frequency, Significance of poles and zeros, Necessary conditions for poles and zeros, Time domain response from pole zero plot.

Module III

Two Port Networks: Characterization of two port networks using different parameters – Z, Y, Hybrid and Transmission parameters; Conditions for reciprocity and symmetry, Interrelation between parameters, Interconnections of two port Networks – Cascade, Series and Parallel, T π and Lattice representation of two port Networks, Terminated Two Port Networks. Filters: T and π network, Classification of Filters, Characteristic Impedance, Design of Constant K - Low Pass, High Pass, Band Pass & Band Reject Filters, Design of m derived Low Pass and High Pass filters. Attenuators – Symmetrical and Asymmetrical, Equalizers – Two terminal and Four terminal.

Module IV

Network Synthesis: Hurwitz Polynomials, Properties of Hurwitz Polynomials, Routh-Hurwitz stability criterion, Positive Real Functions, Basic Philosophy of synthesis- removal of a pole at infinity, removal of a pole at origin, removal of conjugate imaginary poles, removal of a constant, Realization of LC, RC and RL Functions – Foster Form and Cauer Form.

Texts:

1. A Anand Kumar, Network Analysis and Synthesis, PHI, 1/e, (2019)
2. Ravish.R.Singh, Electrical Networks, Tata McGraw Hill, 6/e, (2010)

References:

1. W H Hayt, J E Kemmerly & S M Durbin, Engineering Circuit Analysis, Tata McGraw- Hill, 7/e, (2010)
2. Sudhakar and Shyam Mohan. S. Palli, Circuits and Networks: Analysis and Synthesis, Tata McGraw Hill, 4/e, (2010)
3. Matthew N O Sadiku, Sarhan M.Musa and Charles K Alexander, Applied Circuit Analysis, McGraw-Hill India, 1/e, (2014), ISBN-13:978-93-392-0444-0.
4. Smarajit Ghosh, Network Theory: Analysis and Synthesis, PHI, 6/e, (2010)
5. VanValken Berg, Network Analysis, PHI, 3/e, (2010).

19-203-0304 DIGITAL ELECTRONICS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand and apply Boolean postulates and minimisation techniques for digital solutions
2. To design and analyse various combinational circuits using basic gates ,MUX, PLA
3. To design and analyse various sequential circuits using basic gates / auxiliary devices
4. To develop hardware models of digital systems

Module I

Codes and Boolean Algebra : Binary arithmetic, Binary coded Decimal, Excess - 3 code, Gray Code. Error detection and correction: parity, 7 bit Hamming code . Boolean algebra - minimization of Boolean function using Karnaugh Map (up to 6 variables) and Quine - McClusky methods. Formation of switching functions from word statements, realisation using basic gates and universal gates.

Module II

Combinational circuits: Half adder, Full adder, Subtractor, Binary Parallel adder, Carry look ahead adder, BCD adder, multiplexer, demultiplexer, Basic decoder and encoder circuits. Implementation of simple combinational circuits using ROM and PLA.

Arithmetic circuits: Serial Adder, Difference between parallel adder and serial adder, Binary multiplication, Binary division circuits.

Module III

Sequential circuits: Flip-flops - RS /JK / T / D flip- flops, shift registers - counters - asynchronous and synchronous counters, Up-Down counter, Ring counter, Johnson counter - sequence generators - state table and diagrams.

Logic families: Standard logic levels - Current and voltage parameters - fan in and fan out - Propagation delay, noise consideration. TTL family NAND gate working principle, need for totem pole configuration- Transfer characteristics, Tri- state logic gate.

Module IV

Hardware modelling using HDL: Entity Declaration- Architecture Body- Basic Language Elements – Identifiers- Data Objects- Data Types. Behavioural Modelling: Process Statement- Variable Assignment Statement- Signal Assignment Statement- Wait Statement- If Statement - Case Statement- Null Statement- Loop Statement- Exit Statement- Next Statement- Dataflow Modelling: Concurrent Signal Assignment Statement- Concurrent versus Sequential Signal Assignment, Structural Modelling: Component Declaration- Component Instantiation. Modelling of Basic Binary Arithmetic Circuits.

References:

1. Taub & Schilling, *Digital Integrated Electronics*, Tata Mc Graw Hill,(2008), ISBN-13: 978-0-07-026508
2. Anand Kumar, *Fundamentals of Digital Circuits*, PHI learning, 2/e, (2010), ISBN: 978- 81-203-3679-7
3. Thomas L Floyd, *Digital Fundamentals*, Pearson, 10/e,(2011)
4. R P Jain, *Modern Digital Electronics*, Tata Mc Graw Hill, 4/e, (2009).
5. S Limaye, *VHDL – A Design Oriented Approach*,TMH,(2008),, ISBN: 10:0-07-064825-5
6. Gaganpreet Kaur, *VHDL basics to programming*, Pearson,(2011)

19-203-0305 SOLID STATE ELECTRONICS

Course outcome:
On successful completion of teaching –learning and evaluation activities, a student would
1. Have basic concepts of semiconductor physics
2. Have an insight into the theory of junctions and the working of various diodes
3. Understand the working of JFET and MOSFET
4. Understand the theory of BJT and its applications

Derivations only for discussion in class and assignments are to be open book problem solving based on reference text books

Module I
Carrier concentrations: Electrons and holes, Formation of Energy band, Effective mass, E-K diagram, The Fermi level, Carrier concentration at equilibrium, Direct and Indirect recombination of electrons and holes, Hall effect, Steady-state carrier generation, Quasi-Fermi levels. **Transport phenomena:** Drift and Diffusion of Carriers, Semiconductor in Equilibrium, Einstein Equation, Excess carrier generation and Recombination, carrier lifetime, Continuity and Diffusion equations, Haynes-Shockley experiment

Module II
P-n junctions:
Unbiased junction: Space Charge at a junction, Steady state condition, The Contact Potential, Depletion Region
Biased junction: Current at a junction, Carrier injection, Diode equation, reverse saturation current, diode characteristics, dynamic resistance, Junction breakdown phenomena, Time variation of stored charge, Reverse recovery transient, junction diode switching characteristics, P-N junction Capacitances
Other junction diodes: Metal-Semiconductor Junction, hetero junctions, Varactor Diodes, PIN diodes, Tunnel Diode, Current and Voltage in an illuminated junction, Photo Diode, Photo detector, Solar Cells, Light Emitting Diode

Module III
Bipolar Junction Transistor (BJT): Structure and basic operation, Charge transport and current in a BJT, Terminal currents, generalised biasing, Ebers-Moll Model, BJT switching: Turn-on and Turn-off transients, Base narrowing, BJT configurations, input and output characteristics of CE and CB.

Model IV
FET, MOSFET: Construction and Operation of FET, I-V Characteristics of FET, Pinch-off and Transconductance. MESFET, MOSFET, Band bending, Effect of bias voltage, Threshold voltage, accumulation, Depletion, Inversion, MOS Capacitor, CV characteristics, effects of real surfaces, work function difference, interface charge, Threshold voltage in MOSFET, I-V Characteristics of MOSFET

Reference:
1. “Solid State Electronic Devices” – Ben. G. Streetman,5/e, PHI ,ISBN 9788120318403
2. “Physics of Semiconductor Devices” – S. M. Sze, 3/e, Wiley India, ISBN 9788126517022
3. “Semiconductor Devices”- Jasprit Singh, 1/e, Wiley India, ISBN 81265 11028
4. “Semiconductor Physics and Devices” –Donald Neamen, TMH, 3/e, ISBN 9780072321074

19-203-0306 ELECTRONIC CIRCUITS I

Course outcomes:
On successful completion of teaching learning and evaluation activities, a student would know

1. the working of various electronic circuits and their equivalent circuit.
2. to analyse the different transistor circuits at low and high frequencies
3. to design the circuits using discrete components as per the specifications
4. to design nonlinear circuits.
5. the switching behaviour of BJT.

Derivations only for discussion in class and assignments are to be open book problem solving based on reference text books

Module I
RC Circuits: passive filters-high pass and low pass, differentiators, integrators.
Diodes and their applications: Rectifiers, Filters- C, LC and pi, Clipper, Clamper, Zener diode voltage regulators: shunt and series. **Bipolar Junction Transistors:** Biasing, Load line, Operating point, Biasing circuits, Stability factor, Bias Stability, Thermal runway and thermal stability.

Module II
BJT small signal analysis:
Transistors at low frequencies: Two port devices and the Hybrid model, General analysis of an amplifier using h parameters, analysis of CE, CB and CC amplifiers, Gain, input and output impedances. **Transistors at high frequencies:** Hybrid Π model, Amplifier response at high frequencies. **Frequency response**: RC coupled amplifier response, 3dB gain, Gain- Bandwidth product, cascaded amplifier response.

Module III
Field Effect Transistors: FET & MOSFET biasing and small signal low frequency analysis of CD, CS and CG configurations. **BJT large signal (Power) Amplifier:** Circuits and operations of class-A, Class-B, Class- AB and Class-C amplifiers, Push–Pull amplifiers.

Module IV
Switching characteristics of a BJT - BJT switches with inductive and capacitive loads - Non saturating switches. Astable, monostable and bistable multivibrators using BJT - Voltage time base generators – simple, bootstrap & Miller configurations , current time base generators.

References:

1. "Electronic Devices and Circuits" David A Bell, 5/e, Oxford Higher Education, ISBN 019569340X
2. "Integrated Electronics" Millman & Halkias, 2/e, McGraw Hill, 2010
3. "Electronic Circuits Analysis and Design" Neamen D, 3/e, TMH, 2007
4. "Electronic Devices and Circuits" T F Bogart,6/e, Pearson Education, ISBN 8129705818
5. "Microelectronic Circuits" Sedra A S and K C Smith, 6/e, Oxford University press, 2013
6. "Pulse Digital & Switching waveforms", Jacob Milman &Taub, 3/e, 20011, Tata McGraw Hill, ISBN 97800710727247
7. "Problems and solutions in Basic Electronics", Albert Malvino, ISBN: 9780070702752

19-203-0307 BASIC ELECTRONICS LABORATORY

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze basic discrete circuits and design them.
2. To understand the characteristic of basic electronic devices.

Experiments:

1. Clipping and clamping circuits
2. Frequency responses of RC Low pass and high pass filters.
3. RC Integrating and Differentiating Circuits
4. Rectifying circuits --i) HW rectifier ii) FW rectifier iii) FW Bridge rectifier iv) Filter circuits - Capacitor filter
5. Zener Regulator- shunt and series
6. Characteristics of Diodes & Zener diodes
7. Characteristics of Transistors (CE & CB)
8. Characteristics of JFET
9. Biasing of Active devices

(1) Fixed biasing, current feedback biasing, voltage Feedback biasing and Voltage divider biasing of BJT

(2) Biasing of JFET –voltage divider

References:

1. "Electronic Devices and Circuits" David A Bell, 5/e, Oxford Higher Education, ISBN 019569340
2. "Electronic Circuits Analysis and Design" Neamen D, 3/e, TMH, 2007

19-203-0308 DIGITAL ELECTRONICS LABORATORY

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To design and analyse various digital circuits using components
2. To understand and use latches, bus drivers MUX, DeMUX**,** Shift registers / counters
3. To understand the timing diagrams and solve timing issues
4. To develop teamwork skills

Experiments:

1. Half adder and full adder using standard logic gates / NAND gates.
2. Code converters - Binary to Gray and gray to Binary with mode control
3. Binary addition and subtraction (a) 1's complement (b) 2's complement(using 7483)
4. BCD adder using 7483.
5. Study of MUX, DeMUX &Decoder Circuits and ICs
6. Set up R-S JK & JK Master slave flip flops using NAND/NOR Gates
7. Asynchronous UP / DOWN counter using JK Flip flops
8. Design and realization of sequence generators.
9. Study of shift registers and Implementation of Johnson and Ring counter using it.
10. 10. Study of IC counters 7490, 7492, 7493, 74193 and 74192.
11. Study of seven segment display and decoder driver (7447).

Students are required to submit a simple project fully conceived, designed and developed by them at the end of the semester.

References:

1. Herbert Taub, Donald Schilling , *Digital Integrated Electronics,* Tata Mc Graw Hill, 1/e, (2008), ISBN: 9780070265080
2. Soumitra Kumar Mandal, *Digital Electronics, Principles and applications,* Tata Mc Graw Hill, 2/e, (2011), ISBN 0070153825

19-200-0401 COMPLEX VARIABLES AND PARTIAL DIFFERENTIAL EQUATIONS

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

1. Transform a region to another region using conformal mapping
2. Evaluate real integrals using residue theorem
3. Form and solve 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, 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. Erwin Kreyzig. (2010). Advanced engineering mathematics. (Tenth edition). John Wiley & Sons, Hoboken, N.J
2. Grewal, B.S. (2013). Higher engineering mathematics. (Forty third edition). Khanna Publishers, New Delhi.

19-203-0402 MICROPROCESSOR ARCHITECTURE

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the architecture of 8086 microprocessor and its instruction set
2. To develop efficient programs in Assembly Level language for x86 family of microprocessors
3. To design an x86 based system with necessary interafce
4. To elevate the concept of segmentation, paging, protected mode etc wrf x86 family
5. To understand multitasking/multi user OS and CISC/RISC architectures

Module I

Introduction to microprocessors: Microcomputers and microprocessors, 8/ 16/ 32/ 64-bit microprocessor families. Internal architecture of Intel 8086 microprocessor: Block diagram, Registers, Internal Bus Organization, Functional details of pins, Control signals, External Address / Data bus multiplexing, De- multiplexing, Memory Address space and data organisation, Memory segmentation and segment registers, IO Address space. Basic 8086/8088 configuration, Minimum mode and maximum mode. Comparison of 8086 and 8088.

Module II

Instruction set and Assembly Language Programming of 8086: Instruction set, Instruction Classifications addressing modes, Assembler Directives, Strings, Procedures and Macros Assembly Language Program development tools: editor, assembler, linker, locator, debugger and emulator.

Module III

Interfacing concepts and devices: Memory chips interface to 8086 with examples - Programmable interfacing devices: - Programmable peripheral interface (Intel 8255), Programmable timer interface (Intel 8253/ 54) -Block diagram and modes of operation. Hardware and Software aspects of Interfacing these peripherals to 8086, Idea of a numeric coprocessor interface.

Module IV

Multiuser /Multitasking operating system concepts and the need for protection.

Introduction to 80386: Architecture of 80386, Real and protected modes of operation, Virtual memory, Address translation with Segmentation and Paging, Virtual 8086 mode. RISC architecture, Instruction Level Parallelism- concept and Limitations-Pipelining and Superscalar architecture, Branch Prediction.

References:

1. Lyla B.Das, *The x86 Microprocessors:Architecture,programming and Interfacing (8086 to Pentium*), Pearson Education,(2010), ISBN:9788131732465
2. Douglas V.Hall, *Microprocessors and interfacing, Programming and Hardware,* Tata Mc GrawHill,2/e,(2006), ISBN: 9780070601673.
3. Barry B Brey, *The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64 -bit Extensions*, Pearson/ Prentice Hall, 8/e, (2009), ISBN 0135026458/ 9780135026458.
4. A K Ray and K M Bhurchandi, *Advanced Microprocessors and peripherals,* Tata Mc Graw Hill, 2/e, (2009), ISBN 9780070140622
5. Jean Loup Baer, *Microprocessor Architecture*, Cambridge University Press, (2015), ISBN: 9780521187350.

19-203-0403 SIGNALS AND SYSTEMS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the concept of a signals and systems, their characteristics, classification and analysis using differential /difference equations
2. To understand the concept of impulse response and perform convolution
3. To predict and analyze the response of LTI systems to various types of input signals
4. To understand Sampling theorem and the need for sampling and reconstruction
5. To analyse LTI systems using Laplace transforms /Z transform
6. To understand and evaluate the frequency response of LTI systems using Fourier series and transform

Module I

Continuous time (CT) and Discrete time (DT) Signals - Introduction - exponential and sinusoidal - unit step and impulse functions / sequences – Classification of signals - CT and DT Systems - Properties of systems - Linear time-invariant (LTI) systems –Basic operations on signals - The representation of signals in terms of impulses - convolution - Properties of LTI systems - differential / difference equation representation - calculation of impulse response.

