University Institute of Technology (UIT)

Silver Wood Estate, H. P. University, Shimla-171005

(NAAC Accredited "A-Grade" University)

DEPARTMENT

of

ELECTRONICS & COMMUNICATION ENGINEERING

Course Structure & Syllabus

for

Bachelor of Technology

in

Electronics & Communication Engineering

Semester I to VIII
Effective for Batch 2021-2025 and onwards

Also
Semester V-VIII
Effective for the Batch 2019-2023 and 2020-2024

Course Structure & Scheme

Breakup of the Credit Semester Wise

- Credits required for B. Tech - 160.

Semester/ Projects	Proposed Credits
I	20
II	19
III	20
IV	20
V	22
VI	23
VII	19
VIII	17
Total	160

Semester wise courses Scheme

Semester-I

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	AS-1001	Applied Mathematics-I	3	1	0	4	**4**	100	50
2.	AS-1002	Applied Physics	3	1	0	4	**4**	100	50
3.	EC-1001	Basic Electronics	3	1	0	4	**4**	100	50
4.	IT-1001	Fundamentals of Computers	3	1	0	4	**4**	100	50
5.	AS-1003	Applied Physics Lab	0	0	2	2	**1**	50	50
6.	ME-1001	Engineering Graphics & Design Lab	0	0	4	4	**2**	100	50
7.	EC-1002	Basic Electronics Lab	0	0	2	2	**1**	50	50
TOTAL						**24**	**20**	**600**	**350**
								Total = 950	

Semester-II

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	AS-2001	Applied Mathematics-II	3	1	0	4	**4**	100	50
2.	IT-2001	Introduction to C Language	3	1	0	4	**4**	100	50
3.	HU-2001	Communication & Professional Skill	3	0	0	3	**3**	100	50
4.	EE-2001	Basic Electrical Engineering	3	1	0	4	**4**	100	50
5.	IT-2002	C-Programming Lab	0	0	2	2	**1**	50	50
6.	EE-2002	Basic Electrical Lab	0	0	2	2	**1**	50	50
7.	EC-2001	Electronics & Communications Engineering Workshop	0	0	2	2	**2**	50	50
TOTAL						**21**	**19**	**550**	**350**
								Total = 900	

Semester-III

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exa	IA
1.	EC-3001	Analog Electronics	3	1	0	4	**4**	100	50
2.	EC-3002	Digital Electronics	3	1	0	4	**4**	100	50
3.	EC-3003	Signals and Systems	3	1	0	4	**4**	100	50
4.	EC-3005	Mathematics-III	3	1	0	4	**4**	100	50
5.	HSMC-3001	Principles of Engineering Economics and Management	3	0	0	3	**2**	100	50
6.	EC-3051	Analog Electronics Lab	0	0	2	2	**1**	50	50
7.	EC-3052	Digital Electronics Lab	0	0	2	2	**1**	50	50
TOTAL						**23**	**20**	**600**	**350**
								Total = 950	

Semester-IV

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exa	IA
1.	EC-4001	Microelectronics and VLSI	3	1	0	4	**4**	100	50
2.	EC-4002	Analog and Digital Communication	3	1	0	4	**4**	100	50
3.	EC-4003	Linear Integrated Circuit	3	1	0	4	**4**	100	50
4.	EC-4004	Electromagnetic Field Theory	3	1	0	4	**4**	100	50
5.	HSMC-4001	Organizational Behavior	3	0	0	3	**2**	100	50
6.	EC-4051	Microelectronics and VLSI Lab	0	0	2	2	**1**	50	50
7.	EC-4052	Analog and Digital Communication Lab	0	0	2	2	**1**	50	50
TOTAL						**23**	**20**	**600**	**350**
								Total = 950	

Vocational Training of 4 weeks after fourth semester with satisfactory outcome

Semester-V

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	EC-5001	Microprocessor and Microcontroller	3	1	0	4	**4**	100	50
2.	EC-5002	Measurement & Instrumentation	3	1	0	4	**4**	100	50
3.	EC-5003	Digital Signal Processing	3	1	0	4	**4**	100	50
4.	PEC-5XXXX	Program Elective –I	3	0	0	3	**3**	100	50
5.	OE-XXXX	Open Elective-I	3	0	0	3	**3**	100	50
6.	EC-5051	Microprocessor and Microcontroller Lab	0	0	2	2	**1**	50	50
7.	EC-5052	Measurement & Instrumentation Lab	0	0	2	2	**1**	50	50
8	EC-5053	Digital Signal Processing Lab	0	0	2	2	**1**	50	50
9	EC-5054	Vocational Training*	0	0	2	2	**1**	50	50
TOTAL						**26**	**22**	**700**	**450**
								Total = 1150	

Semester-VI

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	EC-6001	Control Systems	3	1	0	4	**4**	100	50
2.	EC-6002	Antenna & Wave Propagation	3	1	0	4	**4**	100	50
3.	EC-6003	Data Communication Network	3	1	0	4	**4**	100	50
4.	PEC-6XXX	Program Elective – II	3	0	0	3	**3**	100	50
5.	OE-XXXX	Open Elective-II	3	0	0	3	**3**	100	50
6.	EC-6051	Antenna Design & Simulation Lab	0	0	2	2	**1**	50	50
7.	EC-6052	Open Source Software Lab	0	0	2	2	**1**	50	50

8.	HSMC-6001	Ethics & Human Values	3	0	0	3	**3**	50	50
TOTAL						**25**	**23**	**650**	**400**
								Total =1050	

Semester-VII

Sr. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Hrs/ Week**	**C**	**Semester End Marks**	
								Ext. Exam	**IA**
1.	EC-7001	Optical Communication	3	1	0	4	**4**	100	50
2.	EC-7002	Internet of things	3	1	0	4	**4**	100	50
3.	PEC-7XXX	Program Elective –III	3	0	0	3	**3**	100	50
4.	IT-7001	Data Science	3	0	0	3	**3**	100	50
5.	HSMC-7001	Entrepreneurship Development	3	0	0	3	**2**	50	50
6.	EC-7051	Optical Communication Lab	0	0	2	2	**1**	100	50
7.	EC-7052	Minor Project/Seminar	0	0	4	4	**2**	50	50
TOTAL						**23**	**19**	**600**	**350**
								Total = 950	

Industrial Training: Students to undertake summer internships during summer break

Semester-VIII

Sr. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Hrs / Week**	**C**	**Semester End Marks**	
								Ext. Exa	**IA**
1.	EC-8001	Wireless and Mobile communication	3	1	0	4	**4**	100	50
2.	PEC-8XXX	Program Elective -IV	3	0	0	3	**3**	100	50
3.	EC-8002	Microwave & Radar Engineering	3	0	0	3	**3**	100	50
4.	EC-8051	Major Project	0	0	12	12	**6**	50	50
5.	EC-8052	General Proficiency	0	0	2	2	**1**	50	50
TOTAL						**24**	**17**	**400**	**250**
								Total = 650	

Legend:

L - Number of lecture hours per week
T - Number of tutorial hours per week
P - Number of practical hours per week
TOTAL CREDITS – 160

Program Elective-I for 5th Sem

1. PEC-5001: Information Theory and Coding
2. PEC-5002: Biomedical Engineering
3. PEC-5003: Electronic Switching
4. PEC-5004: Computational Intelligence
5. PEC-5005: Low Power VLSI Design

Program Elective-II for 6th Sem

1. PEC-6001: Nanoelectronics
2. PEC-6002: Speech and Audio Processing
3. PEC-6003: Embedded Systems
4. PEC-6004: Satellite Communication
5. PEC-6005: Electronic Device Simulation

Program Elective-III for 7th Sem

1. PEC-7001: Wireless sensor Network
2. PEC-7002: Introduction to MEMS
3. PEC-7003: Cloud computing
4. PEC-7004: VLSI for CAD
5. PEC-7005: Computer Organization and Architecture

Program Elective-IV for 8th Sem

1. PEC-8001: Cryptography and Network Security
2. PEC-8002: IoT Sensor and Actuator
3. PEC-8003: Optoelectronics and photonics
4. PEC-8004: DSP System Design

List of Open Electives

1. OE-1001: Non-Conventional Energy Resources
2. OE-1002: Indian Financial System
3. OE-1003: Total Quality Management
4. OE-1004: Applied Fuzzy Electronic System
5. OE-1005: Artificial Neural Networks
6. OE-1006: Artificial Intelligence and Machine Learning
7. OE-1007: Cyber Law and Ethics
8. OE-1008: Energy Assessment and Auditing

Note:

1. Honours Elective courses as decided by committee to be taken from MOOCs. Course codes will be decided later as per the format.
2. Elective courses may be added or removed later on the recommendation of competent authority.
3. For 5th-8th semesters any of the core courses offered in B. Tech. (IT/CSE/EE) which are not being taught in B. Tech. (ECE) can also be offered as open elective course.

Detailed Syllabus

Name of the Course	**Engineering Mathematics- I**		
Course Code	**AS-1001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To learn operations of matrices, echelon form of matrices and system of equations
- To introduce the concept of limits, continuity and maximum and minimum behaviour of functions.
- To compute curl, divergence of vector fields and definite integrals.

Section	Course Content
Section A	Review of Matrices, Eigen values, Eigen vectors, Properties of Eigen values, Eigen values of Hermitian, skew-Hermitian and unitary matrices, Cayley Hamilton Theorem, Rank of matrix, Normal and Echelon form of matrix, Solutions of Homogeneous and Non-Homogeneous system of equations.
Section B	Limit and Continuity of functions of two variables, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem, Jacobian, Taylor's and Maclaurin's infinite series, Maxima and minima of functions of two variables.
Section C	Double Integrals and Triple integrals (Cartesian and Polar Forms), Change of Order of Integration, Change of Variables, Applications of Double and Triple Integrals to find area and volume, Beta and Gamma functions.
Section D	Differentiation of vectors, Scalar and Vector point functions, Vector Operator 'Del', Gradient, Divergence, Curl and their Geometrical Interpretations, Del applied twice to point function, Del applied to product of point functions, Directional Derivative, Irrotational and Solenoidal Fields, Tangential Line Integral, Normal Surface Integral, Volume integrals.

Course Outcomes:

CO1: Perform matrix operations of addition, multiplication and solve system of linear equations.
CO2: Learn about the basic principle of calculus.
CO3: Calculate directional derivatives, gradient of vectors and understand their

geometrical significance.

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal: Khanna Publishers.
2. Engineering Mathematics (2ndedition): Vol-I and Vol-II, S. S. Shastri, Prentice Hall of India.

Reference Books:

1. Advanced Engineering Mathematics: E. Kreyszig, John Wiley & Sons.
2. Differential and Integral Calculus: N. Piskunov, CBS Publishers.
3. Advanced Engineering Mathematics: R. K. Jain & S. R. K. Iyengar, Narosa Publication House.
4. Advanced Engineering Mathematics: Michael D. Greenberg: Pearson Education.

Name of the Course	**Applied Physics**		
Course Code	**AS – 1002**	Credits-4	L-3, T-1, P-0
Total Lectures	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed.

Course Objectives:

- To develop understanding of Quantum Mechanics and its applications.
- To understand various free electron gas models.
- To know the fundamental concept of theory of relativity and Electromagnetic waves.
- To understand principle and design of various Laser systems, optical fiber and their applications in upcoming technologies like photonics.

