Course Structure & Syllabus for the programs:

Bachelor of Technology in Electronics Engineering

(As per the Ordinances for Bachelor of Technology as per 6th Academic Council)

Approved by

Board of Studies

Submitted By

Department of Electronics Engineering,

Harcourt Butler Technical University,

Nawabganj, Kanpur-208002 (UP)

VISION AND MISSION OF THE DEPARTMENT

Vision

Department of Electronics Engineering aims to deliver Technical Education in the field of Electronics and Communication Engineering, for producing Engineers and Technologists who are happy, healthy and competent professionals, motivated to serve the society through research & innovation.

Mission

1. To educate and train the students with state-of-the-art in Electronics and Communication Engineering.
2. To prepare the students who are fit for meeting the requirements and challenges of the Industry right at the time of their graduation by evolving a sustainable Industry-University interaction system for this.
3. To upgrade the teaching standards through continued efforts toward improvement of the qualification and expertise of the teachers as well as supporting staff.
4. To create awareness amongst the students towards socio environmental technologies by offering related courses and organizing seminars/workshops on these topics in the university and by encouraging participation in similar activities at other places.
5. To expand research and development activities in the frontier areas related to Electronics and Communication.
6. To include the aspect of integration of environmental balance and human values in the curriculum.
7. To provide academic support to other technical institutions at state & national level through the process of networking.
8. To start social service programs like education for masses, particularly using the enhanced means of communication.

VISION AND MISSION OF THE UNIVERSITY

VISION

"To achieve excellence in technical education, research and innovation".

MISSION

1. Imparting Knowledge to develop analytical ability in science and technology to serve the industry and society at large.
2. Equip and enable students with conceptual, technical and managerial skills to transform the organization and society.
3. Inculcating entrepreneurial philosophy and innovative thinking to promote research, consultancy and institutional social responsibility.
4. Serving people, society and nation with utmost professionalism, values and ethics to make development sustainable and quality of life.

Program Educational Objectives (PEOs)

Program graduates, within three years from their graduation will

PEO 1: have knowledge of basic and applied sciences, so as to apply the necessary competence for technically sound, economically feasible and socially acceptable solutions of real life complex engineering problems.

PEO 2: be fit for meeting the requirements and challenges of industries, research and academic institutions both at the national and International level, by applying expertise gained in area of electronics and communication engineering.

PEO 3: be professionally competent with excellent communication and management skills along with being enterprising professionals and responsible citizens capable of delivering their services individually as well as in a collaborative framework.

Structure of the Curriculum
Semester Wise Course Structure & Evaluation Scheme
For B.Tech. in Electronics Engineering
(Effective from Session 2020-21 for New Entrants: As per the th Academic Council)
I Semester

BSC: Basic Science Course
MC: Mandatory Courses
OEC : Open Elective Course
ESC: Engineering Science Course
PEC: Program Elective Course
PCC: Program Core Course
HSMC: Hum., Social Sc. and Management Courses

Sl. No.	Course Type	Subject Code	Course Title	Credits (LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	BSC		Physics	4(3-0-2)	15	20	15	50	50	100
2.	BSC		Mathematics-I	4(3-1-0)	30	20	-	50	50	100
3.	ESC		Electrical Engineering	4(3-0-2)	15	20	15	50	50	100
4.	ESC		Engineering Mechanics	3(3-0-0)	30	20	-	50	50	100
5.	HSMC		Professional Communication	3(2-0-2)	15	20	15	50	50	100
6.	HSMC		English Language and Composition	2(2-0-0)	30	20	-	50	50	100
			Total Credits	20						

***** Subject Code of Electronics & Instrumentation Engineering for odd semester is EET-151

II Semester

Sl. No.	Course Type	Subject Code	Course Title	Credits (LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	BSC		Engineering Chemistry	4(3-0-2)	15	20	15	50	50	100
2.	BSC		Mathematics -II	4(3-1-0)	30	20	-	50	50	100
3.	ESC	EET-152	Electronics & Instrumentation Engineering	3(3-0-0)	30	20	-	50	50	100
4.	ESC		Engineering Graphics	3(0-0-6)	30	20	-	50	50	100
5.	ESC		Computer Concept &C Programming	4(3-0-2)	15	20	15	50	50	100
6.	ESC		Workshop Practice	2(0-0-4)	-	20	30	50	50	100
7.	MC Non Credit		Environment and Ecology	2(2-0-0)	30	20	-	50	50	100
			Total Credits	20						

III Semester

Sr. No	Course Type	Subject code	Course title	Credits	Sessional Marks				ESM	Total Marks
					MSE	TA	Lab	Total		
1.	BSC		Mathematics- III	4(3-1-0)	30	20	-	50	50	100
2.	ESC		Electrical Circuit Analysis	5(3-1-2)	15	20	15	50	50	100
3.	PCC	EET-251	Digital Electronics (ET)	4(3-0-2)	15	20	15	50	50	100
4.	PCC	EET-259	Digital Electronics (CS & IT)	4(3-0-2)	15	20	15	50	50	100
5.	PCC	EET-253	Solid State Devices (ET)	4(2-1-2)	15	20	15	50	50	100
6.	PCC	EET-257	Solid State Devices & Circuits (EE)	4(2-1-2)	15	20	15	50	50	100
7.	PCC	EET-255	Hardware Description Language	2(2-0-0)	30*	20*	*	50	50	100
8.	HSMC		Engineering Economics and Management	3(3-0-0)	30	20	-	50	50	100
9.	MC (Non-credit)		Indian Constitution	2(2-0-0)	30	20	-	50	50	100
Total Credits				22						

IV Semester

Sr. No	Course Type	Subject code	Course title	Credits	Sessional Marks				ESM	Total Marks
					MSE	TA	Lab	Total		
1.	BSC		Computer Oriented Numerical Methods	4(3-1-0)	30	20	-	50	50	100
2.	ESC		Data Structure Using C	5(3-1-2)	15	20	15	50	50	100
3.	PCC	EET-252	Signal and Systems	3(2-1-0)	30	20	-	50	50	100
4.	PCC	EET-254	Analog Circuits	4(2-1-2)	15	20	15	50	50	100
5.	PCC	EET-256	Electromagnetic Field Theory	3(2-1-0)	30	20	-	50	50	100
6.	HSMC		Organizational Behaviour	3(3-0-0)	30	20	-	50	50	100
7.	MC (Non-credit)		Cyber Security	2(2-0-0)	30	20	-	50	50	100
Total Credits				22						

* Note: As per instruction by the DAA, and as per the decision of 7th academic council's decision the MSE will be 30 for the PCC subject with credit 2(2-0-0)

V Semester

Sr. No.	Course Type	Subject code	Course title	Credits	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1	PCC	EET-351	Analog Integrated Circuits	4(2-1-2)	15	20	15	50	50	100
2	PCC	EET-353	Analog Communication	5(3-1-2)	15	20	15	50	50	100
3	PCC	EET-355	Antenna and Wave Propagation	3(2-1-0)	30	20	-	50	50	100
4	PCC	EET-357	Microprocessors	4(2-1-2)	15	20	15	50	50	100
5	PCC	EET-359	VLSI Technology	3(2-1-0)	30	20	-	50	50	100
6	OEC (Maths)		Operation Research	3(3-0-0)	30	20	-	50	50	100
Total Credit				**22**						

VI Semester										
Sr. No.	Course Type	Subject code	Course title	Credits	Sessional Marks				ESE TA	Total Marks
					MSE	TA	Lab	MSE		
1	PCC	EET-352	Optical Communication & Switching Network	4(2-1-2)	30	20	-	50	50	100
2	PCC	EET-354	VLSI Design	3(2-0-2)	15	20	15	50	50	100
3	PCC	EET-356	Advanced Instrumentation	3(2-1-0)	30	20	-	50	50	100
4	PCC	EET-358	Digital Communication	3(2-0-2)	30	20	-	50	50	100
5	PCC	EET-360	Control System	3(2-1-0)	30	20	-	50	50	100
6	PCC	EET-362	Machine Learning	3(3-0-0)	30	20	-	50	50	100
7	OEC (Humanities)		OEC (Humanities)	3(3-0-0)	30	20	-	50	50	100
	Total Credit			**22**						

VII Semester

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	PCC	EET-451	Digital Signal Processing	3(2-0-2)	15	20	15	50	50	100
2.	PCC	EET-453	VLSI Implementation of Digital Signal Processing Algorithms	2(2-0-0)	30	20	-	50	50	100
3.	PEC	EET-	PEC-I	3(3-0-0)	30	20	-	50	50	100
4.	PEC	EET-	PEC-II	3(3-0-0)	30	20	-	50	50	100
5.	OEC	EET-491	OEC-I	3(3-0-0)	30	20	-	50	50	100
6.	Industrial Training	EET-493	Industrial Training	2(0-0-4)	-	50	-	50	50	100
7.	Seminar	EET-495	Seminar	2(0-0-4)	-	50	-	50	50	100
8.	Project	EET-497	Project	4(0-0-8)	-	50	-	50	50	100
				22						

VIII Semester

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	PEC	EET-	PEC-III	4(3-1-0)	30	20	-	50	50	100
2.	PEC	EET-	PEC-IV	4(3-1-0)	30	20	-	50	50	100
3.	OEC	EET-492	OEC-II	4(3-1-0)	30	20	-	50	50	100
4.	Project	EET-498	Project	10(0-0-20)	-	50	-	50	50	100
				22						

*** Note:** Internal Evaluation of Project in VII semester will be conducted by the Departmental Committee. Evaluation of project in VIII semester will be conducted by External and Internal Examiners.

ELECTIVE-I

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	PEC	EET-455	Biomedical Signal Processing	3(3-0-0)	30	20	-	50	50	100
2.	PEC	EET-457	Satellite Communication	3(3-0-0)	30	20	-	50	50	100
3.	PEC	EET-459	Digital System Design using VHDL	3(3-0-0)	30	20	-	50	50	100
4.	PEC	EET-461	Data Communication Networks	3(3-0-0)	30	20	-	50	50	100

ELECTIVE-II

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	PEC	EET-463	Artificial Intelligence	3(3-0-0)	30	20	-	50	50	100
2.	PEC	EET-465	Wireless Communication	3(3-0-0)	30	20	-	50	50	100
3.	PEC	EET-467	VLSI Device Modelling	3(3-0-0)	30	20	-	50	50	100
4.	PEC	EET-469	Microwave and Radar Engineering	3(3-0-0)	30	20	-	50	50	100

ELECTIVE-III

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	PEC	EET-452	Architecture And Applications Of Digital Signal Processors	4(3-1-0)	30	20	-	50	50	100
2.	PEC	EET-454	Information Theory and Coding	4(3-1-0)	30	20	-	50	50	100
3.	PEC	EET-456	Advanced Semiconductor Devices	4(3-1-0)	30	20	-	50	50	100
4.	PEC	EET-458	RF Systems	4(3-1-0)	30	20	-	50	50	100

ELECTIVE-IV

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	PEC	EET-460	Image Processing	4(3-1-0)	30	20	-	50	50	100
2.	PEC	EET-462	Neural Networks	4(3-1-0)	30	20	-	50	50	100
3.	PEC	EET-464	Embedded Systems	4(3-1-0)	30	20	-	50	50	100
4.	PEC	EET-466	Data Analytics	4(3-1-0)	30	20	-	50	50	100

OPEN ELECTIVE-I

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	OEC	EET-491	Mobile Communication	3(3-0-0)	30	20	-	50	50	100
2.	OEC		Biomedical Electronics	3(3-0-0)	30	20	-	50	50	100

OPEN ELECTIVE-II

SI.NO.	Course Type	Subject Code	Course Title	Credits(LTP)	Sessional Marks				ESE	Total Marks
					MSE	TA	Lab	Total		
1.	OEC	EET-492	Image Processing	4(3-1-0)	30	20	-	50	50	100
2.	OEC		Fuzzy Logic with electronics engineering applications	4(3-1-0)	30	20	-	50	50	100

The components of the curriculum

Table (a) Program curriculum grouping based on course components

Course Component	**Curriculum Content (% of total Credits of the program)**	**Total number of credits**
Basic Sciences (BSC)	13.95	24
Engineering Sciences(ESC)	16.86	29
Humanities and Social Sciences (HSMC)	6.39	11
Program Core (PCC)	36.63	63
Program Electives (PEC)	8.14	14
Open Electives (OEC)	7.56	13
Project(s)	8.14	14
Industrial training and Seminars	2.33	2+2 = 4
Any other (Mandatory Courses)	Non Credit	Non Credit
Total		**172**

Table (b) Program curriculum grouping based on course components as per semester: **Frequency & Credits**

Sem	**BSC**		**ESC**		**HSMC**		**PCC**		**PEC**		**OEC**		**Project**		**Ind,training**		**Seminar**		**Total**
	Credits	No.	Credits	No.	Credits	No.	Credits	No.	Credits	No.	Credits	No.	Credit	No.	Credit	No.	Credit	No.	Credit
I	4+4=8	2	4+3=7	2	3+2=5	2	-	-	-	-	-	-	-	-	-	-	-	-	20
II	4+4=8	2	4x3=12	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
III	4	1	5	1	3	1	4+4+2=10	3	-	-	-	-	-	-	-	-	-	-	22
IV	4	1	5	1	3	1	3+4+3=10	3	-	-	-	-	-	-	-	-	-	-	22
V	-	-	-	-	-	-	4+4+5+3+3=19	5	-	-	3	1	-	-	-	-	-	-	22
VI	-	-	-	-	-	-	4+3+3+3+3+3=19	6	-	-	3	1	-	-	-	-	-	-	22
VII	-	-	-	-	-	-	2+3=5	2	6	2	3	1	4	1	2	1	2	1	22
VIII	-	-	-	-	-	-	-	-	8	2	4	1	10	1	-	-	-	-	22
Tot	**24**	**6**	**29**	**8**	**11**	**4**	**63**	**19**	**14**	**4**	**13**	**4**	**14**	**2**	**2**	**1**	**2**	**1**	**172**

I Semester

ESC	**Electronics & Instrumentation Engineering**	**3L:0T:0P**	**3 credits**

Unit-I: P-N Junction Diode, V-I Characteristics and its Equivalent Models, Diode Applications as Half Wave Full Wave & Bridge Rectifier and their efficiency, Clippers and clampers, Varacter diode, Zener Diode and its Applications.

Unit-II: Introduction to BJT, FET & MOSFET and their Applications demonstration, Ebers-Moll Model of BJT, Introduction to Operational Amplifier and its Applications demonstration as Adder, Subtractor, Integrator, and Differentiator

Unit-III: Review of Boolean Algebra, Logic Gates, Concept of Universal Gates & Number system, Elaboration of Minimization using K map,

Basic Combinational Circuits: Adder, Subtractor. Sequential Circuits: Flip-Flops, Registers.

Unit-IV: Functional Elements of Instruments, Classification & Characteristics, Types of Errors, Active and Passive Transducers: Thermocouple, LVDT and their Characteristics

Unit-V: Display Devices: LCD, LED, Seven Segment Display, Alphanumeric Display, Strip chart recorder, modern display technique- OLED, AMOLED, PDP, QLED displays .

Electronic Ammeter and Voltmeter, Digital Multi-meter, Digital Storage Oscilloscope (DSO)

Text Books:

1. Malvino, A.P. / "Electronics Principles" / Tata McGraw-Hill.
2. Boylestad, Robert &Nashelsky, Louis / "Electronic Devices & Circuit Theory" / Prentice Hall of India.
3. H.S. Kalsi / "Electronic Instrumentation" / Tata McGraw-Hill
4. Malvino& Leach / "Digital Principles & Applications" / Tata McGraw-Hill.

Reference Books:

1. Sedra, Adel S., Smith, Kenneth C. / "Microelectronic Circuits"/ Oxford University Press.
2. Sawhney AK/ "Electrical and electronic Measurement and Instrumentation"/ Dhanpat Rai& sons.
3. Behzad Razavi/ "Fundamentals of Microelectronics"/ Wiley
4. Lectures of NPTEL

OUTCOMES:

Upon Completion of the course the students will be able:

1. To understand the basic concept of diodes, transistor, and Operational Amplifier.
2. To apply the knowledge in the calculation of the parameters of the diode, transistor, and Operational Amplifier.
3. To design the simple digital circuits.
4. Having the basic knowledge of measurement and applying it in the transducer.
5. To apply the knowledge of measurement with the help of electronic instruments and displaying it on electronic devices.

BSC	PHYSICS	3L:0T:2P	3 credits

MODULE- 1 (Lectures: 08)
Introductory Mechanics & Theory of Relativity:

Potential energy function *F= -grad(V)*, equipotential surfaces, meaning of gradient, divergence, curl and their physical significance, Conservative and Non-Conservative forces, Curl of a force, Central forces, Examples of Central forces, Conservation of Angular Momentum,
Inertial and Non- Inertial Frames of reference, Galilean transformation, Michelson Morley Experiment, Lorentz Transformation, Length contraction, Time dilation and Evidences for time dilation, Relativistic velocity addition formula, Relativistic variation of mass with velocity, Evidence of mass variation with velocity, Einstein's Mass energy equivalence, Examples from nuclear physics, Relativistic energy momentum relation.
MODULE -2 (Lectures: 08)
Quantum Mechanics-Schrodinger Equation and its Applications:

Dual Nature of matter & Radiation, Heisenberg's uncertainty Principle and their applications, wave group concept, Davisson Germer experiment, Postulates of quantum mechanics, Significance of wave function, Derivation of Schrodinger equation for time independent and time dependent cases.
Application of Schrodinger wave equation for a free particle, Particle in a box (one dimensional and three dimensional), Simple harmonic oscillator (one dimensional).
MODULE – 3 (Lectures: 08)
Electromagnetic Theory:
Ampere's law and Faraday's law of electromagnetic induction, Maxwell's equations, Correction of Ampere's law by Maxwell (concept of displacement current), transformation from integral to differential form, Physical significance of each equation, Poynting theorem, Maxwell's equations in free space, velocity of electromagnetic wave, Transverse character of the wave and orthogonality of **E**, **H** and **v** vectors, Maxwell's equation in dielectric medium and velocity of e.m. wave, Comparison with free space, Maxwell's equations in conducting media, Solution of differential equation in this case, penetration depth, its significance.
MODULE – 4 (Lectures: 09)
Materials of Technological Importance:

Dielectric Materials: Electric field in presence of dielectric medium,concept of electric polarization, different types of polarizations, dielectric in a.c. field, concept of dielectric loss and loss energy.
Semiconducting Materials: Concept of energy bands in solids, carrier concentration and conductivity in intrinsic semiconductors and their temperature dependence, carrier concentration and conductivity in extrinsic semiconductors and their temperature dependence, Hall effect in semiconductors, compound semiconductors.
Nano Materials: Basic principles of nanoscience and technology, preparation, structure and properties of fullerene and carbon nanotubes, applications of nanotechnology.
MODULE: 5 (Lectures: 09)
Statistical Mechanics & Lasers:
Phase space, the probability of distribution, most probable distribution, Maxwell-Boltzmann Statistics, Applications of Maxwell-Boltzmann Statistics, derivation of average velocity, RMS velocity and most probable velocity in the above case, Bose-Einstein Statistics, application to black body radiation, distribution law of energy, Planck's radiation formula and Stefan's law. Fermi – Dirac statics, application in case of free electrons in metals, energy

distribution, Fermi energy.

Lasers: Spontaneous and stimulated emission of radiations, Einstein's theory of matter-radiation interaction, Einstein's coefficients and relation between them, Population inversion, components of a laser, different kinds of lasers, Ruby laser, He-Ne laser, properties of laser beams, mono-chromaticity, coherence, directionality, and brightness, applications of lasers

References:

1. Physics, Marcelo Alonso, J. Finn Edwards, Addison Wesley
2. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill
3. Engineering Physics, R. K.Shukla, Pearson Education
4. Electrical Engineering Materials, R.K.Shukla, McGraw Hill
5. Introduction to Electrodynamics, David Griffiths, Cambridge University Press
6. Principles of Engineering Physics, R.K.Shukla, Ira Books
7. Introduction to Solid State Physics, Charles Kittel, Willey

List of Experiments:(Any ten experiments)

1. To determine the energy of band gap of a N-type Ge-semiconductor using four probe method
2. Verification of Stefan's fourth power law for black body radiation, determination of the exponent of the temperature
3. Study of thermoelectricity: Determination of thermo-power of Copper-constantan thermo-couple
4. To study the variation of magnetic field with distance along the axis of current carrying coil and then to estimate the radius of the coil
5. Study of Carrey Foster's bridge: determination of resistance per unit length of the bridge wire and of a given unknown resistance
6. Determination of specific charge (charge to mass ratio; e/m) for electron
7. Study of tangent galvanometer: determination of reduction factor and horizontal component of earth's magnetic field
8. Determination of the wavelength of sodium light using Newton Rings' method
9. To determine the concentration of sugar solution using half shade polarimeter
10. Determination of wavelength of spectral lines of mercury (for violet, green, yellow-1 and yellow-2) using plane transmission grating
11. Determination of charge sensitivity and ballistic constant of a ballistic galvanometer

12. To determine the wavelength of spectral lines of hydrogen & hence to determine the value of Rydberg Constant
13. Draw the V-I characteristic of Light Emitting Diode (LED) and determine the value of Planck's constant

Course Outcome

Module -1 To understand and to apply principle of conservation of momentum. e.g. in rocket propulsion and in many other space applications.

To understand the theory of relativity and to analyse how the physical quantities undergo drastic changes in their original value at very high velocities and also to see how its principles are applicable in particle accelerators, nuclear devices as an alternative sources of energy and for defense purpose.

Module-2 To understand the basics of quantum mechanics, and to apply its principles to learn the phenomena that occur at subatomic dimensions.

Module–3 To understand and to apply Maxwell's equations which forms the basis of electromagnetic theory. This has a wide application in communication systems. All the information propagating in the universe utilises the principle of electromagnetic theory.

Module–4 To study the fundamentals of material science especially dielectric materials, semiconducting materials and nanomaterial and to apply the knowledge to use how dielectrics are used for the storage of charge. infrared detectors, crystal oscillators, manufacture of microphones, headsets loudspeakers, transducers, ultrasound applications, gas ignitors, accelerometers etc.

Semiconductor material technology which has completely changed the scenario by replacing the older vacuum tube technology, are another technologically important materials which are widely used in LEDs, miniaturisation of electronic devices and to develop materials with improved efficiency and economy.

Nanotechnology is the most emerging field at present and is extremely important. It has got various applications in many areas including information technology, biomedical, energy-storage, automotive industry, electronics industry, textiles and chemical industries.

Model – 5 To understand the statistical behaviour of the constituent particles which give rise to form a material, and to apply the principles of statistical mechanics and to understand the basics of Laser.

BSC	**MATHEMATICS-1**	**3L:1T:0P**	**4 credits**

Unit I- <u>Functions of One Real Variable:</u>
Successive differentiation, Leibnitz theorem, Mean value theorems, sequences and series, Expansion of functions, Improper integrals and their convergence.