Module II

Laplace transform - The region of convergence for Laplace transforms - The inverse Laplace transform - Properties of the Laplace transform - Analysis and characterization of First-order and second-order LTI systems using the Laplace transform. **Z-transform**- The region of convergence – Pole zero plot - Properties of the z-transform - Inverse z-transform (partial fraction method) - Analysis and characterization of LTI systems using z-transforms.

Module III

Fourier Series and Transforms – Fourier series representation of Continuous time periodic signals - Convergence of Fourier series – Properties - Continuous- time Fourier transform representation of Aperiodic signals – Properties - Fourier transform pairs - Duality

Module IV

Sampling – Introduction - Representation of a continuous-time signal by its samples - the sampling theorem –The effect of under sampling: aliasing - Sampling with a zero-order hold - Reconstruction of a signal from its samples using interpolation. Discrete-time Fourier series - Properties - Discrete-time Fourier transform – Properties.

Reference:

1. Alan V Oppenheim, Alan S Willsky, *Signals and Systems*. Prentice Hall India ,2/e, (2010)

19-203-0404 DIGITAL SYSTEM DESIGN

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyse and design using standard combinational circuits and their hardware implementation.
2. To design Synchronous sequential system
3. To understand various design techniques and timing issues for sequential digital networks and their implementations

Module I

Standard Combinational Modules: Binary Decoders – decoder networks, Binary Encoders, Priority Encoders, Multiplexers – multiplexer trees, Demultiplexers, Shifters – barrel shifter, Programmable Modules- PLA, PAL, ROM, Network of ROMs. Implementation of combinational systems with decoder, multiplexers, ROMs and PLAs.

Module II

Synchronous sequential systems- state description of finite state system – Mealy and Moore Machines, representation of the state transition and output functions, time behaviour of finite state machines, finite memory sequential systems, equivalent sequential systems and minimization of the number of states, Binary specification of sequential systems, Different types of sequential systems- modulo-p counter – pattern recognizer – block pattern recognizer
– sequential decoders.

Module III

Sequential Networks: Canonical form of Sequential Networks, Timing characteristics of sequential networks – setup time – hold time – propagation delay – maximum clock frequency, analysis of canonical sequential networks, Design of canonical sequential networks, Flip flop modules, Analysis of network with flip flops, Design of networks with flip flops. Standard Sequential Modules: Registers, Shift registers, Counters, Multimodule implementation of sequential systems – array of registers – Networks of shift registers - cascade counters – parallel counters, Design of sequential systems with standard sequential modules.

Module IV

CPLDs and FPGA: FPGA types- FPGA based system design-FPGA programming technologies: antifuse-static RAM-EPROM-EEPROM.FPGA families: Actel- Actel1 logic module, Xilinx- xilinx LCAXC3000CLB, Altera-Altera FLEX logic element. Logic expander.

References:

1. Milos Ercegovac, Tomas Lang, Jaime H. Moreno, *Introduction to Digital Systems*, John Wiley & Sons, (1999)
2. John F Wakerly, *Digital Design: Principles & Practices*, Pearson Education, 4/e, (2008)
3. John M.Yarbough, *Digital Logic Applications and Design*, Thomson Learning, 1/e, (1991)
4. Micheal John Sebastian Smith, Application Specific Integrated Circuits,Pearson,(2001),ISBN: 978-81-7758-408-0.

19-203-0405 COMMUNICATION ENGINEERING I

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand various continuous-wave modulation and demodulation techniques for communication systems, probability theory, random variables and random processes
2. To study the generation, transmission and reception of different modulated signals, correlation, covariance and power spectral density of stationary random processes
3. To analyze the signal spectrum, bandwidth and power requirements, and effect of noise in different modulation schemes
4. To apply the knowledge to solve the basic problems in communication systems

Module I

Introduction to continuous wave modulation: Elements of communication system, electromagnetic spectrum - need for modulation - amplitude modulation: switching modulators, envelope detector, sideband and carrier power. DSB-SC: Ring modulator, coherent detection. Single sideband: time domain representation, spectra, modulation techniques, demodulation. Vestigial sideband.

Module II

Angle modulation: concept of instantaneous frequency- relationship between FM and PM- power and bandwidth – Carson's rule. FM generation –direct, indirect method- narrowband and wideband FM. FM demodulation –slope detection, demodulation using PLL. Comparison of AM and FM. Superheterodyne analog AM/FM receivers- Characteristics of receivers – sensitivity, selectivity, image frequency.

Module III

Probability theory & Random processes: concept of probability: conditional probability and Baye's theorem- random variables-statistical averages-correlation-central limit theorem. Characterization of random process - autocorrelation and power spectral density- transmission of random processes through LTI system.

Module IV

Noise: external, internal- signal-to-noise ratio – noise figure –noise calculations – equivalent noise temperature,-noise figure in cascaded networks. White noise, filtered white noise, noise equivalent bandwidth, Narrow band noise.

Effect of noise in Systems; Linear and angle modulation systems, threshold effect and threshold extension, pre-emphasis and de-emphasis filtering.

Text books:

1. Simon Haykin and Michael Moher, *Communication Systems*, John Wiley & Sons, 5/e, (2017).
2. B. P. Lathi and Zhi Ding, *Modern Digital and Analog Communication Systems*, Oxford University Press, 4/e,(2017)

References:

1. George Kennedy, *Electronic communication systems*, McGraw Hill,6/e,(2017)
2. Taub & Schilling, *Principles of Communication Systems*, Tata McGraw Hill, 3/e,(2007)
3. Wayne Tomasi, *Electronic Communications Systems (Fundamentals through Advanced)*, Pearson Education ,5/e,(2008)

19-203-0406 ELECTRONIC CIRCUITS II

Course outcome:

On successful completion of teaching learning and evaluation activities, a student would be able to

1. Analyse and design various feedback circuits catering different requirements.
2. Understand widebanding techniques
3. Appreciate the importance of Opamp and its internal circuits.

Assignments are to be open book problem solving based on reference text books and simulation/hands on implementation of different circuits covered in the syllabus

Module I

Feedback: positive and negative feedback properties.

Negative Feedback amplifiers - The four basic feedback topologies-voltage series, current series, voltage shunt and current shunt. Analysis and design of discrete circuits in each feedback topology - Voltage, Current, Transconductance and Transresistance amplifiers, its loop gain, input and output impedance, Stability of feedback circuits. Effect of feedback on amplifier poles, frequency compensation- Dominant pole and Pole-zero.

Oscillators- Barkhausen criteria**,** sinusoidal oscillators –phase shift, wein bridge, Hartley, colpitts and crystal.

Module II

Wide band amplifiers - Wide banding techniques – CC–CE /CD-CS cascade, cascode amplifier, Wide banding using inductors.

Comparator circuits- Schmitt trigger - analysis.

Tuned amplifiers: Synchronous and stagger tuned amplifiers

Module III

Differential Amplifiers - BJT differential pair, large signal and small signal analysis of differential amplifiers, Input resistance, Darlington pair, voltage gain, CMRR, non-ideal characteristics of differential amplifier. Frequency response of differential amplifiers, MOS differential amplifiers.

Module IV

OPAMP- Internal block schematic -Biasing used in IC- Current sources, Active load, cascode load, current mirror circuits, Wilson current mirror circuits – Level Shifters- Power amplifier stages. Op-amp parameters - ideal op amp Frequency response, frequency compensation. Slew rate and its effect; Input bias current – offset - drift - compensating networks CMRR, SVRR, finite gain bandwidth and its effect in opamp circuits' performance.

Typical Opamp741- Open loop gain, input- output impedance & bandwidth and opamp parameters.

References:

1. Millman&Halkias, *Electronic Devices & Circuits*, Tata McGraw Hill, 3/e, 2010, ISBN 9780070700215
2. Sedra&Smith, *Microelectronic circuits*, Oxford University Press, 5/e, 2008, ISBN 0195116631
3. Jacob Milman&Taub, *Pulse Digital & Switching waveforms*, 3/e, 20011, Tata McGraw Hill ISBN 97800710727247
4. Gaykwad , *Op-amps and Linear integrated Circuits*, Pearson Education/ Prentice-Hall India Ltd, 4/e, 2010,ISBN: 978-81-203-2058-1
5. Paynter, *Introductory Electronics Devices and Circuits* 7/e,2008,Pearson Education ISBN 9788131722817
6. Horenstein, *Microelectronics Circuits & devices*, Prentice-Hall India, 2/e, 2009,ISBN: 978-81-203-113

19-200-0407 UNIVERSAL HUMAN VALUES

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

1. Have more aware of themselves and their surroundings (family, society, nature).
2. Be more responsible in life in handling problems with sustainable solutions
3. Keep human relationships and human nature in mind.
4. Have better clarity 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 1: 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 2: 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 3: 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 4: 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 selfregulation 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 5: 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.

Text Book -Human Values and Professional Ethics (2nd revised edition) by R R Gaur, R Asthana, G P Bagaria, Excel Books,New Delhi, 2019

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

19-203-0408 DIGITAL SYSTEMS AND PROGRAMMING LABORATORY

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyse the digital circuits in a programming and simulation platform.
2. To develop assembly-level programming using MASM
3. To interface peripheral to 8086 based trainer kit
4. To develop teamwork skills

Experiments:

1. Block level system design in Simulink® / LabVIEW environment/ Proteus etc
2. Programming using HDL- Basic examples
3. Assembly language program development using Macro assembler and its debugging
   - Typical programming examples (at least 10nos)
4. Interface I/O Devices like stepper motor, key board, ADC and DAC to 8086

References:

1. Peter Abel, Niyaz Nizamuddin, *IBM ®PC Assembly language and Programming,* Prentice Hall India ,5/e ,(2001), ISBN: 9788120320949
2. Lyla B.Das, *The x86 Microprocessors:Architecture,programming and Interfacing (8086 to Pentium*), Pearson Education,(2010), ISBN 978-81-317-3246-5

19-203-0409 ELECTRONIC CIRCUITS LABORATORY I

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. Design different amplifiers and oscillator circuits.
2. Develop different multivibrators, switch & sweep circuits, and triggering circuits catering to different needs.
3. Simulation of electronic circuits using SPICE/Proteus.

Experiments:

1. Amplifying circuits

   (i) Simple common emitter amplifier configuration - gain and bandwidth –with and without emitter bypass capacitor.

   (ii) Common source amplifier- with and without source bypass capacitor.

Functions of each component, gain measurement, frequency responses

2. Feedback amplifier circuits - Current series and voltage shunt - gain and bandwidth
3. Oscillators - RC phase shift. WeinBridge, crystal oscillator
4. Multivibrators - Astable, Bistable, Monostable
5. Switch& Sweep circuits - Simple transistor sweep, bootstrap sweep
6. Schmitt trigger
7. Power amplifiers.
8. Simulation of experiments listed above using SPICE/proteus

(*It is desirable to carry out the implementation followed by simulation*)

References:

1. Millman&Halkias, *Electronic Devices & Circuits*, Tata McGraw Hill, 3/e, 2010, ISBN 9780070700215
2. Sedra&Smith, *Microelectronic circuits*, Oxford University Press, 5/e, 2008, ISBN 0195116631

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. Solve numerical differentiation and integration problems
3. Compute the mean and variance of a probability distribution including the binomial distribution.
4. Test hypotheses on data

Module1
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.

Module2
Numerical differentiation at the tabulated points with forward, backward and central diffrences. 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.

Module3
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.

Module4
Population and Sample-Sampling Distribution (of mean and variance) Testing of Hypothesis- level of significance, Z-test statistic, Chi square test for variance, for goodness of fit and F-test .

References:

1. Erwin Kreyzig. (2010). *Advanced engineering mathematics*. (tenth edition). John Wiley & Sons, Hoboken, N.J
2. Grewal, B.S. (2013). *Higher engineering mathematics*. (forty third edition). Khanna Publishers, New Delhi.
3. Kandaswamy, P. Thilagavathy, K. and Gunavathy, K. (2007) *Numerical methods*. S Chand &Co, New delhi.
4. Richard A. Johnson. Irvin Miller and John E. Freund. (2010). *Probability and statistics for engineers*. (eighth edition). Pearson, New Delhi.

19-203-0502 ELECTROMAGNETIC THEORY

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the significance of Maxwell's Equations and behaviour of electric and magnetic fields under varying boundary conditions
2. To apply the acquired knowledge on electrostatics, magnetostatics and time varying fields to electromagnetic wave propagation
3. To analyze fields and potentials using vector analysis tools

Module 1

Vector Analysis : Vector Algebra, Coordinate Systems and Transformation – Cartesian, Cylindrical and spherical coordinates, Vector Calculus – Differential length, area and volume, Line, surface and volume integrals, Del operator, Gradient of a scalar, Divergence of a vector, Divergence Theorem, Curl of a vector, Stoke's Theorem, Laplacian of a scalar.

Module II

Electrostatics: Electrostatic Fields – Coulomb's Law and field intensity, Electric fields due to continuous charge distributions, Electric flux density, Gauss's Law, Applications of Gauss's Law, Electric Potential, Relationship between E and V, Electric dipole and flux lines, Energy density in Electrostatic fields. **Electric fields in material space**: Properties of materials, Convection and conduction currents, Conductors, Polarization in Dielectrics, Dielectric constant and strength, Linear, Isotropic and Homogeneous Dielectrics, Continuity equation, relaxation time, Boundary conditions-Dielectric-Dielectric, Conductor-Dielectric, Conductor-Free Space.

Electrostatic Boundary value problems: Poisson's and Laplace's Equations, Uniqueness Theorem, Resistance and capacitance [Parallel-plate, coaxial, spherical capacitors].

Module III

Magnetostatics: Magnetostatic Fields- Biot-Savart's Law, Ampere's circuital law, Applications of Ampere's circuital law, Magnetic flux density, Magnetic scalar and vector potentials, Derivation of Biot-Savart's Law and Ampere's Law. **Magnetic forces, Materials and devices**: Forces due to magnetic fields, Magnetic torque and moment, Magnetic dipole, Magnetization in materials, Classification of Magnetic Materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy, Magnetic circuits, Force on magnetic materials. **Maxwell's Equations:** Faraday's Law, Electromotive Forces, Displacement current, Time-harmonic fields, Maxwell's equations for static fields and time varying fields.

Module IV

Electromagnetic wave propagation : Electromagnetic waves-Wave propagation in lossy dielectrics-Wave equations, propagation constant, intrinsic impedance of the medium, complex permittivity, loss tangent, Plane waves in lossless dielectrics, Plane waves in free space – uniform plane wave, Plane waves in good conductors – skin effect, Wave Polarization, Poynting's Theorem, Reflection of a plane wave at normal incidence – standing waves, Reflection of a plane wave at oblique incidence – parallel and perpendicular polarization, Brewster angle.

References:

1. Matthew N.O. Sadiku and S V Kulkarni, *Principles of Electromagnetics*, 6/e, Oxford University press (2017).
2. W.H.Hayt, J.A.Buck and Jaleel M Akhtar *Engineering Electromagnetics*, Tata McGraw Hill, 8/e, (2014).
3. W.H.Hayt, and J.A.Buck, *Problems and solutions in Electromagnetics*, TMH, 7/e, (2011).
4. Jordan and Balmain, *Electromagnetic waves and radiating systems*, PHI Ltd, 2/e,(2010)
5. Kraus and Fleisch, *Electromagnetics with applications*, Tata McGraw Hill, 5/e, (2010).
6. Joseph A. Edminister, *Electromagnetics*, Schaum's outline series - Tata McGraw Hill, 2/e, (2010).
7. Lonngren, *Fundamentals of Electromagnetics with Matlab*, PHI Ltd, 2/e, (2007)

19-203-0503 COMMUNICATION ENGINEERING II

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand waveform coding techniques, signal space representation of signal using GS orthogonalization procedure, digital modulation and demodulation schemes, line coding, optimal receivers
2. To analyse baseband signals in time and frequency domain, error performance of modulation schemes, ISI and pulse shaping techniques, equalizers, synchronization techniques.
3. To evaluate the performance of digital signaling schemes on realistic communication channels.
4. To Apply the knowledge of ISI problems to derive Nyquist criteria for zero ISI and controlled ISI.
5. To design communication systems under given power, spectral and error performance constraints

Module I

Pulse Modulation & Waveform Coding Techniques: PAM, PWM, PPM, Multiplexing- TDM, FDM. PCM system- quantization process- uniform and nonuniform quantization, Quantization Noise & SQNR, Robust quantization, companding- A Law and μ Law characteristics. DPCM-transmitter and receiver. Delta Modulation - transmitter and receiver, quantization error. Adaptive delta modulation.