Section	Course Content
Section A	Optics: Methods of interference-division of wave front, division of amplitude, interference through thin films (qualitative only), Newton rings. Diffraction of light, diffraction through single slit, double slit and diffraction grating. Theory of Relativity: Galilean transformations. Postulates of Einstein's special theory of relativity, Lorentz transformations. Length contraction, time dilation, Variation of mass with velocity, mass-energy equivalence. Electromagnetic Wave Theory: Maxwell's equations and their significance, Electromagnetic waves, Poynting vector, Electromagnetic wave equation.
Section B	Quantum Mechanics: Introduction to quantum mechanics, concept of de Broglie Waves, Davisson- Germer experiment, wave packet, Phase and Group Velocities (qualitative only), wave function and its properties, operators in quantum mechanics, expectation values, eigen values and eigen functions. Postulates of quantum mechanics, time dependent and time independent Schrodinger wave equation, Application: Particle in a box, Tunnel Effect.
Section C	Band Theory of Solids: Free electron theory: Quantum theory of free electrons, Fermi Dirac distribution function and its variation with temperature. Periodic potential and Bloch theorem, Kronig Penney Model (qualitative), E-K diagrams, Brillouin Zones. Superconductivity: Superconductivity, effect of magnetic field, Meissner effect, types of superconductors, BCS theory (qualitative only), Josephson effect, applications of superconductivity.

Section D	LASER: Spontaneous and stimulated emission, LASER action schemes, characteristics of LASER beam, ruby LASER, He-Ne LASER, semiconductor LASER (simple Ideas), applications of LASERs. Fibre Optics: Principle, structure, acceptance angle and acceptance cone, numerical aperture, single mode and multi-mode fibres, step index and graded index fibres, optical fibre communications, losses in optical fibres.

Course Outcomes: After successful completion of this course, students will be able to:

CO1: understand new methods of interference and diffraction.
CO2: understand the fundamentals of relativistic mechanics, Maxwell's equations and their relevance in the modern technology and the concept of electromagnetic waves.
CO3: explain fundamentals of quantum mechanics and its applications in microscopic systems.
CO4: understand the various models of free electron theories and basics of superconductivity.
CO5: understand various laser systems and theory of fiber optics.

Text Books:

1. 1. Modern Engineering Physics: A. S. Vasudeva: S. Chand Publications.
2. 2. A text book of Engineering Physics: M. B. Avadhanulu, P. G. Kshirsagar: S. Chand Publications.

Reference Books:

1. Solid state Physics: Gupta & Saxena: Pragati Publications
2. Concepts of Modern Physics : Arthur Beiser : Tata McGraw Hill
3. Modern Engineering Physics: Bhattacharya Tando: Oxford
4. Modern Engineering Physics : Sharma & Sharma : Pearson

Name of the Course	**Basic Electronics**		
Course Code	**EC– 1001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Regulators and Amplifiers
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts.

Section	Course Content
Section A	Brief review of Band Theory, transport phenomenon in semiconductors, Electrons and holes in Intrinsic semiconductor, Donor and acceptor Impurities, charge densities in semiconductor. PN Junction, Reverse and Forward bias conditions, Diode Characteristic and parameter, Ideal vs. Practical diode. Equivalent circuits and frequency response. Rectification: half and full wave, Zener and Avalanche diode, its role as regulator, photodiode.
Section B	Bipolar junction transistor (BJT) and their characteristics as circuit and gain elements. Two port network analysis, h-parameters and trans-conductance. Equivalent circuits for JFET and MOSFET, enhancement mode and depletion mode MOSFETS. Uni-junction transistor (UJT), UJT characteristics, parameters and circuit operation.
Section C	Bias for transistor amplifier: fixed bias, emitter feedback bias. Feedback principles. Types of feedback, Stabilization of gain, reduction of non-linear distortion, change of inputs and output resistance by negative feedback in amplifier. Amplifiers coupling, types of coupling, Amplifier pass band, Eq circuits for BJT at high frequency response of CE, RC-Coupled amplifiers at mid, low and high frequencies.

Section D	Semiconductor processing, active and passive elements, Integrated circuits, bias for integrated circuits. Basic operational amplifier, applications of operational amplifier – adder, subtractor, Integrator, differentiator and comparator, Photo transistor: its characteristics and applications.

Course Outcomes:

CO1: Understand the current voltage characteristics of semiconductor devices.
CO2: Analyse dc circuits and relate ac models of semiconductor devices with their physical Operation.
CO3: Design and analyse of electronic circuits.
CO4: Evaluate frequency response to understand behaviour of Electronics circuits.

Text Books:

1. Electronic Principles: A. P. Malvino: TMH
2. Electronic Fundamentals and Applications: J. D. Ryder : PHI
3. Electronic Circuits & Devices : J. Millman and C. C. Halkias : TMH

Reference Books:

1. Integrated Circuits & Devices: J. Millman & C. C. Halkias: TMH
2. Basic Electronic & Linear Circuits: N. N. Bhargava & Kulshrestha : TMH

Name of the Course	**Fundamentals of Computers**		
Course Code	**IT–1001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To understand Computer System and its applications in daily life.
- To study the hardware and software of computer.
- To understand how computers are integrated into large system through network.

Section	Course Content
Section A	Computer Appreciation: Definition of an Electronic Digital Computer, history, Generations, Characteristics and applications of Computers, classification of Computers. Information and Data Hardware: CPU, Primary and Secondary storage, I/O devices, Bus structure, Computer Peripherals - VDU, Keyboard, Mouse, Printer. Software: System software, Application software, open source software. Concept of Programming Languages: Machine Language, Assembly Language, High Level Language, Object Oriented Language, Introduction to 4GLS, linker , loader, assembler.
Section B	Number systems and Codes: Number representation: Weighted codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notations, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC Basic Computer Organization: IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation (bit, byte, word), CPU Organization, Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer.
Section C	Storage: memory hierarchy, caparison of memories on the basis of speed, capacity and cost. Operating system: evaluation of Operating system, definition and function: batch processing OS, multi programming and multi-tasking OS, time sharing OS, Real time OS, Spooling Data communication and network :Data transmission modes : Simplex, half-duplex, full-duplex, Data transmission speed: narrowband, voiceband, broadband. Transmission media: Guided and unguided media, twisted wires,

	coaxial cable, optical fiber, microwave. Switching techniques: Circuit switching, message switching, Packet switching.
Section D	Introduction to Networking: Basic Features, LAN, MAN and WAN; Mode of operation and characteristics. LAN Topologies, OSI model of networking, client – Server Architecture's. Intranet and Internet: Servers and Clients; Ports; Domain Name Server (DNS); WWW, Browsers, Dial up, ISDN, ADSN; Cable, Modem; E-mail, Voice and Video Conferencing.

Course Outcomes:

CO1: To exacerbate knowledge by studying Evolution of computer, Basic components of a Digital Computer, Computer Classification.

CO2: To expedite knowledge by studying about Information Representation, Integer Representation, and Binary Arithmetic.

CO3: To gain the knowledge about Memory, Storage Fundamentals, and Various Storage Devices.

CO4: To gain knowledge about operation system, data communication and computer networks.

Text Books:

1. Computer Fundamentals, P.K. Sinha, BPB Publications
2. Fundamentals of Computers, V. Rajaraman, PHI

Reference Book:

1. Computer Organization, Morris Mano, Pearson Publications
2. Introduction to Information Technology, V. Rajaraman, PHI

Name of the Course	**Applied Physics Lab**		
Course Code	**AS-1003**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To find the wavelength of sodium light by Newton's rings experiment.
2	To find the wavelength of sodium light by Fresnel's bi-prism experiment
3	To find the wavelength of various colours of white light using plane transmission diffraction rating.
4	To find the wavelength of sodium light by Michelson interferometer
5	To find the refractive index and Cauchy's constant of a prism by using spectrometer
6	To find the resolving power of a telescope
7	To study the beam parameters of a helium-neon laser
8	To find flashing & quenching potentials of argon & hence to find the capacitance of unknown capacitor.
9	To find the value of high resistance by Substitution method
10	To convert a galvanometer into an ammeter of a given range
11	To study the variation of magnetic field with distance for Stewart and Gee's apparatus
12	To find the reduction factor of two turn coil tangent galvanometer using copper voltammeter
13	To find the value of e/m for electrons by Helical method.
14	To determine the charge of an electron by Millikan's oil drop method
15	To find the value of Planck's constant by using a photoelectric cell
16	To calculate the hysteresis loss by tracing a B-H curve for a given sample
17	To determine the band gap of an intrinsic semiconductor by four probe method
18	To determine the resistivity of a semi-conductor by four probe method at different temperatures
19	To determine the Hall co-efficient
20	To study the photovoltaic cell & hence to verify the inverse square law

Course Outcomes:

CO1: After performing the experiments related to optics, students shall be able to visualise fringe patterns and use them in determination of wavelength of light used.

CO2: Students shall be able to perform experiments based on electricity and magnetism.

CO3: Students shall be able to determine various properties of semiconducting materials.

CO4: Students shall be able to perform experiments based on bridges to determine the characteristic values of various circuit components.

Text Books:

1. Practical Physics: S. L. Gupta & V. Kumar: PRAGATI Publications.
2. Practical Physics for B.Sc. I, II and III: S. L. Arora: S. Chand Publications.

Name of the Course	Engineering Graphics and Design Lab		
Course Code	**ME-1001**	Credits-2	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Drawing Techniques: Various type of lines, principal of dimensioning, size & location as per IS code of practice (SP-46) for general engineering drawing. Practice of drawing, various types of lines & dimensioning exercises. Drawing exercises pertaining to symbols. Conventions & Exercise of lettering techniques. Free hand printing of letters & numerals in 3, 5, 8 & 12-mm sizes, vertical & inclined at 75^{o}. Instrumental lettering in single stroke. Linear Scale, Diagonal scale & vernier scale. Projection of Points, Lines and Planes: Concept of horizontal and vertical planes. First and third angle projections: projections of point & lines, true length of lines and their horizontal & vertical traces, projection of planes & their traces.
2	Projections of Solids: Right regular solids of revolution & polyhedrons etc. and their auxiliary views. Sectioning of Solids: Principal of sanctioning, types of sanctioning & their practice on projection of solids.
3	Practice In: Orthographic projections of individual blocks/ parts. Isometric Projection: Concept of isometric views: isometric scale and exercise on isometric views.
4	Development of Surfaces: Development of surfaces of cylinders, cones, pyramid, prism etc. exercises involving development of unique surfaces like Y-piece, hopper, tray, truncated pieces etc. Intersection of Surfaces: Intersection of cylinders, cones & prisms with their axes being vertical, horizontal or inclines. Exercise on intersection of solids-cylinder & cylinder, cylinder & cone, prism & prism.

Course Outcomes:

CO1: Student's ability to hand letter will improve.
CO2: Student's ability to perform basic sketching techniques will improve
CO3: Students will be able to draw orthographic projections and sections
CO4: Student's ability to use architectural and engineering scales will increase

Text Books:

1. Elementary Engineering Drawing: N. D. Bhatt: Charotar Pub. House.
2. Engineering Drawing & Engg. Graphics. P. S. Gill: S. K. Kataria & sons
3. Engineering Graphics: L.V. Lakshminarayan & R. S. Vaish
4. Engineering Drawing Plane and Solid Geometry: N. D. Bhatt V. M. Panchal: Charotar Pub. House, 2002.

Reference Books

1. Engineering Graphics with AutoCAD 2002: James D. Bethune: Pearson Education
2. Engineering Graphics and Drawing: P. S. Gill: S. K. Kataria.
3. Engineering Graphics using AUTOCAD 2000: T. Jeyapoovan: Vikas Publishing House.

4. Engineering Drawing and Graphics + AutoCAD 4th Edition: K. Venugopal: NewAge International
5. Engg. Drawing: Harwinder Singh: Dhanpat Rai Publications.
6. Engg. Drawing: R. K. Dhawan : S. Chand Publications.