Unit II-<u>Functions of Several Real Variables:</u>
Limit, Continuity, Partial differentiation, Total differential and approximations, Jacobian, Euler's theorem Expansion of functions, Beta and Gamma Functions, Multiple integral, Change of order, Change of variables, Applications to area, volume, mass, surface area etc. Dirichlet's Integral & applications.

Unit III- <u>Vector Calculus:</u>

Point functions, differentiation, Gradient, Directional derivative, Divergence and Curl of a vector and their physical interpretations, Solenoidal &irrotational fields, Integration, Line, Surface and Volume integrals Green's. Stoke's and Gauss Divergence theorems (without proof) and applications.

Unit IV- <u>Matrices and Linear Algebra:</u>

Vector space and subspace, linear dependence, dimensions and basis, Linear transformation and its matrix representation, Elementary transformations, Echelon form, rank & nullity, Consistency of linear system of equations and their solutions, characteristic equation, Cayley Hamilton theorem, Real and complex eigenvalues and eigenvectors, diagonalisation, quadratic forms, complex, orthogonal, and unitary matrices, Application to Cryptography, discrete, Compartmental models and system stability.

Unit V- <u>Optimization:</u>
Engineering applications of optimization, statement and classification of optimization problems, Optimization techniques, single variable optimization, multi variable optimization with no constraint, with equality and inequality constraints, Linear Programming Problems, Graphical method and Simplex method.

Books Recommended:

1. R.K. Jain & S. R. K. lyengar; Advanced Engineering Mathematics, Narosa Publishing House 2002.
2. Erwin Kreyszig: Advanced Engineering Mathematics. John Wiley & Sons 8th Edition.
3. Dennis G. Zill& Michael R Cullen; Advanced Engineering Mathematics, Jones &Bartlett Publishers, 2nd Edition.
4. S.S. Rao; Optimization: Theory & application Wiley Eastern Limited.
5. T.M. Apostol, calculus, Vol. I, 2nd ed., Wiley 1967.
6. T.M. Apostol, Calculus, Vol. II, 2nd ed**.,** Wiley 1969.
7. Gilbert Strang, Linear Algebra & its applications, Nelson Engineering 2007.
8. Calculus & Analytic Geometry, Thomas and Finny.

Objective / Outcomes, Mathematics-I

Calculus is one of the most intellectual achievement in the field of mathematics. It is a collection of fascinating and exciting ideas rather than a technical tool. In particular differential calculus i.e. derivative is useful to solve a variety of problems that arise in engineering, technology, science and fields including social sciences. The study of convergence of the infinite series as well as improper integral has vital importance in engineering & Technology.

The Study of partial differentiation and its applications be needful to solve such engineering problems improving quantity (functions) depends on more than one parametric (variable).

Some special functions are represented by improper integrals such as beta & gamma functions. Which are very useful to solve concern engineering. Problem. Multiple integrals have been found to be basic application in engineering such as to find areas and volume of various bodies, this is applicable in various fields like, while preparing a machine, or the parts to be fitted in any machine its size and volume etc. are very important.

Matrices have been found to be of great utility in many branches of applied mathematics such as algebraic and differential equations , mechanics theory, electrical circuits, nuclear physics, aerodynamics and astronomy. With the advent of computers, the usage of matrix methods has been greatly facilitated.

The Vector calculus extends the basic concepts of (ordinary) differential calculus to vector function, by introducing derivative of a vector function and the new concepts of gradient, divergence and curl.

Vector integral calculus extends the concepts of (ordinary) integral calculus to vector functions. It has applications in fluid flow design of underwater transmission cables, study of satellites. Line integral is useful in the calculation of work done by variable forces along paths in space and the rates at which fluid flow along curve (circulation) and across boundaries (flux).

Optimization theory and methods have been applied in many fields to handle various practical problems. In light of advances in computing systems, optimization techniques have become increasingly important and popular in different engineering applications.

An important application of multivariable differential calculus is finding the maximum and minimum values of functions of several variables. Such as in the study of stability of the equilibrium states of mechanical and physical systems, determination of extrema is of greatest importance.

ESC:	**Electrical Engineering**	**3L:0T:2P**	**4 credits**

Basic Electrical Engineering Detailed contents:

Module I: DC Circuit Analysis and Network Theorems:(9 hours):

Circuit Concepts: Concepts of Network, Active and Passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements. R L and C as linear elements. Source Transformation.

Kirchhoff's Law; loop and nodal methods of analysis; star – delta transformation; Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. (Simple Numerical Problems)

Module II: Steady – State Analysis of Single Phase AC Circuits:(8 hours):

AC Fundamentals: Sinusoidal, Square and Triangular waveforms – average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel, and series – parallel RLC Circuits: Apparent, Active & Reactive Powers, Power factor, causes and problems of low power factor, power factor improvement. Resonance in Series and Parallel Circuits, Bandwidth and Quality Factor. (Simple Numerical Problems)

Module III:

Three Phase AC Circuits:(3 hours)

Three Phase System – its necessity and advantages, meaning of phase sequence and star and delta connections, balanced supply and balanced load, line and phase voltage / current relations, three phase power and its measurement. (Simple Numerical Problems)

Measuring Instruments: (4 hours):

Types of instruments: Construction and Working Principles of PMMC and Moving Iron type Voltmeter & Ammeters, Single Phase Dynamometer Wattmeter and Induction Type Energy Meter, use of Shunts and Multipliers. (Simple Numerical Problems on Energy Meter, Shunts and Multipliers)

Module IV

Introduction To Power System:(2 hours):

General layout of Electrical Power system and functions of its elements, standard transmission and distribution voltages, concept of grid.

Magnetic Circuit:(3 hours):

Magnetic circuit concepts, analogy between Electric & Magnetic circuits, Magnetic circuits with DC and AC excitations, Magnetic leakage. B-H curve, Hysteresis and Eddy Current looses, Magnetic circuit calculations mutual Coupling.

Single Phase Transformer:(3 hours):

Principle of Operation, Construction, e.m.f. equation, equivalent circuit, Power losses, efficiency, introduction to auto transformer. (Simple Numerical Problems)

Module V(8 hours):
Electrical Machines: Principles of electro mechanical energy conversion.
DC Machines:
Types of dc machines, e.m.f. equation of generator and torque equation of motor, characteristics and applications of dc motors. (Simple Numerical Problems)
Three Phase Induction Motor:
Types, Principle of Operation, Slip – torque Characteristics, applications. (Simple Numerical Problems)
Single Phase Induction Motor:
Principle of Operation and introduction to methods of starting, applications.
Three Phase Synchronous Machines:
Principle of Operation of alternator and synchronous motor and their applications.

Text Books:

1. V. Del Toro, " Principles of Electrical Engineering" Prentice Hall International
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Reference Books:

1. Edward Hughes, "Electrical Technology" Longman
2. T.K. Nagsarkar& M.S. Sukhija, "Basic Electrical Engineering" Oxford University Press
3. H. Cotton, " Advanced Electrical Technology" Wheeler Publishing
4. W.H. Hayt& J.E. Kennely, "Engineering Circuit Analysis" Mc - Graw Hill

ESC	ENGINEERING MECHANICS	3L:0T:0P	3 credits

Course Objective: To provide the basic fundamentals of forces, moments, stresses and strains.
Course Prerequisite: Fundamental knowledge of intermediate Physics.

Course Syllabus:

Unit I

Two Dimensional Force Systems: Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position, Resultant of a force system, Simplest Resultant of Two dimensional concurrent and Non-concurrent Force systems, Distributed force system, Free body diagrams, Equilibrium and Equations of Equilibrium, Applications.
Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Belt friction, Applications.

Unit II
Beam: Introduction, Shear force and Bending Moment, Differential Equations for Equilibrium, Shear force and Bending Moment Diagrams for Statically Determinate Beams.
Trusses: Introduction, Simple Truss and Solution of Simple truss, Method of Joints and Method of Sections.

Unit III
Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems, Principal Moment Inertia, Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their Axis of Symmetry.

Unit IV
Simple Stress and Strain: Introduction, Normal and Shear stresses, Stress- Strain Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections, Strain energy.
Compound stress and strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle. Theories of Failure.

Unit V
Pure Bending of Beams: Introduction, Simple Bending Theory, Stress in beams of different cross sections.

Torsion: Introduction to Torsion of circular shaft, combined bending & torsion of solid & hollow shafts.
Textbooks:
1. Engineering Mechanics by R.K.Bansal
2. Strength of Materials by R.K. Rajput

Reference books:
1. Engineering Mechanics by Irving H. Shames, Prentice-Hall
2. Mechanics of Materials by E.P.Popov, PHI
3. Strength of Materials by Ryder
4. Mechanics of Material by Gere & Timoshenko
5. Engineering Mechanics by A. Nelson

6. Engineering Mechanics by U.C. Jindal
7. Engineering Mechanics Statics by J.L. Meriam&L.G.Kraige

Course Outcomes:
Students will be able to:

1. Apply basic principal of mechanics and its application in engineering problems.
2. Determine resultants and apply conditions of static equilibrium to plane force systems
3. Identify and quantify all forces associated with a static framework
4. Generate and sketch shear force and bending moment diagrams
5. Derive and apply stress and strain relationships in single and compound members subject to axial force, bending moment and torsion.
6. Stress analysis for two dimensional stress systems.

HSMC	PROFESSIONAL COMMUNICATION	2L:0T:2P	3 credits

UNIT I Fundamentals of Technical Communication:
Process of communication, language as a tool of communication, levels of communication , flow of communication, barriers to communication, communication across cultures; Technical Communication: meaning, significance, characteristics, difference between technical and general communication.

UNIT II Elements of Written Communication:
Words and phrases, word formation, synonyms and antonyms, homophones, one word substitution, sentence construction, paragraph construction,

UNIT III Forms of Technical Communication:
(A) business letters, job application letter and resume, business letters: sales & credit letters, letters of enquiry, letters of quotation, order, claim and adjustment letters, official letters: D.O. letters, government letters, letters to authorities, etc. ,
(B) Technical Reports: general format of a report, formal and informal reports, memo report, progress report, status report, survey report, trip report, complaint report, , Joining Report ,laboratory report, research papers, dissertations and theses. E-mail writing
Technical Proposals: purpose, characteristics, types, structure

UNIT IV Presentation Strategies:
Defining the subject, scope and purpose, analysing audience & locale, collecting materials, preparing outlines, organising the contents, visual aids, nuances of delivery, extemporaneous, manuscripts, impromptu, non- verbal strategies.

UNIT V Value-based Text Reading:
(A) Study of the following essays from the text book with emphasis on writing skills:
1. Man and Nature by J. Bronowski
2. The Language of Literature and Science by Aldous Huxley
3. The Aims of Science & The Humanities by Moody E Prior
4. Gods in this Godless Universe by Bertrand Russell
5. Science and Survival by Barry Commoner

(B) Readings of selected short stories:
1. The Renunciation by Rabindranath Tagore
2. The Lament by Anton P. Chekhov
3. The Barber's Trade Union by Mulk Raj Anand
4. The Eyes Are Not Here by Ruskin Bond

Text Books:
1. 'Improve Your Writing' ed. By V N Arora and Laxmi Chandra, Oxford University Press, New Delhi
2. 'An Anthology of English Short Stories', edited by R P Singh, Oxford University Press.
3. 'Technical Communication- Principles and Practices' by Meenakshi Raman &Sangeeta Sharma, Oxford University Press, New Delhi.

Reference Books:
1. Effective Technical Communication, by Barun K Mitra, Oxford University Press

2. Business Correspondence & Report Writing by R.C. Sharma & Krishna Mohan, Tata McGraw Hill, N.D.

3. Developing Communication Skills by Krishna Mohan &Meera Banerjee, Macmillan India

4. 'Technical Communication- Principles and Practices' by M R S Sharma, Oxford University Press, New Delhi

Course Objectives (COs)

At the end of this course students should be able to:

1. Effectively communicate their ideas in the contemporary global competitive environment.
2. Convey their messages through constructive writing.
3. Draft potent E-Mails, letters, proposals and reports.
4. Present their presentations along with using all nuances of delivery with clarity and thoroughness.
5. Solve problems based on real time situations and articulate them eventually.

PROFESSIONAL COMMUNICATION LABORATORY

Interactive practical sessions with emphasis on oral presentations/ spoken communication: Practical Sessions on:

1. Group Discussions: selected topical issues to be discussed in groups.

2. Mock interviews

3. Communication skills for seminars/conferences/workshops with emphasis on non-verbal skills.

4. Presentation skills for technical papers/project reports/professional reports.

5. Theme presentation/ key note presentation based on correct argumentation methodologies.

6. Argumentative skills
7. Role play
8. Comprehension skills based on reading and listening practice, asking questions.
9. Introduction to International Phonetics Alphabets
10. Audio Visual demonstration of effective communicative strategies & TED Talks

References:

1. Sethi and Dhamija, 'A Course in Phonetics and Spoken English', Prentice Hall of India, New Delhi.

2. Joans Daniel, 'English Pronouncing Dictionary', Cambridge University Press.

Additional Reference Books

1. R. K. Bansal & J.B. Harrison, Spoken English for India, Orient Longman

2. Excellence in Business Communication, Boeuve&Thill and Courtland

HSMC	**ENGLISH LANGUAGE AND COMPOSITION**	**2L:0T:0P**	**0 credits**

UNIT I Basic Applied Grammar and Usage:

Sentence structure-1: constituent of a sentence- noun, verb, adjective, preposition, etc.; use of articles, adjectival forms, prepositions, adverbs; verb forms; finite and non-finite verbs, gerund and participles, auxiliary verbs. Tense and mood, Subject- verb concord, pronoun concord

UNIT II

Sentence Structure-2:

(i) adverb clause, adjective clause, noun-clause; (ii) negation and interrogation; (iii) passive; (iv) exclamatory; (v) transformations; (vi) tense forms; (vii) varieties of sentences; (viii) placement of modifiers

UNIT III Paragraph Writing:

Structure of Paragraph, Topic Sentence, Construction of Paragraph, Technique of Paragraph writing, Unity, Coherence, Emphasis

UNIT IV Comprehension and Précis Writing

Reading and listening comprehension, improving comprehension skills, précis writing

UNIT V Short Essay Writing

Dimension of essay writing- literary, Scientific, Comparison and Contrast, Narrative, Descriptive, Reflective, Expository, Argumentative and Imaginative

References:

1. Das, B K and A David, 'A Remedial Course in English for Colleges', (Book -1,2,3) Oxford University Press, New Delhi.
2. Sinha, R P, 'Current English Grammar and Usage with Composition', Oxford University Press, New Delhi.
3. Wren, P C & Martin, 'English Grammar and Composition', S Chand & Co Ltd. New Delhi.
4. A. S. Horne, Guide to Pattern and usage in English, Oxford University Press, N.D.
5. M.L. Tickoo& A. E. Subramanian, Intermediate Grammar, usage & composition, Orient Longman

Course Objectives (Cos)

At the end of this course students should be able to:

1. Write professional statements & organizational communications.
2. Develop writing skills by applying different strategies on organisation system.
3. Develop the project reports, their relevance and significance.

BSC	ENGINEERING CHEMISTRY	3L:0T:2P	4 credits

Module I

(i) ***Bonding*:** CFT, Electronic Spectra and Ligands (strong and weak field), Phosphorescence and Fluorescence, Jablonski diagram, hydrogen bonding and their effect on physical properties, Metallic bonds, Classification and Applications of Liquid crystals, Band Theory of Solids and superconductors.
(Lectures: 7-8)

(ii) ***Spectroscopy***: Basic Principles, Instrumentation and Applications of UV-VIS and IR Spectroscopy.

(Lectures: 5-6)

Module II

(i) ***Chemical Kinetics***: Second order reactions. Determination of order, Fast and slow reaction, steady state approximation, Temperature effect, Concept of Activated Complex/Transition State: Energy of activation, Potential energy surface, Theories of reaction rate: Collision and Transition State theories in terms of enzyme catalysis.

(Lectures: 4-5)

Module III

(i) ***Electrochemistry***: Dry and fuel cells, electrochemical cell, Solar cells, Disensitized cell, Photovoltaic cell.

(Lectures: 3-4)

(ii) ***Environmental Chemistry*:** Air and Water Pollution, analysis of gaseous effluents oxides of Nitrogen, oxides of Sulphur and H_2S, chemical analysis of effluents liquid streams, BOD, COD, control of pollution, Depletion of ozone layer.

(Lectures: 5-6)

Module IV

(ii) ***Stereochemistry*:** Stereoisomerism of organic compounds containing one & two chiral centers. Enantiomers &Diastereomers, E-Z nomenclature, R-S configuration, Atropisomerism, and Optical isomerism in Allenes, biphenyl and Spiranes, Circular Dichroism.

(Lectures: 5-6)

(i) ***Reaction Mechanism***: Inductive, Electromeric and Mesomeric effects. Study of reaction intermediates (Carbanion, carbocation, carbene, nitrene and benzyne). Mechanism of nucleophilic and electrophilic substitution reactions. Mechanism and application of following reactions:

a) Suzuki-Miyaura Cross coupling reaction

b) Fries and Photo-Fries Rearrangement

c) Wagner- Meerweir Rearrangement

d) Umpolung Reactions

e) Reaction of vision

(Lectures: 4-5)

Module V

(i) ***Polymers***: Introduction and their classifications, types of polymerization, Free radical, anionic and cationic polymerization, Preparation, Rheological properties and uses of some common polymers. Synthetic Polymers (carbon framework, silicon framework, fluorinated

polymer), Conducting and Biodegradable polymers.

(Lectures: 4-5)

(ii) ***Water Analysis*:** Introduction; Hardness of Water- cause, types, units, Disadvantages of using hard water for domestic and industrial purposes, Softening of hard water, Chemical analysis of Water- estimation of free chlorine, total alkalinity, hardness, Numerical based on determination of hardness.

(Lectures: 4-5)

List of Experiments:

1. Determination of alkalinity in given water sample.
   a. Sodium Carbonate & Sodium Bicarbonate
   b. Sodium Carbonate & Sodium Hydroxide
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Determination of Chloride content of water by Mohr's Method.
4. Determination of Chlorine content in Bleaching powder.
5. Determination of strength of supplied Ferrous Ammonium Sulphate (FAS) solution in using external, internal indicators.
6. Determination of viscosity of a given liquid by Ostwald's viscometer.
7. Determination of surface tension of a given liquid by Stalagmometer.
8. pH determination of given sample.
9. Determination of iron content of water by Mohr's Method.
10. Determination of Dissociation constant of weak acids by conductometric Titration.

Reference Books:

1. Advance Organic Chemistry by Jerry March, Third Edition Wiley Eastern Limited, New Delhi.

2. Organic Chemistry by Morrision& Boyd, Allyn and Bacon, Inc. Boston.

3. Physical Chemistry by Puri, Sharma &Pathania, Peter Atkins & Julio de Paula, ArunBahl, B.S. Bahl&G.D.Tuli.

4. Textbook of Physical Chemistry by S. Glasstone, Macmillan and Co. Ltd., London.

5. Chemical Kinetics and Reaction Dynamics by Puri, Sharma &Pathania.

6. Principles of Polymerization by George Odian.

7. Polymer Science by V. R. Gowarikar, N. V. Vishwanathan and J. Shridhar, Wiley Eastern Ltd., New Delhi.

8. Principles of Instrumental Analysis by Douglas and Skoog, Saunder College Publishing Co., New York.

9. Engineering Chemistry by Jain & Jain, Dhanpat Rai Publication Co., New Delhi.

10. Application of Absorption Spectroscopy of Organic Compounds by John R. Dyer, Prentice Hall of India Pvt. Ltd., New Delhi.

11. Spectroscopy of Organic Compounds by P.S. Kalsi, Y.R. Sharma.

Course Outcome:
After studying the course, the student will be able to:

- Interpret UV-Visible and IR–Spectra.
- Describe a reaction rate having various reaction orders.
- Understand different aspects of corrosion (Chemical and electrochemical corrosion, mechanism, factors affecting, protection and practical problems, prevention methods). Thermodynamic overview of electrochemical processes. Reversible and irreversible cells.
- Gain hands-on experience in making different polymers, distinguish between different polymeric structures, classify polymers and analyze the polymerization mechanism. The uses of polymers in different walks of life.
- Knowledge of conductivity polymers, bio-degradable polymers and fiber reinforced plastics.
- Acquire knowledge about water and treatment of municipal water.

Experimental Outcome:
The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

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- Design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
- Communicate the results of scientific work.
- Measure molecular/system properties such as surface tension, viscosity, conductance of solution.
- Chemical analysis of water-hardness, alkalinity, pH and chloride content.

BSC	MATHEMATICS-II	3L:1T:0P	4 credits

Unit- I: Ordinary Differential Equations:

First order ordinary differential equations, Existence and uniqueness of solutions of initial value problems, Solution of higher order linear differential equation with constant coefficients, Solution of second order differential equations by changing dependent and independent variables, Cauchy- Euler equations, Methods of diagonalization, undetermined coefficients and variation of parameters: Nonlinear equations, Linear and nonlinear models, Initial value and boundary value problems, Systems of equations. Application of differential equations as mathematical models, Models from population dynamics, Newton's Law of cooling, electric circuit, Oscillation of spring.

Unit-II: Series Solutions of Ordinary Differential Equations & Special Fuctions

Ordinary and singular points of an equation, Power series solutions, Frobenius method, Bessel's and Legendre's equations and their series solutions, Properties of Legendre's polynomials and Bessel's functions, Generating functions, Fourier- Bessel series and Fourier-Legendre series expansions, sturm- Liouville Problem and related theorems.

Unit-III: Laplace Transform:

Laplace transform, Existence conditions and ROC, Inverse Laplace transform, Operational properties, Convolution, Unit step function, Dirac-Delta function, Periodic functions, Applications to solve IVP and BVP: Linear ordinary differential equations, Transfer function and control system analysis.

Unit-IV: Fourier Series and Partial Differential Equations:

Orthogonal functions, Fourier series, existence conditions, Fourier series of even and odd functions, convergence of Fourier series, Fourier half range series, Harmonic analysis, Complex Fourier series and frequency spectrum.

Development of partial differential equations and Solutions, Solution of first order partial differential equations, Solutions of linear higher order partial differential equations with constant coefficients.

Unit-V: Boundary-Value Problems:

Classification of second order partial differential equations, Derivation of heat and wave equations, solutions in rectangular coordinates by separation variable method, solution of Laplace equation, D'Alemberts solution of wave equation, Non-homogeneous equations and boundary conditions, Orthogonal series expansions, Fourier series in two dimensions, Boundary value problems in polar, cylindrical and spherical coordinate systems and their solutions.