Module II

Introduction to Digital Communication: Model of digital communication system, Gram-Schmidt orthogonalization procedure, Geometric interpretation of signal, Response of bank of correlators to noisy input, Detection of known signals in noise, Probability of error, correlation & matched filter receiver, detection of signals with unknown phase in noise.

Module III

Digital Modulation Techniques: Digital modulation formats-Coherent binary modulation techniques-ASK, PSK, FSK- probability of error - QPSK. Non-coherent binary modulation techniques: noncoherent BFSK, DPSK. M-ary Modulation techniques: PSK, QAM, FSK (Block level treatment only) – Bandwidth efficiency.

Module IV

Baseband data transmission: Line codes-NRZ, RZ; unipolar, polar, bipolar, Manchester. Intersymbol interference - Pulse shape design for channels with ISI: Nyquist pulse, Partial response signalling. Eye Pattern, scrambling and descrambling, Zero forcing Equalizer, Synchronization: Carrier synchronization, symbol synchronization.

Text Books:

1. Simon Haykin, *Digital Communications*, John Wiley& Sons, (2015)
2. B. P. Lathi and Zhi Ding, *Modern Digital and Analog Communication Systems*, Oxford University Press, 4/e,(2017).

References:

1. John G Proakis & M. Salehi, Digital Communication, 5/e, (2014), McGraw-Hill.
2. Taub & Schilling, *Principles of Communication Systems*, Tata McGraw Hill, 4/e (2013)
3. Bernard Sklar, *Digital Communications Fundamentals and applications* ,Pearson ed., 2/e,(2013)
4. Hwei Hsu, Schaum's Outline, *Analog and Digital Communications*, McGraw Hill, 2/e,(2003).

19-203-0504 ANALOG AND INTEGRATED CIRCUITS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. Analyse and design various feedback circuits using opamps and its applications
2. Understand the working of opamp as comparators, multivibrators, oscillators etc..
3. Design various active filter types using opamp
4. Understand the working of specialized ICs using opamp and its applications

Module I

Introduction to operational amplifiers:

Open loop configurations Op amp in closed loop configuration: Different feedback configurations- Voltage series feedback and voltage shunt feedback - concept of virtual ground- linear circuits: Summer- Subtractor, Integrator and differentiator voltage follower - V/I converters, I/V converters and its applications - Differential amplifiers, instrumentation amplifier- Use of offset minimizing resistor (ROM) and its design.

Module II

Op amp applications: Log amplifier- Antilog amplifier- Comparators: zero crossing- using voltage reference- regenerative (Schmitt trigger) comparators, window detector application – OPAMP as comparators - Astable and monostable multivibrators using opamps- Triangular and saw tooth wave generators- RC phase shift and Wien bridge oscillators-Sample and hold circuit- Peak detector circuit, Precision rectifiers.

Module III

Filters: Transfer functions - LPF, HPF, BPF, BRF. Approximation methods - Butter worth - Chebyshev - Active Filters - I order and II order filters, Quality factor-Design – Gyrator, Negative Impedance Converter (circuit only) - Filter using Simulated Inductance - Universal Active Filters - All Pass filters.

Module IV

Specialized ICs and applications: Voltage regulator IC 723, current limiting, short circuit protection, Thermal protection -555 timers – Functional block diagram- Astable Multivibrator, Monostable Multivibrator and its applications.- 566 VCO chip- Phase locked loop (PLL) - block diagram, Mathematical Derivation of capture range, lock range and pull in time- 565 PLL - PLL applications: Frequency multiplication and division- AM demodulation - FM detection - FSK demodulation, Analog multiplier circuits and applications.

Text Books:

1. Gaykwad, *Op-amps and Linear integrated Circuits,* Pearson Education/ Prentice-Hall India Ltd, 4/e,(2010) (All Modules)
2. Sedra&Smith, *Microelectronic circuits,* Oxford University Press, 5/e, (2009), ISBN :0195116631 (Module II)
3. Sargio Franko, *Design with operational Amplifiers Analog IC*s, Tata McGraw Hill, 3/e, (2003), ISBN :9780070530447 (Module II &III)
4. R F Coughlin ,*Op amps and Linear Integrated circuits* , Pearson Education/ PHI Ltd, 6/e,(2010) (Module II)
5. K R Botkar, *Integrated circuits,* Khanna Publishers, 9/e(Module III&IV)

References:

1. Gray, *Analysis and Design of Analog Integrated Circuit,* John Wiley, 4/e, ISBN 9788126515691.
2. D A Bell, *Opamps and Linear integrated Circuits,* Prentice-Hall India ,2/e
3. Jacob Millman & Arvin , *Micro Electronics* , McGraw Hill (1999),ISBN: 9780074637364
4. Razavi ,*Fundamentals of Microelectronics,* Wiley India, ISBN: 9788126523078

19-203-0505 DIGITAL SIGNAL PROCESSING

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. understand the need for DFT and the properties associated with it
2. apply FFT algorithms (DIT and DIF)
3. know the various forms in which FIR and IIR filters can be realized
4. design simple FIR/IIR filters of different types
5. understand the effects of Finite register length in FIR and IIR filter design
6. gain knowledge on different types of DSP processors available and their architecture

Module I

Discrete Time Fourier Transform (DTFT) – Introduction - Discrete Fourier Transform (DFT) – Properties – circular convolution – Linear convolution – Efficient computation of DFT: Fast Fourier Transform (FFT) – Decimation in Time (DIT) – Decimation in Frequency (DIF) – Block convolution.

Module II

Finite Impulse Response (FIR) Filters – Basic structures – direct, cascade, linear phase and lattice - Design of FIR filters – Fourier series truncation – Windowing: Rectangular - Bartlett - Blackman – Hanning / Hamming – Frequency Sampling – Finite register length effects.

Module III

Infinite Impulse Response (IIR) Filters – Basic structures: Direct form I & II, cascade and Parallel – Design of IIR Filters – Butterworth – Chebyshev - Impulse Invariance – Bilinear Transformation – Frequency transformations –Finite register Length effects.

Module IV

General and Special purpose Digital Signal Processors –Harvard architecture – Pipelining – Hardware Multiplier Accumulator -Special Instructions - Fixed and Floating Point Processors – TMS320C54X – Architecture –Instruction set - Addressing modes – TMS320C67X – Architecture - Instruction set Addressing modes .

References:

1. Oppenheim, Alan V, and Ronald W. Schaffer., *Discrete Time Signal Processing*, Prentice Hall / Pearson Education 2/e, (1989).
2. Sen M.Kuo, Woon-Seng Gan, *Digital Signal Processors: Architectures, Implementations, and Applications*, Pearson Education, (2005)
3. Emmanuel C. Ifeachor & Barni W.Jerris, *Digital Signal Processing ,a practical approach*, Pearson education,2/e,(2002)
4. Andreas Antoniou , *Digital Filters Analysis & Design*, Prentice Hall India , 2/e,(2000)

19-203-0506 (IE) EMBEDDED SYSTEM

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. Analyze the circuit design capability for answering some of the real life problems
2. Acquire Embedded system programming skills.
3. Understand the design of an embedded system.

Module I

Overview of Embedded System: - Embedded System, Categories of Embedded System, Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, major application areas of embedded system. Typical embedded system- Core of the embedded system, memory, sensors and actuators, Communication Interface, reset circuit, Brown-out protection circuit, oscillator circuit, Watchdog timer .Overview of the 8051 family. 8051 architecture- memory organization, registers and I/O ports. Addressing modes, instruction sets, and assembly language programming. Programming timer/counter. Interrupts- handling and programming. Introduction to C programming in 8051.

Module II

8051 interfacing - keyboard, stepper motor, ADC, DAC, LED and LCD module interface. Applications – frequency counter and temperature measurement. Bus architectures & protocol of I2C, SPI, CAN, RS232.

Module III

Memory-Technology & devices -Flash memory-NAND Flash -NOR Flash-DRAM-SDRAM/ DDR/ DDR2. Introduction to embedded CPUs: Basic architecture of ARM core family-features of ARM 926EJS core. Basic architecture of MSP430-features of MSP430.

Module IV

Introduction to embedded firmware & operating systems: Boot loader -Realtime kernel-Embedded OS-Tasks, Processes and Threads, Multiprocessing and Multitasking, Task scheduling, Task communication and synchronisation, Device Drivers.

References:

1. Shibu K.V, *Introduction to Embedded Systems*, Tata McGraw Hill, (2009)
2. K Uma Rao, Andhe Pallavi ,*The 8051 and MSP430 Microcontroller Architecture Programming and Applications*, Pearson,(2010)
3. Rajkamal, *Microcontrollers - Architecture, programming, Interfacing and system Design*, Pearson Education, (2005)
4. Daniel W. Lewis, *Fundamentals of Embedded Software where C and Assembly Meet*, PHI Ltd, (2003)
5. Steve Heath, *Embedded system design* ,second edition , Elsevier,2/e,(2002)
6. Kantha Rao, *Embedded systems*, PHI, ISBN: 978-81-203-4081-7
7. Subrata Ghoshal, *8051 Microcontroller internals, instructions, programming and Interface*, Pearson, ISBN:9788131731437
8. Steve Furber, ARM System on Chip Architecture, Pearson ,2/e,(2009)
9. Andrew Sloss, Dominic Symes , Chris Wright -*ARM Developers Guide, Designing & Optimizing system software*
10. Tammy Noergaard, *Embedded System Architecture , A comprehensive guide for Engineers and Programmers*, Elsevier ,(2005), ISBN-10: 0750677929, ISBN-13: 978-0750677929

19-203-0507 POWER ELECTRONICS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze various single phase and three phase power converter circuits
2. To understand the basic principle of switching circuits.
3. To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications
4. To learn the requirements imposed by electric drives

Module I

Power Semiconductor devices: Basic structure, I V characteristics, switching characteristics and operation of devices like power diode, Bipolar Junction Transistor, Power MOSFET, thyristors, Gate Turn off thyristor, Insulated Gate Bipolar Transistor and TRIAC, two transistor model of thyristor, series and parallel connections of thyristors, protection of thyristors, snubber circuits, Gate and Base drive, firing circuits with resistor and UJT.

Module II

Power Electronic Circuits: Line frequency single phase and three phase diode rectifiers, performance parameters, controlled rectifiers: single phase, semi converter, full converter (with R and R L loads), three phase half converter and full converter (with R and R L loads). Inverters: single phase half bridge and full bridge inverters, three phase inverters, basic concept of Pulse Width Modulation, single pulse, multiple pulse and sinusoidal pulse, basic concept of resonant pulse inverters.

Module III

DC-DC Converters: Various types of commutation techniques, principle of chopper operation, types of chopper circuits, step down operation and step up operation, analysis of Buck regulator, Boost regulator and Buck-Boost regulator. Power Supply Applications: Switching DC power supply, over view of Switching power supplies, control of SMPS, power supply protection, Power Conditioners, Power Line disturbances and Uninterruptible Power supply (UPS), various block of UPS.

Module IV

Motor Drive Applications: Introduction, types of DC motors, basic characteristics of DC motor, operating modes, Single phase drives: Half converter, semi converter and full converter drives. Types of AC motors, induction motor drives, performance characteristics, various types of control drives: such as stator voltage, rotor voltage and frequency control, criteria for selecting drive components.

References:

1. Ned Mohan, Tore M. Undeland, William P. Robbins ,*Power electronics converter, applications and design*, John Wiley.
2. John G Kassakian, Martin F Schlecht, George C Verghese, *Principles of Power Electronics*, Pearson,3/e, (2010).
3. Jai P Agrawal , *Power Electronic System, Theory and Design*,Pearson,(2001)
4. Daniel W. Hart, *Power Electronics*, TataMcGrawHill,1/e,(2011)

19-203-0508 ADVANCED DIGITAL SYSTEM DESIGN

Course Outcomes:
On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the design of sequential circuits, asynchronous circuit and fault diagnosis.
2. To familiarize the various programmable devices in digital domain.

Module I
Sequential Circuit Design
Analysis of clocked synchronous sequential circuits and modeling- State diagram, state table, state table assignment and reduction-Design of synchronous sequential circuits-design of iterative circuits-ASM chart and realization using ASM.

Module II
Asynchronous Sequential Circuit Design
Analysis of asynchronous sequential circuit – flow table reduction-races-state assignment- transition table and problems in transition table- design of asynchronous sequential circuit-Static, dynamic and essential hazards – data synchronizers –mixed operating mode asynchronous circuits – designing vending machine controller.

Module III
Fault Diagnosis And Testability Algorithms
Fault table method-path sensitization method – Boolean difference method-D algorithm - Tolerance techniques – The compact algorithm – Fault in PLA – Test generation-DFT schemes – Built in self test

Module IV
Synchronous Design Using Programmable Devices
Programming logic device families – Designing a synchronous sequential circuit using PLA/PAL – Realization of finite state machine using PLD – FPGA – Xilinx FPGA-Xilinx 4000

References:

1. Charles H. Roth Jr, *Fundamentals of Logic Design* Thomson Learning (2004)
2. Nripendra N Biswas *Logic Design Theory, Prentice* Hall of India,(2001)
3. Parag K. Lala, *Fault Tolerant and Fault Testable Hardware Design* B S Publications, (2002)
4. Parag K. Lala *Digital system Design using PLD* B S Publications,(2003)
5. Charles H Roth Jr., *Digital System Design using VHDL*Thomson learning,(2004)
6. Douglas L.Perry, *VHDL programming by Example*, Tata McGraw.Hill - (2006)

19-203-0509 PROBABILITY AND RANDOM PROCESS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To develop a deep understanding of random process
2. To explain the concepts of expectation and conditional expectation and describe their properties
3. To Formulate and solve the engineering problems involving random processes.
4. To analyze linear systems employing the theory of stochastic processes
5. To develop skills in building stochastic models using Markov chains.
6. To learn about different probability distributions

Module I

Random Variables - Discrete and continuous random variables - Probability density functions and distribution functions - Mathematical Expectations - Properties - Mean and Variance -Joint moments, Moment-generating and characteristic functions and their applications, conditional expectation; covariance and correlation; independent, uncorrelated and orthogonal random variables, covariance matrix and properties- Central limit theorem. Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution. Vector-space representation of random variables, linear independence, inner product, Schwarz Inequality

Module II

Random processes - Classification of random processes and examples - Continuous random process - Discrete random process - Continuous random sequence - Discrete random sequence - Stationary process and evolutionary process - Strict sense stationary process-Wide sense stationary process - Auto correlation, auto covariance and cross correlation - Their relation, properties and problems - Poisson process - Mean, variance, autocorrelation of the Poisson process – Properties

Module III

Markov process - Classification of Markov process - Markov chain - Transition probability matrix. Ergodic process - Time average of random process - Power spectral density and its properties - Spectral representation of real WSS process - Wiener-Khinchin Theorem - Calculation of spectral density given the autocorrelation function

Module IV

Linear time invariant systems - WSS process as input, stationarity of the output, auto- correlation and power-spectral density of the output; examples with white-noise as input to the analog communication coherent & non coherent receiver (AM, FM & PM)

References:

1. Papoulis and S.U. Pillai , *Probability, random variable and stochastic processes* , Tata McGraw Hill, 4/e,(2002), ISBN-: 978-0071226615
2. Stark and Woods, *Probability and Random processes with Application to Signal Processing*, Pearson Education, 3/e,(2002), ISBN 978-81-7758-356-4
3. Sam Shanmugam, *Random signals: Detection ,Estimation and Data analysis*, John Wiley,1/e, (1988), ISBN:978-0-471-81555-6
4. F M Dekking , C K Kraaikamp, L E Meester , *A Modern Introduction to Probability and Statics Understanding Why and How*, Springer , 1/e ,(2005) ,ISBN 978-1-85233-896-1
5. Leon Garcia, *Probability and Random process for Electrical Engineers*, Pearson Education ,2/e, 1994
6. Dougherty, *Random Process for Image and Signal Processing* , Prentice hall of India , ISBN: 81-203-2334-3
7. Wim C van Etten, *Introduction to random Signal and noise*, Wiley India, 1/e, (2005) ISBN 978- 81-265-265-2163-0
8. Richard A. Johnson, Miller &Freud's, *Probability And Statistics For Engineers*, PHI Publications,7/e ,(2008), ISBN 978-01-3143-745-6
9. Peebles, *Probability Random Variables and Random signal principles*, Tata Mc GrawHill ,4/e, (200l)

19-203-0510 DIGITAL SIGNAL PROCESSING LABORATORY

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. Have an idea about the functions of the Signal processing tool box in MATLAB
2. use the tool box to analyse simple signals and systems
3. Understand the techniques involved in DSP.
4. gain knowledge about frequency response / spectrum of signals and systems
5. implement FIR and IIR systems using MATLAB

Experiments:

1. Discrete time signals and Systems : Discrete-time Signals - Discrete Systems - Convolution – Correlation- Difference Equations
2. The *z*-Transform: The Bilateral *z*-Transform - Important Properties of the *z*-Transform - Inversion of the *z*-Transform - System Representation in the *z*-Domain -Solutions of the Difference Equations
3. The Discrete time Fourier Analysis : The Discrete-time Fourier Transform (DTFT) - The Properties of the DTFT -The Frequency Domain Representation of LTI Systems - Sampling and Reconstruction of Analog Signals
4. DFT – FFT
5. Implementation of Discrete Time Filters : IIR Filter Structures - FIR Filter Structures
6. Filter Design : FIR filters – IIR filters

The above experiments should be done using MATLAB

References:

1. Vinay.K.Ingle, John G. Proakis, Digital Signal Processing using MATLAB, Thomson, 1/e, (2003)

19-203-0511 ELECTRONIC CIRCUITS LABORATORY II

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. Design linear Op-Amp circuits.
2. Design various waveform generators using Op-Amps.
3. Design second order RC filters.
4. Understand the use and working of ICs 555 and 723.