Name of the Course	**Basic Electronics Lab**		
Course Code	**EC-1002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To study the use and scope of using an oscilloscope as a measuring device in an electronic laboratory
2	To study the use and scope of using a millimetre (digital and analog) as a measuring device in an electronics laboratory
3	To study the use and scope of function generator as a signal source in an electronics laboratory.
4	Draw forward bias and reverse bias characteristics of a p-n junction diode and use it as a half wave and full wave rectifier
5	Draw the characteristics of a zener diode and use it as a voltage regulator
6	Draw characteristics of common base configuration of p-n-p transistor
7	Draw characteristics of common emitter configuration of an npn transistor
8	Draw characteristics of common drain configuration of a MOSFET
9	Find the voltage and current gain of single stage common emitter amplifier.
10	Draw the characteristics curve of UJT.
11	Find the voltage gain of single stage voltage series feedback amplifier
12	Use operational amplifier as: a) Inverting amplifier , b) Non-inverting amplifier, c) Comparator, d) Integrator e) Differentiator, f) Adder, g) Precision amplifier

Course Outcomes:

CO1: To study basics of semiconductor & devices and their applications in different areas

CO2: To study different biasing techniques to operate transistor, FET, MOSFET and operational amplifier in different modes.

CO3: Analyse output in different operating modes of different semiconductor devices

Text Books:

1. Basic Electronic & Linear Circuits: N. N. Bhargava & Kulshrestha: TMH
2. Electronic Devices & Circuit Theory: Robert L. Boylestad, Louis Nashelsky: Pearson Edu.

SEMESTER-II

Name of the Course	**Applied Mathematics – II**		
Course Code	**AS – 2001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To explain the basics of linear algebra including matrix theory, system of linear equations, eigen values and eigenvectors.
- To elaborate the basic concepts of complex algebra and analysis for applications in engineering subjects.
- To demonstrate the basics of numerical methods for different kind of interpolations; finding roots of algebraic and transcendental equations etc.
- To demonstrate the basics of numerical differentiation and integrations and their applications.
- To display the theories of Laplace, Fourier transformations and their applications in differential equations.
- To impart competence to the students for solving problems of the standards pertaining to standards of the various national level competitive examinations like GATE, UPSC, PSUs etc.

Section	Course Content
Section A	Vector Calculus: Tangent, curvature and torsion, Directional derivative, Gradient of a scalar field, divergence and curl of a vector field. Line, surface and volume integrals, theorem of gauss and Stoke's (proofs not needed).
Section B	Integral Transforms: Fourier series, Euler's formula, even and odd functions, half range expansions. Fourier and Laplace transform, Inverse transform of derivatives and integrals, shifting theorem, application to periodic functions, unit step function.
Section C	Second order Differential Equations: Solution by: Power series method and its basis, Solution of Bessel and Legendre differential equations, properties of Bessel and Legendre functions.
Section D	Partial Differential Equations (PDE): Formulation and classification. Solution

	of wave equation heat equation in one dimension and Laplace equation in two dimensions by the method of separation of variables.

Course Outcomes:

CO1: Gain the knowledge to develop the concepts of surface Z= f (x, y) its partial derivatives, Euler Theorem & modified Euler Theorem for homogenous function & deduction develops ability to solve problems related to partial derivatives.

CO2: Learn to expand any functions of two variables in the ascending power of variables and also develops error and approximation, extremum value of a given function related to engineering application.

CO3: Develops the ability to solve higher order & first degree linear non homogenous differential equation arising in various branch of engineering and related mathematical model develops arising to form mathematical modelling of Real-World Problem with its physical interpretation.

CO4: Solve some differential equation which is not solvable in ordinary case but its series solution gives an idea of developing special function which has important role in some physical phenomena arising in engineering problems.

Text Books:

1. Higher Engineering Mathematics: B. S. Grewal: Khanna Publishers.
2. Advanced Engineering, Mathematics: R. K. Jain and. S. R. K Iyengar: Narosa Publishing House.

Reference Books:

1. Advanced Engineering Mathematics: E. Kreyszig: John Wiley & Sons (Asia) Pvt. Ltd.
2. Engineering Mathematics (2nd edition):S. S. Shastri: Prentice Hall of India Pvt. Ltd. Vol-I and Vol-II.
3. Differential and Integral Calculus: N. Piskunov: CBS Publishers and Distributors.
4. Advanced Engineering Mathematics: Michael D Greenberg: Pearson Education Asia.

Name of the Course	**Introduction to C Language**		
Course Code	**IT-2001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To introduce the concept of computer fundamentals and computer programming
- To enable the student to design algorithms
- To enable the students to understand "C" language and its application in problem solving.

Section	Course Content
Section-A	Problem solving with Computers: Algorithms, pseudo codes and Flowcharts. Overview of C Programming: Structure of C program, character set, keywords & identifiers, Data types, Constants, variables, expressions (arithmetic and logical), typedef, enum Operators: Arithmetic, relational, logical, bitwise, conditional and modulus operator, operator's precedence & associativity, preprocessors statements, data inputs and output functions, assignments statements.
Section-B	Conditional statements: If-else, nested if-else, switch case statement Control statements: for loop, while loop, do-while, nested loops, jump control statements: break, continue, goto, exit, return. Functions: Declaration of functions, definition of functions, calling of functions, call by value and call by reference
Section-C	Arrays: One dimensional arrays,–Declaration of 1D arrays –Initialization of 1D arrays –Accessing element of 1D arrays –Reading and displaying elements – Two dimensional arrays –Declaration of 2D arrays –Initialization of 2D arrays –Accessing element of 2D arrays –Reading and displaying elements. Storage classes, recursion. Strings versus character arrays:–Initializing strings, Reading strings, displaying string, String-handling functions.
Section-D	Pointer Concepts: Need of Pointers, Integer & Character pointers, array and functions, Array & pointers, function & pointers, Parameter passing by reference. Structure & Union: Definition of Structure & union, Structure & Pointers,

	Nesting of Structures, Structure and arrays, Arrays of pointer to structures Files Concepts in C: Using files in C, Buffer and streams, working with text files and Binary Files, file operations using standard library and system calls, File management I/O functions, Random Access Files Reading, Writing text and binary files.

Course Outcomes:

CO1: Know the basic components of the computer and working of each device.
CO2: Design algorithms and flowcharts.
CO3: Understand the fundamentals of C programming.
CO4: Use suitable data structure for problem solving.

Text Books:

1. Kanetkar, "Let us C", BPB Publications
2. E. Balaguruswamy, "Programming in C", Tata McGraw Hill

Reference Books:

1. V Rajaraman "Fundamentals of Computers"
2. D.Dromey, "How to Solve it by Computers" (Prentice Hall)
3. Richie and Kerningham, "C Programming"

Name of the Course	**Communication & Professional Skills in English**		
Course Code	**HU-2001**	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To develop independent perspective through critical thinking.
- To communicate their perspective in clear and correctly articulated language through LSRW skills.
- To instill a lifelong habit of language learning.

Section	Course Content
Section A	Reading Skills: The skill of effective reading – eye movements, fixations, regression and visual wandering, the right approach to reading; Factors affecting the style of reading – reader, related material related and environmental; Memory, retention, association of reading material. Kinds of Reading: Introduction to phonetics – familiarization with speech sounds and their symbols– articulation of speech sounds – stress and intonation. Grammar: Word building use of punctuation marks, articles, tenses, abbreviations, prepositions, idioms & phrases, transformation of sentences, incorrect to correct English, single word for a group of words.

Section B	Writing Skills: Business letters: principles, structure and style of writing business i.e., sales letters, claim and adjustment letters, inviting quotations/tenders, writing a memo, job application letters, preparing a personal resume; Effective Meetings: Qualities i.e. planning, processing the discussion, conducting a meeting, use of different type of questions, summaries, handling problem situations and problem people, writing notices, agenda and minutes of meetings; Report writing: Characteristics, types of reports, structure of technical/research reports, preparatory steps to report writing; Elements of style: Definition of style, characteristics of a good technical style – practical hints to improve the style of writing; précis writing; Comprehension of passages.
Section C	Listening Skills: Barriers to listening, effective listening and feedback skills, Telephone techniques. Considerations of listening and voice, developing telephone skills – preparing for the call, controlling the call, follow up action. Handling difficult calls and difficult callers.
Section D	Speaking And Discussion Skills: Effective speaking: Preparation i.e., deciding the objective, preparing the environments, organizing the material selection of words, voice modulation, speed, expression, body language, dealing with questions, dealing with nervousness, presentation of audio-visual aids; Group Discussions: The art of participating in group discussion i.e., initiative, cooperation with group members, analysis of the issue, putting one's views effectively, establishing leadership. Assignments / Seminars / discussions may be given for following skill development. a) Word processing a (b) Report writing c) Preparing agenda for (d) Preparing minutes of the e) Press Releases (f) Preparing a Brochure g) Advertisements (h) Preparing a power point slide show

Course Outcomes:

CO1. Identify the importance of Communication Skills.
CO2: Apply Critical Thinking to what they read, listen to and observe.
CO3: Apply principles of effective LSRW skills in professional & Social Communication.
CO4: Assess the verbal and non-verbal messages effectively.

Text Books:

1. I. Bhatacharya, "An Approach to Communication Skills", Dhanpat Rai & Co.
2. R.C. Sharma & Krishna Mohan, "Business Correspondence and Report writing", Tata McGraw Hill.
3. K.K.Sinha, "Business Communication", Galgotia Publishing.

Name of the Course	Basic Electrical Engineering		
Course Code	EE-2001	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To impart knowledge about the electrical quantities and to understand the impact of electricity in a global and societal context.
- To introduce the fundamental concepts relevant to DC and AC circuits and network theorems.
- Highlight the importance of electromagnetism and transformers in transmission and distribution of electric power.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.

Section	Course Content
Section A	D.C. circuits: V- I characteristics of ideal voltage and ideal current sources, various types of controlled sources, passive circuit components, V-I characteristics and ratings of different types of R, L, C elements. Ohm's law, Kirchoff's Laws, delta-star transformation, Nodal and Mesh analysis, Thevenin's, Norton's, superposition theorem, Maximum power transfer theorem, Reciprocity, Compensation, Millman and Tellegan's Theorem.
Section B	A. C. Circuits: Sinusoidal signal, instantaneous and peak values, RMS and average values, phase angle, polar and rectangular, exponential and trigonometric representations RL and C components, Concept of complex power, power factor. Series and Parallel A.C. circuit, Series and Parallel resonance. Q factor, cut off frequency and bandwidth. Three Phase Circuits: Phase and line voltages and currents, balanced star and delta circuits, power equation, measurement of power by 2-wattmeter method.
Section C	Magnetic Circuits: Amperes circuital law, B-H curve, concept of reluctance, flux and mmf, analogies between electrical and magnetic quantities, solution of

	magnetic circuits, hysteresis and eddy current losses, mutual inductance and dot convention.
Section D	Electromagnetic Theory of Electric Machines: Electrical Machines: Basic concepts including principle, construction and working of transformers and D.C. Machines.

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

CO1: Identify and predict the behaviour of any electrical and magnetic circuit.

CO2: Formulate and solve complex AC and DC circuits.

CO3: Realize the requirement of transformers in transmission and distribution of electric power and other applications.

CO4: Identify the type of electrical machines used for that particular application.

Books:

1. Charles K Alexander and Matthew N. O. Sadiku, “Fundamental of Electric Circuits", TMH Publication.
2. Vincent Del Toro, “Electrical Engineering Fundamentals”, PHI Publication.
3. V N Mittal & Arvind Mittal, “Basic Electrical Engineering”, TMH Publication.

References:

1. A.E. Fitzgerald, “Basic Electrical Technology”, McGraw Hill Publication.
2.N Alagappan and B Ekambaram, “Electrical Estimating and Costing”, TMH Publication.

Name of the Course	**C Programming Lab.**		
Course Code	**IT -2002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Write a program to find the largest of three numbers (if-then-else).
2	Write a program to find the largest number out of ten numbers (for statement).
3	Write a program to find the average male height & average female heights in the class (input is in form of sex code, height).
4	Write a program to find roots of quadratic equation using functions and switch statement.
5	Write a program using arrays to find the largest and second largest no.
6	Write a program to multiply two matrices.
7	Write a program to read a string and write it in reverse order
8	Write a program to concatenate two strings.
9	Write a program to sort numbers using the Quick sort Algorithm. Represent a deck of playing cards using arrays.
10	Write a program to compute the Fibonacci series.
11	Write a program to find weather the number is palindrome or not.