Books Recommended:

1. E.A. Coddington, An Introduction to Ordinary Differential Equations, Practice Hall, 1995.

2. I.N. Sneddon, Elements of Partial Differential equations, McGraw-Hill 1957.

3. Dennis G, Zill& Michael R. Cullen; Advanced Engineering Mathematics, Jones & Bartlett Publishers. 2nd Edition.

4. R.K. Jain & S.R.K. Iyengar; Advanced Engineering Mathematics, Narosa Publishing House, 2002.

5. Erwin Kreyszig; Advaced Engineering Mathematics, John Wiley & Sons 8th Edition.

Objective / Outcomes. Mathematics II

All the physical & engineering problems related to rate of change and many practical laws, used in engineering, are expressed mathematically in the form of differential equations so the primary use of differential equations is to serve as a tool for the study of problems regarding change in almost all the branches of engineering & technology.

The solutions of many differential equations arises from physical problems and important differential equations such as Bessel's equation and Legendre equation cannot be expressed in terms of elementary functions in closed form so in such cases, it is easier to find an approximate solution in the form of the convergent infinite series. The series solutions many reveal important information's about the nature of solution such as passing through the origin even or odd, increasing & decreasing on a given interval and so on.

Laplace transform is a very powerful technique it replaces operations of calculus by operations of algebra. Laplace transform is useful since particular solution can be obtained without first determining the general solution of differential equation. Non-homogeneous equation also can be solved. Solution of mechanical and electrical problems involving discontinuous force function of periodic function are obtained easily.

Fourier series is the simple representation of a complicated periodic functions associated as the periodic phenomenon which occur frequently in many physical and engineering problems.

It is very useful in the study of heat conduction, mechanics, concentration of chemical and pollutants, electrostatics. The Fourier Transform and series and their analytic properties are very commonly used in telecommunications, digital signal processing, electronic design and more.

Several problems in fluid mechanics, solid mechanics, heat transfer, electromagnetic theory and other areas of physics& engineering are modeled as boundary value problems i.e. partial differential equations with boundary value conditions in the different coordinate systems.

ESC	ENGINEERING GRAPHICS	0L:0T:6P	3 credits

Unit-I
Lettering and Dimensioning
Introduction, lettering practice, Elements of dimensioning - systems of dimensioning.
Geometric Constructions
Free hand sketching, Conic sections, Special curves.
Engineering Scales
Unit-II
Projection of Points and Projection of Lines
Projection of Points: First and Third Angle Projections; Projection of points. Projection of Lines: Projection of straight lines (First angle projection only); Projection of lines inclined to one plane and both planes, true length and true inclinations.
Unit-III
Projection of Solids and Section of Solids
Projection of solids: Classification of solids, Projection of solids in simple position, Projection of solids inclined to one plane. Sections of Solids: Right regular solids and auxiliary views for the true shape of the sections.
Unit-IV
Development of Surfaces
Development of surfaces for various regular solids.
Isometric Projection and Perspective Projection
Isometric Projection: Isometric scales, Isometric projections of simple and combination of solids; Perspective Projection: Orthographic representation of a perspective views – Plane figures and simple solids - Visual ray method.

Unit-V
Orthographic Projection
Conversion of pictorial view into orthographic Projection.
Introduction to auto CAD
Text Book(s)
1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New AGE International Publishers, 2015.

Reference Books
1. N. D. Bhatt, Engineering Drawing, Charotar publishing House,
2. Natarajan, K. V., A Text book of Engineering Graphics, Dhanalakshmi Publishers, 2012.
3. K.L.Narayana, P. Kannaiah&K.VenkataReddy New Age International publishers

Course Objectives:
- To follow basic drawing standards and conventions.
- To develop skills in three-dimensional visualization of engineering components.
- To prepare sectional views of solids.
- To draw the development of surfaces and estimate the sheet metal requirement.
- To develop an understanding of solid modelling using CAD software.

Expected Course Outcome:

- Prepare drawings as per standards.
- Solve specific geometrical problems in plane geometry involving lines, plane figures and special Curves.
- Prepare sectional views of solids.
- Draw isometric drawings of combined solids and simple components.
- Produce orthographic projection of engineering components working from pictorial drawings.

Prepare solid modelling of machine components using CAD software

ESC	**COMPUTER CONCEPTS & 'C' PROGRAMMING**	**3L:0T:2P**	**4 credits**

Unit-1:
Introduction to Computers: Computer hardware Components, peripherals and their functions, Number Systems and conversion methods, Concept of an algorithm; termination and correctness. Algorithms to programs: specification, top-down development and stepwise refinement, Introduction to programming environment, use of high level programming language for the systematic development of programs. Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic.

Unit-2:
Basic operating System Concepts: Introduction of MS-DOS, WINDOWS, and LINUX Operating Systems, Functional Knowledge of these operating systems, Introduction of basic commands of LINUX and Editors, Managing Files and Directories in LINUX, Programming Environment in LINUX, Writing and executing programs in LINUX.

Unit-3:
Programming in C: History, Introduction to C Programming Languages, Structure of C programs, compilation and execution of C programs, Debugging Techniques, Data Types and Sizes, Declaration of variables, Modifiers, Identifiers and keywords, Symbolic constants, Storage classes (automatic, external, register and static), Enumerations, command line parameters, Macros, The C Preprocessor.

Unit-4:
Operators: Unary operators, Arithmetic & logical operators, Bit wise operators, Assignment operators and expressions, Conditional expressions, Precedence and order of evaluation. Control statements: if-else, switch, break, and continue, the comma operator, goto statement. Loops: for, while, do-while. Functions: built-in and user-defined, function declaration, definition and function call, and parameter passing: call by value, call by reference, recursive functions, Multi-file programs. Arrays: linear arrays, multidimensional arrays, passing arrays to functions, Arrays and strings.

Unit-5:
Structure and Union: definition and differences, self-referential structure. Pointers: value at (*) and address of (&) operator, pointer to pointer, Dynamic Memory Allocation, calloc and malloc functions, array of pointers, function of pointers, structures and pointers. File Handling in C: opening and closing a data file, creating a data file, read and write functions, unformatted data files.

Lab Work:

1. Write C program to find largest of three integers.
2. Write C program to check whether the given string is palindrome or not.
3. Write C program to find whether the given integer is (i). a prime number
(ii). an Armstrong number.
4. Write C program for Pascal triangle.
5. Write C program to find sum and average of n integer using linear array.
6. Write C program to perform addition, multiplication, transpose on matrices.

7. Write C program to find Fibonacci series of iterative method using user-defined function.

8. Write C program to find factorial of n by recursion using user-defined functions.

9. Write C program to perform following operations by using user defined functions:

(i) Concatenation

(ii) Reverse

(iii) String Matching

10. Write C program to find sum of n terms of series: n – n*2/2! + n*3/3! - n*4/4! + ...

11. Write C program to interchange two values using (i).
Call by value.
(ii). Call by reference

12. Write C program to sort the list of integers using dynamic memory allocation.

13. Write C program to display the mark sheet of a student using structure.

14. Write C program to perform following operations on data files:

(i) Read from data file.

(ii) Write to data file.

15. Write C program to copy the content of one file to another file using command line argument.

Text and References Books:

1. Kernighan, Ritchie, “The C Programming Language”, PHI
2. V. Rajaraman, “Fundamentals of Computers”, PHI
3. Peter Norton’s, “Introduction to Computers”, TMH
4. Gottfried, “Programming in C”, Schaum’s Series, Tata McGraw Hill
5. YashwantKanitkar, “Working with C”, BPB
6. E. Balagurusamy, “Programming in ANSI C”, TMH

Course Outcomes:

1. Identify the parts of the computer system and explain the functioning of its components along with the process of problem solving. (Remember, Understand)
2. Design an algorithmic solution for a given problem and translate it into a program. (Design)
3. Understand different operating systems, related concepts and their functions. (Understand)
4. Use the appropriate control statements to solve the given problem. (Apply)
5. Implement different Operations on arrays and use functions to solve the given problem. (Apply)

Understand pointers, structures and unions &Implement file Operations in C programming. (Understand, Apply)

ESC	WORKSHOP PRACTICE	0L:0T:4P	2credits

Name of Different Shops:

- **Carpentry Shop:**

Practice (I) : To prepare half lap corner joint from given pieces of mango wood.
Practice (II): To prepare mortise and tenon joint from given pieces of mango wood.
Instruction : Description and demonstration of different tools, joints along with advanced Carpentry joints, classification and definition of timber, wood seasoning, demonstration of wood working lathe and advanced power tools used in carpentry work, safety precaution during actual working.

- **Fitting and Bench Working Shop:**

Practice (I): To prepare male-female joint form given pieces of mild steel.
Practice (II): To prepare practice work piece involving marking, measuring, sawing, drilling, and tapping operations.
Instruction : Classification and description of different tools used in fitting shop e.g. making and measuring tools, holding and supporting tools, striking tools and cutting tools etc, safety precaution during actual working.

- **Black Smithy Shop:**

Practice (I) : To prepare 'L' shape job form given piece of mild steel rod by hand forging.
Practice (II): To prepare a 'Ring' form given piece of mild steel rod by hand forging.
Instruction : Description of various forging processes done in black-smithy work e.g upsetting, drawing down, punching, bending, fulleringetc, classification and description of different tools, equipments used in black smithy shop, safety precaution during actual working.

- **Welding Shop :**

Practice (I) : To prepare simple butt joint and lap joint by electric arc welding form given pieces of mild steel.
Practice (II): To Prepare simple lap joint by oxy-acetylence gas welding and gas flame cutting practice.
Instruction : Concept of welding, classification and explanation of various types of welding with the help of flow chart description of different tools. Equipments required for arc welding and gas welding, demonstration of various types of lames in Oxy-acetylence gas welding, setting of current and selection of electrodes along with different welding joints, safety precaution during actual working.

- **Sheet metal Shop :**

Practice (I) : To prepare a funnel complete withsoldering form given G.I.Sheet..
Practice (II): To fabricate tray/tool box or electric panel box form given G.I. Sheet.

Instruction : Classification and description of different types of tools, equipments used in sheet metal work, different types of metals used in sheet metal shop e.g Galvanized iron, copper, aluminum etc, concept of development of surfaces along with different types of joints in sheet metal work, safety precaution during actual working.

- **Machine Shop :**

Practice (I) : To prepare a job by plain turning, facing, step turning and chamfering operation form given mild steel rod.

Practice (II): To Prepare a job by taper turning, threading, knurling operations form given mild steel rod.

Instruction : Classification of lathe machines, different parts of lathe machine, tools and equipments used, explanation and demonstration of various operations on lathe machine, tool geometry of single point cutting tool, cutting speed, feed and depth of cut in turning, safety precaution during actual working.

- **Foundry Shop :**

Practice (I) : To prepare a mould of given pattern in Green Sand.

Practice (II): To prepare a mould with two step pulley with runner and riser.

Instruction : Description and use of various foundry tools, shovel, flat rammer, hand rammer, strike off bars, vent wire, trowels, hand riddle etc Types of various molding sands, types of patterns, pattern materials, pattern allowances, safety precaution during actual working.

Course Outcome

- Acquire skills in basic engineering practice
- Identify the hand tools
- Obtain practical skills in the trades.
- Gain measuring skills.

e Outcome (CO)		s Knowledge Level (KL)
end of the course the student should be able to:		
	and practice on machine tools and their operations	
CO 2	e on manufacturing of components using workshop trades including fitting, carpentry, foundry, black-smithy and welding work	K3
CO 3	y and apply suitable tools for machining processes including plain turning, step turning, taper turning, facing, thread cutting operations	K4
CO 4	stand and practice welding and forging operations	K3
CO 5	the appropriate tools required for specific operation	K2, K3
CO 6	rehend the proper safety measures required to be taken while using different tools.	K1, K2

Note : K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Text and References :

- A course in Workshop Technology - By R. S. Khurmi& J. K. Gupta
- Manufacturing Processes - By B. S. Raghuwanshi
- Elements of Workshop Technology (Vol - I) - By S. K. HajraChudhary, Nirjhar Roy & A. K. (Vol - I) HajraChudhury

- Workshop Technology (part -1 / part-2) - By W. A. J. Chapman

MC	ENVIRONMENTAL AND ECOLOGY	2L:0T:0P	0 credits

Unit-I

Definition, Scope and importance, Need for Public awareness, Environment definition, Ecosystem, Concept of ecosystem, Structure and function of an ecosystem, Energy flow in ecosystem, Ecological succession, Balanced ecosystem, Human activities, Food shelter, Economic and Social Security.

Effects of Human Activities on Environment : Agriculture, Housing Industry, Mining and Transportation Activities, Basic of Environmental Impact Assessment, Sustainable Development.

Unit-II

Natural Resources : Water Resources – Availability and Quality Aspects, Conservation of water, Water Borne Diseases, Water induced Diseases, Fluoride problems in Drinking Water, Mineral Resources, Forest Wealth, Material Cycles-Carbon, Nitrogen and Sulphur Cycles.

Energy-Different Types of Energy, Electro-magnetic Radiation, Conventional and Non- Conventional Sources, Hydro Electric Fossil Fuel Based, Nuclear, Solar, Biomass, Bio-gas, Hydrogen as an Alternative Future Sources of energy.

Unit-III

Environmental Pollution : Water Pollution, Land Pollution, Noise Pollution, Public Health aspects, Air Pollution, Soil Pollution, Marine Pollution, Thermal Pollution, Nuclear Hazards. Solid Waste Management : Cause , effects and control measures of urban and industrial wastes, Role of an Individual in prevention of pollution, Pollution case studies, Disaster management : Floods, earthquake, cyclone and landslides.

Unit-IV

Current Environmental Issue of Importance, Population Growth, Variation among nations, Population explosion, Family welfare Programme, Climate Change and Global Warming- Effects, Urbanization, Automobile Pollution, Acid Rain, Ozone Layer Depletion.

Environmental Protection-Role of Government, Legal Aspects, Initiatives by Non- Government Organizations (NGO), Environmental Education, Value Education, Human Rights, HIV/AIDS, Women and Child Welfare, Case Studies.

Course Objectives :

1. To make students understand and appreciate the unity of life in all its forms, the implications of the life style on the environment.
2. To understand the various causes for environmental degradation.
3. To understand individual contribution in the environmental pollution.
4. To understand the impact of pollution at the global level and also in the local environment.
5. To understand the concept of sustainable development.

Expected Course Outcome :

Student will be able to

1. Understand the need for eco-balance.
2. Acquire basic knowledge about global climate change with a particular reference to the Indian context.
3. Find ways to protect the environment and play pro-active roles.

4. Involve themselves in activities for environment protection.

B.Tech 2nd year ET:

BSC	Mathematics-III	3L:1T:0P	4 credits

Unit – I: Transform Methods:

Fourier integral, conditions of convergence, Fourier sine and cosine integrals, complex form, applications, Fourier transform pairs, existence conditions, operational properties. Applications of Laplace transform and Fourier transform to solve boundary value problems, Discrete and Fast Fourier transforms and its applications. Development of difference equations as models, operator method, method of undetermined coefficients, Z-transform pairs, ROC. Operational properties, limiting- value theorems, its applications to solve difference equations and BVP, systems of difference equations.

Unit- II: Functions of a Complex Variable and Conformal mapping:

Limit, continuity, differentiability and analyticity, Cauchy-Riemann equations, harmonic functions, complex functions as mappings, liner transformation, inverse transformation, bilinear transformations, conformal mapping, applications.

Unit- III: Integration of Complex Functions:

Contour integrals and evaluations, Cauchy- integral theorem, Cauchy's integral formulae, Liouville's theorem, convergence of power series, Taylor series, Laurent series, zeros and singularities of a complex function, residues and residue theorem, Fundamental theorem of algebra Rouche's theorem, Argument Principle and maximum modules theorem, evaluation of definite and improper integrals.

Unit- IV: Curve- Fitting, Correlation, Regression and Probability:

Curve-fitting, method of least- squares, fitting of straight lines, polynomials, non-linear and exponential curves etc., correlation analysis, linear, non-linear and multi-regression analysis, probability, random variables and probability distributions, expectation, moments and transform methods, Binomial, Poisson and Normal distributions.

Unit- V: Statistical Methods:

Sampling theory (small and large), parameter estimation, confidence intervals, tests of hypotheses and significance; Overview of t-distribution, F-distributions and _2-distribution. Z-, t-, F-, and _2 tests, goodness of fit test- _2test, analysis of variance, non-parametric tests (Simple application). time series analysis, index numbers, quality control charts.

Books Recommended:

1. Dennis G, Zill& Michael R. Cullen; Advanced Engineering Mathematics, Jones & Bartlett Publishers. 2nd Edition.
2. R.K. Jain & S.R.K. Iyengar; advanced Engineering Mathematics, Narosa Publishing House, 2002.
3. Erwin Kreyszig; Advanced Engineering Mathematics, John Wiley & Sons 8th Edition.
4. R.V. Churchill and J.L. Brown, Complex Variables and Applications, McGraw Hill, 1990.
5. J.N. Kapur and H.C. Saxena, Mathematical Statistics, S.Chand. & Co., 2001.
6. H.C. Saxena, Practical Mathematical Statistics, S. chand& Co., 2000.

7. J.H. Mathews and R.W. Howell, Complex analysis for Mathematics and Engineering, 3rd Ed. Narosa, 1998.

Objective / Outcomes, Mathematics-III

Fourier transform is useful in study of frequency response of filter, In the theories of communication engineering, wave propagation, transmission lines and solution of boundary value problems. Discrete and fast fourier transform are used in signal analysis. Fourier transform is also used in electromagnetic field, medical application and in error control coding.

Solution of a discrete system, expressed as a difference equation is obtained using ztransform. Discrete analysis played important role in the development of communication engineering. Basic theory of z-transform help us to obtain the response of output sequence for a discrete system. This will involve the concept of the transfer function.

Complex Analysis is the study of analytic functions. It is an elegant and powerful method useful in the study of heat flow, fluid dynamics and electrostatics. Two-dimensional potential problem can be solved using analytic functions. The other important applications of this theory is to evaluate many real integrals which can not be evaluated by usual methods.

In many engineering problems to establish a linear, quadratic, cubic or exponential relationship between two quantities, it is required two or more unknowns in such a way that these follow whole data, such situations occur in the problems of curve fitting etc. Correlation and regression are the most commonly used techniques for investigating the relationship between two quantitative variables. The theory of probability is the study of such random phenomenon, which are not deterministic. In analyzing and interpreting data that involves an element of “chance” or uncertainty, probability theory plays a vital role in the theory and application of statistics. probability distribution is the theoretical counterpart of frequency distribution and plays an important role in the theoretical study of populations.

Statistical methods are useful in engineering, medical sciences, industries, banking, and economics. These methods are used to present the data effectively, help in critical analysis of information and summarizing the large data into a simple form using the frequency distribution and graph. In many situations, assumptions are made about the population parameters involved in order to arrive at decisions related to population on the basis of sample information. Quality control and process control use statistics as a tool to manage conformance to specifications of manufacturing processes and their products.

ESC	Electrical Circuit Analysis	3L:1T:2P	5 credits

Course Outcomes:

At the end of this course, students will demonstrate the ability toApply network theorems for the analysis of electrical circuits. Obtain the transient and steady-state response of electrical circuits. Analyse circuits in the sinusoidal steady-state (single-phase and three-phase). Analyse two port circuit behavior.

Module 1: Graph Theory(06 Hours):

Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix, Loop and Node equation based analysis, Concept of duality and dual networks.

Module2: Network Theorems (08 Hours)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis.

Module 3: Electrical Circuit Analysis Using Laplace Transforms (10 Hours)

Solution of first and second order Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

Module 4: Two Port Network and Network Functions (6 Hours)

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Module 5: (a) Network Synthesis (10) :

(a) Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b) Filters: Passive and active filter fundamentals, low pass, high-pass(constant K type) filters, introduction to active filters.

Text / References:

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.

Lab:

1. Verification of principle of superposition ac sources.
2. Verification of Thevenin, Norton
3. Maximum power transfer theorems in ac circuits

4. Verification of Tellegin's theorem for two networks of the same topology
5. Determination of transient response of current in RL and RC circuits with step voltage input
6. Determination of transient response of current in RLC circuit with step voltage input for underdamped, critically damp and overdamped cases
7. Determination of frequency response of current in RLC circuit with sinusoidal ac input
8. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD
parameters
9. Determination of driving point and transfer functions of a two port ladder network and verify
with theoretical values
10. Determination of image impedance and characteristic impedance of T and Π networks
11. Verification of parameter properties in inter-connected two port networks: series, parallel and
cascade
12. To determine attenuation characteristics of a low pass/high pass active filters.

Software based experiments:

13. To determine node voltages and branch currents in a resistive network.
14. To obtain Thevenin's equivalent circuit of a resistive network.
15. To obtain transient response of a series R-L-C circuit for step voltage& current input.
16. To obtain transient response of a series R-L-C circuit for alternating square voltage waveform.
17. To determine line and load currents in a three phase delta circuit connected to a 3-phase

PCC	Digital Electronics	3L:0T:2P	4 credits

Number System: Quantization and implementation of digital number system, Data representations and arithmetic using Floating point & fixed point number system: Signed, Unsigned, Fractional & Integer representation.

Combinational Circuits: Design procedure – Half adder, Full Adder, half-subtractor, Full subtractor, Parallel binary adder, parallel binary subtractor, Fast Adder, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ DE multiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator

Sequential Circuits: Latches, Flip-flops -SR, JK, D, T, and Master-Slave , Characteristic table and equation ,Application table , Edge triggering & Level Triggering , Realization of one flip flop using other flip flops, serial adder/subtractor, Asynchronous Ripple or serial counter , Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, Programmable counters, Design of Synchronous counters: state diagram, State table, State minimization , State assignment, Excitation table and maps-Circuit implementation, Modulo–n counter, Registers – shift registers, Universal shift registers, Shift register counters, Ring counter, Shift counters, Sequence generators.

Memory Devices: Classification of memories, ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM – RAM organization, Write operation & Read operation, Memory cycle, Timing wave forms, Memory decoding, memory expansion, Static RAM Cell, Bipolar RAM cell, MOSFET RAM cell, Dynamic RAM cell, Programmable Logic Devices, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA), Implementation of combinational logic circuits using ROM, PLA, PAL.

Logic Families: NMOS and CMOS Logic, Designing of NAND and NOR gate using NMOS and CMOS logic, CMOS Dynamic Electrical Behavior, Bipolar Logic: Diode Logic, Transistor Logic Inverter, TTL Logic, NMOS, CMOS / TTL Interface, ECL

LIST OF EXPERIMENTS:

1. Input, Output & Transfer Characteristics of CMOS Inverter
2. Design and simulation of NAND and NOR gate using NMOS and CMOS logic.
3. Design and simulation (HDL) of a Given Function Using Basic Gates (AND, OR, NOR, NAND, EXOR).
4. Design and simulation of Function Generation Using Decoders and Multiplexers.
5. Design and simulation of Priority Encoder Using 74LS148 and HDL simulations.
6. Applications of Multiplexers.
7. Seven Segment Display Experiments.
8. Four Bit and Eight Bit Adder and Subtractor.
9. Experiments on SR Latch and Master-Slave JK Flip-Flop Using SSI Gates.
10. Design and Testing of Ripple Counters Using ICs
11. Design and Testing of Mod-K Synchronous Counters.
12. Design and Testing of Shift Registers.