Experiments:

1. Linear circuits
   Circuits using Op- Amps - Inverting & non inverting amplifiers , Summing Amplifier, Differential Amplifier,
   Instrumentation Amplifier, Integrators & Differentiators , Measurements of offset voltage and its compensation. Precision rectifiers
2. Circuits using op-amps for waveform generation
   i) Astable, monostable multivibrators.
   ii) Wein bridge oscillator
   iii) Triangular, Saw tooth waveform generators
3. Second order Active RC filters: High pass, Low pass
4. Astable and monostable multi-vibrator circuit using 555
5. Voltage regulator using 723
6. Filters using simulated inductance

(*It is desirable to carry out the implementation followed by simulation*)

References:

1. Gaykwad, *Op-amps and Linear integrated Circuits*, Pearson Education/ Prentice-Hall India Ltd, 4/e,(2010) (All Modules)
2. Sedra&Smith, *Microelectronic circuits*, Oxford University Press, 5/e, (2009), ISBN :0195116631 (Module II)

19-203-0601 CONTROL SYSTEMS ENGINEERING

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze control systems using mathematical model ·
2. To determine the response of different order systems for various inputs
3. To analyse the stability of the analog control system
4. To undertake state space analysis and solve state equations.

Module I - General schematic diagram of control systems - open loop and closed loop systems – concept of feedback - Review of Laplace transform - Mathematical modelling of control systems - Electrical Systems and mechanical translational systems - transfer function – Electrical analogous of mechanical translational systems - block diagrams representation and reduction methods - signal flow graph - mason's gain formula

Module II - Analysis of continuous time systems - time domain solution of first order systems – time constant, time domain specifications - time domain solution of second order systems – damping ratio - response of second order systems for step input - steady state error and static error coefficients for standard inputs - concept of stability –location of roots on the s plane - Routh- Hurwitz techniques - construction of root locus

Module III - Frequency response analysis – construction of bode diagrams - phase margin - gain margin - polar plots - theory of Nyquist stability criterion - Theory of lag, lead and lag- lead compensators.

Module IV - Introduction to the state variable concept - state space models for continuous time systems - phase variables - solution of state equations - homogenous and non homogenous cases - properties of state transition matrix - Concepts of Controllability and Observability - Kalman's Test.

References:

1. K. Ogata, *Modern Control Engineering* Prentice Hall of India , 5/e, (2010)
2. Norman S. Nise, *Control Systems Engineering* John Wiley and Sons Inc,4/e, ISBN 9788126510979
3. Nagarath I.J. & Gopal M., *Control System Engineering*, Wiley Eastern Ltd,(1995)
4. Kuo B C & Golnaraghi ,*Automatic Control Systems* 8/e, (2003), Wiley India, ISBN 9788126513710
5. Gopal, *Control System principles and design* McGrawhill,3/e
6. Dorf R.C. & Bishop R.H., Modern Control Systems, Addison Wesley,9/e,(2001)

19-203-0602 MICROWAVE TECHNIQUES AND DEVICES

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the working of transmission lines and waveguides
2. To characterise Microwave networks and devices using S parameters
3. To acquire knowledge on Microwave solid state devices, tubes and Microwave Measurements

Module I

Introduction to microwaves - frequency range, significance, applications.

Transmission Line Theory: Lumped element circuit model, Transmission Line equations and Solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Line impedance and admittance, Smith Chart, Input impedance of a Lossless Line, short circuited and open circuited lines, Impedance matching devices – Quarter wave transformer, Transmission line resonators – $\lambda/2$ and $\lambda/4$ resonators, Stub matching, Smith Chart and its applications.

Module II

Waveguides - Rectangular Waveguide: TE waves, TM waves, Velocities of propagation; dominant and degenerate modes, Impossibility of TEM waves in wave guides; Power Transmission and Power Losses in Rectangular Waveguides, Excitation of modes in Rectangular Waveguides

Rectangular Cavity Resonator: Resonant frequency and Q factor, Cavity excitation and tuning.

Microwave Hybrid Circuits: E plane Tee, H plane Tee, Hybrid Tee, Hybrid Ring, Two hole directional coupler, Isolator, Circulator, Phase shifter, Attenuator.

Scattering matrix representation: Properties of S matrix, S matrix formulation of E plane Tee, H plane Tee, Magic Tee, Directional coupler, Circulator

Module III

Solid State Microwave Devices: Diodes – Principle of operation and applications of Crystal diode, Schottky diode, PIN diode, Varactor diode, Tunnel diode, Gunn diode.

Avalanche Transit time devices: IMPATT, TRAPATT

Parametric amplifiers: Basic principle of operation, Manley-Rowe power relations, Negative resistance amplifiers

Module IV

Microwave tubes: High frequency limitations – Structure and Principle of operation of Two Cavity Klystron, Reflex Klystron, Traveling Wave Tube Amplifier, Magnetron Oscillator (detailed mathematical analysis not needed)

Microwave measurements: Measurement of Power, VSWR, frequency, wavelength, insertion loss, impedance and attenuation; Basic concepts of Network Analyzer and Anechoic chamber

Text Books:

1. David.M. Pozar, *Microwave Engineering*, John Wiley, 4/e, 2012.
2. Samuel Y Liao, *Microwave Devices & Circuits*, Pearson Education ,3/e,2003.

References:

1. Jordan and Balmain, *Electromagnetic waves and Radiating systems*, PHI Ltd, 2/e,2010.
2. Peter A. Rizzi, *Microwave Engineering – Passive circuits*, PHI Ltd ,1/e,2010.
3. Robert E. Collin, *Foundations for Microwave Engineering*, Wiley India,2/e,2009.
4. Annapurna Das and Sisir K Das, *Microwave Engineering*, Tata McGraw Hill, 2/e, 2009.
5. Herbert J.Reich, *Microwave Principles*, Affiliated East-West Press Limited.

19-203-0603 VLSI DESIGN

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to

1. To gain knowledge about the different processing steps in IC fabrication and the various second order MOS device effects
2. To understand the concept of nMOS, CMOS and switch logic and to design these circuits using the design rules
3. To learn about the various performance estimation parameters like resistance, capacitance and time delay and the concept of scaling in MOS circuits
4. To understand the concepts of timing issues in VLSI system design

Module I

VLSI process integration: NMOS IC technology - CMOS IC technology- n-well process, p-well process, twin-tub process, silicon on insulator. Second order MOS device effects: short-channel effect, narrow width effect, sub-threshold current, field dependent carrier mobility, device saturation characteristics, drain punch through, hot electron effect.

Module II

Switch logic- pass transistors and transmission gates, Gate logic - The basic inverter using NMOS - pull up to pull down ratio- transfer characteristics- Alternate forms of pull up. CMOS logic – inverter, NAND, NOR, 0 compound gates - CMOS inverter DC characteristics. Design rules and Layout of static MOS circuits: general principles & steps of lay-out design - use of stick diagrams – NMOS and CMOS design rules - Layout examples of inverter, NAND and NOR - Interlayer contacts, butting and buried contacts - use of layout tools like MICROWIND for integrated circuits.

Module III

Circuit characterization and performance estimation: resistance estimation - sheet resistance, capacitance estimation, Switching characteristics of CMOS inverter- rise time, fall time, delay time, delay unit, inverter delays - driving large capacitive loads - cascaded inverters, super buffers, BiCMOS drivers. Scaling of MOS circuits: scaling models and scaling factors for device parameters.

Module IV

Timing issues in VLSI system design: timing classification- synchronous timing basics – skew and jitter-latch based clocking- self timed circuit design - self timed logic, completion signal generation, self-timed signalling– synchronizers and arbiters.

References:

1. Weste and Eshraghian, *Principles of CMOS VLSI Design-A Systems Perspective*, Pearson Education,2/e.
2. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, *Digital Integrated Circuits- A Design perspective*, Pearson education, 2/e,(2003)
3. Douglas A Pucknell, Kamran Eshraghian , *Basic VLSI Design*, Prentice Hall India, 3/e,(2010)
4. S M Sze, *VLSI Technology*, Mc Graw Hill, 2/e,(2003)
5. Wolf, Modern *VLSI Design-System- on -Chip Design*, Pearson Education, 3/e,(2002)
6. Mead & Conway , *Introduction to VLSI System Design* , Addison-Wesley Publishing Co., (1980)
7. Fabricius, *Introduction to VLSI Design*, McGraw-Hill, (1990)
8. Thomas E. Dillinger , *VLSI Engineering* , PHI,
9. Charles H Roth Jr ,*Fundamentals of Logic Design* , Jaico Publishers,5/e
10. Albert Raj and T. Latha, *VLSI Design*, PHI Learning private limited,(2008),ISBN-976-61-203-3431-1

19-203-0604 INFORMATION THEORY & CODING

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze and understand about understand Entropy and Loss-less Source Coding
2. To understand the concepts of Channel Capacity and Coding Theorem
3. To learn about different linear block codes and decoding techniques
4. To learn about the different convolutional codes

Module I

Entropy and Loss-less Source Coding: Entropy, Entropy of discrete random variables- Joint, conditional and relative entropy- Chain rule for entropy, Mutual information and conditional mutual information, Relative entropy and mutual Information Lossless source coding- Discrete Memory-less sources, Uniquely decodable codes- Instantaneous codes- Kraft's inequality – Average code word length, Optimal codes- Huffman coding, Arithmetic Coding, Shannon's Source Coding Theorem.

Module II

Channel Capacity and Coding Theorem: Channel Capacity- Discrete memory-less channels (DMC) and channel transition probabilities, Capacity computation for simple channels- Shannon's Channel Coding Theorem, Converse of Channel Coding Theorem.

Module III

Continuous Sources and Channels: Differential Entropy- Mutual information- Waveform channels- Gaussian channels- Shannon- Hartley Theorem, Shannon limit, efficiency of digital modulation schemes-power limited and bandwidth limited systems.

Module IV

Coding - linear block codes-generator matrices-parity check matrices-encoder-syndrome and error correction-minimum distance-error correction and error detection capabilities - cyclic codes-coding and decoding. Convolutional codes-encoder -state diagram-distance properties- maximum likelihood decoding-viterbi decoding.

References:

1. John P Proakis & Salehi *Digital Communication*, McGrawHill,5/e, (2008), ISBN 9780070591172
2. Thomas M. Cover and Joy A. Thomas, *Elements of Information Theory*, Wiley India, ISBN 9788126508143
3. B. P. Lathi, *Modern Digital and analog Communication Systems*, Oxford University Press, 3/e
4. Ranjan Bose, *Information Theory ,Coding and Cryptography* ,Tata McGraw-Hill ,2/e, (2008)

19-203-0605 DATA STRUCTURES AND ALGORITHMS

Course Outcomes:

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

1. Explain the important features of data structures like arrays, linked lists, trees and graphs.
2. Define advanced data structures such as balanced search trees, hash tables, spatial data structures etc.
3. Create the different data structures to solve a problem.
4. Describe and compare the performance of various sorting algorithms like quicksort, merge sort and heapsort.
5. Describe algorithms on trees and graphs such as traversals, shortest path and minimum spanning tree.
6. Design a data structure and algorithm for maximum efficiency.

Module I

Introduction to Data structures - Arrays & sparse matrices - representation, Searching - linear, binary – Sorting – selection, bubble, insertion, quick, merge, heap - Hash tables – Hashing functions-Associative arrays.

Module II

Linked lists – singly, doubly and circular lists, Application of linked lists – Polynomial manipulation, stacks – Implementation of stacks using arrays and lists – Typical problems – Conversion of infix to postfix – Evaluation of postfix expression . Queues and Deques – implementation., priority queues.

Module III

Trees, Definition and mathematical properties. Representation – sequential, lists - Binary trees – Binary tree traversals – pre-order, in-order & post-order, Expression trees. Threaded binary trees. Binary Search trees. AVL trees-tries-Spatial data structures- k-d tree.

Module IV

Graphs – Graph representation using adjacency matrices and lists – Graph traversals – DFS, BFS -shortest path – Dijkstra's algorithm, Minimum spanning tree – Kruskal Algorithm, Prims algorithm – Tree based indexing, B trees and B+ trees.

References:

1. Robert Lafore, Data structures and algorithms in JAVA, 2nd Edition, Pearson, ISBN: 978-8131718124.
2. Adam Drozdek, Data Structures and Algorithms in Java, Thomson Publications, 2nd Edition , ISBN-13: 9780534492526.
3. Aaron M. Tanenbaum, Moshe J. Augenstein, Yedidyah Langsam, Data Structures using Java, Pearson Education, 2003, ISBN 13: 9780130477217.
4. Ellis Horowitz, Sartaj Sahni, Dinesh P. Mehta, Fundamentals of Data Structures in C++, Silicon Press, 2007.
5. Jean Paul Tremblay and Paul G Sorenson, An introduction to Data Structures with Applications, McGraw-Hill, Singapore, 1984.
6. Clifford A. Shaffer, Data structures and Algorithm analysis in Java, Dover Publications, 2012, ISBN 97804864858127.

19-203-0606 (IE) FPGA BASED SYSTEM DESIGN

Course Outcomes:

1. Design combinational and sequential digital circuits.
2. Model circuits with Verilog HDL at behavioural, structural and RTL levels.
3. Development of test benches for the simulation of circuits.
4. General understanding of FPGA architecture, reconfigurable computing and hardware software co design.

Module I

Introduction to Verilog HDL: Lexical Conventions - Ports and Modules – Operators - Gate Level Modelling - System Tasks &CompilerDirectives - Test Bench - Data Flow Modelling - Behavioural level Modelling -Tasks & Functions.

Module II

Modelling of combinational and sequential circuits using HDL: Behavioural, Data Flow and Structural Realization – Adders – Multipliers-Comparators - Flip Flops -Realization of Shift Register - Realization of a Counter- Synchronous and Asynchronous FIFO –Single port and Dual port RAM – Pseudo Random LFSR – Cyclic Redundancy Check.