Course Outcomes:

CO1: Identify and abstract the programming task involved for a given problem.

CO2: Design and develop modular programming skills.

CO3: Trace and debug a program.

Text Books:

1. Let us C: Yashwant Kanetkar: BPB Publication
2. Programming in C: E. Balaguruswamy: Tata McGraw Hill

Name of the Course	Basic Electrical Engineering Lab		
Course Code	**EE – 2002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To verify KCL and KVL.
2	To study frequency response of series RLC circuit and determine resonance frequency and power factor for various values of R,L,C.
3	To study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
4	To perform direct load test of transformer and plot efficiency v/s load characteristics.
5	To perform direct load test of the DC shunt generator and plot load v/s current curve
6	To study and verify Thevenins, Norton's, superposition, Milliman's, maximum power, reciprocity theorems.
7	To perform O.C and S.C test of transformer.
8	To study various types of meters.
9	Measurement of power by 3 voltmeter/ 3 ammeter method.
10	Measurement of power in 3-phase system by 2-wattmeter method.

Course Outcomes:

CO1: Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

CO2: Use different meters and instruments for the measurement of common electrical quantities

CO3: Understand the importance of various theorems and transformer tests

Text Books:

1. Experiment in Basic Electrical Engineering: S. K. Bhattachrya & K. M. Rastogi: New Age International Pub.
2. Experiment and Viva – Voce on Electrical Machines: V. N. Mittal & A. Mittal: Standard Publishers.

Name of the Course	Electronics and Communication Engineering Workshop		
Course Code	EC-2001	Credits-2	L-0,T-0,P-3
Total Practical Sessions	39Hrs.(Lab Session=13(3hrs.each))		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Familiarization/Identification of electronics components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. Active, passive, electronics, electromechanical, wires, cables, connector, fuses, switches, relays, crystals, displays, fasteners, heat sink etc.
2	Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools, interpret data sheets of discrete components and IC's, estimation and costing.
3	Familiarization/application of testing instruments and commonly used tools (multimeter, CRO, Function generator, Power Supply, IC tester).
4	Testing of electronic components (resistor, capacitor, diode, transistor, UJT and JFET using multimeter).
5	Interconnection methods and soldering practices (Bread board, wrapping, crimping, soldering – types – selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, crimping).
6	Printed Circuit Board (PCB) (Types, single sided, double sided, PTH, Processing methods, design and fabrication of a single sided PCB for simple circuit with manual etching (ferric chloride) and drilling).
7	Assembling electronic circuits: Diode rectifiers, capacitor filters, zener/IC regulator, square wave generation using IC 555 timer in IC base, sine wave generator using IC 741 OP-AMP in IC base, AND and NAND gates in DTL.

Note:-
Industrial visits can be undertaken to various industries available in the vicinity of the concerned Engineering College. One project at the end of semester has to be submitted by a group of six students.

Course Outcomes:

CO1: familiarization with various electronic components to be used in the coming semesters.
CO2: make the students acquainted with CROs, bread boards, printed circuit boards and other electronic equipments
CO3: adhere "Hands on" on the circuit boards
CO4: assembling simple electronic circuits.

Text Books:

1. Electronic Principles: A. P. Malvino: TMH
2. Electronic Fundamentals and Applications: J. D. Ryder : PHI
3. Electronic Circuits & Devices : J. Millman and C. C. Halkias : TMH

Reference Books:

1. Integrated Circuits & Devices: J. Millman & C. C. Halkias: TMH
2. Basic Electronic & Linear Circuits: N. N. Bhargava & Kulshrestha : TMH

SEMESTER-III

Name of the Course	**Analog Electronics**		
Course Code	**EC-3001** Credits-4		L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time:3Hrs
Continuous Assessment (based on sessional tests (2) 50%, Tutorials / Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. SectionE will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts ofthe questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To prepare students to perform the analysis of any Analog electronics circuit.
- To empower students to understand the design and working of BJT / FET amplifiers, oscillators and Operational Amplifier.
- To prepare the students for advanced courses in Communication system Circuit Design.

Sections	Course Content
Section A	Low Frequency Transistor Amplifier: Basics of BJT & FET amplifier, biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, Equivalent Circuit of BJT using h-parameter for CB,CE and CC & configuration, Calculation of Transistor Parameter for CB, CE & CC using parameters, Comparison of Transistor Amplifier Configuration. Multistage Amplifier: General Cascaded System, RC Coupled Amplifier and its Frequency Response, Merits and Demerits, Cascade Amplifier, Darlington Compound Configuration, Multistage Frequency Effect.
Section B	High Frequency Response of Transistor Amplifier: High Frequency Model for CE Configuration, Approximate CE High Frequency Model with Resistive Load, CE Short Circuit Current Gain, HF Current Gain with Resistive Load. Large Signal Amplifier: Analysis and Design of class A, B, AB, C Amplifiers, Push-pull Amplifiers, Transformer Less Output Stages, Distortion Calculations.
Section C	Tuned Amplifier: General Behavior of Tuned Amplifiers, Series and Parallel Resonant Circuit, Calculations of Circuit Impedance at Resonance, Variation of Impedance with Frequency, Q Factor of a Circuit & Coil, Bandwidth of Series and Parallel Resonant Circuit, Single Tuned Amplifiers, Voltage Gain and Frequency Response of Single Tuned Amplifiers, Double Tuned Amplifiers.

Section D	Feedback Amplifier: Feedback concept, Characteristics of Negative and Positive Feedback, Effect of Negative and Positive Feedback on Input Impedance, Output Impedance, Gain, Noise and Frequency Response. Oscillators: Classification of Oscillators, Frequency Stability of Oscillatory Circuits, Tuned based Oscillators, Hartley Oscillator, Colpitt Oscillators, Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator and Wein Bridge Oscillator, 555 Timer as a monostable and astable multivibrator.

Course Outcomes: Upon Completion of the course, the students will be able to:

CO1: Understand the design and working of BJT / FET amplifiers.
CO2: Design amplifier circuits using BJT s And FET's.
CO3: Understand the amplitude and frequency responses of common amplifier circuits.
CO4: Understand the effect of negative feedback on different parameters of an amplifier and different types of negative feedback topologies.
CO5: Understand the effect of positive feedback and able to design and working of different oscillators using BJTS.
CO6: To build, and troubleshoot Analog circuits.

Text Books:

1. Integrated Electronics: Analog and Digital Circuits and Systems by J. Millman and C. Halkias, McGraw-Hill, Inc.
2. Electronic Devices & Circuit Theory by R. Boylestad and L. Nashelsky, Pearson.

Reference Books:

1. Microelectronic Circuits by A. Sedra and K. Smith, Oxford University Press.

Name of the Course	Digital Electronics		
Course Code	**EC-3002**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests 50%, Tutorials / Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Understanding the basics of digital electronics and different number systems and conversion between them.
- Design and construction of the basic and universal logic gates.
- Study and construction of sequential logic circuits, understanding various design of flip flops.
- Studying the programmable logic devices, shift registers counters and various memory devices.

Sections	Course Content
Section A	Number System and Boolean Algebra: Digital and Analog quantities, Binary digits, logic levels & digital waveform. Review of number system (Binary, Octal, Decimal, Hexadecimal, Number base conversions), compliments, and signed binary numbers. Binary arithmetic (addition, subtraction, division, and multiplication), Binary codes: Weighted- BCD- 8421- gray code- ASCII code – Excess 3, error detecting (Parity, checksum and block parity) and correcting code(hamming code). Minimization of logic function: Binary Arithmetic(Addition, subtraction, multiplication and division) OR,AND,NOT,NOR,NAND,EX-OR, implementation of logic functions using NAND and NOR gate, Boolean postulates and laws, De –Morgan's theorem ,minimization of Boolean expression, sum of product (SOP),product of sum(POS), canonical forms , Karnaugh map, and Q-M method of minimization.
Section B	Combination Circuits: Design procedure: Binary Adders & Subtractors (half & full).magnitude Comparator, Multiplexer and Demultiplexer. Encoder/Decoder, code converters, parity generators and checkers. Digital Logic Families: Introduction to bipolar Logic families: RTL, DCTL, DTL, TTL, ECL andMOS Logic families. TTL and CMOS logic comparison in terms of threshold voltage, Fan in, Fan out, Propagation delay, Noise margin, voltage and current parameters, operating temperature and speed

	power product.
Section C	Sequential Circuit: Flip flops SR, JK, T, D and Master slave- Characteristics table & equation, Excitation table, Realization of one flip flop using other flip flops. Classification of sequential circuits, Registers. Design & analysis of synchronous and asynchronous sequential circuits: Counters.
Section D	D/A Converter and A/D converters: Basic concepts, Weighted Resistor D/A converter, R-2R Ladder D/A converter. A/D Converter: Analog to digital conversion using Successive approximation method, Dual slope method. Semiconductor Memories: program and data memory, types and terminology, SRAM and DRAM. Implementation of combinational logic ROM, PAL, and PLA.

Course outcomes: After completion of the course, the students will be able to:

CO1: understand the basics of difference between analog and digital circuits and their applications.

CO2: implement simple logical operations required for the designing of digital circuits and understand common forms of number representation.

CO3: understand the reduction of Boolean expressions for the designing of minimized logical circuits.

CO4: design and implementation of combinational circuits.

CO5: design and implementation of sequential circuits and their application.

Text Books:

1. A. Anand Kumar, Fundamentals of digital circuits, 3rd Edition, PHI.
2. M. Morris Mano, Digital Design, 4.ed., Prentice Hall of India Pvt. Ltd., New Delhi, Sixth impression /Pearson Education (Singapore) Pvt. Ltd., New Delhi.
3. Jain R. P. "Modern Digital Electronics", 3rd edition, Tata McGraw-Hill 2003.
4. Malvino and Leach "Digital principles and Applications", 5th edition, Tata McGraw Hill, 2003.

Reference Books:

1. Thomas L. Floyd, 10th Edition, Digital Fundamentals, Pearson Publications.
2. James W. Bignell and Robert Donovan, "Digital Electronics", 5th edition, Delmar Publishers, 2007.
3. Fletcher "An Engineering Approach to Digital Design", 1st edition, PHI, 2009.

Name of the Course	**Signals and Systems**		
Course Code	**EC-3003**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time:3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Understanding the fundamental characteristics of signals and systems.
- To provide with necessary tools and techniques to analyze electrical networks and systems.
- Analyze signals and systems to represent real world system in terms of both the time and transform domains.
- Develop the mathematical skills to design solutions to real world problems using convoluti on, filtering, modulation and sampling.

Sections	Course Content
Section A	Introduction to Signals and Systems: Signal basics, classification of signals, Elementary signals, Transformations of the independent variables, Exponential and Sinusoidal signals, signal operations, signal properties, Sampling and Reconstruction of signals, System basics, classification of systems, Continuous-Time Systems, Discrete-Time Systems, system properties, linearity, time/shift-invariance, causality, stability.
Section B	Linear Time-invariant Systems: Continuous-time Linear Time-invariant (LTI) system, Discrete-time LTI system, Properties of LTI systems, Impulse response and step response, response to an arbitrary input, Convolution, Correlation, System representation through linear constant coefficient differential equations.
Section C	Frequency Analysis of Signal and Systems: Fourier series representation of continuous-time periodic signals, Properties of continuous-time Fourier series, Fourier series and LTI systems, Representation of aperiodic signals, The Fourier transform for periodic signals, Properties of the Continuous-time Fourier transform (CTFT), Convolution and multiplication properties and their effect in the frequency domain. Frequency Analysis of Continuous-Time Signals, Frequency Analysis of Discrete-Time Signals, Properties of Discrete-Time Fourier Transformation (DTFT), Frequency-domain characteristics of Liner-Invariant Systems.