Text Book:

1. Wakerly, John F. / "Digital Design Principles & Practices" / Pearson Education / 3rd Ed.

References Books:

1. Bartee, Thomas C. / "Fundamentals of Digital Computers"/ Tata McGraw-Hill
2. Gopalan, K. "Gopal" / "Introduction to Digital Microelectronic Circuits" / Tata McGraw-Hill
3. Taub, Herbert & Schilling, Donald / "Digital Integrated Electronics"/ Tata McGraw- Hill
4. Millman, Jocob&Taub, Herbert / "Pulse, Digital & Switching Waveforms" / Tata McGraw-Hill
5. Mano, M. Morris / "Digital Design"/ Prentice Hall /
6. Malvino, A.P. & Leach, Donald P. / "Digital Principles & Applications" / Tata McGraw-Hill
7. Mano, M. Morris / "Digital Logic and Computer Design"/ Prentice Hall (India)
8. Tokheim, H. Roger L. / "Digital Electronics Principles & Application"/ Tata McGraw-Hill
9. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
10. Charles H. Roth. "Fundamentals of Logic Design", Thomson Learning.
11. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc.
12. Donald D. Givone, "Digital Principles and Design", TMH
13. Lectures of NPTEL

Course Outcome:
After the completion of syllabus student will be able to:

1. Analyze different methods used for simplification of Boolean expressions.
2. Design and implement Combinational circuits.
3. Design and implement synchronous and asynchronous sequential circuits.
4. Logic level simulation of logic gates using HDL.
5. Learn about logic families and its interfacing with real world.

PCC	Solid State Devices	2L:1T:2P	4 credits

Solid State Physics: Properties of semiconductor, Energy bands in intrinsic and extrinsic semiconductor; effect of doping on Fermi potential and quasi Fermi potential, Carrier transport: drift, diffusion, tunnelling, diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; **C**ontact potential, Schottky Contact and ohmic contact, impurity and lattice scattering, Poisson and continuity equations;

Diode: P-N Junction Diode, Depletion Region, Transition Capacitance, Junction Breakdown Diodes. Diffusion Capacitance, I-V Characteristics, and Equation, Models: Piecewise & Small Signal, Effect of Temperature, Switching Characteristics, Application: Rectifier, clipper, clamper circuits and analysis.

BJT & MOSFET: BJT- Introduction to Bipolar Junction Transistors, Device Structure, Theory and Physical Operation of BJT (PNP and NPN), Transistor current components, Current–Voltage Characteristics, Transistor Breakdown and Temperature, Effects, Application

MOSFET - Device Structure, Theory and Physical Operation of MOSFET, I-V Characteristics, current equation derivation for MOSFET. Current–Voltage Characteristics, Body Effect, Temperature Effects, Breakdown and Input Protection, Velocity saturation, The Depletion-Type MOSFET, Application

Special Diode: LED, Photodiode, Schottky Diode, Varactor Diode, PIN Diode, Tunnel Diode, Gunn Diode: Structure, working and Application; Silicon Controlled Rectifier and solar cell: Modes of Operation, Structure, working and Application

Emerging Semiconductor devices: Introduction of SOI technology, Structure, the working principle and the application of FDSOI MOSFET, PDSOI MOSFET, DG MOSFET, FINFET, TFET, Gate All Around (GAA)/nano Wire, HEMT.

LIST OF EXPERIMENTS:

1. Familiarization of electronics components (Resistor, Capacitor, diode, BJT, MOSFET, JFET)
2. Familiarization of generation and measuring instruments (Signal generator, DC supply, CRO, DSO, Multimeter)
3. To verify the PN Junction Diode characteristics
4. Half wave, full wave (centre tap & Bridge) Rectifier
5. Clipper and clamper circuit
6. To implement a voltage regulator circuit using zener diode
7. To verify the I/P and O/P characteristics of BJT in CE configuration
8. To verify the I/P and O/P characteristics of MOSFET in CG configuration
9. To verify the I/P and O/P characteristics of MOSFET in CS configuration
10. Calculate the α, β and γ of CB, CE and CC BJT

Text Books

1. Streetman, B.G. & Banerjee, Sanjay / "Solid State Electronic Devices" / Prentice Hall (India).
2. Millman , J. &Halkias, C. / "Integrated Electronics" / McGraw-Hill International
3. Louis Nashelsky and Robert Boylestad / Electronic Devices and Circuit Theory/ Pearson New International Edition
4. Sedra, Adel S., Smith, Kenneth C. / "Microelectronic Circuits"/ Oxford University Press

Reference Books:

1. Streetman, B.G. & Banerjee, Sanjay / "Solid-state Electronic Devices" / Prentice Hall (India), Pearson Education
2. Bell, David A. / "Electronic Devices & Circuits"/ Prentice-Hall (India).
3. Millman, J. and Grabel, A. / "Microelectronics"/ McGraw –Hill.
4. Nair, B. Somanathan/ "Electronic Devices & Applications"/ Prentice-Hall (India)
5. Nagrath, I. J. / "Electronics, Analog & Digital"/ Prentice-Hall (India).
6. Neamen, Donald A. / "Electronic circuit Analysis & design" / Tata McGraw Hill
7. Neamen, Donald A. / "Semiconductor physics & Devices" / Tata McGraw Hill
8. Salivahanan, S. & Kumar, Suresh N. &Vallavraj / "Electronic Devices & Circuits" / Tata McGraw-Hill.
9. Schaum's Outlines / "Electronic Devices & Circuits"/ Tata McGraw Hill
10. Lectures of NPTEL, Razavi.

Course Outcome:

1. Concepts of the basic psychical concept of band formation, Fermi potential and all reverent physics knowledge to understand the operation of semiconductor devices
2. Understanding of the working Diode, BJT and MOSFET
3. Numerical solutions on working of Diode, BJT, MOSFET and broader aspect of the devices
4. Understanding the Application of Diode, BJT and MOSFET
5. Acquire the knowledge of state-of-art semiconductor devices currently in use in the industry.

PCC	Hardware Description Language	2L:0T:0P	2 credits

Introduction to VHDL: What is VHDL, Programming languages Vs. HDL, Describing digital systems: behavioral, data flow, structural, Design Flow, VHDL Syntax, Number and Character Representations in VHDL

Code Structure: VHDL Libraries and Packages, Library/Package Declarations, ENTITY, ARCHITECTURE, PORT, Specifying PORT Arrays GENERIC, Introductory VHDL Examples: basic Gates & universal gates, multiplexer, decoder.

Data Types: VHDL Objects, Data-Type Libraries and Packages, Type Classifications, Standard Data Types, Standard-Logic Data Types, Unsigned and Signed Data Types, Fixed- and Floating-Point Types,

User defined data type: Predefined Data Types Summary User-Defined Scalar Types, Specifying PORT Arrays, Qualified Types and Overloading ,Type Conversion.

Modeling and simulation of digital systems: Adder, Subtractor: Single bit, nibble, byte.

Text Book:

1. Charles H Roth Jr, "Digital System Design using VHDL", Thomson Learning
2. Voleni A. Pedroni, “Circuit Design and Simulation with VHDL”, MIT Press, Second Edition, 2004.

Reference Books:

1. Stephen Brown & ZvonkoVranesic, "Fundamentals of digital logic design with VHDL, TMH.
2. John F Wakerly, "Digital design", PHI.
3. Lecturers of NPTEL.

Course Outcomes:

After the completion of syllabus student will be able to:

1. Understand the need of Hardware Descriptive Languages vs. programming languages.
2. Design and simulate basic gates and combinational circuits using VHDL.
3. Understand the basic data types used in VHDL.
4. Have the knowledge of designing user defined data types.
5. Apply these concepts for adder and subtractor.

HSMC	Engineering Economics and Management	3L:0T:0P	3 credits

UNIT I Introduction to Economics:
Overview: production possibility curve, choices-what, how and for whom, micro- and macro economics, inflation, unemployment, GDP and business cycle; demand and supply, elasticity of demand, consumer surplus and its applications, utility theory.
UNIT II Production and Cost:
Factors of production, production function, law of variable proportion, isoquant analysis, return to scale, economies of scale; Types of costs: direct and indirect costs, explicit and implicit costs, opportunity cost, economic cost, fixed cost and variable costs, average and marginal costs, short-run and longrun costs, optimal combination of factor-inputs.
UNIT III Market Structure:
Perfectly Competitive Market, Imperfect market: Monopoly, Oligopoly, Monopolistic Market
UNIT IV Fundamentals of Management:
Development of Management Thoughts, Objectives, Functions of Management: Planning, Organising, Directing, Controlling and Coordination.
UNIT V Business Enterprises-
Business Ownership: Sole Proprietorship, Partnership, Company: Promotion, Formation & Development, Cooperative Firms.

Text books:
1. **Koutsoyiannis, A**., 'Modern Microeconomics', English Language Book Society, Macmillan.
2. **Joseph, L Massod,** "Essential of Management", Prentice Hall, India.
Additional Reference Books:
1. **Armstrong, Michel**, "A Handbook of Management Techniques", Kogan Page Limited
2. **Babcock, D L and Lucy C Morse**, "Managing Engineering and Technology", third edition, Pearson Education, 2006
3. **Pindyck, R S, Rubinfeld, D L &Mehta** , 'Microeconomics', 6 th Edition, Pearson Education India.
4. **Barthwal, R R , Microeconomic Analysis**
5. **Samuelson, Paul A** , 'Economics', 5th edition, McGraw Hill New York.
6. **Henderson, J M and Quadnt, R E** , 'Microeconomic Theory: A Mathematical Approach.', Tata MacGraw Hill, New Delhi,2003
7. **H. Varian,** 'Intermediate Micro Economics'
8. **G. Mankiw,''**Principles of Micro Economics
**Additional references will be provided in class
Course Objectives (COs)
At the end of this course students should be able to:
1. Understanding essential economic principle for solving economic problem with suitable policy alternatives and know how rational consumers can maximize their satisfaction with limited incomes and make best use of their resources.
2. Understand production principles and cost analysis.
3. Gain market knowledge and study the contemporary market situations, market strategy to manage the industries.
4. It gives basic knowledge of management technique.
5. Develop Entrepreneurship skills towards formation of partnership, companies and their functions.

MC (Non-credit)	INDIAN CONSTITUTION	2L:0T:0P	2 credits

UNIT – I- Indian Constitution
Sources and Features, Preamble, Fundamental Rights, Fundamental Duties and Directive Principles of State Policy
UNIT-II- Union Executive
President, Vice President, Prime Minister, Council of Ministers, State Executives- Governor, Chief Minister and Council of Ministers
UNIT- III- Union Legislature
Parliament- Composition and Functions, Speaker of Lok Sabha, Amendment Process, State Legislature- Vidhaan Sabha, Panchaayati Raj, Institutions- History, Basic Features and 73rd Amendment
UNIT- IV- Judiciary
Supreme Court, High Courts, Judicial Review and Judicial Activism
UNIT-V- Election Commission
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the Welfare of SC/ST/OBC and Women.

Reference Books:
1. Indian Constitution : D.D Basu
2. Indian Administration: Avasthi and Avasti

Additional Reference Books
1. The Indian Constitution: Corner Stone of a Nation, G. Austin, Oxford University Press.
2. Indian Politics: Contemporary Issues and Concerns, M. P. Singh and RekhaSaxena, Prentice Hall of India, Delhi

Course Objectives (COs)
At the end of this course students should be able to:
1. Configure the preambles & fundamental rights.
2. Actuate the governance & functioning of constitutional functionaries.
3. Describe the functions of legislative bodies.
4. Decipher the judiciary system & its role in governance.
5. Develop a democratic process through electoral mechanism into system.

BSC	COMPUTER ORIENTED NUMERICAL METHODS	3L:1T:0P	4 credits

UNIT I: Nonlinear Equations and Simultaneous Linear Equations:
Roots of nonlinear equation, Methods of solution, Order of convergence of iterative methods, Simple roots: Bisection, False position, secant, Newton-Raphson, Chebyshev, Iteration and multi point iteration methods, Multiple roots: Newton-Raphson and Chebyshev, Complex roots: Newton-Raphson and Muller's method, a system of nonlinear equations: Newton-Raphson and Iteration methods, Polynomial equations: Bairstow's method, convergence analysis of above methods.
Linear systems: Introduction, Direct methods, Operation count, Pivoting, III conditioned linear systems & condition number, Iteration methods: Jacobi, Gauss-Seidel, SOR methods, convergence conditions. Special system of
equations: Thomas algorithm. Eigen value problems: Given's and Power methods.
UNIT II: Interpolation, Differentiation and Integration:
Curve fitting: Polynomial interpolation, error, Existence and Uniqueness, Truncation error bounds, difference operators, Newton forward and backward difference interpolations, Lagrange, Newton divided difference and Iterated interpolations, stirling and Bessel's interpolations, Spline interpolation, Least squares and Chebyshev approximations. Numerical Differentiation: Methods based on interpolation, Error analysis. Numerical
Integration: Methods based on interpolations (Trapezoidal, Simpson's 1/3, simpson's 3/8 rule), Gauss
quadrature methods, Romberg integration, Error bounds and estimates.
UNIT III: Numerical Solution of Ordinary Differential Equations:
Initial-value problems, Single step methods: Taylor's, Picard's, Euler's, Modified Euler's method and Runge-Kutta method (fourth Order), Error estimates, Multi-step methods: Adam's-Bashforth and Milne's methods, convergence and stability analysis, Simultaneous and Higher order equations: RK Fourth order method.
UNIT IV: Initial & Boundary Value Problems and Iterative Solvers:
BVP: Shooting method and Finite difference methods for Ordinary Differential Equations, Solution of Partial differential equation; solution of Laplace, Poisson equations: Standard 5-point and diagonal 5- point formulae, Jacobi method, Gauss Seidel method (Liebmann's iterative method) Relaxation method. Solution of heat equation: Crank – Nicolson method, Solution of wave equation.
UNIT V: Finite Element Method:
Basic concepts, variational formulation and functional, base functions, approximations weighted residual methods: Ritz method, Galerkin method, Least squares method, collocation method, Finite element and solution of simple problems and time dependent problems.

Books Recommended:
1. M.K.Jain, S.R.K. Iyengar&R.K.Jain, Numerical methods for Scientific and Engineering Computation, N age International Publication.
2. S.S Sastry, Intoductory Methods of Numerical Analysis, Eastern Economy Edition.
3. S. Rajasekaran, Numerical Method in Science and Engineering, Wheeler Publishing House.
4. B.S. Grewal, Numerical Method in Engineering & Science, Khanna Publishers.

Objective / Outcomes, CONM

Using Mathematical Modeling, most of the problems in Engineering, physical and Economical sciences canbe formulated in terms of systems of linear or non-linear equations, ordinary or partial differential equations or integral equations. In majority of the cases, the solutions to these problems in analytical form are difficult or not amenable for direct interpretation. In all such problems, Numerical Analysis provides approximate solutions to the desired degree of accuracy.

Numerical Methods provide easier computational process to solve various mathematical problems like Interpolation,

Differentiation, Integration, ODE & PDE and Initial & Boundary value problems. Analytical solutions can be obtained only for selected class of ODE and PDE. For certain problems, analytical solutions cannot be obtained. However numerical solutions can be obtained to the desired degree of accuracy

using computers.

In civil engineering, numerical methods are used routinely in structural analysis to determine the member forces and moments in structural systems, prior to design. They are most useful in analyzing civil engineering problems with complicated geometries, material properties and loading conditions.

Finite element method has been extensively used in the field of structural mechanics, it has been successfully applied to solve several other types of engineering problems like heat conduction, fluid dynamics, electric and magnetic field. The general applicability of the method is to find the solution of complicated boundary value and other problems.

ESC	DATA STRUCTURE USING C	3L:1T:2P	5 credits

Unit -1:

Introduction: Basic Terminology, Elementary Data Organization, Structure operations, Algorithm Complexity and Time-Space trade-off.

Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices and Vectors.

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations associated with Stacks, Applications of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack, Applications of recursion in problems like 'Tower of Hanoi'.

Unit-2:

Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues**.**

Linked list: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

Unit-3:

Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm**.**

Searching and Hashing: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

Unit-4:

Sorting: Insertion Sort, Bubble Sort, Quick Sort, Two Way Merge Sort, and Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting**.**

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

Unit-5:

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

File Structures: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

Text and Reference Books:

1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., New Delhi.

2. R. Kruse et. al, "Data Structures and Program Design in C", Pearson Education Asia, Delhi-2002

3. A. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd., New Delhi.

4. K Loudon, "Mastering Algorithms with C", Shroff Publisher & Distributors Pvt.

Ltd.
5. Bruno R Preiss, “Data Structures and Algorithms with Object Oriented Design Pattern in C++”, Jhon Wiley & Sons, Inc.
6. Adam Drozdek, “Data Structures and Algorithms in C++”, Thomson Asia Pvt. Ltd.(Singapore)

Lab Work:
Write Program in C or C++ for the following
1. Array implementation of Stack, Queue, Circular Queue, List.
2. Implementation of Stack, Queue, Circular Queue, List using Dynamic memory Allocation.
3. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
4. Implementation of Searching and Sorting Algorithms.
5. Graph Implementation, BFS, DFS, Min. cost spanning tree, shortest path algorithm.

Course Outcomes:
1. Analyze the algorithms to determine the time and computation complexity and justify the correctness. (Analyze)
2. Implement Arrays, Stacks, Queues and linked list based problems and analyze the algorithm to determine the time complexity. (Apply, Analyze)
3. Implement search and traversal algorithms on Trees and Graphs and determine the time complexity. (Apply, Analyze)
4. Algorithms for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of space and time complexity. (Apply, Analyze, Evaluate)
5. Understand file structures and file handling. (Understand)\

PCC	Signals & System	2L:1T:0P	3 credits

Classification of Signals& Systems: Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & aperiodic signals, Deterministic & Random signals, Energy & Power signals - CT systems and DT systems Classification of systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable Continuous-Time and Discrete-Time LTI Systems and their properties, convolution sum and convolution integrals, LTI System described by differential and difference equations.

Fourier Series and Fourier Transforms: The response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-time Periodic Signals and their Properties, Continuous time and discrete time Fourier Transforms and their properties, System Characterized by Linear Constant Coefficient Differential equations and Difference equations.

Time and Frequency Characterization of Signals and Systems: Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency response of LTI systems, Time domain Properties of Ideal Frequency Selective filter, Time Domain and Frequency Domain aspects of Non ideal filters, First Order and Second Order Continuous Time and Discrete Time Systems.

Sampling and Laplace Transform: Signal representation by samples, sampling theorem, Impulse train sampling, sampling of discrete time signals, discrete time processing of continuous time signals. Laplace Transforms, Region of Convergence, Inverse Laplace Transforms, Analysis and Characterization of LTI system, Block diagram representation, unilateral Laplace Transform.

Z-Transform: z- Transform, Region of convergence, Inverse Z-transform, analysis and characterization of LTI system, Block diagram representation, Unilateral Z-transform.

TEXT BOOK:

1. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, “Signals and Systems”, Pearson.

REFERENCE BOOK:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford.
2. R. E. Zeimer, W. H. Tranter and R. D. Fannin, “Signals & Systems - Continuous and Discrete”, Pearson.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson.

4. M.J. Roberts, “Signals & Systems Analysis using Transform Methods & MATLAB”, Tata McGraw Hill.
5. Ambardar, Ashok /“Analog and Digital Signal Processing”/ Thomson/ 2nd Ed.
6. Mitra, S.K. / “Digital Signal Processing” / Tata McGraw-Hill
7. Chen 'Signals & Systems, Oxford University, Press.
8. Lectures of NPTEL.

COURSE OUTCOMES (old):

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

1. Analyze the properties of signals & LTI systems
2. To study Fourier series and Fourier transform and its properties for analysis of signals of aperiodic as well as periodic signals in Continuous and discrete-time domain
3. Magnitude and phase representation of Fourier transform in time as well as frequency domain, with its application in filters.
4. To study the sampling process and analyze LTI systems using Laplace-transform.
5. Analyze discrete-time LTI systems using z-Transform.

PCC	Analog Circuits	2L:1T:2P	4 credits

Biasing: Significance of biasing, Biasing of BJT and MOSFET, Stability Factor, Q point, Small Signal model of BJT and MOSFET, switching operation of BJT, BJT & MOSFET as a switch, BJT and MOSFET Circuits at DC

Amplifiers: Significance and principles of Amplifiers, Amplifier Operation principle/VTC/ Deciding on a Location for the Bias Point Q, Analysis of Single Stage MOS Amplifier: Small signal Operation and Model, Large signal analysis, Analysis of Single Stage CS, CG & CD (MOSFET Amplifiers) in Mid-band & High Frequency Region, Frequency Response of the CS Amplifier, 8. Impedance and gain analysis of amplifier, Discrete-Circuit Amplifiers, Multistage Amplifiers, practical application

Feedback and stability: Significance and importance of Feedback network, The General Feedback Structure, Properties of Negative Feedback, Effect of Negative Feedback, Simple Analysis on Stability of Feedback Amplifier. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth, poles and zeros etc., calculation with practical circuits, concept of stability, gain margin and phase margin. practical application

Power Amplifiers: Significance of power amplifiers, Classification of Output Stages; Class A, Class B, Class AB, Class C amplifier: Circuit Operation, Signal Waveforms / Transfer Characteristic, Power Dissipation and Power-Conversion Efficiency; Crossover Distortion, IC Power Amplifiers, Power Transistors: power BJT & MOSFET, practical application; Power Supply: Unregulated Power Supply, Ripple Factor, Filters, Regulated Power Supply (ripple removal and regulation).

Oscillators and Waveform-Shaping Circuits: Significance of Oscillators, Conditions for Oscillations, The Oscillator Feedback Loop, Op-Amp Based RC Oscillators: Phase Shift, Wein Bridge, LC and Crystal Oscillators: Generalized form of Hartley & Colpitts Oscillators, Crystal Oscillators; Frequency Stability. Multivibrators: Basic circuit and operation concept of Astable Multivibrator, monostable Multivibrator and Bistable Multivibrator using transistors, practical application

LIST OF EXPERIMENTS:

1. Designing of Voltage divider and fixed biasing circuit of BJT and implementation of it in PCB.
2. Designing of Voltage divider and fixed biasing of MOSFET and implementation of it in PCB.
3. Study of switching characteristics of BJT and MOSFET
4. Measurement of BJT & MOSFET's h-parameter
5. Designing of controlled gain negative feedback MOSFET / BJT amplifier.
6. Design of an OP-Amp circuit for adding and subtracting operation

7. Design of an OP-Amp circuit for integration and derivative operations
8. Analysis of Hartley & Colpitts Oscillators (LC)
9. Designing of Class A power amplifier to achieve a particular gain
10. Mini-project in design and implementation of an advanced analog circuit (related to this course) using PCB.