Module III

FSM Design using HDL: State diagram-state table –state assignment-choice of flip-flops – Timing diagram –One hot encoding-Mealy and Moore state machines – Design of serial adder using Mealy and Moore state machines -State minimization – Sequence detection- Design of vending machine using One Hot Controller

Module IV

FPGA Architecture and basis of Hardware software co design: Types of Programmable Logic Devices-PLA & PAL- FPGA Generic Architecture. Interfacing using FPGA: VGA, Keyboard, LCD. FPGA Implementation of FIR filter and FFT architectures.

References:

1. Wayne Wolf , FPGA Based System Design, Prentices Hall Modern Semiconductor Design Series, first edition
2. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall, Second Edition, 2003.
3. Stephen Brown &ZvonkoVranesic, Digital Logic Design with VerilogHDL TATAMcGraw Hill Ltd. 2nd Edition 2007.
4. S.Ramachandran, Digital VLSI System Design: A Design Manual forimplementation of Projects on FPGAs and ASICs Using Verilog, SpringerPublication, 2007 edition.
5. Kesab K Parhi, VLSI digital signal processing systems: design and implementation. John Wiley & Sons, 2007 edition.

19-203-0607 OBJECT ORIENTED PROGRAMMING

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To differentiate between procedural and Object oriented concepts in programming
2. To understand the concept of objects , class, inheritance, polymorphism
3. To develop efficient programs utilising proper functions and handles

Module I

Object oriented technology, comparison with procedural programming (C and C++),key concepts of object programming, input and output in C++, declarations ,control structures, functions.

Module II

Classes and Objects, declaring objects, accessing member variables, defining member functions, inline functions, static member variables and functions, friend function, overloading, constructors and destructors, overloading constructors, copy constructors anonymous objects, dynamic initialization using constructors, dynamic operators and constructors, recursive constructors encapsulation

Module III

Inheritance, types of inheritance, virtual base class, abstract class, advantages and disadvantages of inheritance, pointers and arrays, C++ and memory

Module IV

Binding, polymorphism and virtual functions, generic programming with templates, exception handling, string handling and file handling

Text Books:

1. Ashok N Kamthane , Pearson education - *Object oriented programming with ANSI and TURBO C++*, Thomson Learning.
2. Saurav Sahay- *Object oriented programming with C++*,Oxford

References:

1. Malik*C++ Programming*:*From Problem Analysis To Program Design,* , Thomson Learning
2. Forouzan, - *Computer Science :A Structured Approach Using C++,2/e*, Thomson Learning.

19-203-0608 OPTICAL FIBER COMMUNICATION

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. Theoretical background of components and devices used in optical communication
2. Should be able design and implement a simple optical communication system.

Module 1

Overview of optical communication systems, History of optical communications, Wave theory of light, Reflection and refraction of plane waves; Optical waveguides Planar waveguides, Characteristics of optical fibers , numerical aperture, Wave propagation in multimode and single-mode optical fibers, Coupling into and out of fibers, attenuation, group-velocity dispersion, optical nonlinearities, polarization-mode dispersion. dispersionshifted and polarization maintaining fiber

Module 1I

Optical sources and transmitters: Optical sources, Physics of light emission and amplification in semiconductors, -direct and indirect band gap materials-LED structures- quantum efficiency- modulation. Laser diodes- rate equations- diode structure- single mode laser- modulation- temperature effects-quantum cascade lasers-vertical cavity surface emitting lasers- modal noise- partition noise- reflection noise. Light coupling-source to fiber coupling.Photo detectors-PIN, APD, Photo detector noise - response time- structure of detectors- receiver units.

Module 1II

Components of fiber optic networks: – couplers - splitters- semiconductor optical amplifiers- Erbium doped fiber amplifiers- wavelength division multiplexers/ demultiplexers. Filters- isolators-circulators-optical switches- Wavelength converters- Fiber gratings tunable sources- tunable filters.

Module 1V

Dispersion in optical communication systems, Dispersion in single-mode and multimode fibers, Dispersion-induced pulse broadening in single-mode fiber, coherent & non coherent detection, channel capacity, various limits of transmission rate- Optical link design, Power and noise budget, Jitter and rise timebudgets.

References:

1. Gerd Kaiser , *Optical fiber communication*, McGraw Hill ,4/e, 2007, ISBN 9780070648104
2. John M. Senior, *Optical fiber Communication*, Pearson Education India, 3/e
3. John Gowar, *Optical communication systems*, Prentice Hall Inc, 1984
4. Mynbaev and Scheiner, *Fiber optic communications technology*, Pearson Education, 2001
5. Ray Tricker, *Optoelectronics and Fiber Optic Technology*, Elsevier India Pvt. Ltd, 2006
6. Joachim Piprek, *Semiconductor Optoelectronic Devices*, Elsevier India Pvt. Ltd, 2005
7. Govind P. Agrawal, *Fiber-Optic Communication Systems*, Wiley India, 3/e
8. Max Ming-Kang Liu, *Principles and applications of optical communications*, McGraw hill,1/e, 2010
9. Kasap, *Optoelectronics and Photonics: Principles and Practices*, Pearson Education, 2009, ISBN 978131726482

19-203-0609 ELECTRONIC MEASUREMENTS AND

INSTRUMENTATION

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyse the errors in measurements and their rectification.
2. To understand the different transducers used in measurements
3. To understand different techniques used for parameter measurements
4. To study different types of signal generators and analysers

Module-I

Introduction – Measurements - Monitoring, Control, Analysis. Instruments- Transducer, Signal Conditioner and Transmitter, Display/Recording Devices. Static characteristics of Instruments. Estimation of Static errors and reliability-errors, types of errors, probability of errors, limiting errors, Reliability Principles. Dynamic characteristics of Instruments- Transfer function-Zero, first and second order instruments-Dynamic response of first and second order Instruments.

Module II

Transducers and Sensors: Transducers- active and passive, Selection Criteria- Smart Sensors and IEEE 1451 Standard.Temperature measurements-RTD, Thermocouples. Displacement Measurement- LVDT. Strain Measurement. Measurement of acceleration, force, and Torque. Piezo-electric transducers.

Module III

Industrial instrumentation: Pressure Measurement- Flow measurements Level Measurement. Bridge measurements:-DC bridges for low, medium and high resistance-ac bridges for capacitance and inductance. Vector impedance meter, Multimeters: - Principles of analog and digital multimeters, Digital storage oscilloscope (DSO).Recording instruments- Strip chart recorders, x-y- recorders

Module IV

Signal generators: - Sine-wave Generators-AF and RF Signal Generators- Non-sinusoidal Generators, Function generator- Sweep frequency generator- Frequency synthesizers. Digital Signal Generators-Arbitrary Wave form Generator, Data Generator. Signal analyzers-Wave Analyzer –Harmonic Distortion Analyzer, Spectrum Analyzer. FFT Analyzer, Vector Analyzer, Logic Analyzer, Data Acquisition Systems:Types, Telemetry, Virtual Instrumentation Systems

References:

1. Arun K Ghosh, *Introduction to Measurements and Instrumentation*, PHI Learning Pvt.Ltd, 4/e, (2017).
2. M.M.S Anand, *Electronic Instruments and Instrumentation technology*, PHI Learning Pvt.Ltd, India, (2018).
3. A. K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons, 2015
4. Albert D.Helfrick & W.D.Cooper, *Modern Electronic Instrumentation and Measurement*
5. C.S. Rangan, G.R. Sharma ,*VSV Mani, Instrumentation Devices and Systems* , Tata McGraw Hill,2/e,(2001)
6. D. Patranabis, Principles *of Industrial Instrumentation*, PHI Learning Pvt.Ltd, 1/e, (2011).

19-203-0610 ELECTRONIC PRODUCT DESIGN PROJECT

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze the circuit designing capability and the documentation capability.
2. To understand the process of making an electronic product.

Case Study/tutorial: Take a simple electronic product and analyze / study: - Overview of product design from Requirement to Product. The design process - Electronic Design Factors- Computer Aided Design. Product Life Cycle. Various dimensions of Electronic Product Design- Industrial design and Engineering design- Aesthetics and Ergonomics- Inputs, control and display interface. Student should do sample Design Documentation, Engineering Documentation and Test Documentation -Component Specification/ Bill of materials. Enclosure sizing, requirement of enclosure, Noise and thermal management - EMI/EMC, EMI standards and regulations, Grounding, cabling, Shielding, Guarding. Students should study the PCB design criteria and its CAD tools taking some case studies. The above analysis/study shall be focused on functionality, strength, material, manufacture/construction, quality, reliability, aesthetics, ergonomics, safety, maintenance, handling, sustainability, cost etc. whichever are applicable.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design based on the above study. Each batch comprising of 3 to 5 students shall design, develop and realize a complete electronic product. Basic elements of product design must be considered. Fully software/simulation projects are not allowed. Each student shall submit a project report at the end of the semester. The project report should contain the design and engineering documentation including the Bill of Materials and test results. Product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations and aesthetics / ergonomic aspects taken care of in the project shall be given due weight.

Guidelines for evaluation:

Continuous evaluation	20
End-Semester presentation, Oral	20
Examination and evaluation Level of completion, demonstration and documentation	10
Total	50

Reference:

1. Michael Luchs, Scott Swan, Abbie Griffin Design Thinking. John Wiley & Sons, Inc, 2015.
Paul Horowitz and Winfield Hill The Art of Electronics 3rd edition Cambridge 2015

19-203-0611 COMMUNICATION LAB

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able To

design circuits of different analog modulation techniques like AM, FM etc., its generation and demodulation.

To design different pulse modulation techniques like PAM, generation and demodulation

To simulate digital communication systems and evaluate its performance

Experiments:

1. Amplitude modulation and demodulation
2. Frequency modulation
3. PAM modulator and demodulator
4. Simulation of digital and analog communication systems
5. Digital modulation techniques and it performance measures
6. Matched filter receiver for rectangular pulse.
7. Error correction & coding & LPDC, Viterbi algorithm

Reference:

1. Contemporary Communication Systems Using MATLAB, Third Edition John G. Proakis, Masoud Salehi , Gerhard Bauch

19-203-0701* PRINCIPLES OF MANAGEMENT

(* Common for CS, EC, EE, IT Branches)

Course Outcomes:

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

1. Understand the basic principles underlying in the management of organizations.
2. Get exposure in all Industrial management functions
3. Get knowledge to 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, Engineering Management, Addison-Wesley, (1997).
2. Koontz and O'Donnell, Essentials of Management, McGraw Hill, (1978).
3. Kotler P., Marketing Management, Prentice Hall, (2011).
4. Prasanna Chandra, Finance Management, Tata McGraw Hill, (2008).
5. Monks, J. G., Operations Management, McGraw Hill, (1982).
6. Production and Operations Management,PHI (2010)

19-203-0702 ANTENNAS AND PROPAGATION

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand basic terminology, parameters and concepts of Antennas
2. To analyze the electric and magnetic field of various basic antennas
3. To study the performance of Antenna Arrays
4. To acquire knowledge on antenna types as well as their application
5. To understand the propagation of the waves at different frequencies through different layers of atmosphere

Module I

Radiation Mechanism, Antenna parameters: Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Effective aperture area.Radiation Integrals and Auxiliary Potential Functions: The Vector Potential A for an Electric Current Source J, The Vector Potential F for a Magnetic Current Source.

Module II

Radiation from an infinitesimal dipole, total power radiated and its radiation resistance. Radiation from half wave dipole radiation fields and its radiation resistance. Near field and far field. Small loop antennas. Antenna arrays: Point Sources - arrays of 2 Isotropic Sources and N element point sources, Principle of Pattern Multiplication, Uniform Linear Arrays - Broadside Arrays, End fire Arrays.

Module III

Types of antennas: Yagi-Uda Antenna, Helical Antenna - Axial mode helix, Normal mode helix, Biconical Antenna, Log periodic Dipole Array, Microwave antennas: Horn antennas, E plane and H plane Sectoral Horn, Parabolic reflector, Microstrip Patch Antennas – Radiation Mechanism, Radiation Pattern, Design of Rectangular Patch Antenna.

Module IV

Fundamentals of Wave propagation: Ground waves, Space waves and Sky wave. Free space propagation, Frii's Transmission Equation, Path loss, Plane earth loss, Spherical earth effects, Multipath Effects, Tropospheric refraction, Path profiles - Line of sight versus non-line of sight. Refraction and Reflection of sky waves by ionosphere – ray paths – skip distance – virtual height-critical frequency- maximum usable frequency -vertical and oblique incidence.

Text:

1. C. A Balanis, *Antenna Theory: Analysis and design*, John Wiley, 4/e, (2016), ISBN:978-1-118-64206-1
2. Jordan and Balmain, *Electromagnetic waves and Radiating systems*, PHI 2/e, (1986), ISBN - 13:978-9332551770

References:

1. J.D. Kraus, R. J Marhefka , Ahmed S Khan, *Antennas and wave propagation* , McGraw Hill India, 5/e,(2017)
2. G.S.N Raju, *Antennas and Wave Propagation*, Pearson education,(2009), ISBN-13: 978-8131701843
3. Sisir K Das and Annapurna Das , "*Antenna and Wave Propagation*," McGraw Hill Education India Private limited, 2017. ISBN: 978-1-25-900632-6

19-203-0703 DIGITAL IMAGE PROCESSING

Course Objectives:
To understand and apply various transformations and formulate solutions to general image processing problem

Course Outcomes:
On successful completion of teaching-learning and valuation activities, a student would be able
1. To understand the fundamentals of gray scale image ,color image and transforms
2. To understand image enhancement and restoration techniques
3. To understand image segmentation and morphological techniques
4. To understand image representation and description and color image processing

Module I
Digital Image Fundamentals: Representation of digital image -Elements of visual perception – Image sampling and quantization- Basic relationship between pixels.
Review of Matrix Theory: Row and column ordering-Toeplitz, Circulant and Block Matrices
Image Transforms: 2D DFT, Hadamard, DCT, Wavelet Transforms.

Module II
Image Enhancement: Spatial domain methods: Basic Gray Level Transformations-Histogram Processing: Equalization and specification- Fundamentals of Spatial Filtering: Smoothing, Sharpening spatial filters. Frequency domain methods: low pass filtering, high pass filtering, Homomorphic filtering.
Image Restoration: Degradation Model- Restoration in the presence of Noise only -Spatial Filtering –Inverse filtering - Wiener filter

Module III
Image segmentation: Detection of discontinuities: Point Line and Edge Detection - Edge linking and boundary detection - Hough transform – Thresholding - Region based segmentation: Region growing -Region splitting and merging - Use of motion in segmentation
Morphological Image Processing: The structuring element, Basic operations on sets, Erosion, Dilation, Opening and Closing

Module IV
Representation and Description: Representation, Boundary Descriptors: Shape numbers, Fourier descriptors, statistical moments - Regional Descriptors: Topological descriptors, texture.
Fundamentals of Colour image processing: Colour models - RGB, CMY, HSI - Pseudo colour image processing - intensity slicing, gray level to color transformation.

References:

1. Gonzalez and Woods, *Digital Image Processing*, Pearson Education,4/e, (2018)
2. Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall India, (2010)

19-203-0704 (IE) IoT SYSTEM DESIGN

Course Outcomes:
On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyse the circuit design capability for practical IOT applications
2. To acquire knowledge regarding various protocols for IoT
3. To acquire technical skills for a prototyping an IoT
4. To acquire knowledge in programming the IoT devices

Module I
Introduction to IOT: Definition of IoT, Application Areas, Characteristics, IoT stack, Enabling Technologies, Challenges, IoT levels,
Introduction to sensors and Interfacing: Types of sensors, LDR sensor, ultrasound sensor, Obstacle sensors, Heartbeat sensors, GPS, Color sensor, pH sensor, Gyro sensor and its interfacing with microcontrollers.

Module II
Protocols for IoT: Messaging Protocol- MQTT, CoAP, Transport protocol- Bluetooth low energy(BLE), Light Fidelity(LiFi) , Protocol for Addressing and Identification- Ipv4, Ipv6, URI
Cloud for IoT: Challenges, Selection of cloud service provider, Introduction to fog Computing, security aspects of cloud computing, Case study on cloud.

Module III
Prototyping and Designing Software for IoT Applications: introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development.