Section D	Laplace Transform and Z-Transform: The Laplace transforms for continuous-time signals and systems, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform, z-transformation, Properties of the Z-Transformations, Inversion of the z-transform, The One-Sided Z-transformation, Analysis of Linear-Time-Invariant Systems in the Z-Domain.

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

CO1: Classify signals and systems based on their properties and determine the response of LTI system using convolution.

CO2: Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.

CO3: Analyze system properties based on impulse response and Fourier analysis.

CO4: Apply the Laplace transform and Z- transform to analyze continuous-time and discrete-time signals and systems.

Text Books:

1. V. Oppenheim, A. S. Willsky, and S. H. Nawab, "Signals and Systems", Prentice Hall, 2nd Edition, 2003.
2. B.P. Lathi, "Principles of Linear Systems and Signals", Oxford University Press, 2nd Edition, 2009

Reference Books:

1. M. J. Roberts, "Fundamentals of Signals & Systems", Tata McGrawHill, 2007.
2. R. E. Zeimer, W. H. Tranter and R. D. Fannin, "Signals & Systems - Continuous and Discrete", Pearson Education, 2007.
3. S. Haykin and B. V. Veen, "Signals and Systems‖ 2nd Edition", Wiley, 2007.

Name of the Course	**Mathematics-III**		
Course Code	**ES-3005**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time:3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To familiarize students with the concept of Eigen values and diagonalization of a matrix which have many applications in Engineering.
- To understand the concept of vector differential operators and their physical interpretation.
- To provide the concepts and the understanding of basics in Partial Differential equations.

Sections	Course Content
Section A	Linear dependence of vectors and rank of matrices, linear transformations and inverse of matrices , reduction to normal form , bilinear form and quadratic form , consistency and solution of linear algebraic system of equation , Eigen values , Eigen vectors and their applications to system of ordinary differential equations, Cayley Hamilton theorem, orthogonal, unitary Hermitian and similar matrices.
Section B	Differential calculus of functions of several variables, partial differentiation, homogeneous functions and Euler's theorem, Taylor's and Maclaurin's series, Taylor's theorem for functions of two variables maxima and minima of functions of several variables, Langrange's method of multipliers.
Section C	Double and triple integrals, change of order of integration, change of variables, applications to evaluation of area, surface area, and volume. Scalar and vector fields differentiation of vectors, velocity and acceleration, vector differential operators Del, Gradient, Divergence and Curl and their physical interpretations, formulae involving these operators, line, surface and volume integrals, solenoid and irrotational vectors, Green's theorem, Gauss divergence theorem, Stoke's theorem and their applications.

Section D	Formulation and classification of partial differential equations, solution of first order linear equations, standard forms of non- linear equations, Charpit's method, linear equations with constant coefficients, non-homogenous linear equations, Monge's method for non-homogenous equations of second order, separation of variables methods for solution for solution of heat, wave and Laplace equation.

Course Outcomes: After completing the course, students should be able to:

CO1: Solve qualitative problems based on vector analysis and matrix analysis such as linear independence and dependence of vectors, rank etc.

CO2: Know the applications of double and triple integration in finding the area and volume.

CO3: Know about qualitative applications of Gauss, Stoke's and Green's theorem.

CO4: To describe real time engineering problems using PDEs.

Text Books:

1. E Kreyszig, "Advanced Engineering Mathematics", 8th Ed. John Wiley, Singapore (2001)
2. R K Jain and S R K Iyengar, Advanced Engineering Mathematics", 2nd Ed, Narosa Publishing House, New Delhi (2003).
3. I A N Sneddon, "Elements of Partial Differential Equations", Tata McGraw Hill, Delhi (1974).

Reference Books:

1. B S Grewal, "Higher Engineering Mathematics", Thirty –fifth edition, Khanna Publishers, Delhi.

Name of course	**Principles of Engineering Economics**		
Course code	**HSMC-3001**	Credits -2	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	**Max Marks: 100**	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To make fundamentally strong base for decision making skills by applying the concepts of economics.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision making process to justify or reject alternatives/projects.

Sections	Course Content
Section A	Economics: Definitions; Nature & scope of Economics; Economics Systems-meaning of Capitalism; Socialism & mixed economy. Demand and supplies analysis: Law of demand and supply, exception to the law of demand; Elasticity of demand and supply and their types; Methods of measuring elasticity of demand and supply.
Section B	Theory of Production: Scales of production, Law of returns; Break even analysis. MONETARY SYSTEM: Monetary policy Meaning; objectives, methods; Fiscal policy Meaning & objectives of fiscal policy in a developing country like India; Functions of Reserve Bank of India and commercial banks. Economics &Business Environment: Privatization; Growth of private capitalism in India; Business/Trade Cycles – Meaning; Characteristics & classification; foreign capital & economic development.
Section C	Management Principles: Meaning & types of Management; Concept of Scientific Management; Management by Objectives; System Approach to Management. Financial Management: Meaning; Functional areas of financial management; Sources of Finance; Meaning of financial accounting; accounting principles-concepts & conventions; Importance of final accounts – profit & loss a/c and balance sheet; Need and importance of capital budgeting.

	Marketing Management: Introduction to marketing management; Market segmentation; Developing & managing advertising programs; Deciding on media & measuring effectiveness.
Section D	Production Management: Procedure for production planning & Control; Plant Location & Lay-out; Routing; Scheduling; CPM & PERT Quality Management: Quality Management System, Quality Management Principles, ISO 9001 Structure, Quality Audits, ISO Registration, Requirements, Benefits of ISO registration.

Course Outcomes: Upon completing the course, students will be able to:

CO1: Understand major principles of economic analysis for decision making among alternative courses of action in engineering.

CO2: Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.

CO3: Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.

CO4: understand the aspects related to management and its applicability in engineering.

Text Books:

1. B.P. Singh, T.N. Chabra, "Business Organisation & Management", Dhanpat Rai & Sons
2. K .K. Dewett, "Modern Economic Theory", S. Chand & Co.
3. Philip Kotler, "Marketing Management", Prentice Hall of India
4. I.M. Pandey, "Financial Management", Vikas Publishing House

Reference Books:

1. Ruddar Dutt, K. P. M. Sundaram, "Indian Economic", S. Chand & Co.
2. H.L. Ahuja, "Advanced Economic Theory", S. Chand & Co.
3. Dr. B.S. Goel, "Production Operation Management", Pragati Prakash.
4. Grant, Leaven Worth, "Statistical Quality Control", Tata Mc. Graw Hill.
5. Edwin B. Flippo, "Personnel Management" , Tata Mc Graw Hill.
6. Grant, Leaven Worth, "Management-A Global Perspective"TMH.

Name of the Course	Analog Electronics Lab		
Course Code	**EC-3051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	30 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To study the working of Hartley Oscillator and measure the frequency of oscillations.
2	To study the working of Colpit's Oscillator and measure the frequency of oscillations.
3	To study the functioning of Crystal Oscillator and measure the frequency of oscillations.
4	To study the frequency response of two-stage RC coupled amplifier and find the voltage gain.
5	To identify the type of feedback used in an amplifier and determine the voltage gain.
6	To study the push-pull amplifier and plot the frequency response.
7	To study the transformer coupled amplifier and determine the frequency response.
8	To study the voltage gain and frequency response of FET amplifier.
9	To study the astable, monostable and bistable multivibrators and their timing parameter.

Course Outcomes: Upon Completion of the course, the students will be able to:

CO1: Understand the design and working of BJT / FET amplifiers.

CO2: Design amplifier circuits using BJT s And FET's.

CO3: Understand the amplitude and frequency responses of common amplifier circuits.

CO4: Understand the effect of negative feedback on different parameters of an amplifier and different types of negative feedback topologies.

Text Books:

1. Integrated Electronics: Analog and Digital Circuits and Systems by J. Millman and C. Halkias, McGraw-Hill, Inc.
2. Electronic Devices & Circuit Theory by R. Boylestad and L. Nashelsky, Pearson.

Reference Books:

1. Microelectronic Circuits by A. Sedra and K. Smith, Oxford University Press.

Name of the Course	Digital Electronics Lab		
Course Code	EC-3052	Credits-1	L-0, T-0, P-2
Total Practical Sessions	26 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Verify the truth tables of all logic gates on trainer kit using TTL ICs.
2	Design and implement half and full adder using basic/universal gates.
3	Design and implement half and full subtractor using basic/universal gates.
4	To design and verify the operation of magnitude comparator.
5	Implementation of 4x1 multiplexer using logic gates.
6	Implementation of 1x4 de-multiplexer using logic gates.
7	Design and implement a code converter that converts gray code to binary code and vice-versa.
8	To verify the truth tables of S-R; J-K; T and D type flip flops.
9	To verify the operation of SISO, SIPO, PISO and PIPO shift register.
10	Design, and verify the 4- bit synchronous counter.
11	Design, and Verify the 4-Bit asynchronous counter.
12	Implement and verify the operation of BCD to 7 segment display.

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

CO1: understand the digital logic and create various systems by using these logics.
CO2: develop an understanding of design and simulation of digital logic circuits.
CO3: get a basic understanding of layout of electronic circuits.
CO4: use the Multisim tool for design and simulation.

Text Books:

1. A. Anand Kumar, Fundamentals of digital circuits, 3rd Edition, PHI.
2. M. Morris Mano, Digital Design, 4.ed., Prentice Hall of India Pvt. Ltd., New Delhi, Sixth impression /Pearson Education (Singapore) Pvt. Ltd., New Delhi.
3. Jain R. P. "Modern Digital Electronics", 3rd edition, Tata McGraw-Hill 2003.
4. Malvino and Leach "Digital principles and Applications", 5th edition, Tata McGraw Hill, 2003.

Reference Books:

1. Thomas L. Floyd, 10th Edition, Digital Fundamentals, Pearson Publications.
2. James W. Bignell and Robert Donovan, "Digital Electronics", 5th edition, Delmar Publishers, 2007.
3. Flecther "An Engineering Approach to Digital Design", 1st edition, PHI, 2009.

SEMESTER-IV

Name of the Course	**Microelectronics and VLSI**		
Course Code	**EC-4001**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Be familiar with the MOSFET physical structure and operation, electrical characteristics, circuit models and basic circuit applications.
- To develop the ability to analyze and design microelectronic circuits
- Understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon, computer aided simulation and synthesis tool for hardware design.

Sections	Course Content
Section A	MOSFET overview: Structure and Electrical Characteristics, Second-Order Effects - MOSFET Capacitance- MOSFET scaling techniques-MOSFET Device Model.
Section B	VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structure)
Section C	Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist ; Basic CMOS Technology – (Steps in fabricating CMOS , Basic n-well CMOS process, p-well CMOS process, Twin tub process , Silicon on insulator; Layout Design Rule: Stick diagram with examples, Layout rules.
Section D	CMOS inverter: static and dynamic characteristics; VTC, Power-Speed Trade-Off, power dissipation, CMOS logic circuits, NAND & NOR Gates, Complex logic circuits, CMOS Full Adder, CMOS Transmission GATE

Course Outcomes: After studying this course, students will be able to:

CO1: Understand the underlying physics and principles of operation of MOS field effect transistors (MOSFETs).

CO2: To be aware about the trends in semiconductor technology, and how it impacts scaling and its effect on device density, speed and power consumption.

CO3: To understand MOS transistor as a switch and its capacitance.

CO4: Student will be able to design digital systems using MOS circuits (Static and Switching characteristics of inverters).

CO5: Able to learn Layout, Stick diagrams, Fabrication steps.

Text Books:

1. B. Razavi, "Fundamentals of Microelectronics", 2nd edition, Wiley, 2013.
2. S.M. Kang & Y. Leblebici, "CMOS Digital Integrated Circuits-Analysis & Design", McGraw-Hill, 4th edition, 2016.
3. S.M. Sze, "VLSI Technology", TMH, 2nd edition, 2003.
4. S.K. Gandhi, "VLSI Fabrication Principles", John Willey & Sons, 2nd edition, 2008.