Text Books:

1. Millman , J. &Halkias, C. / "Integrated Electronics" / McGraw-Hill International.
2. Behzad Razavi/ "Design Of Analog CMOS Integrated Circuit", 2nd Edition/ McGraw-Hill Education.
3. Phillip E. Allen and Douglas R. Holberg/ "CMOS Analog Circuit Design"/The Oxford Series in Electrical and Computer Engineering, 3rd Edition/
4. Sedra, Adel S., Smith, Kenneth C. / "Microelectronic Circuits"/ Oxford University Press.
5. Shilling, D. H. &Belove, Ch. / "Electronic Circuit"/ McGraw-Hill International.

Reference Books:

1. Streetman, B.G. & Banerjee, Sanjay / "Solid-state Electronic Devices" / Prentice Hall (India), Pearson Education
2. Bell, David A. / "Electronic Devices & Circuits"/ Prentice-Hall (India).
3. Millman, J. and Grabel, A. / "Microelectronics"/ McGraw –Hill.
4. Nair, B. Somanathan/ "Electronic Devices & Applications"/ Prentice-Hall (India)
5. Nagrath, I. J. / "Electronics, Analog & Digital"/ Prentice-Hall (India).
6. Neamen, Donald A. / "Electronic circuit Analysis & design" / Tata McGraw Hill
7. Neamen, Donald A. / "Semiconductor physics & Devices" / Tata McGraw Hill
8. Salivahanan, S. & Kumar, Suresh N. &Vallavraj / "Electronic Devices & Circuits" / Tata McGraw-Hill.
9. Schaum's Outlines / "Electronic Devices & Circuits"/ Tata McGraw Hill
10. Lectures of NPTEL, Razavi.

Course outcomes:

After the completion of syllabus student will be able to:

1. Analyze the concept of biasing its effect on circuit operation
2. Design, analysis and implemention of the amplifier cicuit.
3. Feedback and different amplifiers in mid-band and high frequency region.
4. Analyze the principle of regulated DC power supply and oscillator.
5. Implement and test the circuits related with signal generator (oscillators) and signal shaping.

PCC	Electromagnetic Field Theory	2L:1T:0P	3 credits

Review of: Vector Analysis, Static Electric Fields, Solution of Electrostatic Problems
Review of: Steady Electric Currents, Static Magnetic Fields
Time Varying Fields: Faraday's Law of Electromagnetic Induction, Maxwell's Equations. Potential Functions, Electromagnetic Boundary Conditions, Wave Equations & Their Solutions, Time Harmonic Fields
Plane Electromagnetic Waves: Plane Waves in Lossless &Lossy Media, Group Velocity, Poynting Vector &Poynting Theorem, Refractions and Reflections at Normal and Oblique Incidence at Plane Conducting and Plane Dielectric Boundary
Transmission Lines: Transverse Electromagnetic Wave Along a Parallel Plate Transmission Line, Transmission-Line Equation, Wave Characteristics on Finite Transmission Lines, Transient on Transmission Lines Transmission Line as circuit element, Transmission Line Impedance Matching, Smith Chart, Introduction to Wave Guides

TEXT BOOKS:
1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics" , Tata McGraw- Hill Publishing Company Ltd, New Delhi, 2008
2. David K Cheng, "Field and Wave Electromagnetics", Pearson Education.
3. Sadiku M H, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009

REFERENCE BOOKS:
1. John D Kraus and Daniel A Fleisch, "Electromagnetics with Applications", McGraw Hill Book Co.
2. Karl E Longman and Sava V Savov, "Fundamentals of Electromagnetics", Prentice Hall of India.
3. AshutoshPramanik, "Electromagnetism", Prentice Hall of India.
4. Harington, R. F. / "Time Harmonic EM Fields" / McGraw Hills
5. Schaum's Outlines / "Electromagnetics" / Tata McGraw-Hill /.
6. Collin, R. E. / "Antennas and Radio Wave Propagation"/ Tata McGraw-Hill.

COURSE OUTCOMES:
Upon completion of the course, the students should be able to
1. Analyze field potentials due to static changes and static magnetic fields.
2. Explain how materials affect electric and magnetic fields.
3. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
4. Examine the phenomena of wave propagation in different media and its interfaces.
5. Have knowledge about different parameters and properties of transmission line.

HSMC	Organizational Behaviour	3L:0T:0P	3 credits

Unit 1: Introduction to organizations
What is an organization, components of organization, nature and variety of organizations (in terms of objectives, structure etc.), models of analyzing organizational phenomena, organizational and business variables, organizations in the Indian context, institutions and structures.
Unit 2: Dimensions of Individual Behavior
Individual Behavior, Dimensions of individual behavior: Perceptions, Learning, Motivation, Personality, Commitment, Attitudes, Values & Ethics, Stress Management
Unit 3: Dimensions of Interpersonal Behavior
Transactional Analysis, Interpersonal communication, Listening, Feedback, Counseling,
Unit 4: Group Behavior
Leadership, Communication, Group: Formal Vs Informal Groups, Group Decision making, Team: Team building, team problem solving.
Unit 5: Organizational Dimensions
Organizational Structure: Elements of Organizational Structure, Dimensions of Organizational Structure, Organizational change, Organizational Development, Power, Authority, Politics

Note: *Integrating cases (s). Case method and lectures should be supplemented with a variety of other methodologies such as feedback on questionnaires and tests, role plays, and behavior simulation exercise.*

References:
1. Luthans Fred., "Organizational Behavior", McGraw Hill, 1998
2. Pareek, Udai, "Understanding Organizational Behavior, Oxford university press
Additional Reference Books
1. Robbins (4th ed.), "Essentials of organizational behavior", Prentice Hall of India Pv1. Ltd., New Delhi, 1995
2. Keith Davis, "OrganisationalBehaviour,
3. Hersey and Blanchard (6th ed.). "Management of organizational behavior L utilising human resources", Prentice Hall of India Pv1. Ltd., New Delhi, 1996.
4. Nancy J. Adler, “International OrganisationalBehaviour’, Cengage Learning
5. Nelson Quick, ‘Organizational Behaviour Function Learning’Fifth Edition

Course Objectives (COs)
At the end of this course students should be able to:
1. Apply organizational objectives, components and models in Indian context for better results for attaining organizational goals.
2. Demonstrate individual behavioural dimensions, learning theories, perceptual process, values & ethics with motivational techniques in stressed situations.
3. Identify mechanism for, conducive survival of individual in an organization with interpersonal understanding.
4. Ascertain group, group behaviour, Team & Team building with its key role in organization.
5. Demonstrate organisational structure, organisational change, organisational development for achieving higher productivity and accomplishing goals of organisation.

MC (Non-credit)	CYBER SECURITY	2L:0T:0P	2 credits

Unit-1:
Introduction to information systems, Types of information systems, Development of Information systems, Introduction to information security, Need for Information security, Threats of Information Systems, Information Assurance, Cyber Security and Security Risk Analysis.

Unit-2
Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology- Firewall and VPNs, Intrusion Detection, Access Control, Security Threats- Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce – Electronic Payment System, e-Cash, Credit/Debit Cards, Digital Signature, public Key Cryptography.

Unit-3
Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design, Security Issues in Hardware, Data Storage & Downloadable devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

Unit-4
Security Policies, why Policies should be developed, WWW Policies, Email Security Policies, Policy Review Process- Corporate policies- Sample Security Policies, Publishing and Notification requirement of the Policies.Information Security Standards- ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India: IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Pattern Law.

Text and Reference Books:
1. Charles, P., and Shari Lawrence P fleeger, "*Analyzing Computer Security"*. Pearson Education India.
2. V.K. Pachghare, "*Cryptography and information security",* PHI Learning Pvt. Ltd., Delhi India.
3. Dr Surya Prakash Tripathi, RitendraGoyal, and Praveen Kumar Shukla, "Introduction to Information Security and Cyber Law", Willey Dream tech Press.
4. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
5. Chander Harish, "Cyber Laws and their Protection", PHI Learning Private Limited, Delhi, India.

Course Outcomes:
1. Understand information, information systems, information security, Cyber Security and Security Risk Analysis. (Understand)
2. Understand and apply application security, data security, security technology, security threats from malicious software. (Understand, Apply)
3. Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc. (Understand)
4. Understand and apply Information Security Governance & Risk Management, Security of IT Assets and Intrusion Detection Systems. (Understand, Apply)
5. Understand various types of Security Policies, Cyber Ethics, IT Act, IPR and Cyber Laws in India. (Understand).

V Semester

PCC	Analog Integrated Circuits	2L:1T:2P	4 credits

Single Stage Integrated Circuit Amplifiers: Comparison of the MOSFET, BJT & Bi- CMOS Circuits, IC Biasing & Modified Current Sources, Amplifiers with Active Load, Cascode Amplifier,

Differential Amplifiers: MOS Differential Pair, Non Ideal Characteristics of the Differential Amplifier, Differential Amplifier with Active Load, Freq. Response of Differential Amplifier, Two Stage CMOS Op-Amp, Introduction to OTA

Data Converters: DAC/ADC

Filters: Active Filters: Transmission, Types & Specifications, Transfer Function, Butterworth &Chebyshev Filters, First Order & Second Order Filter Functions, Second Order Filter Realization Based on Two Integrator Loop Topology, Noise in Devices, Switched capacitor filters

Signal Generators & Wave Shaping Circuits: Bi-Stable Circuits**,** Comparator, Schmitt Trigger, Generation of Square & Triangular Waveforms, IC Timer 555 and its Applications, PLL And Its Applications, Precision Rectifier Circuits, Voltage Regulators ICs, SMPS.

LIST OF EXPERIMENTS:
Note: At least 08 experiments are to be performed from the following.

1. Measurement of Op-amp Parameters. (Open Loop Gain, input offset Voltage, CMRR, Slew rate).
2. Determination of Frequency response of Op-Amp.
3. Precision Rectifier.
4. Instrumentation Amplifier.
5. Open Loop operation of Op-amp -Comparators - Schmitt Trigger.
6. PAM, PWM, PPM generation and detection
7. IC Voltage Regulator.
8. Voltage Controlled Oscillator.
9. Phase Locked Loop.
10. Frequency Multiplier.
11. A/D Converters & D/A Converters.
12. Second Order Active Filter-High Pass & Low Pass Realization.

Text Books:

1. Sedra, Adel S., Smith, Kenneth C. / "Microelectronic Circuits"/ Oxford University Press.
2. Millman, J. &Grabel, A. / "Microelectronics"/ McGraw-Hill.
3. Gray, P.R., Hurst, P.J., Lewis, S.H. & Meyer, R.G. / "Analysis and Design of Analog Integrated Circuits" / John Wiley & Sons /.
4. Gayakwad, R.A. / "Op-Amps and Linear Integrated Circuits" / Prentice-Hall (India).
5. BehzadRazavi, "Design of Analog CMOS Integrated Circuits", MGH.
6. J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", PHI

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. . Understand the characteristics of differential amplifier, Filters.
2. Design sinusoidal and non-sinusoidal oscillators
3. Understand the functioning of OP-AMP and design OP-AMP based circuits.
4. To apply the knowledge of ADC and DAC in different systems.
5. Design simple wave shaping circuits.

PCC	Analog Communication	3L:1T:2P	5 credits

Communication (Transmission) System: Elements of Communication System and its Limitations, Mismatch between Signal & Channel- Modification of Channel or Modification of Signal, Modulation Benefits and Application, An Overview of Different types of Modulations- Analog & Digital, In Analog- Amplitude & Angle (Frequency & Phase) Modulation

Amplitude (Linear) Modulation: Generation and Detection of DSB, SSB and VSB, Carrier Acquisition, AM Transmitter and Receiver circuits.

Angle (Exponential) Modulation: Types of Angle Modulation, Concepts of Instantaneous Frequency, Wide band & Narrow band FM, Generation and Detection of FM, Generation and Detection of PM, FDM, Intermediate Frequency, Double Heterodyne Receiver, Transmitter and Receiver circuits.

Noise: Random Variable & Random Processes, Stationary Processes, Ergodic Processes, Transmission Through LTI, Power Spectral Density, Gaussian Processes, External and Internal Source of Noise, Thermal Noise, Voltage and Current models of a noisy resistor, Calculation of thermal noise in RC circuits, Shot Noise, Noise Figure, Noise Temperature, Equivalent Noise Band width, Noise Figure for cascaded networks

Noise Performance of C. W. Modulation Systems: Noise in DSB-SC, SSB-SC, & AM System, Noise in FM and PM, FM Threshold and its extension, Pre-Emphasis and De Emphasis in FM and De Emphasis in FM

LIST OF EXPERIMENTS:

Note: At least 08 experiments are to be performed from the following.

1. Generation of AM Signal and measurement of Modulation Index.
2. Envelop Detector for AM Signals
3. Generation & Detection of DSB-SC Signal.
4. SSB Generation.
5. Detection of SSB signal
6. Study of AM Transmitter and Receiver Circuit.
7. Generation of NBFM Signal.
8. Generation of FM Signal.
9. FM Detector using PLL.
10. Generation & Detection of VSB signals.

Text Books:

1. Haykin, S. / "Communication Systems" / John Wiley & Sons / 4th Ed.
2. Lathi, B. P. / "Modern Analog & Digital Communication Systems" / Oxford University Press

References Books:

1. Taub, Herbert & Schilling, Donald L. / "Communication Systems" / Tata McGraw- Hill
2. Kennedy, G. & Davis, B. / "Electronic Communication Systems" / Tata McGraw- Hill.
3. Carlson, A. Bruce, Crilly, Paul B. & Rutledge, Janet C. / "Communication Systems

an Introduction to Signals & Noise in Electrical Communication"/ Tata McGraw-Hill.
4. Singh, R.P. &Sapre, S.D. / "Communication Systems: Analog & Digital" / Tata McGraw- Hill
5. Lectures of NPTEL

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the basics of communication systems, basic resources and their tradeoff, frequency domain analysis and need and types of modulation
2. Do comparative study of various schemes for Amplitude modulation and demodulation for different applications
3. Do comparative study of different types of Angle modulation and various schemes of modulation and demodulation thereof
4. Do the probabilistic analysis of random processes and their frequency domain behavior and to understand the various noise types and noise models
5. Analyze the comparative noise behavior of AM-FM-PM systems and to understand the noise compensation schemes

PCC	Antennas and Wave Propagation	2L:1T:0P	3 credits

Antenna Principles: Potential Functions & Electromagnetic Field, Current Elements, Radiation from Monopole & Half Wave Dipole, Directional Properties of Dipole Antenna.
Antenna Gain, Effective Area, Antenna Terminal Impedance, Antenna as an Opened Out Transmission Line, Practical Antennas and Methods of Excitation, Transmission Loss between Antennas, Antenna Temperature and Signal to Noise Ratio, Types of Antenna e.g. Horn antenna, Patch antenna, Parabolic antenna and loop antenna etc. Return Loss of antenna.
Antennas Arrays: Two Element Array, Horizontal Patterns in Broadcast Arrays, Linear Arrays, Binomial Array, Tschebyscheff Distribution, LF antenna, MF antenna, VHF and UHF antenna. Retarded potential, linear and binomial array,
Wave Propagation: Modes of Propagation, Plane Earth Reflection, Space wave and Surface Wave, Elevated Dipole Antennas above a Plane Earth, Wave Tilt of the Surface Wave, Spherical Earth Propagation, Tropospheric Wave, Ionosphere Propagation, Sky Wave Transmission Calculations, Effects of the Earth's Magnetic Field, Wave Propagation in the Ionosphere, Virtual Height, MUF/LUF, Skip Distance, Duct Propagation, Space wave

Text Books:

1. Jordan Edwards C. and Balmain Keith G./ "Electromagnetic Waves and Radiating Systems"/ Prentice Hall (India)
2. Liao, S.Y. / "Microwave Devices & Circuits" / Prentice Hall (India) /.
3. Collin, R. / "Antennas and Radiowave Propagation" / Tata McGraw-Hill.
4. C. A. Balanis / "Antenna Theory Analysis and Design" / Wiley

Reference Books:

1. Kraus, John D. &Mashefka, Ronald J. / "Antennas: For All Applications" / Tata McGraw Hill.
2. Prasad, K.D./ "Antennas and Wave Propagation"/ Khanna Publications
3. Hayt Jr. William H./ "Engineering Electromagnetics "/ Tata McGraw-Hill
4. Das, Annapurna & Das, Sisir K. / "Microwave Engineering"/ Tata McGraw Hill.
5. Roy, Sitesh Kumar &Mitra, Monojit / "Microwave Semiconductor Devices" / Prentice Hall (India).
6. Lectures of NPTEL

Course Outcomes:
At the end of the course, students will demonstrate the ability to:

1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of required specifications.
4. Apply the concepts for understanding different antenna arrays.
5. Have the knowledge of different modes of radio wave propagation and various effecting parameters.

PCC	Microprocessors	2L:1T:2P	4 credits

Introduction to Microprocessors: Introduction to 8085: Architecture, Register structure, ALU, Bus Organization, Timing and Control. Machine/Instruction cycle Addressing Modes, Data Transfer Instructions, Arithmetic and Logic instructions, Program Control Instructions (jumps, conditional jumps, and subroutine call) Loop and string instructions, Basic knowledge of assembly level programing. Concept of Assembler, Compiler, Cross Compiler.

Architecture of 16-bit, 32-bit and 64-bit Microprocessors: Internal Organization and pin description of 8086, Bus Interface Unit (Address and Data bus Demultiplexing), Execution unit, Register Organization, Memory Organization, Bus Cycle, Clock generation. Machine and Instruction cycle Addressing Modes, Interrupt Structures, 8086 Instructions set; Introduction and brief discussion of the 32 Bit and 64 bit Microprocessor architecture.

Basic I/O Interfacing: Programmed I/O, Interrupt Driven I/O, DMA; Parallel I/O: 8255-PPI, Minimum Mode CPU Module, Maximum Mode operation, Centronics Parallel port; Serial I/O: 8251/8250,RS-232 Standard; Interrupt Controller: 8259 Programmable Interrupt Controller; 8237 - DMA Controller, 8253/8254 - Programmable Timer/Counter; ADC and DAC interfacing, Memory Interfacing.

Introduction to Microcontroller: 8051 Introduction, architecture, instruction set, timers/counters, interrupts and serial interface (including multi-processor communication), Memory organization. Introduction to RISC processor. RISC Architecture and its operation principle.

ARM (Advanced RISC Microprocessor): Architecture of ARM Cortex M3 and instruction sets, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, Memory mapping, Bus interfaces.

LIST OF EXPERIMENTS:
8085/8086/ARM Based Experiments:

1. Signed and unsigned binary addition.
2. Signed Multiplication.
3. Signed and unsigned binary division.
4. BCD Addition and subtraction
5. Look up table method for finding the ASCII of an alpha-numeric code.
6. Toggle the LED‘s with some time delay using ARM
7. program for interfacing the LCD with ARM
8. Interfacing with 8255 in I/O mode/BSR mode.
9. Interfacing with seven segment display.
10. Interfacing with 8253.
11. Verification of Interrupts.
12. Interfacing with ADC/DAC.
13. Mini Project on some interfacing applications (preferably ARM based)

Text Books:

1. Brey, Barry B. / “INTEL microprocessors” / Prentice Hall (India) /4th Ed.
2. Gaonkar, Ramesh S. / “Microprocessor Architecture, Programming, and Applications with the 8085” / Pen ram International Publishing / 5th Ed.

3. Liu and Gibson G.A. / “Microcomputer Systems: The 8086/8088 Family” / Prentice Hall (India) / 2nd Ed.
4. Hall D.V. / “Microprocessors Interfacing” /Tata McGraw Hill / 2nd Ed.

Reference Books:

1. Singh, B.P. / “Advanced Microprocessors and Microcontrollers” / New Age International
2. Ray, A.K. & Burchandi, K.M. / “Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing”/ Tata McGraw Hill.
3. Ayala, Kenneth J. / “The 8086 Microprocessor Programming & Interfacing The PC”/ Pen ram International Publishing (India) Limited.
4. Lectures of NPTEL

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand 16 bit and32 bit microprocessor; apply those concepts on advance processor.
2. Formulate a real world problem in assembly language programming.
3. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
4. Understand the concept of microcontroller and RISC processor.
5. Have the basic knowledge of ARM processor and its operation.

PCC	VLSI Technology	2L:1T:0P	3 credits

Orientation and familiarization of basic fabrication steps

Crystal Growth & Wafer Characterization: Electronic Grade Silicon, CZ Crystal, Growing, Silicon Shaping, Processing Consideration. Material Characterization

Epitaxy: Vapor Phase Epitaxy, Molecular Beam Epitaxy

Oxidation: Growth Mechanisms, Thin Oxides, Oxide Properties, Oxidation Induced Defects, oxide thickness Characterization

Lithography: Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography

Etching: Wet Chemical Etching: Silicon, SiO_2, Silicon Nitride, Polysilicon, Aluminium, GaAs;
Reactive Plasma Etching (Dry)**:** Feature Size Control in Isotropic and Anisotropic, Etch Mechanisms, Reactive Plasma Etching Techniques and Equipment

Diffusion: Models of Diffusion in Solids, Fick's One Dimensional Diffusion Equations, Atomic Diffusion Mechanisms

Ion Implantation: Range Theory, Implantation Equipment, Implant damage and Annealing, Implantation related processes

Dielectric and Polysilicon Film Deposition: Deposition Processes (CVD & MBE), Poly Silicon, Silicon Dioxide, Silicon Nitride, Silicon on Insulators, Low-dielectric-Constant Material, High-dielectric-Constant Material

Metallization: Metallization Applications, Metallization Choice, Physical Vapour Deposition, Chemical Vapour Deposition, Aluminium Metallization, Copper Metallization. Patterning,

Process Integration: Passive Component, Bipolar IC Technology, MOSFET Technology, MESFET Technology and MEMS Technology, Packaging

MOS Transistors and its fabrications process: MOS, CMOS IC Technology, Metal Gate, Poly Silicon Gate, P-Channel, N- Channel Devices, Enhancement Mode and Depletion Mode Devices

Text Books:

1. Sze, S.M./ "VLSI Technology" / Tata McGraw-Hill
2. James D. Plummer, Michael Deal, and Peter B. Griffin, / "Silicon VLSI Technology: Fundamentals, Practice and Modeling"/ / Prentice Hall (India)
3. Streetman, B.G. & Banerjee, Sanjay / "Solid State Electronic Devices" / Prentice Hall (India)

Reference Books:

1. Campbell, Stephen A. / "The Science & Engineering of Microelectronic Fabrication" Oxford University Press.
2. Gandhi, S. / "VLSI Fabrication Principle" / John Wiley
3. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. Understand the basic process of crystal growth and different steps for fabrication of ICs
2. Understand the concept of crystal growth, epitaxy and on film deposition
3. Understand basic steps for formation of ICs like lithography, Etching, Ion implantation, Metallization.
4. Understand the process integration concept of IC Technology
5. Apply these concepts to finalized the fabrication process of different types of MOSFETs

OEC	Operation Research	3L:0T:0P	0 credits

UNIT I: Linear Programming Problems (LPP)

OR model, Formulation of LPP. model, Graphical LPP solution and sensitivity analysis, simplex method, M-method, Two-phase method, Special cases in simplex method application, Duality theory, Dual simplex method, Revised simplex method, Degeneracy, Sensitivity analysis, Various industrial application of LP.