Module IV
Introduction to Python Programming, Programming Raspberry Pi with Python, Python Web application Framework-Django, Amazon web services for IoT.

Text Books:
1. Shriram K Vasudevan, Abhishek S Nagarajan & RMD Sundaram, 'Internet of Things' , Wiley
2. Arshdeep Bahga and Vijay Madisetti "Internet of Things: A Hands-on Approach", Universities Press

References:

1. Adrian McEwen and Hakim Cassimally ,'Design of internet of Things' , Wiley
2. Pethuru Raj, Anupama C. Raman, 'The Internet of Things: Enabling Technologies, Platforms, and Use Cases'
3. Raj Kamal, 'Internet of Things : Architecture And Design Principles' , MG

19-203-0705 SATELLITE COMMUNICATION

Course Outcome:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the basics of satellite orbits.
2. To understand the satellite segment and earth segment.
3. To analyze the various methods of satellite access.
4. To understand the applications of satellites**.**

Module I

Kepler‟s Laws, Newton‟s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point – Sun transit outage-Launching Procedures - launch vehicles and propulsion.

Module II

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

Module III

Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit – Receive earth stations – Problems – Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrierto- Noise ratio – Uplink – Saturation flux density – Input back off – The earth station - HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Uplink rain– Fade margin – Downlink rain – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise.

Module IV

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Brocast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption. Sattellite Applications: INTELSAT Series, LEO, MEO, Satellite Navigational Systems. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH)

References:

1. Dennis Roddy, “Satellite Communication”, 4th Edition, Mc Graw Hill International, 2006.
2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, 2007. N.Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986.
3. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book, Artech House Bostan London, 1997.
4. Tri T. Ha, “Digital Satellite Communication”, II nd edition, 1990.
5. Emanuel Fthenakis, “Manual of Satellite Communications”, Mc Graw Hill Book Co., 1984. Brian Ackroyd, “World Satellite Communication and earth station Design”, BSP professional Books, 1990.M.R.ichharia, “Satellite Communication Systems-Design Principles”, Macmillan 2003.

19-203-0706 DIGITAL INTEGRATED CIRCUIT DESIGN

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze the design of combinational and sequential digital circuits using CMOS**.**
2. To analyse and design arithmetic building blocks and Shifters
3. To understand various Memory Architectures

Module I

Designing combinational logic gates in CMOS

Introduction - Static CMOS Design - Complementary CMOS, Ratioed Logic, Pass-Transistor Logic - Dynamic CMOS Design - Dynamic Logic: Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates

Module II

Designing sequential logic circuits

Static Latches and Registers - The Bistability Principle - Multiplexer-Based Latches - Master-Slave Edge-Triggered Register - Low-Voltage Static Latches - Static SR Flip-Flops - Dynamic Latches and Registers - Dynamic Transmission-Gate Edge-triggered Registers - C^2MOS—True Single-Phase Clocked Register (TSPCR) - Alternative Register Styles - Pulse Registers - Sense-Amplifier Based Registers

Module III

Designing arithmetic building blocks

Datapaths in Digital Processor Architectures - The Adder - The Full Adder: Circuit Design Considerations – The Binary Adder: Logic Design Considerations - The Multiplier - Partial-Product Generation - Partial Product Accumulation - Final Addition - The Shifter - Barrel Shifter - Logarithmic Shifter

Module IV

Designing memory and array structures

Memory Classification - Memory Architectures and Building Blocks - The Memory Core - Read-Only Memories - Nonvolatile Read-Write Memories - Read-Write Memories (RAM) - Contents- Addressable or Associative Memory (CAM) - Memory Peripheral Circuitry - The Address Decoders - Sense Amplifiers

References:

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, *Digital Integrated Circuits*- A Design Perspective, Pearson e ducation,2/e,(2003)
2. Hubert Kaeslin, ETH Zürich *Digital Integrated Circuit Design - From VLSI Architectures to CMOS Fabrication,* ISBN:9780521882675, *(2008)*
3. John F Wakerly, *Digital Design – Principles and Practices,* Pearson education, Fourth edition

19-203-0707 ADAPTIVE SIGNAL PROCESSING

Course Outcomes:
On successful completion of teaching-learning and valuation activities, a student would be able

1. To analyze need for adaptive signal Processing system and their properties
2. To understand various performance measures and their characteristics
3. To familiarise various adaptive algorithms
4. To perform adaptive modelling and design of filters and arrays for beam forming

Module I
Adaptive Systems – Definition & Characteristics – Properties - Open loop and closed loop adaptation – Example of adaptive system –Adaptive linear combiner – Input signal and Weight vectors – Desired response and Error – Performance Function – Gradient - Minimum mean square error – Example of performance surface - Alternative expressions of the Gradient – De-correlation of error and input components.

Module II
Properties of Quadratic performance surface – Normal form of input correlation matrix – Eigen values and vectors - Geometrical significance - Searching the performance surface – Methods – Gradient search methods – Stability and rate of convergence – learning curve – Newton's Method – Steepest Descent Method – Comparison of learning curves –Gradient estimation and its effect on adaptation – Performance penalty – Variance of gradient estimate – Excess Mean Square Error and Time constants – Mis-adjustment.

Module III
Adaptive Algorithms - The LMS Algorithm – Derivation - Convergence – Learning curve – Noise –Misadjustment – Performance - LMS/ Newton Algorithm – Properties – Sequential regression algorithm – Adaptive recursive filter – Random search algorithms – RLS Algorithm – The matrix inversion Lemma – Convergence.

Module IV
Adaptive modeling and system identification – Multipath communication channel –FIR digital filter synthesis –Introduction to adaptive arrays and beamforming – Sidelobe cancellation – Beamforming with a pilot signal –spatial configurations – Adaptive algorithms.

References:

1. Bernard Widrow and Samuel D. Stearns, *Adaptive Signal Processing*, Pearson Education, ISBN:9788131705322
2. Simon Haykin, *Adaptive Filter Theory*, Pearson Education, 4/e, (2002).
3. B. Farhang-Boroujeny, *Adaptive Filters – Theory and Applications*, John Wiley and Sons, (1998), ISBN:978-0-471-98337-8
4. Ali H Sayed, *Fundamentals of Adaptive Filtering*, John Wiley and Sons, 1/e,(2003)

19-203-0708 UNIVERSAL HUMAN VALUES- UNDIVIDED SOCIETY & HUMAN ORDER (*Common for EE/EC)

Course Outcomes:

After successful completion of the course student will be able to:

1. Have a clear understanding about the importance and types of relationships.
2. Express the right feelings in relationships
3. Develop the competence to think about the conceptual framework of undivided society as well as universal human order.
4. Have better exposure for transition from current state to the undivided society and universal human order.

Module I: Introduction to the course:

Basic aspiration of a Human Being and program for its fulfillment, Need for family and relationship for a Human Being, Human-human relationship and role of behavior in its fulfillment, Human-rest of Nature relationship and role of work in its fulfillment, Comprehensive Human Goal, Need for Undivided Society, Need for Universal Human Order, an appraisal of the Current State, Appraisal of Efforts in
this Direction in Human History.

Module II: Understanding Human-Human Relationship & its fulfillment:

Recognition of Human-Human Relationship, Recognition of feelings in relationship, Established Values and Expressed Values in Relationship, interrelatedness of feelings and their fulfillment, Expression of feelings, Types of relationship and their purpose, mutual evaluation in relationship, Meaning of justice in relationship, Justice leading to culture, civilization and Human Conduct.

Module III: Justice from family to world family order:

Undivided Society as continuity and expanse of Justice in behavior – family to world family order, continuity of culture and civilization, Universal Order on the basis of Undivided Society, Conceptual Framework for Universal human order, Universal Human Order as continuity and expanse of order in living: from family order to world family order, a conceptual framework for universal human order.

Module IV: Undivided Society and Universal Human Order:

Education – Sanskar, Health – Self Regulation, Production-work, Exchange – storage, Justice preservation
Scope and Steps of Universal Human Order, Human Tradition (Ex. Family order to world family order), Steps for transition from the current state, Possibilities of participation of students in this direction, Present efforts in this direction, Sum up.

Reference Books:

1. *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
3. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
4. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak
5. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers

19-203-0709 ADVANCED COMPUTER ARCHITECTURE

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. Learn and appreciate computer architecture with an emphasis on system design - performance and analysis.
2. Understand the detailed design concepts with respect to primary and secondary memory.
3. Familiarize with the concept of multicores, multicore processing.

Module I

Introduction to computer architecture - Instruction Set Principles - Instruction execution fundamentals - concept of memory and addressing - Performance measurement of computer hardware - MIPS - IPC - Speed-up and Amdahl's Law - MIPS instruction set - RISC vs CISC architectures - Concept of instruction pipelining - RISC instruction set - RISC 5 stage pipeline - pipeline hazards - operand forwarding - branch prediction techniques

Module II

Introduction to memory hierarchy - locality of reference - Memory Hierarchy Design – Cache Memory Hierarchy – cache memory fundamentals - cache performance parameters - Block level issues - mapping - identification - replacement - write strategy - types of misses-compulsory - capacity - conflict misses - Basic cache optimizations by adjusting cache size - block size - associativity - Advanced cache optimizations - Virtual memory concepts

Module III

Memory Hierarchy Design – Main Memory Design - Introduction to DRAM organization- DIMMs - channels - ranks - banks - rows - columns - sense amplifiers and device control logic - Memory controllers- DRAM timing and signaling - access protocols - commands - bank and rank conflicts - DRAM refresh circuitry and power managements schemes - DRAM scheduling

Module IV

Instruction Level Parallelism - Out-of-Order Execution -Thread-Level Parallelism – Cache Coherency problem - Synchronization - Memory Consistency - Multi-core Processor – Introduction to Network on Chip (NoC)

References:

1. Computer Architecture-A Quantitative Approach (5th edition), John L. Hennessy, David A. Patterson, Morgan Kaufman Publishers Inc.
2. Modern processor Design: Fundamentals of superscalar Processors, John Paul Shen and Mikko H. Lipast.
3. Memory System-Cache, DRAM and Disk, Bruce Jacob, Spencer W. Ng, David T. Wang, Morgan Kaufman Publishers Inc.
4. Computer Architecture-Pipelined and Parallel Processor Design, Michael J. Flynn, Narosa Publishing House.

19-203-0710 MECHATRONICS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To identify Engineering problems that can be implemented using the concepts of Mechatronics.
2. To learn techniques of integrating multidisciplinary tasks from Electronics, Mechanical, Electrical & Computer science.

Module I

Introduction to Mechatronics - Elements of Mechatronic Systems. Mechatronics in manufacturing -Mechatronics in products - Scope of Mechatronics.

Mathematical modeling of Engineering Systems: System Building blocks for Mechanical, Electrical, Fluid and Thermal systems. **General Engineering System Modeling:** Rotational - Translational, Electromechanical, Hydraulic_ Mechanical systems - System Transfer Function - Dynamic response of systems for standard test signals (Detailed mathematical analysis not required).

Module II

Actuation Systems: Pneumatic & Hydraulic Systems: Process Control Valves, Directional and Pressure Control valves, Linear and Rotary actuators.

Mechanical Actuation Systems: Translational and Rotational motions, Kinematic Chains, Cams, Gear Trains, Ratchet and Pawl, Belt and Chain drives, Bearings.

Electrical Actuation Systems: Mechanical and Solid State Relays, Solenoids, DC & AC motors, Servo & Stepper motors- feedback devices - encoders - pulse digitizers - resolvers - inductosyn – tachometers.

Module III

Fundamentals of numerical control - advantages of NC systems - classification of NC systems - point to point and contouring systems - NC and CNC - incremental and absolute systems - open loop and closed loop systems - features of NC machine tools - fundamentals of machining - design consideration of NC machine tools - methods of improving machine accuracy and productivity

Industrial robotics - basic concepts - robot anatomy - robotics and automation - specification of robots – resolution-repeatability and accuracy of manipulator - classification of robots.

Module IV

MEMS: Internal Structure, advantages, manufacturing, applications - Fibre Optic Devices in Mechatronics **Mechatronic System Controllers:** ON/OFF, P, I, D, PI and PID Controllers, Digital controllers, Intelligent Controllers in Mechatronics. **Programmable Logic Controllers:** Structure, I/O processing, Programming, applications – Selection Criteria.

References:

1. Bolton. N, *Mechatronics- Electronic Control systems in Mechanical and Electrical Engineering,* Pearson Education,4/e, 2008
2. M.D. Singh, J.G. Joshi, *Mechatronics,* Prentice Hall India, New Delhi, 2006
3. Dradly. D.A, Dawson.D, Burd N.C and Loader A.J, *Mechatronics – Electronics in Products & Processes*, Chapmen & Hail, 1993.
4. James Harter, *Electromechanics- Principles concept and Devices,* Prentice Hall, 1995.
5. Michel P. Groover, *Industrial Robots-Technology, Programming and Applications,* McGraw Hill,1986
6. Yoram Koren & Ben Yuri, *Numerical Control of Machine Tools,* Khanna Publishers,1984
7. A.Smaili,F.Mrad,*Mechatronics-Integrated Technologies for Intelligent Machines,*Oxford,2009
8. Appukuttan .K.K, *Introduction To Mechatronics,* Oxford University Press,1/e, 2007
9. David G Alciatore,Micheal ,*Introduction to Mechatronics and Measurement Systems,*TMH,3/e,2007
10. Nitaigour P Premchand,*Mechatronics-Principles,Concepts and Applications,*TMH,11/e,2011

19-203-0711 INTELLECTUAL PROPERTY RIGHTS

Course Outcomes

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

1. Understand the basic concepts of IPR
2. Get exposure to various aspects of IPR
3. Get knowledge of Registration of IPR and its enforcement

Module I - Basic Concept of IPR: Basic Concepts of Intellectual Property- Introduction to intellectual property rights, laws and its Scope, Trade Related Aspects of Intellectual Property Rights.
Introduction to patent law and condition for patentability, Procedure for obtaining patents, Rights of a patentee, Patent infringements, Bio-technology patents and patents on computer programs, Patents from an international perspective.

Module II

Trademark & Geological Indications - Trademark and 'geographical Indications: Statutory authorities and registration procedure, Rights conferred by registration, Licensing, assignment and transfer of trademark rights, Trademark infringement, Geographical Indication of Goods & Appellations of Origin.

Module III

Copyright: Copyright Registration procedure and copyright authorities, Assignment and transfer of copyright, copyright infringement and exceptions to infringement, Software copyright

Module IV

Law on Industrial Designs -Introduction to the law on Industrial Designs, Registration and piracy, International perspective, Introduction to the law on semiconductor layout design, Registration, commercial exploitation and infringement.

Text Books:

1. Vinod V Sople, Managing Intellectual Property, 4/e – PHI (2014)
2. Krishna Kumar, Cyber law, intellectual property and e-commerce security, Dominent Publication and distribution, New Delhi. (2011)

References:

1. Craig Fellenstein, Rachel Ralson , Inventors Guide to Trademarks and Patents-- Pearson Education (2005).
2. David Bainbridge, Longman, Intellectual Property 8/e

19-203-0712 MICROWAVE ENGINEERING LAB

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To design and simulate different Microwave systems.

Experiments:

1. Determine the Reflex Klystron frequency and mode characteristics
2. Obtain the characteristics of crystal detector
3. Measurement of guide wavelength and source frequency
4. Study of V-I characteristics of GUNN diode
5. Determine the Parameters of : directional coupler, isolator and circulator
6. Determine the unknown impedance using slotted section and smith chart
7. Study of: attenuators, E-plane, H-plane and Magic Tees
8. Determine the radiation patterns of E-plane sectoral, H-plane sectoral and horn antennas.
9. Study of input impedance and S parameters of various microwave networks using network analyzer.
10. Design and optimization of various microwave networks like filters and antennas using microwave simulators like HFSS/IE3D/MICROWAVE STUDIO/ADS

Reference:

1. K.C.Raveendranathan, Communication Systems Modelling and Simulation, Using MATLAB® and SIMULINK®, University Press, 1/e, 201

19-203-0713 IMAGE PROCESSING LAB

Course Objectives

1. The students will be able to do image processing experiments using Python programming

Course Outcomes:

1. To students will be able to understand Python programming in a virtual environment
2. The students will be able to do image processing experiments in Python

Experiments:

I. Python Programming Fundamentals
   a. Introduction to Jupyter Notebbook, Google Colab
   b. Familiarisation of Basic libraries like numpy, matplotlib etc.