Reference Books:

1. B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", PHI, 6th edition, 2009.
2. Sedra and Smith, Microlectronics Circuits, Oxford University Press, 7th edition, 2017.

Name of the Course	**Analog and Digital Communication**		
Course Code	**EC-4002**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To provides a thorough introduction to the basic principles and techniques used in analog and digital communications.
- To introduce analog and digital modulation techniques, communication receiver and transmitter design, baseband and bandpass communication techniques, line coding techniques, noise analysis, and multiplexing techniques.

Sections	Course Content
Section A	Modulation Techniques Definition of communication, Block Diagram of Communication System, Various frequency bands used for communication, Types of Communication and need of modulation. Introduction to AM, FM, PM, frequency spectrum of AM Waves, Representation of AM, Frequency spectrum of AM waves, Power relation in AM waves, Mathematical representation of FM, Phase Modulation, Mathematical Representation of Phase modulation, Comparison between analog and digital modulation, wide band and narrow band FM.
Section B	Transmitters & Receivers AM Transmitters: Generation of AM, low level and high level modulation, comparison of levels, AM transmitter block diagram, AM Receiver: Super heterodyne receiver, AM receiver characteristics, Generator of SSB, Demodulation of SSB, FM Transmitters: Basic requirements and generation of FM, FM Modulation methods, FM Receivers: Block diagram of FM Receivers, RF Amplifiers, FM Receiver characteristics, Pulse amplitude modulation and demodulation.
Section C	Principles of Digital Data transmission Digital communication system, Nyquist criterion for distortion less baseband binary transmission, Digital receivers and regenerative repeaters, Digital Pulse Modulation technique: Analog and Digital Multiplexing, Quantization, Elements of Pulse code modulation system, Transmission Bandwidth of PCM

	system, DPCM, Delta modulation, Adaptive delta modulation-Design of typical systems and performance analysis.
Section D	Digital Modulation & Spread Spectrum Systems Digital Modulation Techniques: Digital carrier system, Method of generation and detection of coherent & non-coherent binary ASK, FSK & PSK, Differential phase shift keying, Quadrature modulation techniques, Spread spectrum Communications: Frequency Hopping Spread Spectrum (FHSS) systems, Multiple FHSS user system and performance, application of FHSS, Direct Sequence Spread Spectrum (DSSS), Features of DSSS, Code Division Multiple Access of DSSS.

Course Outcomes: Upon completion of this course, students should be able to:

CO1: Understand basic elements of a communication system

CO2: Conduct analysis of baseband signals in time domain and in frequency domain

CO3: Demonstrate understanding of various analog and digital modulation and demodulation techniques.

CO4: Appreciate the importance of synchronization in communication systems.

Text Books:

1. H. Taub, D L Schilling, Goutom Saha, "Principles of Communication", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd.
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley India.
3. John G. Proakis, "Digital Communications", 4th Edition, McGraw-Hill International
4. Electronic Communication systems by Tomasi.

Reference Books:

1. Digital Communication system by Dr. Sanjay Sharma.
2. Electronic Communication systems by George Kennedy.
3. Analog Communication System by Dr. Sanjay Sharma

Name of the Course	**Linear Integrated Circuit**		
Course Code	**EC-4003**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculator is allowed.

Course Objectives:

- To understand the basic concepts of operational amplifier and its various applications.
- Analyze circuits for inverting and non inverting amplifiers and differential amplifier.
- Elucidate and design the active filter oscillators.
- Identify the needs of voltage regulators and timers.

Sections	Course Content
Section A	Differential amplifiers: Introduction, Differential Amplifier configurations– Dual Input-Balanced output, Dual Input-Unbalanced output, Single Input-Balanced output, Single Input-Unbalanced output Differential amplifier with their DC and AC analysis, Differential amplifier using FET, Differential amplifier with swamping resistors, Constant current bias, Current mirror, Cascaded differential amplifier Stages, Level Translator, Cascode amplifier.
Section B	Introduction to Op-amps: Block diagram of a typical Op-Amp, Schematic symbol, Characteristics and performance parameters of ideal Op-Amp, Open loop configurations: Differential, Inverting &Non Inverting. Practical Op-Amp: offset voltage analysis and compensation, input bias and offset current analysis and compensation, Change in Input offset voltage and Input offset current with time, Temperature and supply voltage, Common mode configuration and Common mode rejection Ratio, Frequency response, slew rate.
Section C	Op-amp with Negative Feedback: Block diagram representation of feedback configurations, Voltage-series and Voltage–shunt feedback amplifier, Differential amplifiers-using one op-amp, two op-amps, three op-amps. Op-amp Applications: DC and AC amplifiers, Peaking amplifiers, Summing,

	Scaling and Averaging amplifiers, Differential amplifier, Instrumentation amplifiers, V to I and I to V converters, Differentiator and integrator, A to D and D to A converters, Log and antilog amplifiers, Sample and hold circuits, Schmitt trigger.
Section D	Active Filters and Oscillators: Active filters- Low-Pass, High-Pass, Band-Pass, Band-Reject Butterworth filters, State variable filters, All pass filters, Sallen and Key structures, Introduction to Chebyshev and Cauer Filters, phase-shift & Wein bridge Oscillators, Square wave, triangular wave and saw-tooth wave generators, Voltage controlled oscillator. Specialised ICs: Phase Locked Loop-Operating principles and applications, Voltage Regulators - Fixed, adjustable and switching regulators, 555 Timer- its applications as Monostable and Astable multivibrators.

Course Outcomes: Upon completion of this course, students should be able to

CO1: Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.

CO2: Elucidate and design the linear and non-linear applications of an op amp and special application Ics.

CO3: Explain and compare the working of multivibrators using special application IC 555 and general purpose op amp.

CO4: Illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication.

Text Books:

1. Gayakwad Ramakant A., "Op-amps and Linear Integrated Circuits", 4th edition, Pearson Education Inc, Delhi, 2000.
2. Botkar K B, "Integrated Electronics", 10th edition, Khanna Publishers, 2005.
3. Sedra, Adel S and Smith, Kenneth C, "Microelectronic Circuits", 5th edition, Oxford University Press, 2005.

Reference Books:

1. Roy Choudhary D and Jain Shail, "Linear Integrated Circuits", 3rd edition, New Age International Publishers, 2007.
2. Michael Jacob, Applications and design with Analog Integrated Circuits", 2nd edition, PHI.

Name of the Course	**Electromagnetic Field Theory**		
Course Code	**EC-4004**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Create and develop the basic skills to design various applications involve electromagnetic fields.
- Analyse Maxwell's equation and apply them to diverse engineering problems.
- Apply the concept of electromagnetism in modern communications such as antenna and microwave engineering.

Sections	Course Content
Section A	Vector Analysis: Introduction to Coordinate systems and Transformation, Differential Length, Area and Volume, Line, Surface and Volume Integrals, Del Operator, Gradient, Divergence and Curl, Stoke's Theorem, Divergence Theorem, Laplacian of a Scalar.
Section B	Electrostatics : Coulomb Law, Permittivity and Electric flux density, Gauss Law, Applications of Gauss's Law, Electric potential, Continuity Equation, Relaxation time, boundary conditions, Poisson's and Laplace's Equations. Magnetostatics: Biot Savart Law, Ampere's circuit law and its application, Magnetic flux and magnetic flux density, Derivation of the steady magnetic field laws
Section C	Waves and Applications: Faraday's law, Transformer and Motional EMFs, Displacement current, Maxwell's equations in point form and integral form for steady fields, Phasor form of Maxwell's equation. Electromagnetic Wave Propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plane waves in good conductors, power and the pointing vector, Reflection at boundaries.

Section D	Transmission lines and Antenna Introduction: Introduction, Circuit representation of parallel plane transmission lines, Transmission lines with losses, Characteristic impedance, Propagation constant, Attenuation constant and phase constant, Reflection, Reflection coefficient, Expression for input impedance in terms of reflection coefficient, Standing wave ratio (SWR), Relation between SWR and reflection coefficient, Principle of impedance matching devices, Smith Chart Antenna Introduction: Basic antenna parameters: Reflection and Radiation Mechanism: Patterns, Beam area (or Beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and Gain G, Antenna apertures, Antenna temperature, Antenna impedance.

Course outcomes: Upon completion of this course, students will:

CO1: Get ready for advanced courses in antenna, microwave, radar, and wireless Communication.

CO2: Able to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems.

CO3: Have knowledge of physical interpretation, and ability to apply Maxwell's equations to determine field waves, potential waves, energy and charge conservation conditions.

CO4: Be familiar with Electromagnetic wave propagation and wave polarization.

Text Books:

1. Matthew N.O. Sadiku, "Principles of Electromagnetics", Oxford University Press.

Reference Books:

1. William H. Hayt, Jr And John A. Buck, "Engineering Electromagnetics", McGraw Hill Education.
2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, McGraw Hill, 2017

Name of course	**Organizational Behaviour**		
Course code	**HSMC-4001**	Credits -2	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Course Objectives:

- To expose the students to basic concepts of management.
- To equip the students with requisite knowledge, skills & right attitude necessary to understand behavioral processes at individual, team and organizational level.
- To provide effective leadership in a global environment.

Sections	Course Content
Section A	Organizational Behaviour: Learning objective, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager LEARNING: Nature of learning, How learning occurs, Learning & OB
Section B	Personality: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB Perception: Meaning & Definition, Perceptual process, Importance of Perception in OB Motivation: Nature & Importance, Herzberg's Two Factor theory and Maslow's Need Hierarchy theory
Section C	Groups In Organisation: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building Leadership: Leadership & management, Theories of leadership- Trait theory, Behavioral Theory Contingency Theory, Leadership & Followership, How to be an Effective Leader Conflict: Nature of Conflict & Conflict Resolution

Section D	Organizational Culture And Climate: Factors affecting organizational climate, Importance. Job Satisfaction: Determinants, Measurements, Influence on behaviour, Stress: Work Stressors, Prevention and Management of stress, Balancing work and Life.

Course outcomes: At the end of the course, student will able to:

CO1: Identify and discuss the role and importance of organizational behaviour in engineering.

CO2: Identify and discuss the issues and concepts related behavior.

CO3: Identify and discuss issues related to working in organisation.

CO4: Identify and discuss the complex issues related to management.

Text Books:

1. Organizational Behaviour by Robbins, S.P., Prentice Hall of India.
2. Organizational Behavior by Luthans F., McGraw-Hill.

Reference Books:

1. Human Behaviour at Work: Organizational Behaviour by Davis K., Tata McGraw Hill.

Name of the Course	Microelectronics and VLSI Lab		
Course Code	**EC-4051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	30 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Introduction to Tanner and Cadence EDA simulation tool.
2	To simulate N-MOS transistor and obtain its transfer and output characteristics.
3	To simulate P-MOS transistor and obtain its transfer and output characteristics.
4	To simulate CMOS inverter, obtain their VTC.
5	Transient analysis of CMOS inverter.
6	To simulate NAND and NOR logic gate using CMOS and study its performance.
7	To simulate EX-OR and EX-NOR logic gate using CMOS and study its performance.
8	Layout extraction and simulation of NMOS.
9	Layout extraction and simulation of PMOS.
10	Layout extraction and simulation of CMOS inverter.

Course Outcomes: After completion of this Lab, the student will

CO1: be familiar with various EDA tools.
CO2: understand the characteristics of various electronic components.
CO3: design and analyze the characteristics of various CMOS circuits.
CO4: draw the layout of different schematics.