UNIT II: Transportation Models, Assignment Models and Integer Programming:

Formulation and Optimal solution of transportation models, Assignment models, Transshipment models, Degeneracy in TP model, Industrial application, Formulation and Solution of integer linear programming problems; Cutting- plane algorithm, Branch and Bound algorithm, 0-1 ILPP, applications, Knapsack problem, facility-location problem.

UNIT III: Sequencing and Scheduling Model:

Sequencing problems- Travelling salesman problem, Machine-scheduling problem (Job shop), Network based planning models, Objectives of CPM and PERT, Characteristics of CPM/PERT projects, Network diagram, Terminology, Critical path, Project duration, PERT Network, Activity time, Probabilities of project completion, Optimal crashing of project activities.

UNIT IV: Replacement and Inventory mod

Replacement Problems: Optimal age of equipment replacement, capital equipment discounting cost, Replacement of items that fail, Individual and group replacement policies.
Inventory Models: Deterministic inventory models, Classic EOQ model, EOQ with price breaks, Multiterm, stochastic inventory models under probabilistic demand and lead times.

UNIT V: Dynamic Programming and Genetic Algorithms:

Dynamic programming: Bellman's principle of optimality, computations in DP, Forward and Backward recursions, Dynamic Programming formulations, Investment problem, General allocation problem, Storage coach problem, Production scheduling.

Genetic Algorithms: Working principles, similarities and differences between Gas and Traditional methods, Gas for constrained optimization, Applications of Gas to solve simple problems.

Text Books Recommended:

1. S.S. Rao, "Optimization: Theory and Applications" Willey Eastern Limited.
2. H.A. Taha, " Operations Research- AN Introduction", Macmillan.
3. Hiller, F.S., G.J. Lieberman, "Introduction to Operations Research", Hoiden-Day.
4. Kalyanmoy Deb, "Optimizaton for Engineering Design: Algorithms & Examples " Prentice- Hall of India
5. B.E. Gillet, Introduction Operations Research- A Computer Oriented Algorithmic Approach, McGraw Hill 1989.

Objective / Outcomes, Operations Research

Operation Research is the application of modern methods of mathematical science to complex problems involving management of large systems of men, machines, materials and money in industry, business, government and defence. Operations research has wide scope and has been successfully applied in the following areas:

- Financial Management
- Inventory Control
- Simulation Technique
- Capital Budgeting
- Decision Making

Linear programming has been used to solve problems involving assignment of jobs to machines, blending, product mix, advertising media selection, least cost diet, distribution, transportation, investment portfolio selection and many others.

Transportation problem is the most useful model of L.P.P. which simplify calculation to find solution of L.P.P. containing more number of variables and constraints. It deals with the transportation of a product available at several sources to a number of different destination. Transportation model can be used for a wide variety of situations such as scheduling, production, investment, plant location, inventory control, employment scheduling, personnel assignment, product mix problems and many others.

Sequencing and Scheduling Model has been helpful to solve problems of appropriate selection of the number of jobs (operations) which are assigned to a finite number of service facilities (machines or equipments) so as to optimize the output in items of time, cost or profit. Network techniques of PERT and CPM have been used in planning, scheduling and controlling construction of dams, bridges, roads, highways and development and production of aircrafts, ships, computers, etc.

Inventory control models have been used to determine economic order quantities, safety stocks, reorder levels, minimum and maximum stock levels.

Replacement theory has been extensively employed to determine the optimum replacement interval for three types of replacement problems.

Dynamic programming has been applied to capital budgeting, selection of advertising media, employment smoothening, cargo loading and optimal routing problems

VI Semester

PCC	Optical Communication and Switching Network	3L:1T:0P	4 credits

Wave Propagation through Optical Fibers:
Introduction to optical fiber communication system and its advantages, Structure of optical wave-guide, light propagation in optical fiber, Total internal reflection, Dielectric Slab waveguides, Optical fiber waveguides, Modes in optical fiber: Step & graded index optical fibers, modes of propagation, Fiber jointing, Fiber materials, manufacture of fiber cables (fiber fabrication). **Signal degradation in optical fibers:** Losses in fibers, Attenuation, dispersion and pulse broadening in different types of fibers. Modal birefringence and polarization maintaining fibers.

Photo Sources:
Review of semiconductor physics, p-n junction, Injection Luminescence & the light emitting diode, materials, construction & drive Circuitry; LED power & Quantum efficiency, LED characteristics & modulation bandwidth (modulation of LED).
Lasers: Emission & absorption of radiation, Einstein relations, Population inversion, Optical feedback, Threshold conditions, Laser modes. Semiconductor Lasers

Photo Detectors:
Optical detection principles, Absorption, Quantum efficiency, Responsivity, Long wavelength cut-off, P-N photodiode, PIN photodiodes, avalanche photodiodes (working principle and structures of photodiodes), Speed of response, Response time characteristic, Noise, Avalanche photodiode, Multiplication factor, Avalanche multiplication noise, Optical Fiber sensors

Optical Receivers: Fundamental receiver operation, Digital receiver noise, shot noise. Preamplifier types, Analog receivers. **Optical Communication Systems:** Optical receiver system, Modulation formats for analog optical communication systems, Introduction to WDM concepts, Advanced multiplexing strategies

Optical Networks:
Elements of optical networks-SONET/SDH, Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Solation. SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test beds. Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

LIST OF EXPERIMENTS:
Note: At least 08 experiments are to be performed from the following.
1. To setup and study fiber optic analog link for voice transmission.
2. To setup and study fiber optic digital link for measuring maximum bit rate supportable.
3. To measure the losses in an optical fiber communication link.
4. To estimate the Numerical Aperture of the opticalfiber.
5. To study the effect of pulse broadening on the bandwidth of a communication link.
6. To study the Manchestor Coding/Decoding used in the OFT Trainer.

7. To compare the effect of EMI/RFI on a copper medium and on an optical fiber medium.
8. Study of TDM, Framing and Marker in TDM.
9. Analysis of LED spectral distribution using optisym.
10. Optical receiver design using optisym.
11. EDFA design using optisym.
12. WDM design using optisym.

Text Books:

1. Senior, John M. / "Optical Fiber communication"/ Prentice Hall (India)
2. Keiser, Gerd / "Optical Fiber Communications" / McGraw-Hill
3. Wilson, J. & Hawkes, J.F.B. / "Opto-Electronics An Introduction"/ Prentice Hall (India)

Reference Books:

1. Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" / Pearson Education.
2. Singh, Jasprit / "Optoelectronics An Introduction to Materials and Devices"/McGraw-Hill
3. Khare, R.P. / "Fiber Optics & Optoelectronics" / Oxford University Press
4. Gupta, S.C. / "Text Book of Optical Fiber Communication & Its Applications"/Prentice–Hall (India).
5. Agrawal, G.P. / "Fiber-optic Communication Systems" / Wiley
6. Slavarajan, A., Kar.S. & Srinivasan T. / "Optical Fiber Communication, Principles & Systems" / Tata McGraw Hill

Course Outcomes:

At the end of course student will be able to

1. Understand the concept of waveguide, optical fiber.
2. Know the photo sources and photo detectors.
3. Apply the concept of wave guide on optical communication system.
4. Analyze the multiplexing strategies in optical communication system.
5. Have the knowledge of the switching network

PCC	VLSI Design	2L:0T:2P	3 credits

Introduction: Issues in Digital Integrated Circuit Design, Quality Metrics of a Digital Design, Review of the Manufacturing Process.

The Devices: Spice Diode Model, The MOSFET Transistors: The MOS Transistor Under Static Condition, Secondary Effects, Spice Models For the MOS Transistors, Scaling, Circuit Simulation

The CMOS Inverter: The Static CMOS Inverter, Performance of CMOS Inverter, Power, Energy and Energy Delay

Designing Combinational Logic Gates in CMOS: Static CMOS Design, Dynamic CMOS Design, Simulation and Layout Techniques for Logic Gates

Designing Sequential Logic Circuits: Static Latches and Register, Dynamic Latches and Register

Designing Arithmetic Building Blocks: Data Paths in Digital Processors, Adders, Designing Memory and Implementation Strategies For Digital ICs, From Custom to Semi Custom and Structured – Array Design Approaches

Custom Circuit Design, Cell Based Design Methodology, Array Based Implementation Approaches

List of Experiments:

1.Design, Simulation and Analysis of following circuits using Circuit simulator:
   i. NMOS and CMOS inverter
   ii. Two input NAND Gate
   iii. Two input NOR Gate
2.Simulation of Full Adder using HDL
3.Simulation of BCD to Seven Segment using HDL
4. Simulation of MUX using VHDL
5.Simulation of RS Flip Flop.
6.Mini project.

Text Books:

1. Rebaey, John M. & Chandrakasan, Anantha&Nikolic, Borivoje / "Digital Integrated Circuits: A Design Prospective" / Pearson Education / 2nd Ed.

References Books:

1. Kang, Sun-mo & Leblebici, Yusuf / "CMOS Digital integrated Circuits, Analysis & Design"/ Tata McGraw-Hill / 3rd Ed.
2. Pucknell, Douglas A. &Eshraghian, Kamran / "Basic VLSI Design"/ Prentice – Hall (India).
3. Razavi, Behzad / "Design of Analog CMOS integrated circuits" / Tata McGraw-Hill.
4. Wayne Wolf, "Modern VLSI Design- Systems on Silicon" / Addison-Wesley / 2nd Ed.
5. Geiger, R.L., Allen, P.E. &Strader, N.R. / "VLSI: Design Techniques for Analog & Digital Circuits" / McGraw-Hill.
6. Weste, N.H.E. &Eshraghian, K. / "Principles of CMOS VLSI Design" / Pearson Education Asia

7. Gopalan, K. / “Introduction to Digital Microelectronics Circuits” / Tata McGraw-Hill.
8. Millman and Grabel / “Microelectronics”/ McGraw –Hill.
9. Tsividis, Yannis / "Operation & Modeling of the MOS Transistor" / OxfordUniversity Press.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
2. Design Complementary MOSFET based logic circuit
3. Synthesis of digital VLSI systems from register-transfer or higher level descriptions in hardware design languages. Realize logic circuits with different design styles.
4. Get the basic detail for designing of Sequential circuits.
5. Learn about the designing of different arithmetic building blocks.

PCC	Advanced Instrumentation	2L:1T:0P	3 credits

Measurement of Non Electrical Quantities: Measurement of Temperature: Absolute, Thermodynamic Scale, Bimetallic Element, Fluid Expansion Systems, Pressure: Manometers, Ring Balance Manometer & Bell Type Manometer, Bellows Element, Bourdon Tube Elements, Force: Helical Spiral Springs, Cantilever Beams, Loads Cells, Liquid Level: Float Element, Level to Pressure Converters, Level to force Converters Flow

Passive Electrical Transducers: Resistive: Resistance Thermometers, Resistive Displacement Transducer, Resistive Strain Transducer, Resistive Pressure Transducer, Inductive: Inductive Thickness Transducers, Inductive Displacement Transducers, Eddy Current Type Inductive Transducers, Capacitive: Capacitive Thickness Transducers, Capacitive Displacement Transducer

Active Electrical Transducers: Thermo Electric Transducers, Piezo Electric Transducers: Force Transducers, Strain Transducers, Torque Transducers, Pressure Transducers, Photo Electric Transducers, Digital Transducers: Digital Displacement Transducers, Digital Tachometers

Telemetry and Data Acquisition System: Telemetry: Introduction & Characteristics, Land Line Telemetry, Radio Telemetry, Components of an Analog Data Acquisition System, Components of an Digital Data Acquisition System, Types of Multiplexing Systems, Uses of Data Acquisition Systems, Use of Recorders in Digital Systems, Modern Digital Data Acquisition System

Advanced Measuring Instruments: Data Loggers, Digital Read Out Systems, Digital Input Output devices, Digital Storage Oscilloscope, Spectrum Analyzer, Logic Analyzer, Microwave Instruments: Vector Network analyzer, power meter, Instrument Interfacing

Text Books:

1. Shawhney, A.K. / "Electrical & Electronic Measurement & Measuring Instruments" / Dhanpat Rai& Co.
2. Doebelin, E.O. / "Measurement Systems" / McGraw Hill.
3. Murty, D.B.S. / "Transducers & Instrumentation" / Prentice Hall (India).
4. Anand, M.M.S. / "Electronic Instruments & Instrumentation Technology" / Prentice Hall (India) / 2004

Reference books:

1. Cooper, W.D. &Helfrick, A.D. / "Modern Electronic Instrument & Measurement Techniques" / Prentice Hall (India).
2. Oliver & Cage / "Electronic Measurement & Instrumentation" / McGraw Hill.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. To define the need of measurement and list characteristics and types of basic measuring instruments used for electrical and non-electrical quantities.
2. To understand the identification, classification, construction, working principle of various transducers.
3. To apply the knowledge of measuring instruments in transmitting data.
4. To analyze basic measuring instruments to implement advance measuring instruments.

5. To differentiate between various transducers and measuring instruments

PCC	Digital Communication	2L:1T:0P	3 credits

Elements of Digital Communication and Information Theory: Model of a Digital Communication System, Introduction to Information Theory, Source Coding,

Digital Base Band Transmission: PCM Coding / DM / DPCM / ADCM, Data Transfer Rate, PAM, PWM, PPM, Line Coding and its Properties, NRZ & RZ Types, Signalling Format For Unipolar, Polar, Bipolar(AMI) & Manchester Coding and their Power Spectra (No Derivation)
Matched Filter Reciver, Derivation of Its Impulse Response and Peak Pulse Signal to Noise Ratio, Correlation Detector, Decision Threshold and Error Probability for Binary Unipolar (On-Off) Signalling, ISI, Nyquist Criterion For Zero ISI & Raised Cosine Spectrum.

Digital Modulation Techniques: Gram-Schmidt Orthogonalization Procedure, Types of Digital Modulation, Waveforms for Amplitude, Frequency and Phase Shift Keying, Method of Generation and Detection of Coherent & Non-Coherent Binary ASK, FSK & PSK, Differential Phase Shift Keying, Quadrature Modulation Techniques, QPSK, Probability of Error and Comparison of Various Digital Modulation Techniques

Introduction to spread spectrum communication, CDMA

Error Control Coding: Error Free Communication over a Noise Channel, Linear Block Codes, Cyclic Codes, and Convolution Codes

LIST OF EXPERIMENTS:

1. Sample and hold circuit.
2. PAM, PWM, PPM generation and detection
3. Delta modulation and detection.
4. Pulse data coding and decoding techniques for NRZ formats
5. ASK, FSK, PSK modulation and detection
6. Single bit error detection and correction.
7. PCM Modulation and detection

Text Book:

1. Haykin, Simon / “Communication Systems” / John Wiley.

References Books:

1. Simon Haykin / “Digital Communication” / John Wiley.
2. Taub& Schilling / “Principles of Communication Systems” / Tata McGraw-Hill /
3. Singh, R. P. &Sapre, S.D. / “Communication Systems: Analog & Digital” / Tata McGraw-Hill.
4. Lathi, B.P / “Modern Digital & Analog Communication Systems” / Oxford University Press /
5. A.B. Carlson / “Communication Systems” / Tata McGraw-Hill.
6. Proakis J.J / “Digital Communications” / McGraw Hill /
7. Charkrabarti, P. / “Analog Communication Systems” / Dhanpat Rai& Co.
8. Schaum’s Outlines / “Analog & Digital Communication” / Tata McGraw-Hill.
9. Kennedy, George & Davis, Bernard / “Electronic communication systems” / Tata McGraw-Hill.
10. Lectures of NPTEL

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze and compare different digital modulation schemes for their efficiency and bandwidth
2. Investigate pulsed modulation system and analyze their system performance.
3. Understand different multiple access schemes.
4. Analyze different digital modulation schemes and can compute the bit error performance.
5. To learn about different digital multiplexing and error control coding schemes

PCC	Control Systems	2L:1T:0P	3 credits

Module 1: Introduction to Control Problem
Industrial control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of feedback, Block diagram algebra.

Module 2: Time Response Analysis
Standard test signals. Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Design specifications for second-order systems based on the time-response, Concept of Stability. Routh-Hurwitz Criteria, Relative stability analysis, Root-Locus technique, Construction of Root-loci,

Module 3: Frequency-response analysis
Relationship between time and frequency response, Polar plots, Bode plots, Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin, Closed-loop frequency response,

Module 4: Introduction to Controller Design
Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems, Root-loci method of feedback controller design, Design specifications in frequency-domain, Frequency-domain methods of design, Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs,

Module 5: State variable Analysis
Concepts of state variables, State space model, Diagonalization of State Matrix, Solution of state equations, Eigen values and Stability Analysis, Concept of controllability and observability, Pole-placement by state feedback, Discrete-time systems, Difference Equations, State-space models of linear discrete-time systems, Stability of linear discrete-time systems, Introduction to Optimal Control and Nonlinear Control, Kalman Base Control

Text/References:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.
3. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
4. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009 Hands-on/Computer experiments related to the course contents of EEE-303.

Course Outcomes:
At the end of this course students will demonstrate the ability to:
1. Understand the modelling of linear- time-invariant systems using transfer function and state-space representations.
2. Time domain and frequency domain analysis of the systems
3. Understand the concept of stability and its assessment for linear-time invariant systems.
4. Analyse the stability of Discrete-time systems
5. Design simple feedback controllers

PCC	Machine Learning	3L:0T:0P	3 credits

Unit-1: Introduction to Machine Learning
Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.

Unit-2: Classification and Regression
Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class probability Estimates, Multiclass Classification. Regression: Assessing performance of Regression- Error measures, Overfitting: Catalysts for Overfitting, Case study of Polynomial Regression. Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

Unit-3: Linear Models
Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification, Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity.

Unit-4: Logic Based and Algebraic Models
Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, Rule Based Models: Rule learning for subgroup discovery, Association rule mining. Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.

Unit-5: Probabilistic Models
Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.
Trends in Machine Learning: Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text and Reference Books:
1. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
4. Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013.
5. Parag Kulkarni, Reinforcement and Systematic Machine Learning for Decision Making, Wiley, IEEE Press, Edition July 2012.

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Understand Machine learning and Machine Learning Models.
2. Apply various classification and regression techniques and assess their performance.

3. Apply various clustering algorithms for the problems to be solved with machine learning.
4. Assessment of various machine learning models.
5. Understand probabilistic learning models and trends in machine learning

OEC (Humanities)	**Entrepreneurship Development***	**3L:0T:0P**	**3 credits**

UNIT I Entrepreneurship:
Definition, requirements to be an entrepreneur, entrepreneur and intrapreneur, entrepreneur and manager, growth of entrepreneurship in India, women entrepreneurship, rural and urban entrepreneurship.

Entrepreneurial Motivation: motivating factors, motivation theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory, government's policy actions towards entrepreneurial motivation, entrepreneurship development programmes.

UNIT II Business Enterprises and Ownership Structure:
Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, companies and co-operatives firms: their formation, capital structure and source of finance.

UNIT III Project Management:
Identification and selection of projects; project report: contents and formulation, concept of project evaluation, methods of project evaluation: internal rate of return method and net present value method.

UNIT IV Management of Enterprises:
Strategy & policy, introduction to human resource management, marketing strategies, financial management & strategies: raising and managing capital, shares, debentures and bonds, cost of capital; break- even analysis.

UNIT V Institutional Support and Policies:
Institutional support towards the development of entrepreneurship in India: Institutional framework, venture capitalist; technical consultancy organizations (TCOs), government policies for small scale enterprises.

References:
1. Khanka, S S. 'Entrepreneurial Development', S Chand & Company Ltd. New Delhi
2. Desai, Vasant, ' Project Management and Entrepreneurship', Himalayan Publishing House, Mumbai, 2002.

Additional Reference Books
1. Gupta and Srinivasan, 'Entrepreneurial Development', S Chand & Sons, New Delhi.
2. Ram Chandran, 'Entrepreneurial Development', Tata McGraw Hill, New Delhi
3. Saini, J. S. 'Entrepreneurial Development Programmes and Practices', Deep & Deep Publications (P), Ltd
4. Holt, Davis, 'Entrepreneurship : New Venture Creations, PHI

Course Objectives (COs)

At the end of this course students should be able to:

1. Describe what it takes an Entrepreneur; describe multiple ways to become an entrepreneur; including, entrepreneur, and manager, woman entrepreneur rural & urban: highlights motives to become entrepreneur.
2. Apply the beginner concept, ownership and various forms with focus on small scale enterprises.
3. Identify opportunities using identification; project conceptualization, formulation & evaluation.
4. Identify potential contribution of human resources, marketing, financial and strategic management with fund, opportunities
5. Decipher the role of Institution support and policy framework of Government for enterprises in India.

PCC	DIGITAL SIGNAL PROCESSING	2L:0T:2P	3 Credits

Structures for Discrete-Time Systems: Block Diagram Representation, Signal Flow Graph Representation, Basic Structures for IIR Systems: Direct Form, Cascade Form, Parallel Form, and Feedback in IIR Systems. Transposed Forms, Basic Network Structures for FIR Systems, Direct Form, Cascade Form, Structures for Linear-Phase FIR Systems.

Coefficient Quantization of Discrete-Time Systems: Overview of finite precision Numerical Effects, Effects of Coefficient quantization, Effects of Round-off Noise in Digital Filters, Zero-input Limit cycles in Fixed-point Realizations of IIR Digital filters.

Digital Filter Design Techniques: Design of D-T IIR Filters from continuous-time filters, Design of FIR filters by windowing, Kaiser Window method, Optimum Approximations of FIR Filters, FIR Equiripple approximation.

Discrete and Fast Fourier Transforms: Discrete Fourier transform, Properties, Linear convolution using DFT, DCT, Efficient computation of the DFT, Goertzel algorithm, Decimation in time and decimation in frequency FFT algorithm, Practical considerations, Implementation of the DFT using Convolution, Effects of Finite Register Length.

List of Experiments:

Note: At least 08 experiments are to be performed from the following.

1. Sampling & Waveform Generation.
2. DFT Computation.
3. Analysis of different windows
4. Design of FIR Filter
5. Design of IIR Filter
6. Implementation of FFT algorithm
7. Quantization and analysis of FIR filter
8. Quantization and analysis of IIR filter
9. Floating point Implementation of FIR and IIR filtering using digital signal processors.
10. Fixed point Implementation of FIR and IIR filtering using digital signal processors.