II. Image Processing Experiments to be done on gray scale images
   a. Transforms on images: DFT, DCT
   b. Basic Intensity Transformations
   c. Median and Averaging filter using various sized masks
   d. Histogram equalisation
   e. Edge Detection using various operators.
   f. Filtering in frequency domain
   g. Thresholding
   h. Morphological operations: dilation and erosion

References:

1. https://cs231n.github.io/python-numpy-tutorial/
2. https://jakevdp.github.io/PythonDataScienceHandbook/
3. Gonzalez and Woods, *Digital Image Processing*, Pearson Education,4/e, (2018)

19-203-0714 ENTREPRENEURSHIP DEVELOPMENT

Course Outcomes

On completion of this course the student will be able to

1. Recognize different types of entrepreneurial ventures
2. Interpret opportunity and risk analysis
3. Summarize the strategies for valuing their own company, and how venture capitalist and angel investors use valuations in negotiating milestones, influence and control
4. Determine correct marketing mix and how to position the company in the market by using analytical tools
5. Explain how organizations operate and their process matrices

Module I

Market Research: Introduction to Entrepreneurship, Profile of the Entrepreneur, Market Gap /Opportunity Analysis, Market Research Methods, Defining the Focal Market: Market Segmentation, Industry analysing – Research / Competitive Analysis.

Types of Companies and Organizations: Company/ Organization Types, Legal Aspects, Taxation, Government Liaison, Building the Team, Mergers and Acquisitions, import and export nuances.

Module II

Business Finance: Shares and Stakes, Valuation, Finance Creation (Investors / Financers), Revenue Plans and Projections, Financial Ratios, Business Lifecycle, Break Even, Balance Sheets, game theory.

Module III

Marketing: Marketing Basics, Marketing Strategy and Brand Positioning, Plans and Execution Techniques, Marketing Analytics, Online Marketing, Product Life Cycle.

Sales: Understanding Sales, Pitching Techniques, Sales strategies, Inside Sales v/s Outside Sales, RFP

Module IV

Operations Management and HR: Operational Basics, Process Analysis, Productivity, Quality

Start-ups: Start-up Basics, Terms, Start-up Financing, Start-up Incubation, Getting Listed

References:

1. David Kidder. The Startup Playbook: Secrets of the Fastest-Growing Start-ups from their Founding Entrepreneurs
2. Ed Catmull. Creativity, Inc.: Overcoming the Unseen Forces That Stand in the Way of True Inspiration
3. Bhargava, S. (2003). Transformational leadership: Value based management for Indian Organizations (Ed.). New Delhi: Response-Sage.
4. Hisrich, R. D. & Peters, M. P. (2001). Entrepreneurship: Starting, developing, and managing a new enterprise (5th Ed.). New York: McGraw-Hill.
5. Verma, J. C., & Singh, G. (2002). Small business and industry: A handbook for entrepreneurs. New Delhi: Response-Sage.
6. Prasanna Chandra, Financial Management: Theory and Practice, Tata McGraw Hills, 6th Edn, 2004

19-203-0715 PROJECT PHASE I

Course Objectives:

To identify a research/industry related problem for the undergraduate project work with the guidance of the respective faculty and prepare a design and work plan for a relevant problem of real world application.

Course Outcomes:

On successful completion, a student would be able to

I. 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. To understand and analyse a technically solvable social problem

PROJECT PHASE I

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.

-Application and feasibility of the project

- Complete and detailed design specifications.
- Block level design documentation
- Detailed design documentation including circuit diagrams and algorithms / circuits
- Bill of materials in standard format and cost model, if applicable
- Project implementation action plan using standard presentation tools

***Guidelines for evaluation*:**

Attendance and Regularity	10
Theoretical knowledge and Involvement in study or project	30
End-Semester presentation & Oral examination	20
Level of completion of design as per specifications	20
Project Phase 1 Report	20
Total	100

Note: *Points (i)-(iii) to be evaluated by the respective project guides and pro}ect coordinator based on continuous evaluation (iv)-(v) to be evaluated by the final evaluation team comprising of 3 internal examiners including the pro}ect guide, coordinator & a senior faculty member*

The project phase I includes the literature survey, schematic block or algorithms, design of the project and implementation of the initial phase of the project by approximately 30%. A report on the work done in this phase shall be submitted by each student by the end of the VIII semester. There will be an internal examination of the project that includes oral presentation regarding the overall project and demonstration, if any, of the completed work. The evaluation panel shall consist of at least three faculty members including the project guide.

19-203-0716: INDUSTRIAL INTERNSHIP

Course Outcomes:

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

1. Work safely in industrial environment.
2. Work with various interest groups, disciplines, professionals, managers, technicians etc.
3. Polish the engineering skills by applying the knowledge in day-to-day operation, troubleshooting and minor-modifications.
4. Build relations with University and Industry that will help mutual cooperation over long-term.

Every Student shall undergo a summer internship program of minimum two weeks duration in an Electronics industry/ Communication industry/ allied engineering industry/ R&D organization during May - June vacation before the commencement of VII semester and submit a report on the activities performed in July.

Evaluation of internship will be conducted along with Project - Phase- I

19-203-0801 WIRELESS COMMUNICATION

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand wireless systems
2. To analyze the performance of multicarrier modulation
3. To understand adaptive modulation
4. To understand diversity reception techniques.

Module I

Overview of Wireless Systems. Wireless spectrum, Signal Propagation, Path Loss Models and Shadowing, Combined Path Loss shadowing, Coverage Area, Statistical Fading Models, Narrowband Models, Signal Envelope Distribution, Fading Distributions and Duration- Wideband Fading. Doppler and Delay Spread, Wideband Channel Models.

Module II

Capacity of wireless channels- Fading Channels, Capacity of Flat and FS Fading Channels, Modulation schemes, Linear Modulation Performance in Fading, Performance in Fading and ISI. Diversity, receiver diversity, Transmit Diversity . Adaptive Modulation

Module III

MIMO and Space/Time Communications, MIMO Capacity, Beam forming, Diversity, Space time codes.

Module IV

Broad Band communication: Multi carrier modulation – OFDM- spread spectrum communication- Multi user systems - random access- ALOHA, slotted ALOHA, CSMA, CSMA/CD, scheduling approaches

References:

1. Goldsmith, *Wireless Communication* , Cambridge ,(2011)
2. C Y Lee, *Mobile Communication Engineering* , TataMcGrawhill ,2/e ,(2008)
3. Theodore S. Rappaport, Simon: *Wireless communication principles and practice*, Pearson Education,2/e
4. Haykin, Michael Mohar, *Modern wireless communication*, Pearson Education, (2008)
5. William Stallings, *Wireless communication and networks*, Pearson Education, (2006).
6. Molisch, *Wireless communication* ,Wiley India ISBN 978812651056
7. William C Y Lee: *Mobile cellular Telecommunications*, McGraw Hill, 2/e
8. John P Proakis&Salehi ,*Digital Communication*, McGrawHill,5/e, (2008),ISBN 9780070591172
9. S R Saunders AA Zavala, *Antennas and propagation for Wireless Communication Systems*, Wiley India, 2/e India, 2/ e.

19-203-0802 COMPUTER COMMUNICATION AND NETWORKING

Course Objectives

On successful completion of teaching-learning and valuation activities, a student would be able

1. To demonstrate the knowledge and ability to independently understand basic computer network technologies
2. To identify the different types of network topologies and protocols
3. To enumerate the layers of OST model and TCP/TP Protocols with its application.
4. To familiarize with network design and implementation of basic protocols of computer network

Module I

Introduction to Computer Networks: The Internet, Protocols and Standards. Network models- the OSI reference model, the TCP/IP reference model. Addressing. Packet switching, circuit switching. Network Topologies.

The physical layer: Transmission media –guided and wireless. Digital modulation -baseband and passband transmission, multiplexing - FDM, TDM.

Module II

The data link layer: Forward Error Correction – linear block codes, CRC. Framing, flow and error control. Data link protocols –noiseless stop and wait, ARQ, HDLC. Multiple access- random access, ALOHA, CSMA, controlled access - reservation, polling, token rings. LAN standards - Standard Ethernet, WLAN - IEEE 802.11. Devices – hubs, bridges, switches.

Module III

Network layer: Packet Switching Networks. Routing algorithms - routing tables, shortest path algorithm, link state, distance vector routing. IPv4 protocol: IPv4 addresses, transition to IPv6, Network address translation (NAT). Devices - Routers, gateway

Module IV

Transport Layer: User Datagram Protocol (UDP), Transmission Control Protocol (TCP).
Application Layer: WWW and HTTP, Domain Name System (DNS).
Network Security: Symmetric key - DES, AES, cipher. Public key - RSA. Firewall. SSL.

Textbooks:

1. Behrouz A. Fourouzan, *Data Communications and Networking*, Tata McGraw Hill, 2/e
2. Andrew S. Tanenbaum, *Computer Networks*, Pearson education/ PHI Ltd., 4/e

References:

1. James F. Kurose and Keith W. Ross, *Computer Networking - A Top-Down Approach Featuring the Internet*, Pearson Education, 2/e
2. Bertsekas and Gallagar, *Data Networks*, Prentice Hall India, 2/e.
3. Leon Garcia &Widjaja ,*Communication Networks* Tata McGraw Hill Publication, 2/e, ISBN 9780070595019
4. F. Halsall, *Data Communication, Computer Networks and Open System*s, Addison Wesley, 1996
5. S. Keshav, *An Engineering Approach to Computer Networkin*g, Pearson education, (2002)
6. William Stallings, *Wireless Communications & Networks*, Prentice Hall, (2001)

19-203-0803 RADAR SYSTEMS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
2. To refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
3. To understand principles of navigation, in addition to approach and landing aids as related to navigation.

Module I

Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm-Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters- System losses – Other Radar Equation Considerations

Module II

Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar – Other Doppler Radar Topics-Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics - Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).

Module lII

Matched –Filter Receiver –Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters - Frequency-Scan Arrays
Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter.- The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

Module IV

Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments.
Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System -Decca Receivers - Range and Accuracy of Decca - The Omega System.

References:

1. Merrill I. Skolnik ," Introduction to Radar Systems", 3rd Edition Tata Mc Graw-Hill 2003.
2. N.S.Nagaraja, “Elements of Electronic Navigation Systems”, 2nd Edition, TMH, 2000.
3. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004
4. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004

19-203-0804 NEURO-FUZZY SYSTEMS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the basics of Neural Networks and essentials of Artificial Neural Network
2. To understand Fuzzy sets and Fuzzy Logic system components
3. To differentiate between Neuro – Fuzzy and Fuzzy – Neural Controllers

Module I

Introduction to ANNs: Classical AI and Neural Networks, Human brain and the biological neuron, Artificial Neurons, Neural Networks and architectures, feed forward and feedback architectures, geometry of binary threshold neurons and their networks, Supervised and unsupervised learning, concepts of generalization and fault tolerance Supervised learning: Perceptrons and LMS, Back propagation Neural Networks, Fast variants of Back propagation.

Module II

Statistical pattern recognition perspective of ANNs: Bayes theorem, Implementing classification decisions with the Bayes theorem, interpreting neuron signals as probabilities, Multilayered networks, error functions, posterior probabilities, error functions for classification problems, Support vector machines, RBFNNs, regularization theory, learning in RBFNNs, Image classification application, PNNs.

Module III

Recurrent Neural Networks: Dynamical systems, states, state vectors, state equations, attractors and stability, linear and non-linear dynamical systems, Lyupanov stability, Cohen Grossberg theorem, Attractor neural networks: Associative learning, associative memory, Hopfield memory, Simulated annealing and the Boltzmann Machine, BAM, ART principles, Self Organizing Maps

Module IV

Fuzzy Logic- Introduction, Fuzzy Sets, Concept of Fuzzy Number, Operation of Fuzzy sets, Properties of Fuzzy Set, Fuzzy versus probability, Fuzzy relations and Fuzzy relation calculations – Fuzzy members – Indices of Fuzziness –Comparison of Fuzzy quantities – Methods of determination of membership functions. Fuzzy Rule systems and interpretability of Fuzzy Rule systems, Knowledge Processing with Fuzzy Logic, Fuzzy Linguistic variables, Linguistic Modifier, Fuzzy Implication Relations/ Compositional Rules.

References:

1. B.Yegnanarayana, *Artificial Neural Networks,* Prentice Hall of India,(2009)
2. Yaochu Jin, *Advanced Fuzzy Systems Design and Applications*, Springer.
3. Bart Kosco, *Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence,* Prentice Hall of India.
4. Laxmidhar Behera, Indrani Kar, *Intelligent Systems and Control-Principles and applications.* Oxford.
5. M.Ganesh, *Fuzzy Set and Fuzzy Logic*, Prentice Hall of India.
6. John Harris, *An Introduction to Fuzzy logic Applications,* Springer.
7. James J Buckley, *Fuzzy Probabilities-New approach and Applications,* Springer.
8. James A Anderson, *An Introduction to Neural Networks,* Prentice Hall of India,(2009)
9. Robert J Schalkoff_*Artificial Neural network,* TMH,(2011),
10. Satish kumar, *Neural Networks-A class room approach,*TMH,(2011)

19-203-0805 LOW POWER VLSI DESIGN

Course Outcome:

On successful completion of teaching-learning and valuation activities, a student would be able

1. Identify the source of power dissipation.
2. Understanding low power design methodologies
3. Application of low power design principles in combinational and sequential circuit design.

Module I

Power dissipation in CMOS VLSI Circuits,Need for low power VLSI chips, MOS Transistor structure and device modelling, Dynamic Power Dissipation-Short Circuit Power-Switching Power- Gliching Power, Static Power Dissipation, Degrees of Freedom, Scaling of device dimensions , Impact of technology Scaling.

Module II

Leakage power minimization and supply voltage scaling Variable-threshold-voltage CMOS (VTCMOS) approach, Multi-threshold-voltage CMOS (MTCMOS) approach, Power gating, Transistor stacking, Dual-V_t assignment approach (DTCMOS), Dynamic voltage scaling, Impact of supply voltage scaling on parallel and pipelined architectures.

Module III

Circuit and logic level power reduction techniques, Circuit level: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Module IV

Architecture level power reduction techniques and clock distribution, Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, Adaptive filter design.

Low power Clock Distribution: Clock gating, Power dissipation in clock distribution, single driver vs. distributed buffers, Zero skew vs. tolerable skew, chip & package co design of clock network.

References:

1. Neil H. E. Weste, DavidHaris and Ayan Banerjee, CMOS VLSI Design, A circuits and Systems perspective, fourth edition.
2. Pal, Ajit. Low-Power VLSI Circuits and Systems. Springer, 2015 edition.
3. Gary K. Yeap, Practical Low Power Digital VLSI Design, KAP, 2002,ISBN 981-02- 2518-0
4. Kaushik Roy,Sharat Prasad, Low-Power CMOS VLSI Circuit DesignWiley,2009 edition.

19-203-0806 MULTIMEDIA COMMUNICATION SYSTEMS

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To understand the underlying concepts, principles, techniques related to video coding.
2. To learn basic techniques and international standards for image, video, and audio coding.
3. To familiarize with the international standards
4. To understand state-of-the-art compression technologies

Module I

Introduction to Multimedia: Multimedia applications. Multimedia Information Representation, digitization principles, Text, Images, Audio, Fundamental Concepts in Video, Color in Image and Video RGB CMY, YUV YC_BC_R, Digital Video

Module II

Multimedia Compression Techniques:

Lossless Compression - Run Length Coding, Statistical Coding, Huffman Coding, Dictionary Coding, Arithmetic Coding.

Lossy Compression - Transform coding, DFT, DCT, Harr Transform, KLT, Wavelet Transforms, Embedded Zero Tree Coder.