Text Books:

1. B. Razavi, "Fundamentals of Microelectronics", 2nd edition, Wiley, 2013.
2. S.M. Kang & Y. Leblebici, "CMOS Digital Integrated Circuits-Analysis & Design", McGraw-Hill, 4th edition, 2016.
3. S.M. Sze, "VLSI Technology", TMH, 2nd edition, 2003.
4. S.K. Gandhi, "VLSI Fabrication Principles", John Willey & Sons, 2nd edition, 2008.

Reference Books:

1. B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", PHI, 6th edition, 2009.
2. Sedra and Smith, Microlectronics Circuits, Oxford University Press, 7th edition, 2017.

Name of the Course	Analog and Digital Communication Lab		
Course Code	**EC-4052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	30 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To study amplitude modulation and amplitude demodulation and calculation of modulation index.
2	To study frequency modulation and frequency demodulation and calculation of modulation index.
3	Generation of DSB-SC signal using balanced modulator, single sideband signal.
4	Study of phase lock loop and detection of FM signal using PLL.
5	Measurement of noise figure using a noise generator.
6	Study of super heterodyne AM receiver and measurement of sensitivity, selectivity & fidelity.
7	Study of pulse code modulation and demodulation.
8	Study of delta modulation and demodulation and observe effect of slope overload.
9	Study of amplitude shift keying modulator and demodulator.
10	Study of frequency shift keying modulator and demodulator.
11	Study of phase shift keying modulator and demodulator.

Course Outcomes: After studying this course the students will be able to:

CO1: identify and describe different analog modulation techniques.

CO2: design and measure AM, FM, QPSK, and spread spectrum communication systems.

CO3: routinely use communications test equipment.

CO4: gain the knowledge of different digital modulation techniques.

Text Books:

1. H. Taub, D L Schilling, Goutom Saha, "Principles of Communication", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd.
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley India.
3. John G. Proakis, "Digital Communications", 4th Edition, McGraw-Hill International
4. Electronic Communication systems by Tomasi.

Reference Books:

1. Sanjay Sharma, "Digital Communication System".
2. George Kennedy, "Electronic Communication Systems".

SEMESTER-V

Name of the Course	**Microprocessor and Microcontroller**		
Course Code	**EC-5001**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To introduce basics of microcontrollers and microprocessor, their architecture, internal organization and their functions, interfacing an external device with the controllers/processor.
- To provide strong foundation for designing real world applications using microprocessors and microcontroller.

Sections	Course Content
Section A	Introduction to Microprocessor: Microprocessor architecture and its operations, Memory, Input & output devices, The 8085 MPU- architecture, Pins and signals, Timing Diagrams, Logic devices for interfacing, Memory interfacing, Interfacing output displays, Interfacing input devices, Memory mapped I/O.
Section B	Basic Programming concepts:, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing. Additional data transfer and 16 bit arithmetic instruction, Logic operation: rotate, compare, counter and time delays, 8085 Interrupts.
Section C	16-bit Microprocessors (8086): Architecture, Pin Description, Physical address, segmentation, memory organization, Addressing modes. Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.

Section D	8051 Microcontroller Basics: Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, I/O Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes. Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions.

Course outcomes: After the completion of the course the students will be able to:

CO1: Identify a detailed s/w & h/w structure of the Microprocessor.

CO2: Interface different external peripheral devices with microprocessors and microcontrollers.

CO3: Distinguish and analyze the properties of Microprocessors & Microcontrollers.

CO4: Analyze the data transfer information through serial & parallel ports.

Text Books:

1. Ramesh Gaonkar, "Microprocessor architecture, programming, and application with the 8085", Penram International, 2002.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
3. Doughlas V. Hall, Microprocessors and Interfacing, TMH, 2nd edition, 2006.

Reference Books:

1. Ashok Kumar Mukhopadhyay, "Microprocessor, Microcomputer and Their Applications", 3rd Edition, Alpha Science International Limited, 2007.
2. K. Uma Rao, Andhe Pallavi, "The 8051 microcontrollers, architecture and programming and applications", Pearson, 2009.
3. Liu & Gibson, "Microcomputer Systems - The 8086/8088 Family Architecture, Programming and Design", Prentice Hall of India, 2nd Ed, 2006.

Name of the Course	**Measurement & Instrumentation**		
Course Code	**EC-5002**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To provide overview of basic measurement characteristics and system
- Analyze the working principle of electronic instruments.
- Demonstrate ability to select suitable instrument for measurement of physical quantity.

Sections	Course Content
Section A	Measurement Fundamentals & Errors: Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Measurements SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors. MEASUREMENT OF RESISTANCE: Wheat stone bridge, Carey-Foster Bridge, Kelvin doublebridge, Measurement of Insulation resistance.
Section B	DC & AC Measurement: Analog Ammeter, Voltmeter and Ohmmeters, PMMC, Moving Iron, Electro-dynamometer, Electrostatic, Ohmmeter, Digital type voltmeter, AC voltmeter using rectifier, Digital VOM meter, CRO. A-C BRIDGES: Maxwell Inductance bridge. Maxwell Inductance Capacitance Bridge, Anderson's Bridge, Hay's Bridge, De-Sauty's Bridge, Schering's bridge and Wein's bridge.
Section C	Transducers: Principles, classification, Guidelines for selection, Requirements, Types and Application of Transducers, Resistance, Capacitance, inductance Transducers, Potentiometer, Strain gauges, LVDT, Piezo-Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Photosensitive Device, Capacitive transducer, Micro-sensors (Pyroelectric sensors, Thermo sensors using Semiconductor devices, Thermal radiation sensor), Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, Proximity and displacement.

Section D	Signal Generators & Analyzers: Function generators, RF signal generators, Sweep Frequency generator, Frequency synthesizer, Wave analyzer, Harmonic distortion analyzer, Spectrum analyzer.

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

CO1: Understand philosophy of Measurement system

CO2: Identify the various parameters that are measurable in electronic instrumentation.

CO3: Employ appropriate instruments to measure given sets of parameters.

CO4: Practice the construction of testing and measuring set up for electronic systems.

Text Books:

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co. 2010.
2. William D Cooper & Albert C. Helfric, "Electronic Instrumentation & Measurement" PHI Pub.
3. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 2013.
4. Doebelin E.O. and Manik D.N., "Measurement Systems-Applications and Design", Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

Reference Books:

1. H.S. Kalsi, "Electronic Instrumentation", McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd, 2015.
3. David Bell, "Electronic Instrumentation & Measurements", Oxford University Press, 2013.
4. Clyde N. Herrick, "Instruments & Measurement for Electronic".
5. Alan. S. Morris, "Principles of Measurements and Instrumentation", 2nd Edition, Prentice Hall of India, 2003.

Name of the Course	**Digital Signal Processing**		
Course Code	**EC-5003**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems.

Sections	Course Content
Section A	Discrete-Time Signals And Systems: Basic Elements of a Digital Signal Processing System, Advantages of Digital Signal Processing, Classification of Signals, The Concept of Frequency In Continuous-Time and Discrete-Time Domain, Discrete-Time Signals and Systems, Analysis Of Discrete-Time Linear Shift-Invariant Systems, Linearity, Causality And Stability Criterion, Discrete-Time Systems Described By Difference Equations.
Section B	Discrete-Time Fourier Transform: The Fourier Transform of Discrete-Time Signals (DTFT), Properties of the DTFT, The Frequency Response of An LTI Discrete-Time System, The Fourier Series Of Discrete-Time Signals (DTFS). Discrete Fourier Transform: Frequency Domain Sampling and The DFT, Properties of The DFT, Linear Filtering Methods Based on The DFT, Efficient Computation of the DFT: Decimation-In-Time And Decimation-In Frequency Fast Fourier Transform Algorithms.
Section C	Z-Transform: Introduction To The Z-Transform & The Inverse Z-Transform, Properties of The Z-Transform, Relationship Between The Fourier Transform And The Z-Transform, Rational Z-Transforms & The System Function, Analysis of Linear Time-Invariant Systems In The Z-Domain. Digital Filter Structures: Digital Filter Categories, Realization Structures For FIR & IIR Digital Filters, Representation of Numbers: Fixed-Point, Floating Point, Error Resulting From Rounding And Truncation.

Section D	Digital Filter Design: General considerations; design of IIR filter from analog filters: IIR filter design using Approximation of derivative, impulse invariant method, Bilinear transformation; Design of linear phase FIR digital filters: Symmetry and Anti-symmetry FIR filters, FIR digital filter design using the windowing method and the frequency-sampling method.

Course Outcomes: Upon successful completion of this course the students will be able to:

CO1: interpret, represent and process discrete/digital signals and systems.
CO2: thorough understanding of frequency domain analysis of discrete time signals.
CO3: design & analyze DSP systems like FIR and IIR Filter etc.
CO4: Understanding of spectral analysis of the signals.

Text Books:

1. Digital Signal Processing: Principles, Algorithms and Applications by John G. Proakis & Dimitris G. Manolakis; Pearson Education.

Reference Books:

1. Digital Signal Processing by Sanjit K. Mitra; Tata McGraw Hill Publication.
2. Digital Signal Processing by P Ramesh Babu; SCITECH Publication (India) Pvt Ltd.

Name of the Course	Microprocessors and Microcontrollers Lab		
Course Code	**EC-5051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	30 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two numbers.
2	Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two numbers.
3	To find the largest and smallest number in an array of data using 8085 instruction set.
4	To write a program using 8086 to arrange an array of data in ascending and descending order.
5	To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8086 instruction set.
6	To convert given Hexadecimal number into its equivalent BCD number and vice versa using 8086 instruction set.
7	To interface 8253 programmable interval timer and verify the operation of 8253 in six different modes.
8	Serial communication between two 8085 through RS-232 C port.
9	Write a program to generate 10 kHz square wave using 8051.
10	Interfacing of Stepper motorto.8051.
11	Interfacing of ADC to 8051.

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

CO1: Understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller.
CO2: Work with standard microprocessor real time interfaces.
CO3: Troubleshoot interactions between software and hardware.
CO4: Choose the appropriate programming level for a specified application.

Text Books:

1. Ramesh Gaonkar, "Microprocessor architecture, programming, and application with the 8085", Penram International, 2002.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
3. Doughlas V. Hall, Microprocessors and Interfacing, TMH, 2nd edition, 2006.

Reference Books:

1. Ashok Kumar Mukhopadhyay, "Microprocessor, Microcomputer and Their

Applications", 3rd Edition, Alpha Science International Limited, 2007.
2. K. Uma Rao, Andhe Pallavi, "The 8051 microcontrollers, architecture and programming and applications", Pearson, 2009.
3. Liu & Gibson, "Microcomputer Systems - The 8086/8088 Family Architecture, Programming and Design", Prentice Hall of India, 2nd Ed, 2006.

Name of the Course	Measurement & Instrumentation Lab		
Course Code	**EC-5052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	30 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To measure the unknown Inductance in terms of capacitance and resistance by using Maxwell's Inductance bridge.
2	To measure unknown Inductance using Hay's bridge.
3	To measure unknown capacitance of small capacitors by using Schering's bridge.
4	To measure unknown capacitance using De-Sauty's bridge.
5	To measure unknown frequency using Wein's frequency bridge.
6	To measure unknown low resistance by Kelvin's Double bridge.
7	To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure as mall displacement.
8	To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
9	Study of Spectrum Analyzers.
10	Study of the characteristics of Thermistor.
11	Project based on SENSOR (Hardware).

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

CO1: recognize the evolution and history of units and standards in Measurements.
CO2: identify the various parameters that are measurable in electronic instrumentation.
CO3: employ appropriate instruments to measure given sets of parameters.
CO4: practice the construction of testing and measuring set up for electronic systems.
CO5: to have a deep understanding about instrumentation concepts that can be applied to Control systems.