Text Books:

1. Oppenheim A.V., Schafer, Ronald W. & Buck, John R. / "Discrete Time Signal Processing" / Pearson Education / 2nd Ed. / Prentice-Hall (India)
2. Sen M. Kuo & Woon-Seng S. Gan, "Digital Signal Processors-architectures, implementation and applications" / Pearson Education /I Ed. /

Reference Books:

1. Proakis, J.G. & Manolakis, D.G. / "Digital Signal Processing: Principles Algorithms and Applications" / Prentice Hall (India) / Pearson Education
2. Oppenheim A.V. & Schafer, Ronald W. / "Digital Signal Processing" / Pearson Education
3. Rabiner, L.R. and Gold B./ "Theory and applications of DSP" / Prentice Hall (India)
4. Oppenheim, Alan V. & Willsky, Alan S. / "Signals and Systems" / Prentice Hall (India)
5. Johnson, J.R. / "Introduction to Digital Signal Processing" / Prentice Hall (India)
6. DeFatta, D.J., Lucas, J.G. & Hodgkiss, W.S / "Digital Signal Processing"/ John Wiley & Sons.

Course Outcomes:
At the end of course student will be able to

1. Learn the basic forms of FIR and IIR filters, and how to design filters with desired frequency responses using MATLAB.
2. Analyze the effect of coefficient quantization in digital filters for processing of discrete time signals.
3. Master the representation of discrete-time signals in the frequency domain using discrete Fourier transform (DFT).
4. Understand the implementation of the DFT in terms of the FFT, as well as its application i.e. computation of convolution sums.
5. Employ signal processing strategies at multidisciplinary team activities.

PCC	**VLSI IMPLEMENTATION OF DIGITAL SIGNAL PROCESSING ALGORITHMS**	**2L:0T:0P**	**2 Credits**

Basics concepts of Digital Signal Processing, Iteration bound, Pipelining and parallel processing, Retiming, Unfolding and folding algorithms, Systolic Architecture Design Fast convolution, Algorithmic Strength Reduction in Filters and Transforms, Pipelined and parallel recursive and adaptive filters

References:

1. "VLSI Digital Signal Processing Systems-Design and Implementations" by Keshab K. Parhi; John Wiley & Sons, Inc.
2. "Digital Signal Processors-Architectures, Implementations and Applications" by Sen M. Kuo and Woon-seng S. Gan; Pearson Education, Inc.
3. "Digital Signal Processing and Applications with the C6713 and C6416 DSK" by Rulph Chassaing.

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

1. Represent the signal flow graph, data flow graph and dependence graph of DSP algorithms.
2. Apply the pipelining and parallel processing to speed up the DSP algorithms.
3. Apply the concept of retiming the DSP algorithms for trade off the speed and power.
4. Apply the concepts unfolding and folding the DSP algorithms.
5. Design the Systolic Architecture of the DSP algorithm

ELECTIVE-I

	BIOMEDICAL SIGNAL PROCESSING	3L:0T:0P	3credits

Introduction to Bio-Medical Signals:

Classification, Acquisition and Difficulties during Acquisition, Basics of Electrocardiography, Electroencephalography, Electromyography, & electro-retinography, Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field.

ECG: Measurement of Amplitude and Time Intervals, QRS Detection (Different Methods), ST Segment Analysis, Removal of Baseline Wander and Power Line Interferences, Arrhythmia Analysis, Portable Arrhythmia Monitors.

Data Reduction: Turning Point algorithm, AZTEC Algorithm, Fan Algorithm, Huffman and Modified Huffman Coding, Run Length Coding

EEG: Neurological Signal Processing, EEG characteristic, linear prediction theory, Sleep EEG, Dynamics of Sleep / Wake transition. Study of pattern of brain waves, Epilepsy- Transition, detection and Estimation

EEG Analysis by Spectral Estimation: The Bt Method, Period gram, -Maximum Entropy Method & AR Method, Moving Average Method. The ARMA Methods, Maximum Likelihood Method.

EP Estimation: by Signal Averaging, Adaptive Filtering: - General Structures of Adaptive filters, LMS Adaptive Filter, Adaptive Noise Canceling, Wavelet Detection: - Introduction, Detection by Structural features, Matched Filtering, Adaptive Wavelet Detection, Detection of Overlapping Wavelets

Text Books:

1. Biomedical Digital Signal Processing, Willis J Tomkin, PHI.
2. Biomedical Signal Processing, D.C Reddy McGrawhill
3. Biomedical Instrumentation and Measurement., Cropunwell, Weibel and Pfeifer, PHI.

Reference Book:

1. Biomedical Signal Processing, Amon Cohen, volume I CRC Press.
2. Biomedical Signal Analysis a Case Study Approach, Rangaraj M.

Rangayyan, John Wiley and Sons Inc.
3. Medical instrumentation Application and Design, john G. Webster, John Wiley & Sons Inc.
4. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. To understand about basic biomedical signals and data analysis.
2. To get the information about different measuring instrument for biomedical.
3. To apply these concepts on ECG and EEG and different algorithm.
4. To analyze EEG Analysis and spectral estimation.
5. Have the knowledge on EP estimation.

	SATELLITE COMMUNICATION	3L:0T:0P	3 credits

Introduction: Origin & Brief History of Satellite Communication,

Orbital Mechanism & Launching of Satellite: Equation of Orbit, Locating the Satellite in the Orbit, Look Angles Calculation, Orbital Perturbations, Mechanics of Launching a Satellite

Spacecraft: Introduction to Satellite Subsystems, Telemetry, Tracking & Command, Communication Subsystem, Spacecraft Antenna Systems

Satellite Link Design: G/T Ratio of Earth Station, Design of Downlinks, Design of Uplinks, Design for Specified C/N, System Design, Propagation Effects, Introduction to Analog FM Links, Digital Transmission, Baseband and Band-pass Transmission of Digital Data, Digital Links.

Multiple Access Techniques: FDMA, Calculation of C/N, TDMA, Bits, Symbols and Channels, TDMA Frame Structure, Synchronization in TDMA Networks, Satellite Switched TDMA, DAMA, FDMA-SCPC-DA, Random Access, CDMA, Spread Spectrum Transmission and Reception.

Direct Broadcast Satellite Television and Radio, Satellite Navigation, GPS: Introduction to Digital DBS TV, System Design, Satellite Radio Broadcasting, Introduction to Satellite Navigation and Global Positioning System and modern applications and developments.

Text Books:

1. Pratt, T, Bostian, C.W. and Allnutt, J. E. / Satellite Communications / John Wiley and Sons / 2nd Ed.

Reference Books:

1. Ha, Tri T. / "Digital Satellite Communications" / Macmillan Publishing Company
2. Richharia, M. / "Mobile Satellite Communications" / Pearson Education
3. Roddy, D./ "Satellite Communication"/ Prentice Hall (India)
4. D.C. Agarwal / "Satellite Communication" / Khanna Publishing.
5. Raja Rao, K. N. / "Fundamentals of Satellite Communication" / Prentice Hall (India)
6. R.N. Mutagi. "Satellite communication: principles and application"/oxford
7. Lectures of NPTEL

Course Outcomes:

At the end of course student will be able to

1. To understand the basic components of orbital mechanism, launching and satellite.
2. To solve the satellite link design numerical problems.
3. To analyze this knowledge on different multiple access technique like FDMA, TDMA, DAMA, FDMA-SCPC-DA.
4. To understand the mechanism used for broadcasting and navigation.
5. Have the knowledge of GPS.

	DIGITAL SYSTEM DESIGN USING VHDL	**3L:0T:0P**	**3 credits**

Introduction to VHDL: VHDL description, combinational networks, modeling flip flop using VHDL, VHDL model for multiplexer, compliance and simulation of VHDL, codes, modeling a sequential machine, variables, signals and constants, VHDL operators, VHDL functions, VHDL procedures, packages and libraries, VHDL model for a counter.

Advanced VHDL: Attributes, transport and inertial delays, operator over loading, multi valued logic and signal resolution, IEEE-1164, standard logic, generic, generates statements, synthesis of VHDL codes, synthesis exam les, file handle in and TEXTIO.

Design of Networks for Arithmetic Operations: Design of serial adder with accumulator, state graph for control networks design of binary multiplier, multipication of signed binary numbers, design of binary divider.

Digital Design with SM Chart: state machine charts, derivation of SM charts, realization of SM charts, implementation of dice game, alternative realization of SM charts using microprogramming, linked state machine.

Floating Point Arithmetic: Representation of floating point numbers, floating point multiplication, other floating point operations. Designing with Programmable Gate Arrays and Complex Programmable Logic Devices: Xilinx 3000 series FPGAs, Xilinx 4000 series FPGAs, using one hot per state assignment.

Memory Models for Memories and Buses: Static RAM, a simplified 486 bus model, interfacing memory to microprocessor bus.

Design Examples: UART design, description of MC68HC05, microcontroller, design of microcontroller CPU, complete microcontroller design, Design of ARM Processor

Text Book:

1. Charles H Roth Jr, "Digital System Design using VHDL", Thomson Learning

Reference Books:

1. Stephen Brown &ZvonkoVranesic, "Fundamentals of digital logic design with VHDL, TMH
2. John F Wakerly, "Digital design", PHI.
3. Lecturers of NPTEL

Course Outcomes:

At the end of course student will be able to

1. Understand the basic syntax of VHDL and IEEE libraries for modeling of combinational and sequential circuits.
2. Design different networks for arithmetic operation and on floating point arithmetic.
3. Design SM chart for real world problems.
4. Understand the different families of Xilinx FPGA and bus model.
5. Apply these concepts to understand UART and microcontroller.

	DATA COMMUNICATION NETWORKS	**3L:0T:0P**	**3 credits**

UNIT-I

Data communication, communication system, Signal and Data, Analog and Digital Signals, Networking: Needs and Advantages, Network, Types- Client, Server and Peers, introduction to various types of servers, client/server architecture. Transmission Media types: Wired & Wireless transmission, properties & speciality of various media – types, comparative study. Classification of Networks: LAN, MAN, WAN Network Topology: Bus, Star, Ring, Star bus, Star ring, Mesh – Features, Advantages and disadvantages of each type. Transmission technology: Signal Transmission, Digital signalling, Analog Signalling, Transmission Modes: simplex, half duplex and full duplex, Asynchronous & synchronous Transmission, Parallel and Serial Transmission, Base band and Broadband transmission.

UNIT–II

Connectivity Devices: Modem, Repeater, NIC, Network adapters, Connectors, Transceiver, Hub – Active, Passive and Intelligent, Bridge-Local, Remote, Wireless, Routers-Static and Dynamic, Switches, Brouters and Gateways, NOS.Real World Networks: Ethernet, Fast Ethernet, Token Rings, FDDI, ATM, ARCnet and AppleTalk.IEEE 802 standards: 802.3, 802.4, 802.5 Addressing: physical, port, logicalAddresses (IPv4): classfull and classless Addressing, subnetting, NAT, IPv6

UNIT–III

Standards Organizations, Protocols and Standards,OSI reference model,TCP/IP suite Comparison between OSI and TCP/IP Models, TCP/IP protocols: IP, ARP, RARP, ICMP, TCP, UDP ,TCP/IP Services Protocols: DHCP, DNS, FTP, TFTP, SMTP, TELNET, and NFS.WWW, URL, e-mail, HTTP, Subnet & subnet mask.

UNIT–IV

Modulation: PCM, ASK, FSK, PSK,Connectionless and Connection oriented Services,Multiplexing: FDM, TDM, CDM and WDM,Switching: circuit, Packet, and message switching ,Routing : routing methods, routing protocols: distance vector, link state, path vector,Transmission impairments, flow control and error control

UNIT- V

Network Security: Network security issues, approaches to network security, hacking. Firewalls: types of firewall technology- network level and application level, IP packets filter screening routers, limitations of firewalls. Encryption and Decryption – Cryptography, Public/Private key encryption. Overview of Digital Signature and Digital Certificates technology ,Network building blocks required for setting up a small LAN using Windows in an office, Hardware & software required, Simple Installation and configuration of Networking under Windows. Some basic networking configuration using Windows 2003 Server and clients, Simple network administration.

Text Books:

1. Fourauzan B., “Data Communications and Networking”, 3rd edition, TataMcGraw-HillPublications, 2004, ISBN 0 – 07 – 058408 – 7
2. Tanenbaum A., “Computer Networks”, 4th Edition, PHI, ISBN 81 – 203 –2175 – 8

Reference Books:

1. Keshav S., “An Engineering Approach to Computer Networking”, PearsonEducation,ISBN 981 – 235 – 986 – 9
2. Comer D., “Computer Networks and Internet”, 2ND Edition, PearsonEducation, ISBN 81–7808 – 086 –9
3. S.K.Basandra & S. Jaiswal, “Local Area Networks”, Galgotia Publications
4. William Stallings, “Data and Computer Communication”

Course Outcomes:

After completion of the course student will be able to:

CO1 Understand and explain the concept of Data Communication and networks, layered architecture and their applications.
CO2 Analyse and Set up protocol designing issues for Communication networks.
CO3 Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
CO4 Apply various network layer techniques for designing subnets and supernets and analyse packet flow on basis of routing protocols.
CO5 Estimate the congestion control mechanism to improve quality of service of networking application
CO6 Understand and design application layer protocols and internet applications such as network security, Email and DNS,

ELECTIVE-II

	ARTIFICIAL INTELLIGENCE	3L:0T:0P	3credits

Unit-1: Introduction to Machine Learning
Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.
Unit-2: Classification and Regression

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class probability Estimates, Multiclass Classification. Regression: Assessing performance of Regression- Error measures, Overfitting: Catalysts for Overfitting, Case study of Polynomial Regression. Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

Unit-3: Linear Models

Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification, Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity.

Unit-4: Logic Based and Algebraic Models

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, Rule Based Models: Rule learning for subgroup discovery, Association rule mining. Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.

Unit-5: Probabilistic Models

Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.

Trends in Machine Learning: Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text and Reference Books:

1. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
4. Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013.
5. Parag Kulkarni, Reinforcement and Systematic Machine Learning for Decision Making, Wiley, IEEE Press, Edition July 2012.

Course Outcomes:

At the end of syllabus students will be able to

1. Understand Machine learning and Machine Learning Models. (Understand)
2. Apply various classification and regression techniques and assess their performance. (Apply)
3. Apply various clustering algorithms for the problems to be solved with machine learning. (Apply)
4. Assessment of various machine learning models. (Analyze)
5. Understand probabilistic learning models and trends in machine learning. (Understand)

	WIRELESS COMMUNICATION	**3L:0T:0P**	**3credits**

Evolution of mobile radio communication fundamentals: 1G,2G, 3G and 4G fundamentals; Concept of Cell Architecture, Frequency reuse, Channel

assignment strategies and Power Allocation Strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems.

Large scale path loss: Propagation models, Reflection, Diffraction, Scattering, Practical link budget design using path loss model. Small scale fading & multipath propagation and measurements, impulse response model and parameters of multi path channels, types of fading, theory of multi-path shape factor for fading wireless channels.

Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FHSS), performance of DS-SS, performance of FH-SS, modulation performance in fading and multipath channels.

Fundamentals of equalization: Equalizer in communication receiver, Survey of equalization techniques, linear equalizer, non-linear equalization,

Diversity Techniques: Introduction to Diversity Schemes, Types of Diversity Techniques, RAKE receiver.

Characteristics of speech signals: Quantization techniques, Vocoders, linear predictive coders.

Multiple Access Schemes: Frequency division multiple access, Time division multiple access, Code division multiple access, and other advanced multiple access schemes.

Introduction to other wireless systems: OFDM and related technologies, UWB Technology, WIMAX Technology, Various Wireless standards.

Text Book:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson Edition

Reference Books:

1. William C. Y. Lee, "Mobile Communication Design and Fundamentals"
2. D. R. KamiloFehar, "Wireless Digital Communication"
3. Haykin. S & Moher M., "Modern Wireless Communication", Pearson.
4. R. Pandya, “Mobile and Personnel Communication system", PHI

Course Outcomes:

At the end of course student will be able to

1. An understanding of the requirements of modern wireless communication systems
2. An understanding of key enabling technologies including Spread Spectrum, CDMA, Equalization, Diversity etc.
3. Ability to understand the infrastructure for developing mobile Communication System Cellular Theory.
4. An understanding of implementation of the key enabling techniques in commercial wireless systems such as UMTS, HSPA and LTE.
5. An appreciation of evolving trends leading to a vision of future heterogeneous wireless communication systems.

	VLSI Device Modeling	**3L:0T:0P**	**3credits**

MODELING OF MOSFETS: Equivalent circuit representation of MOS Transistor-Types of Compact Model - Basic modeling - Advanced MOSFET modeling, evaluation of DC MOS model from two terminal MOSFET to Four terminal MOSFET - RF modeling of MOS transistors- charge model-Quasi and non-Quasi static model, noise sources in MOSFET, Flicker & Thermal Noise modeling.

MOS SECOND ORDER EFFECTS:
Long Channel MOSFET: Review of MOSFET Current Equation –Substrate Bias, and Temperature Dependence of Threshold Voltage -MOSFET Channel Mobility – MOSFET capacitances and Inversion-Layer Capacitance effect – frequency dependent capacitance model of MOSFET. Short Channel MOSFETs – Short-Channel Effect – Velocity saturation and High-Field Transport – Channel Length Modulation – Source-Drain series resistance – MOSFET Degradation and Breakdown at High Fields.

MOSFET SCALING : Constant-Field scaling – Generalized Scaling – Non scaling Effects – Threshold-Voltage Requirement – Channel Profile Design – Non-uniform Doping – Quantum Effect on Threshold Voltage – Discrete Dopant Effects on Threshold Voltage – MOSFET Channel Length.
CMOS SCALING ISSUES AND SOLUTIONS:
MOSFET scaling, short channel effects, quantum effects, volume inversion, threshold voltage, channel engineering, source/drain engineering, high-k dielectric, strain engineering, multigate technology mobility, stack gate.

NON – CLASSICAL MOSFET STRUCTURES:

Silicon-On-Insulator Devices – SOI CMOS- Partially Depleted SOI MOSFETs – Fully Depleted SOI MOSFETs – Dual Material Gate MOSFETs – Surrounding Gate MOSFETs - Multigate MOSFETs – FINFETs-TFETs – HEMTs – Silicon Nanowires – Junction less FETs.

NUMERICAL METHODS FOR TECHNOLOGY COMPUTER AIDED DESIGN:
TCAD Flow for IC Process and Device Simulation, Numerical Solution Methods, Non-linear Iteration, Convergence criteria for Non-linear iterations, Numerical method Implementation, Drift Diffusion Calculations, Energy Balance Calculation, Modeling of multigate FETs.

Texts/References book:

1. Yannis Tsividis , Operation and Modeling of the MOS Transistor, Oxford University Press.-
2. N. Arora, MOSFET models for VLSI Circuit Simulation, Springer-Verlag.
3. Ning and Taur, Fundamentals of modern VLSI devices, Oxford university press.

Course Outcomes:
At the end of the course the student will be able to
1. Acquire knowledge about physics involved in modelling of semiconductor device.
2. Acquire the basic knowledge about quantum mechanical fundamentals.
3. Model MOSFET devices.
4. Identify characteristics of Advanced Device Technology
5. Understand Numerical methods applications related to modelling using softwares

	MICROWAVE AND RADAR ENGINEERING	**3L:0T:0P**	**3 credits**

Wave Guides: Rectangular, Circular, Transmission Line Analogy for Waveguides, Dielectric Slab Waveguide, S-parameters, Microstrip Lines

Microwave Generation: Conventional Vacuum Tubes, Klystrons; Reflex & Multicavity, TWT, Magnetrons, FWCFA, BWCFA & BWO, IMPATT, Parametric Devices, Gunn, InP, CdTe Diodes, Cyclotrons, Directional Couplers, T-Junctions, Microwave Filters, Microwave High Power Devices

Nature of Radar: Radar block diagram & operation, Radar range performance & its equations, Minimum detectable signal, Cross-section of a target, PRF & Range ambiguity, Antenna parameters

MTI & Doppler radar: Doppler effect, CW radar, FM CW, Delay line cancellers, Multiple or staggered, PRF, Non coherent MTI, Pulse Doppler Radar, Radar Imaging

Scanning, Duplexers and Radar receivers: Sequential lobbing, Conical Scanning, Monopulse Tracking RADAR, tracking with surveillance RADAR, Acquisition, Radar receiver, Display Duplexers

Electronic Navigation: Introduction, loop antenna, loop i/p ckts, Aural null detection finder, Goniometer, Adcock detection finder, VHF Omni-directional range finder, The LF/MF four course radio range

Navigation Systems and Clutter: VOR receiving equipment, Loran-A, DECCA navigation system, DME, TACAN, Surface clutters Radar equation, Sea clutter, Land clutter

Text Book:

1. Skolnik M. I. / “Introduction to Radar Systems”/ McGraw-Hill
2. Nagraja, N.S. / “Elements of Electronic Navigation”/ Tata McGraw Hill.

3. Liao, S.Y. / “Microwave Devices & Circuits” / Prentice Hall (India) / 3rd Ed.

Reference Book:

1. Nathanson, Fred E. / “Radar an Overview Design Principles”/ Prentice–Hall (India)
2. Toomay, J. C. / “Principles of Radar”/ Prentice–Hall (India)
3. Das, Annapurna & Das, Sisir K. / “Microwave Engineering”/ Tata McGraw Hill.
4. Roy, Sitesh Kumar &Mitra, Monojit / “Microwave Semiconductor Devices” / Prentice Hall
5. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. Understand various microwave system components their properties.
2. To study microwave systems for different practical application.
3. Understand the basic concept and working of Radar
4. Apply these concepts on MTI and Doppler Radar
5. Study different navigation systems VOR, DECCA, DME, TACAN

ELECTIVE-III

	ARCHITECTURE AND APPLICATIONS OF DIGITAL SIGNAL PROCESSORS	**3L:1T: 0P**	**4credits**

DSP Processors: DSP Hardware & Circuits; 8-bit, 16-bit and 32-bit DSP Processors; Analog Devices, Motorola and Texas Instruments DSP Devices and their Comparison. Data width and dynamic range, Limitations of DSPs

Architecture: DSP System, ADSP-2100 Family base Architecture, MAC & Shifter block diagrams, architecture of real DSP processors, A Fast ADC/DAC on board.

Instruction Set: Instruction Sets, Certain application programs: ADC/DAC, Filter design, Function Generation etc.

Applications: Filtering, Voice/Speech processing, Telecommunication, Imaging, Instrumentation, Military applications.

Text Book:

1. Sen M. Kuo&Woon-Seng S. Gan, "Digital Signal Processors-architectures, implementation and applications" / Pearson Education
2. K. Padmanabhan, S. Ananthi& R.V. Rajeshwaran / "A Practical Approach to Digital Signal Processing"
3. TMS, Data Manual
4. ADSP Data Manual

Reference Book:

1. Robiner, L.R. & Gold, B. / "Theory and application of Digital Signal Processing" / Prentice–Hall (India)
2. Oppenheim, A.V. & Schafer R.W. / "Digital Signal Processing" / Prentice–Hall (India)
3. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. Understand about different Digital Signal Processors hardware and circuits.
2. Know the architecture and instruction set for various digital signal processors.
3. To apply these concepts on programming & downloader.
4. Apply the concepts in synchronization filtering voice /speech processer
5. Apply these concepts in applications e.g. telecomm., Image, military & other apps.