Module III

Audio Compression: Basic Audio Compression Techniques- Quantization, Non-linear Quantization, Differential Encoding, Linear Prediction Coding- LPC, DPCM, DM, Adaptive DPCM. Speech compression. MPEG audio coders, Dolby audio coders.

Module IV

Image and Video Compression: JPEG Standards-Baseline JPEG, JPEG Models. Basic Video Compression Principles, and standards H.261 and MPEG series

Textbooks:

1. Fred Halsall, *Multimedia Communications: Applications, Networks, Protocols and Standards*, Pearson, (2011)
2. Li, Ze-Nian, Drew, Mark S, *Fundamentals Of Multimedia*, PHI, (2011)

References:

1. Krishna Kumar D N, *Multimedia communication*, Pearson (2010).
2. K.Sayood, Morgan Kauffman, *Introduction to Data Compression*, 2/e, (2000)
3. Iain E. G. Richardson. *H.264 and MPEG-4 Video Compression*, John Wiley & Sons (2003)

19-203-0807 ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY

Course outcomes:

At the end of this course, the student should be able to:

1. Identify Standards.
2. Compare EMI test methods,
3. Apply EMI mitigation techniques,
4. Learn about the precautions and shielding used in electronic gadgets.
5. Calculate EMI of a system
6. EMC Design of PCBs

Module I

Introduction to EMC, Aspects of EMC, decibels and common EMC units. EMC requirements for Electronic systems: Governmental requirements, Product requirements. FCC and CISPR classifications. Antennas, elemental dipole antennas, characterization of antennas, Directivity and gain, effective aperture, Antenna Factor. Broad band Measurement Antennas.

Module II

Non Ideal behavior of components; Wires, resistance and internal inductance of wires, external inductance and capacitance of parallel wires, Per unit length parameters of Resistors, Capacitors, and Inductors, Ferrites and common-mode chokes. Conducted Emission, The Line Impedance Stabilization Network (LISN).

Module III

Spectra of digital circuit waveforms, spectral bounds for Trapezoidal waveforms, Spectrum analyzers. Radiated Emissions and Susceptibility: Simple emission models for wires and PCB lands, Differential-mode versus common-mode currents, differential-mode current model, common-mode current model. Simple susceptibility models for wires and PCB lands. Power supply and filter placement.

Module IV

Common and differential mode current gain, power supply filters. Electro static Discharge (ESD), origin of ESD and effects of ESD. Shielding, shielding effectiveness –far-field sources, shielding effectiveness – near-field sources. EMI measurement: Open Area Test sites, Anechoic chamber, TEM Cell, GTEM Cell

References:

1. Clayton R. Paul, *Introduction to Electromagnetic compatibility*, John Wiley and Sons Inc,1992, ISBN-10: 0471549274, ISBN-13: 978-0471549277
2. V. Prasad Kodali, *Engineering Electromagnetic Compatibility Principles, Measuments, technologies and Computer Models* IEEE PRESS, ISBN 0-7803-4743-9
3. Henry W Ott, *Electromagnetic Compatibility Engineering,* John Wiley and Sons,1/e,2009, ISBN-13: 978-0470189306, ISBN-10: 0470189304
4. Archambeault Bruce R, Ramihi Omar M, Brench, *EMI/EMC Computational Modeling Handbook*, Springer publications/e,200

19-203-0808 ASIC DESIGN

Course outcome:

1. Achieve basic knowledge of ASIC internals.
2. Achieve impart knowledge on ASIC types and tools used.
3. Explain algorithms for floor planning and placement of cells for optimized area and speed.
4. Explain and apply routing algorithms for optimization of length and speed.

Module I

Introduction to ASICs, Full custom, Semi-custom and Programmable ASICs, ASIC Design flow, ASIC cell libraries. CMOS Logic: Data path Logic Cells: Data Path Elements, Adders: Carry skip, Carry bypass, Carry save, Carry select, Conditional sum, Multiplier (Booth encoding), Data path Operators, I/O cells.

Module II

Programmable ASICs, Anti-fuse, Static RAM, EPROM and technology, Programmable ASIC logic cell: Altera flex1 I/O cells: DC output, AC output, Clock input ,Interconnects: Actel ACT & amp; Xilinx LCA, Low level design entry: Hierarchical design entry.

Module III

Simulation, Synthesis and Testing Basics of HDL, simulation, types of simulation, Synthesis of combinational circuit, FSM synthesis, Memory synthesis, static timing analysis, Fault simulation and ATPG algorithm.

Module IV

Floor planning, Placement and Routing, Floor planning: Goals and objectives, Floor planning tools, Channel definition, I/O and Power planning and Clock planning. Placement: Goals and Objectives, Min-cut Placement algorithm, Iterative Placement Improvement, Physical Design Flow. Routing: Global Routing: Goals and objectives, Global Routing Methods, Back- annotation. Detailed Routing: Goals and objectives, Measurement of Channel Density, Left- Edge and Area-Routing Algorithms. Special Routing, Circuit extraction and DRC.

References:

1. Michael John Sebastian Smith, “Application - Specific Integrated Circuits” Addison- Wesley Professional, 2005.
2. Neil H.E. Weste, David Harris, and Ayan Banerjee, “CMOS VLSI Design: A Circuits and Systems Perspective”, 3rd edition, Addison Wesley/ Pearson education, 2011.
3. Design manuals of Altera, Xilinx and Actel.
4. Vikram Arkalgud Chandrasetty, “VLSI Design: A Practical Guide for FPGA and ASIC Implementations”, Springer, 2011, ISBN: 978-1-4614-1119-2.
5. Rakesh Chadha, Bhasker J., “An ASIC Low Power Primer”, Springer, ISBN: 978-1- 4614-4270-7

19-203-0809 INDUSTRIAL ELECTRONICS

Course outcome:
By the end of this course, the student will:

1. Learn about the latest electronic devices available in industry
2. Be able to effectively provide detailed explanation to the structure and operation of common linear components.
3. Learn about the digital ICs and sensory electronic devices
4. Perform basic electronics troubleshooting
5. Learn about industrial control devices

Module I

Introduction to electronics in industry application. Discrete & continuous Control, Input and Output Devices, Mechanical and Electrical Switch Classifications, Mutually-Activated Electronic Circuit Switches, Mechanically-Activated Electronic Circuit Switches, Discrete Output Devices,, Relays, Operational Amplifiers and Linear ICs - Introduction to the Op-Amp Parameters Understanding Op-Amp Data Sheets Inverting Amplifiers Non-inverting amplifiers Comparators and Detectors, Active Filter Circuits, Instrumentation Amplifiers

Module II

Thyristors (SCRs, TRIACs), Silicon Controlled Rectifiers, Thyristor Triggering Devices, SCR Application,s Triacs, Triac Applications, Controlled Thyristor Switches, Automation Sensors and Devices, Introduction to Electronic Sensors, Non-contact Sensors, Sensor Output Interfaces, Analog Automation Sensors, Sensor Applications and Selection, Integrating Sensors into Power and Control Circuits

Module III
Common transducers for measurement of chemical quantities by electro-chemical methods, range, accuracy, sensitivity, relative cost and environmental suitability of transducers Analog Process Control Devices and Sensor Process, Actuators and Output Devices, Control Valves, Electrical Heating Elements, Control Sensors, Transmitters and Transducers, Temperature Sensors, Pressure Sensors, Flow Sensors, Level Sensors, Position Sensors

Module IV
Introduction to Safety, Safety Standards, Presence Sensors, Interlock Devices, Developing a Safety Strategy, Grounding, circuit breakers, fuses Data Communication between Intelligent Machines, Classification of Network, Media Enterprise Networks, Fieldbus Networks, Factory- Floor Data Network

References

1. Maloney, Timothy. Modern Industrial Electronics, 5th ed. Prentice Hall. 2004

2. Rehg, James, A., Sartori, Glenn. Industrial Electronics. 5th ed. Prentice Hall. 2006

19-203-0810 MEMORY AND INTERCONNECTS

Course Outcome:
On successful completion of teaching-learning and valuation activities, a student would be able

1. Learn and appreciate computer architecture with an emphasis on system design - performance and analysis.
2. Elevate computer architecture related discussions and thoughts to performance improvement of storage and interconnect mechanisms in multi-core systems.
3. Understand and analyze events happening at hardware level with the help of open source simulators.
4. Enable exploration of future directions in computer architecture research.

Module I
Processor design trends - instruction pipeline concepts - out-of-order execution - introduction to superscalar processors - Cache memory concepts and optimization techniques - DRAM organization - design concepts in memory controllers.

Module II
Tiled Chip Multicore Processors & Network-On-Chip - Introduction to TCMP - Multicore processors - communication issues in TCMPs - role of NoCs - topology schemes - routing – deterministic and adaptive routings - input and output selection strategies - congestion managements with selection strategies.

Module III
NoC router micro architecture - input buffered routers - flow control techniques - virtual channels and deadlock management - allocators and arbiter algorithms for crossbar switch - Introduction to deflection routers – (Bufferless design) - minimally buffered router designs - compression and prefetch aware NoC designs.

Module IV
Need for QoS at on-chip shared resources like caches, NoC and memory controllers - cache management techniques for multi-core systems – Emerging trends in Network on chips - Introduction to wireless and optical NoCs – Concepts in TCMP systems.

References:

1. Computer Architecture-A Quantitative Approach (5th edition), John L. Hennessy, David A. Patterson, Morgan Kaufman Publishers Inc.
2. W. Dally and B. Towles Principles and Practices of Interconnection Networks USA: Morgan Kaufmann Publishers Inc.
3. Advanced Computer Architectures-A Design Space Approach, Dezso sima, Terence Fountain, Peter Kacsuk, Pearson Publication.
4. Memory System-Cache, DRAM and Disk, Bruce Jacob, Spencer W. Ng, David T. Wang, Morgan Kaufman Publishers Inc.

19-203-0811 INTRODUCTION TO MACHINE LEARNING

Course Objective:
On completion of the course the student will be able to acquire different machine learning techniques.
Course outcome:

1. To understand various machine learning techniques
2. To acquire knowledge about classification techniques.
3. To understand dimensionality reduction techniques and decision trees.
4. To understand unsupervised machine learning techniques.

Module I
Introduction: Machine Learning, Applications, Supervised Learning -Classification, Regression, Unsupervised Learning, Reinforcement Learning, Supervised Learning: Learning a Class from Examples, Vapnik - Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm

Module II
Multilayer Perceptrons: Introduction, The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptrons, Backpropagation Algorithm, Training Procedures. Classification- Cross validation and re-sampling methods- Kfold cross validation, Boot strapping, Measuring classifier performance- Precision, recall, ROC curves. Bayes Theorem, Bayesian classifier, Maximum Likelihood estimation, Density Functions.

Module III
Dimensionality Reduction: Introduction, Subset Selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis, Isomap, Locally Linear Embedding, Decision Trees: Introduction, Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees, Introduction to Linear Discrimination, Generalizing the Linear Model.

Module IV
Clustering: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters.

References:

1. Stephen Marsland, "*MACHINE LEARNING An Algorithmic Perspective*", 2nd Edition, CRC Press, 2015.
2. Christopher M. Bishop, "*Pattern Recognition and Machine Learning"*, Springer, 2006.
3. Ethem Alpaydin, "*Introduction to Machine Learning*", Second Edition, 2010

19-203-0812 NON–CONVENTIONAL SOURCES OF ENERGY

Course Objective:

It introduces solar energy its radiation, collection, storage and application. It also introduces the Wind energy, Biomass energy, Geothermal energy and ocean energy as alternative energy sources.

Module I

Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra- terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar energy collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar energy storage and applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

Module II

Wind energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria **Bio-mass:** Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

Module III

Geothermal energy: Resources, types of wells, methods of harnessing the energy, potential in India. **Ocean energy**: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Module IV

Direct energy conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermoelectric generators, seebeck, Peltier and joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Text books:

1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

References:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

19-203-0813 SELF AWARNESS & INTEGRAL DEVELOPMENT

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able to:

1. To have a clear understanding of one's self
2. To take decisions effectively
3. To resolve conflicts in relationships
4. To develop leadership skills

Module I

Self-awareness: Introduction to self-assessment tools - identify strengths and weaknesses, impact on leadership style, developing statement of life purpose, self actualisation and beyond
Creativity - Out of box thinking, Lateral Thinking
Attitude- Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette
Motivation - Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators
Spirituality and perfection in work.

Module II

Decision making: Individual vs. Group Decisions, steps of decision making, effective decision making, importance and necessity of decision making, the process and practical way of decision making, weighing positives and negatives

Module III

Integral development: Conflicts resolution-conflicts in human relation, approaches to conflicts resolution
Stress management – causes of stress and its impacts, how to manage and distress, stress busters,
Gratitude, time management

Module IV

Leadership skills: Leadership Styles - Personal Attributes, Myths About Leaders and Leadership, Becoming a Successful Leader, Personal Leadership Plan, Leadership Trait, Abilities, and Skills
Group Leadership and Teamwork, Communication Skills

References:

1. Goleman, Daniel. *Emotional Intelligence: Why It Can Matter More Than Iq*. New York: Bantam Books, 1995.
2. Covey, Stephen R., and Sean Covey. *The 7 habits of highly effective people*. Simon & Schuster, 2020.
3. HARRIS, Thomas Anthony. *The Book of Choice. I'm OK, You're OK*. Pan Books, 1973.
4. Kahneman, Daniel. *Thinking, fast and slow*. Macmillan, 2011.
5. Menon, Devdas. *Stop Sleepwalking Through Life!: 9 Lessons to Increase Your Awareness*. Yogi Impressions, 2004.
6. Carnegie, Dale, and Brent Cole. *How to win friends and influence people in the digital age*. Simon and Schuster, 2011.
7. Harari, Yuval Noah. *21 Lessons for the 21st Century*. Random House, 2018

19-200-0814 CONSTITUTIONAL LAW

19-203-0814 SEMINAR

Course Objectives:

To encourage and motivate the students to read and collect recent and relevant information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conferences, books, project reports, etc., prepare a report based on a central theme and present it before a peer audience

Course Outcomes:

On successful completion of teaching-learning and valuation activities, a student would be able

1. To Identify and familiarize with some of the good publications and journals in their field of study.
2. To 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. To Understand effective use of tools of presentation, generate confidence in presenting a report before an audience and improve their skills in the same.
4. To Develop skills like time management, leadership quality and rapport with an audience

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Electronics & Communication Engineering. The reference 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.

19-203-0815 PROJECT PHASE II

Course Outcomes:

On successful completion, a student would be able

1. Realize various steps involved in conducting a project work, like literature survey, methodology adopted - field study I survey I experiments I numerical work, analysis of the data to arrive at final results and conclusions, etc.
2. 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.
3. Conceive the pros and cons of working in a team and the wonderful results which could evolve through team-work.
4. Present and defend self-prepared and corrected report (with the help of project guide) of a self-created work to a peer audienceTo analyze and formulate a sociallyrelevant problem

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

- For hardware projects, practical verification of the design, PCB design, fabrication, design analysis and testing shall be done.
- For software projects, a proper front end (GUI) if applicable shall be designed. A detailed algorithm level implementation, test data selection, validation, analysis of outputs and necessary trial run shallbe done
- Integration of hardware and software, ifapplicable, 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 include

- Presentation of the work,
- Oral examination,
- Demonstration of the project against design specifications,
- Complete project report

GUIDELINES FOR EVALUTION

i.	Regularity and progress of work	40
ii.	Work knowledge and Involvement	40
iii.	End semester presentation and oral examination	40
iv.	Level of completion and demonstration of	40
v.	Project Report - Presentation style and content	40
	Total	200 marks

Note: Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation

(iii)-(v) to be evaluated by the final evaluation team

19-203-0816 COMPREHENSIVE VIVA VOCE

Course Objective:
To test the student's learning and understanding of the theory and applications of the various concepts taught during the entire course of their program and to prepare the students to face interviews in both the academic and industrial sectors

Course Outcomes:
On successful completion, a student would be able to

1. To refresh all the subjects covered during the programme
2. To gain good knowledge of theory and practice
3. To develop oral communication skills and positive attitude
4. To face 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 Head of Division or his/her nominee and one senior faculty of the Division and an external expert appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the program of study and practical/analysis skills in the field of Electronics and Communication