	INFORMATION THEORY AND CODING	3L:1T:0P	4 credits

Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, The Lempel- Ziv Algorithm, Rate Distortion Function, Optimum Quantizer Design,

Channel Capacity and Coding: Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection of Codes, **Linear Block Codes for Error Correction:** Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes

Hamming Codes, Optimal Linear Codes, Cyclic Codes, Introduction to Cyclic Codes, Polynomials: The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Fire Code, Golay Codes, Cyclic Redundancy Check (CRC) Codes

Introduction to BCH Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials in Terms of Minimal Polynomials, Some Examples of BCH Codes, Decoding of BCH Codes

Reed-Solomon Codes, Implementation of Reed-Solomon Encoders and Decoders Nested Codes,

Convolutional Codes: Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Notions for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Viterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes,

Performance Bounds, Known Good Convolutional Codes, Turbo Codes, Turbo Decoding.

Trellis Codes Modulation: Introduction to TCM, The concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder, Performance Evaluation for AWGN Channel, Computation of d_{free}, TCM for Fading Channel

Text Books:

1. Bose, Ranjan "Information Theory, Coding & Cryptography" / Tata McGraw Hill /

Reference Books:

1. Van Lint, J.H./ "Introduction to Coding Theory" / Springer
2. Proakis, John G. / "Digital Communications" / McGraw Hill
3. Sathyanarayana, P.S. / "Probability Information and Coding Theory"/ Dynaram Publications, Bangalore
4. Gallager / "Information Theory and Reliable Communication"
5. Shulin& Costello/ "Error Correcting Codes" / Prentice Hall (India).
6. Taub& Schilling / "Principles of Communication Systems" / Tata McGraw Hill
7. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. To understand about different source coding and channel capacity.
2. To apply these concepts on different type of codes and also get knowledge about error corrections.
3. To analyze to apply these concepts for analysis of video abstraction, secure data transmission and speech coding.
4. To apply coding concepts for analysis of different coder and decoder
5. Learn about different modulation schemes and evaluate the performance on AWGN channel.

	ADVANCED SEMICONDUCTOR DEVICES	**3L:1T:0P**	**4 credits**

Energy Bands & Charge Carriers in Semiconductors: Bonding Forces & Energy Bands in Solid, Charge Carriers in Semiconductors, Carrier Concentrations, Drift of Carriers in Electric & Magnetic, Fields, Invariance of the Fermi Level at Equilibrium,

Excess Carriers in Semiconductors: Optical Absorption, Luminescence, Carrier, Lifetime& Photo Conductivity, Diffusion of Carriers

Junctions: Fabrication of P-N Junctions, Equilibrium Condition, Forward & Reverse Bias Junctions, Reverse Bias Breakdown, Transient & AC Conditions, Deviations from the Simple Theory, Metal Semiconductor Junctions, Hetero-Junction

Field Effect Transistors: Transistor Operation, the Junction FET, the Metal Semiconductor FET, the Metal insulator, Semiconductor FET, MOSFET, BJT

Fundamentals of BJT Operation: Amplification with BJT, BJT Fabrication, Minority Carrier Distributions & Terminal Currents, Generalized Biasing, Switching, Other Important Effects, Freq. Limitation of Transistors, Hetero-Junction BJT

Optoelectronic Devices: Photodiodes, Light Emitting Diodes, Lasers, Semiconductor Lasers

Text Book:

1. Streetman, B.G. & Banerjee, Sanjay / "Solid State Electronic Devices" / Prentice Hall (India).

Reference Books:

1. Karl, Hess / "Advance Theory of Semiconductor Devices" / Prentice Hall (India)
2. Sze, S.M. / "Physics of Semiconductor Devices" / Wiley Eastern Limited
3. Watson, H.A. / "Microwave Semiconductor Devices and Their Circuit Applications"

   / Tata McGraw-Hill.

4. Bell, David A. / "Electronic Devices & Circuits" / Prentice Hall (India).
5. Nair, B. Somanathan / "Electronic Devices & Applications"/ Prentice Hall (India)
6. Roy, Sitesh Kumar &Mitra, Monojit / "Microwave Semiconductor Devices"/ Prentice Hall (India)
7. Salivahanan, S. & Kumar, Suresh N. &Vallavraj / "Electronic Devices & Circuits" / Tata McGraw-Hill.
8. Neamen, Donald A./ "Semiconductor Physics & Devices" / Tata McGraw-Hill.

9. Das Gupta, N. / “Semiconductor Devices Modeling & Technology” / Prentice Hall (india)
10. Muller, Richard &Kamins, Theodone L./ “Device Electronics for IC”/ John Wiley.
11. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. Understand the basic concept for formation of energy band, charge carriers and excess charge carriers.
2. Apply these concepts to understand the operation of different electronic devices like diode, BJT, JFET and MOSFET.
3. Analyze the working of these devices and solve mathematical problems of Diode, BJT, MOSFET and Diode.
4. To design a circuit using transistor at a desired operating point.
5. Apply these concepts on to understand the operation of heterojunction devices and have the basic knowledge of optically active devices.

	RF Systems	3L:1T: 0P	4 Credits

Introduction: Importance of RF and Microwave Concepts and Applications- and Units Frequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.

The Smith Chart: Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications.

Single and Multiport Networks: Basic Definitions, Interconnecting Networks.

Scattering Parameters: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion between S- and Z-parameters, Signal Flow Chart Modelling.

Stability and Gain Considerations – RF Design RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, Stabilization Methods-Unilateral and Bilateral Design for Constant Gain, Noise Figure Circles, Constant VSWR Circles.

Rf Filters, Amplifiers and Oscillators Design Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters, Filter Implementation using Unit Element and Kuroda's Identities Transformations. Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA), Design of Large Signal Amplifiers Oscillator vs Amplifier Design, Design procedure of Transistor Oscillators.

Text Books:

1. Mathew M. Radmanesh, “Radio Frequency & Microwave Electronics”, Pearson Education Asia, Second Edition,
2. Reinhold Ludwig and Powel Bretchko,” RF Circuit Design – Theory and Applications”, Pearson Education Asia, First Edition.

References Books:

1. Joseph J. Carr, “Secrets of RF Circuit Design”, McGraw Hill Publishers, Third Edition.
2. Ulrich L. Rohde and David P. New Kirk, “RF Microwave Circuit

Design", John Wiley & Sons USA, 2000.
3. Roland E. Best, "Phase - Locked Loops: Design, simulation and applications", McGraw Hill Publishers.
4. Devendra K. Misra, "Radio Frequency and Microwave Communication Circuits – Analysis and Design" John Wiley & Sons, Inc.
5. Jon B. Hagen, "Radio Frequency Electronics", Cambridge university press, Cambridge.
6. James Hardy, " High Frequency Circuit Design ", Resto Publishing Co., NewYork.
7. Ian Hickman, " RF HandBook ", Butter Worth Heinemann Ltd., Oxford.
8. Ulrich L.Rohde, T. T. N. Bucher, "Communication Recievers", Mc Graw-Hill, New York.

Course Outcomes:

At the end of course student will be able to

1. Understand the importance of microwave concepts and its applications.
2. Apply smith chart on different applications
3. Know about different single and multiport networks and their stability considerations.
4. Use of RF filters, amplifiers and oscillators.
5. Design different amplifiers and transistor oscillator.

ELECTIVE-IV

	DIGITAL IMAGE PROCESSING	3L:1T:0P	4 credits

Digitized Image & Its Properties: Basic Concepts, Image Digitization, Digital Image Properties

Data Structure for Image Analysis: Label of Image Data Representation, Traditional Image Data Structures, Hierarchical Data Structures

Image Processing: Pixel Brightness, Transformation, Geometric Transformation, Local Preprocessing, Image Restoration

Segmentation: Thresholding, Edge Based Segmentation, Region Based Segmentation, Matching

Shape Representation: Region Identification, Contour Base Representation, Region Based Shape Representation, Shape Classes

Image Transforms: Two Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two Dimensional DFT, Cosine Transforms, Sine Transforms, Hudmard Transforms, KK Transforms, SVD Transforms

Image Enhancement: Point Operation, Histogram Modeling, Transform Operation

Image Data Compression: Image Data Properties, Discrete Image Transforms in Image Data Compression, Predictive Compression Methods, Vector Quantization, Hierarchical and Progressive Compression Methods, Comparison of Compression Methods, Coding, JPEG and MPEG Image Compression.

3-D Vision, Geometry and Radiometry: 3-D Vision Tasks, Geometry for 3-D Vision, Radiometry and 3-D Vision, 3-D Model Based Vision, 2-D Based Representation of a 3-D Scheme.

Text Books:

1. Milan Sonya, Vaclav Hlavac& Roger Boyle / "Image Processing Analysis and Machine Vision"/ Vikas Publishing House
2. A.K. Jain / "Digital Image Processing" / Pearson Education

Reference Books:

1. Chanda, B. &Majumder, D. D. / "Digital Image Processing&Analysis" / Prentice Hall (India)
2. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. To understand the digitization, segmentation shape representation of images.
2. Have the basic knowledge of data structure for image processing.
3. To apply these concepts on image transforms and image enhancement.
4. Also analyze image data compression on different image representation techniques.
5. To apply the concepts on 3D vision, geometry and radiometry.

	NEURAL NETWORKS	3L:1T:0P	4 credits

Unit-I

Neurocomputing and Neuroscience Historical notes, human Brain, neuron Model, Knowledge representation, Al and NN. Learning process: Supervised and unsupervised learning, Error correction learning, competitive learning, adaptation, statistical nature of the learning process.

Unit-II

Data processing Scaling, normalization, Transformation (FT/FFT), principal component analysis, regression, co-variance matrix, eigen values & eigen vectors. Basic Models of Artificial neurons, activation Functions, aggregation function, single neuron computation.

Unit-III

Multilayered network architecture, back propagation algorithm, heuristics for making BP-algorithm performs better. Accelerated learning BP (like recursive least square, quick prop, RPROP algorithm).

Unit-IV

Recurrent network and temporal feed-forward network, implementation with BP, self organizing map and SOM algorithm, properties of feature map and computer simulation.

Unit-V

Complex valued NN and complex valued BP, analyticity of activation function, application in 2D information processing. Soft computing. Neuro-Fuzzy-genetic algorithm Intergration.

Text books:

1. Kevin Gurney “An Introduction to Neural Networks”, 1997
2. David Kriesel “ A brief introduction to neural networks”, 2005 http://www.dkriesel.com/en/science/neural_networks

Course Outcomes:

At the end of the course the student will be able to:

1.Gain Knowledge and understand principles of neural networks and fuzzy logic fundamentals;

2.Design the required and related systems .

3.Will develop Cognitive skills (thinking and analysis).

4. To understand fuzzy algorithms and related applications

5. To understand simulation analysis of real time fuzzy problems

	EMBEDDED SYSTEMS	3L:1T:0P	4 credits

Introduction: Embedded systems and its applications, Embedded Operating system, Design parameters of an embedded system and its significance, design life cycle, tools introduction, hardware and software partitioning and co-design

Hardware Fundamentals for the embedded developers Digital circuit parameters- Open collector outputs Tristate outputs I/O sinking and Sourcing, PLD's, Watchdog Timers, Hardware design and development.

Custom Single Purpose Processors: Optimizing program, FSMD, Data path & FSM. General purpose processors and ASIP's (Application Specific Instruction set Programming): Software and operation of general purpose Processors-Programmers, View Development Environment-ASIPs Microcontrollers-DSP Chips.

Introduction to Microcontrollers and Microprocessors: Embedded versus external, memory devices, CISC and RISC processors, Harvard and Von Neumann Architectures.

8051 Microcontrollers: Assembly language, architecture, registers, addressing modes, Instruction set, I/O ports and memory organization Interrupts Timer/counter, and serial communication.

RTOS: Tasks, states, Data, Semaphores and shared data, Operating system, services, Message queues, Mailboxes.

Advanced Processor: (only architectures) 80386, 80486 and ARM (References) **Communication basics**: Microprocessor Interfacing, I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel Protocols and wireless protocols.

Real world Interfacing: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Kev board, Latch Interconnection, PPI.

One project based on advance microcontroller.

Text Books:

1. Embedded System Design-Frank Vahid / Tony Givargis, John WilIey
2. Microcontroller (Theory and Applications) / Ajay V Deshmukh, / Tata McGraw-Hill
3. An Embedded Software Primer-David E. Simon, Pearson Education

Reference Books:

1. 8051 Microcontroller and Embedded Systems / Muhammad Ali Mazidi and Janice Gillispie.
2. Microcontrollers (Architecture, Implementation and Programming) / Kenneth Hintz, Daniel Tabak / TMH
3. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. Understand the basic of hardware fundamentals about embedded systems.
2. Learn about microprocessor and microcontroller.
3. Have the knowledge of interfacing from microprocessors using different techniques.
4. apply these concepts to understand different advance processor.
5. apply the concepts to solve real world problems.

	Data Analytics	**3L:1T:0P**	**4 credits**

Descriptive Statistics: Introduction to the course, Descriptive Statistics Probability Distributions

Inferential Statistics: Inferential Statistics through hypothesis tests Permutation & Randomization Test

Regression & ANOVA: Regression ANOVA (Analysis of Variance)

Machine Learning: Introduction and Concepts: Differentiating algorithmic and model based frameworks

Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K

Nearest Neighbours Regression & Classification

Supervised Learning with Regression and Classification techniques -1: Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant, Analysis, Regression and Classification, Trees, Support Vector Machines

Supervised Learning with Regression and Classification techniques -2: Ensemble Methods: Random Forest, Neural Networks, Deep learning

Unsupervised Learning and Challenges for Big Data Analytics: Clustering, Associative Rule Mining, Challenges for big data analytics

Prescriptive analytics: Creating data for analytics through designed experiments, creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning.

Text books:

2. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer.
3. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons.

Reference books:

1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press.
2. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications.
3. Ian H. Witten, Eibe Frank "Data Mining – Practical Machine Learning Tools and Techniques", Morgan Kaufman Publications .
4. David Hand, HeikkiMannila and Padhraic Smyth, "Principles of Data Mining", MIT PRESS.

Course Outcomes:

At the end of course student will be able to

1. understand algorithms by employing Map Reduce technique for solving Big Data problems
2. implement algorithms for Big Data by deciding on the apt Features set
3. Design algorithms for Big Data by optimizing main memory consumption
4. Design for Big Data by suggesting appropriate clustering techniques.
5. Know about supervised and unsupervised learning techniques for data analytics.

OPEN ELECTIVE-I

	MOBILE COMMUNICATION	3L:0T:0P	3 credits

Introduction: Evolution of Mobile Communication, Mobile and Wireless devices. A history of wireless communication. A market for mobile communications. A simplified reference model for mobile communications.

Wireless-transmission: A brief introduction of frequencies for radio transmission, signals propagation, Multiplexing, Modulation, spread spectrum, cellular system

Medium Access Control: Introduction to MAC, Telecommunication systems, GSM, DECT, TETRA, UMTS & IMT-2000

Satellite System: Review of the System, Broadcast System-Review,

Wireless LAN: IEEE 802-11 Protocol, System Architecture, Protocol Architecture, Physical Layer & MAC Layer, Newer developments, Hiper LAN, Bluetooth Technology,

Mobile Network Layer: Mobile IP, Mobile host configuration Network, Mobile ad-hoc networks

Mobile transport Layer: Traditional TCP, classical TCP improvement TCP over wireless network, performance Enhancing, proxies

Support for Mobility: File systems, World Wide Web, wireless application protocol, i- mode, Sync ML, WAP2-0 etc. Architecture of future Network & Applications

Text Books:

1. Schiller, J. / “Mobile Communication” / Pearson Education / 2nd Ed.

Reference Books:

1. Richharia, M. / “Mobile Satellite communications” / Pearson Education

2. Lee, W.C.Y. / “Mobile Communication Engineering”/ McGraw-Hill
3. Gibson, J.D. / “Mobile Communication”/ IEEE Press Hand Book
4. Feher, Kamilo / “Wireless Digital Communications”/ Prentice–Hall (India).

Course Outcomes:

At the end of course student will be able to

1. To understand the techniques involved in mobile communication.
2. To review MAC, satellite and broadcast system.
3. Analyze architecture of mobile associated systems.
4. Have the in depth knowledge of network and transport layer.
5. To understand various systems that support for mobility.

	BIOMEDICAL ELECTRONICS	3L:0T:0P	3 credits

Introduction: The age of Biomedical Engineering, Development of Biomedical Instrumentation, Man–Instrumentation system, Components, Physiological system of the body, Problem encountered in measuring a living system.

Transducers & Electrodes: The Transducers & Transduction principles, Active transducers, Passive Transducers, Transducer for Biomedical Applications.

Sources of Bioelectric potentials: Resting & Action potentials, propagation of active potential, The Bioelectric potentials-ECG, EEG, EMG, and Invoked responses

Electrodes: Electrode theory, Biopotential Electrodes–Microelectrodes Body surface electrodes, Needle Electrodes, Biochemical Transducers, Reference electrodes, PH electrodes, Blood Gas electrodes.

Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes & leads, ECG recorders - Three channel, Vector Cardiographs, ECG system for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow

measurement, Heart sound measurements.

Patient Care & Monitoring- Elements of Intensive Care monitoring, patient monitoring displays, Diagnosis, Calibration &Repairability of patient monitoring equipment, pacemakers & Defibrillators.

Measurements in Respiratory system: Physiology of respiratory system Measurement of breathing mechanics- Spiro meter, Respiratory Therapy equipments: Inhalators ventilators & Respirators, Humidifiers, Nebulizers & Aspirators.

Diagnostic Techniques: Ultrasonic Diagnosis Echocardiography, Echo Encephalography, Ophthalmic scans, X-Ray & Radio-isotope Instrumentation,

Computerized Axial Tomography Scanners

Bio Telemetry: The components of Biotelemetry system Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring.

Physiological Effects of Electric Current Safety of Medical Electronic Equipments, Shock hazards from Electrical equipment and prevention against them.

Text Books:

1. Cormwell / "Biomedical Instrumentation and Measurements"/ Prentice Hall (India).

Reference Books:

1. Khandpur R.S./ "Biomedical Instrumentation"/ Tata McGraw-Hill.
2. Tompkins / "Biomedical DSP: C Language Examples and Laboratory Experiments for the IBM PC"/ Prentice Hall (India).

Course Outcomes:

At the end of course student will be able to:

1. To understand the concept of transducer and electrode.
2. To study about Cardiovascularand respiratory systems measurements.
3. Apply these concepts on patient care & monitoring.
4. To analyze diagnostic techniques and study bio telemetry systems.

5. To apply bio telemetry technique on engineering domain.

OPEN ELECTIVE-II

	IMAGE PROCESSING	3L:1T:0P	4 credits

Digitized Image & Its Properties: Basic Concepts, Image Digitization, Digital Image Properties

Data Structure for Image Analysis: Label of Image Data Representation, Traditional Image Data Structures, Hierarchical Data Structures

Image Processing: Pixel Brightness, Transformation, Geometric Transformation, Local Preprocessing, Image Restoration

Segmentation: Thresholding, Edge Based Segmentation, Region Based Segmentation, Matching

Shape Representation: Region Identification, Contour Base Representation, Region Based Shape Representation, Shape Classes

Image Transforms: Two Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two Dimensional DFT, Cosine Transforms, Sine Transforms, Hudmard Transforms, KK Transforms, SVD Transforms

Image Enhancement: Point Operation, Histogram Modeling, Transform Operation

Image Data Compression: Image Data Properties, Discrete Image Transforms in Image Data Compression, Predictive Compression Methods, Vector Quantization, Hierarchical and Progressive Compression Methods, Comparison of Compression Methods, Coding, JPEG and MPEG Image Compression.

3-D Vision, Geometry and Radiometry: 3-D Vision Tasks, Geometry for 3-D Vision, Radiometry and 3-D Vision, 3-D Model Based Vision, 2-D Based Representation of a 3-D Scheme.

Text Books:

1. Milan Sonya, Vaclav Hlavac& Roger Boyle / "Image Processing Analysis and Machine Vision"/ Vikas Publishing House
2. A.K. Jain / "Digital Image Processing" / Pearson Education

Reference Books:

1. Chanda, B. &Majumder, D. D. / "Digital Image Processing&Analysis" / Prentice Hall (India)
2. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. To understand the digitization, segmentation shape representation of images.
2. Have the basic knowledge of data structure for image processing.
3. To apply these concepts on image transforms and image enhancement.
4. Also analyze image data compression on different image representation techniques.
5. To apply the concepts on 3D vision, geometry and radiometry.

	FUZZY LOGIC WITH ELECTRONIC ENGG. APPLICATIONS	**3L:1T:0P**	**4 credits**

Uncertainty in information; Classical Sets, Fuzzy Sets and their properties; Cardinality of Classical Relations and their properties, The a- Level Set, Cardinality of Fuzzy Relations and their properties; Composition; Tolerance and Equivalence relationship;

Membership Functions; Fuzzification and De-Fuzzification process; Fuzzy to Crisp Conversions; Lambda cuts;

Extension Principle, Crisp functions and its mapping, Fuzzy functions and its mapping; Fuzzy Numbers; Internal Analysis in Arithmetic; Approximate method of Extension, Vertex Method, DSW Algorithm, and Restricted DSW Algorithm and their comparison

Classical Predicate Logic; Fuzzy Logic; Approximate Reasoning; Fuzzy Tautologies, Contradictions, Equivalence, and Logical Proof; Fuzzy Rule Based Systems

Models of Fuzzy AND, OR, and Inverter; Fuzzy Algebra; Truth Tables; Fuzzy Functions; Concept of Fuzzy Logic Circuits; Fuzzy Flip-Flop; Fuzzy Logic Circuits in Current Mode.

Text Books:

1. Ibrahim Ahmad / "Introduction To Applied Fuzzy Electronics"/ Oxford University Press / Prentice-Hall (India).

Reference Books:

1. Ross, Timothy, J. / "Fuzzy Logic with Engineering Applications," / John Wiley & Sons / 2nd Edition.

2. Ahmad M. Ibrahim, / "FUZZY LOGIC for Embedded Systems Applications"/ Newnes Publication/ Elsevier Science (USA).

3. Lecturers of NPTEL.

Course Outcomes:

At the end of course student will be able to

1. To understand uncertainty if information and different sets of fuzzy sets and their properties.
2. To understand and apply different DSW algorithm.
3. To apply these concepts on Fuzzification and defuzzification.
4. To analyze different models of fuzzy on digital components.
5. To apply fuzzy logic on real time applications.