Text Books:

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co. 2010.
2. William D Cooper & Albert C. Helfric, "Electronic Instrumentation & Measurement" PHI Pub.
3. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 2013.
4. Doebelin E.O. and Manik D.N., "Measurement Systems-Applications and Design", Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

Reference Books:

1. H.S. Kalsi, "Electronic Instrumentation", McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd, 2015.
3. David Bell, "Electronic Instrumentation & Measurements", Oxford University Press, 2013.
4. Clyde N. Herrick, "Instruments & Measurement for Electronic".
5. Alan. S. Morris, "Principles of Measurements and Instrumentation", 2nd Edition, 2003.

Name of the Course	**Digital Signal Processing Lab**		
Course Code	**EC-5053**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	30 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Generation of Basic continuous and discrete signals.
2	Write a MATLAB program to find the linear convolution of two discrete signals.
3	Write a MATLAB program to find the correlation of two signals.
4	Write a MATLAB program to find the circular convolution of two discrete signals.
5	Write a MATLAB program to find the DFT and IDFT of a discrete signal using FFT algorithm.
6	Write a MATLAB program to find the Z-transform of a discrete signal.
7	Design a FIR filters (LPF, HPF, BPF and BSF) using windowing technique and plot their magnitude and phase spectrum.
8	Design a FIR filters (LPF, HPF, BPF and BSF) using frequency sampling technique and plot their magnitude and phase spectrum.
9	Design a Butterworth IIR filters (LPF, HPF, BPF and BSF) and plots their magnitude and phase spectrum.
10	Design a Cheby-I and Cheby-II IIR filters (LPF, HPF, BPF and BSF) and plot their magnitude and phase spectrum.
11	Design a filter to remove noise from a signal.
12	Introduction toTMS320C6713Processor.
13	Addition, Subtraction and multiplication in fixed point representation.
14	Addition, Subtraction and multiplication in floating point representation.
15	Linear Convolution using DSP kit. Note: The concerned Course Coordinator will prepare the actual list of experiments/problems at the start of semester based on above generic list.

Course Outcomes: Upon successful completion of this course the students will be able to:

CO1: interpret, represent and process discrete/digital signals and systems.
CO2: thorough understanding of frequency domain analysis of discrete time signals.
CO3: design & analyze DSP systems like FIR and IIR Filter etc.
CO4: Understanding of spectral analysis of the signals.

Text Books:

1. Digital Signal Processing: Principles, Algorithms and Applications by John G. Proakis & Dimitris G. Manolakis; Pearson Education.

Reference Books:

1. Digital Signal Processing by Sanjit K. Mitra; Tata McGraw Hill Publication.
2. Digital Signal Processing by P Ramesh Babu; SCITECH Publication (India) Pvt Ltd.

SEMESTER-VI

Name of the Course	**Control Systems**		
Course Code	**EC-6001**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To be able to analyze a working mathematical model of control systems.
- To be perform time-domain and frequency-domain analyses of the mathematical model to predict the transient and steady state system performance.
- Design a stable control system satisfying requirements of stability and reduced steady state error.

Sections	Course Content
Section A	Introduction to Control Systems: Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, free body diagram, analogous Systems, sensors and encoders in control systems.
Section B	Time Response Analysis: Standard test signals. Time response of first and second order systems for standard test inputs. 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.
Section C	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.

Section D	State variable Analysis and Introduction to Controllers: 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. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Integral and Derivative Controllers, Lead and Lag compensation in designs.

Course Outcomes: After the completion of the course students will be able to :

CO1: understand the working of control system via mathematical modelling.

CO2: analyze the behavior of the control system in both time and frequency domain.

CO3: analyse the mechanisms and operation of various control systems.

CO4: develop their mathematical model of feedback control systems.

Text Books:

1. Nise Norman S., Control Systems Engineering, Wiley India, 7th edition (2018)
2. I. J. Nagrath and M. Gopal, Control system Engineering, New Age International, 5th edition (2009).

Reference Books:

1. Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, (2000).
2. Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, (1991).

Name of the Course	**Antenna & Wave Propagation**		
Course Code	**EC-6002**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidate: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Students will be introduced to antennas, their principle of operation.
- Antenna analysis and their applications.
- Introduce the student to wave propagation over ground, through troposphere and ionosphere; diversity principles.
- Propagation effects in microwave systems, satellite, space, and radar links.

Sections	Course Content
Section A	Antennas Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area (or Beam Solid Angle) ΩA, Radiation Intensity, Beam Efficiency, Directivity D and Gain G, Directivity and Resolution, Antenna Apertures, Effective Height, The radio Communication link, Fields from Oscillating Dipole, Single-to-Noise Ratio(SNR), Antenna Temperature, Antenna Impedance.
Section B	Point Sources and Their Arrays: Introduction, Point Source, Power Theorem and its Application to an Isotropic Source, Radiation Intensity, Arrays of Two Isotropic Point Sources, Non-isotropic but Similar Point Sources Electric Dipoles, Thin Liner Antennas and Arrays of Dipoles and Apertures The Short Electric Dipole, The Fields of a Short Dipole, Radiation Resistance of Short Electric Dipole, Thin Linear Antenna, Radiation Resistance of λ/2 Antenna, Array of Two Driven λ/2 Elements: Broadside Case and End-Fire Case, Horizontal Antennas Above a Plane Ground, Vertical Antennas Above a Plane Ground, Yagi-Uda Antenna Design, Long-Wire Antennas, folded Dipole Antennas, The Loop Antenna, Slot Antennas, Horn Antennas, Helical Antennas, The Log-Periodic Antenna.

Section C	Reflector Antennas Flat Sheet Reflectors, Corner Reflectors, The Parabola-General Properties, A comparison Between Parabolic and Corner Reflectors, The Paraboloidal Reflector, Patterns of Large Circular Apertures with Uniform Illumination, Reflector Types (summarized), Feed Methods for Parabolic Reflectors. Antenna Measurements Introduction, Antenna Measurement ranges, Radiation pattern Measurements, Gain and Directivity Measurements, Impedance Measurement, current measurement.
Section D	Ground Wave Propagation Plane Earth Reflection, Space Wave and Surface Wave, Space Wave Propagation Introduction, Field Strength Relation, Effects of Imperfect Earth, Effects of Curvature of Earth, Sky wave Propagation Introduction structural Details of the ionosphere, Wave Propagation Mechanism, Refraction and Reflection of Sky Waves by ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation Between MUF and the Skip Distance, Multi-Hop Propagation, Wave Characteristics.

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

CO1: define various antenna parameters.
CO2: analyze radiation patterns of antennas.
CO3: illustrate techniques for antenna parameter measurements.
CO4: to understand the various applications of antennas.
CO5: understand radio wave propagation.

Text Books:

1. Antenna Theory, Ballanis John Wiley & Sons, (2003) 2nd ed.
2. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", Tata McGraw Hill Publication.

Reference Books:

1. A. R. Harish, M. Sachidananda, "Antennas and Wave Propogation", Oxford University Press.

Name of the Course	**Data Communication Networks**		
Course Code	**EC-6003**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To introduce the basics of data communications and computer networks.
- To examine and understand network protocols and architectures.
- To educate the student in modern networking technologies.

Sections	Course Content
Section A	Data Communications, Network criteria, Physical topology, Categories of networks, Protocols and standards, Network Models – Layered Tasks, The OSI model, Layers in the OSI model, TCP/IP protocol suite,. Transmission impairments, Transmission Media: Guided Media, Unguided Media: wireless Switching: Circuit switched networks, Datagram networks, virtual circuit Networks. Framing, Character stuffing, bit stuffing, Error Detection and Correction (CRC, Hamming Code, Parity Bit, checksum)
Section B	Physical Layer: Transmission Media, Wireless Transmission, Data Link Layer: data link layer protocols- Media access control, Ethernet protocols, Ethernet MAC address, LAN switches- working, switch forwarding methods, Address resolution protocol (ARP), Network layer: network layer protocols i.e. IPv4 and IPv6, routing(routing tables) , routers, configuration of a routerIP addressing: IPv4 Network, Addresses- structure and characteristics, IPv6 network addresses, connectivity verification, Subnetting IP networks: Subnetting an IPv4 Network, Addressing Schemes, Design Considerations for IPv6.
Section C	Transport Layer: transport layer protocols-TCP and UDP, communication process of TCP and UDP, comparison of TCP and UDP, Application Layer: Introduction, application layer protocols, well known application layer protocols and services- web and mail protocols(HTTP, HTTPS, email, SMTP, POP, IMAP), IP addressing services (DNS, DHCP), File sharing services(FTP, SMB)

Section D	Routing Concepts: Routing Concepts, Initial Configuration of a Router, Routing Decisions, Router Operation Static and dynamic routing, RIP, single OSPF, EIGRP- Implementation and troubleshooting, Access Control Lists: IP ACL Operation, Standard IPv4 ACLs.

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

CO1: Understand the rudiments of how computers communicate.
CO2: Familiarize with the architecture of a number of different networks.
CO3: Understand the principles of protocol layering.
CO4: Familiarize with modern communication systems.
CO5: Understand the basic aspects of packet-based protocol design and implementation.

Text Books:

1. **'**Introduction to Data Communications and Networking' by B. Forouzan, Tata McGraw Hill, Fourth Edition, 2004 Edition.
2. 'Computer Networks' by Andrew S. Tanenbaum, Pearson Education, Fourth Edition.
3. Stallings, W., (2010), Data and Computer Communications, Pearson.

Reference Books:

1. Robert G. Gallager, "Data Networks", Prentice Hall, 1992.
2. Ajit Pal, "Data Communication and Computer Networks", PHI 6. DimitriBertsekas

Name of the Course	**Ethics and Human Values**		
Course Code	**HSMC-6001**	Credits-2	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To develop a critical ability to distinguish between essence and form, or between what is of value and what is superficial, to life.
- To move from discrimination to commitment. It is to create an ability to act on any discrimination in a given situation.
- It encourages students to discover what they consider valuable. After learning the course, they should be able to discriminate between valuable and the superficial in real situations in their life.

Sections	Course Content
Section A	Human Values: Morals, Values and Ethics Integrity- Work ethic- Service learning – Civic virtue – Respect for others - Living peacefully- Caring- Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy- Self-confidence- Character- Spirituality – Introduction to Yoga and meditation for professional excellence and Stress management.
Section B	Engineering Ethics: Senses of Engineering ethics – Variety of moral issues, types of inquiry- Moral dilemmas- Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories of right action – Self-interest – Customs and Religion – Uses of Ethical theories.
Section C	Engineering as Social Experimentation: Engineering as Experimentation – Engineers as responsible experimenters – Code of ethics – A Balanced Outlook on Law Safety, Responsibilities And Ethics: Safety and Risk – Assessment of Safety and risk, Risk Benefit Analysis and Reducing Risk – Respect for authority – Collective Bargaining – Confidentiality – Conflict of interest –Occupational crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Section D	Global Issues: Multinational Corporations – Environmental Ethics – Computer ethics – Weapons Development – Engineers as managers – Consulting engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of conduct – Corporate Social Responsibility.

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

CO1: identify the essentials of human values and skills.

CO2: have a correct understanding between profession and happiness.

CO3: understand practically the importance of trust, mutually satisfying human behaviour and enriching interaction with nature.

CO4: develop appropriate technologies and management patterns to create harmony in professional and personal life.

Text Books:

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004

Reference Books:

1. Charles B Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics-Concepts and Cases", Cengage learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for scientists and engineers", Oxford university press, 2001.
5. Laura P Hartman and Joe Desjardins, "Business Ethics: Decision making for personal integrity and social responsibility", McGraw Hill education, India Pvt, New Delhi, 2013.

Name of the Course	Antenna Design and Simulation Lab		
Course Code	**EC-6051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	26 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Design of fundamental parameters of the antenna and an overview of HFSS to measure different antenna parameters.
2	Design of a half-wave dipole antenna.
3	Design of a quarter-wave monopole antenna.
4	Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness.
5	Design of microstrip patch antenna using a coaxial feeding technique.
6	Design and simulation of dual-band rectangular patch antenna using the inset feeding technique.
7	Design and simulation of rectangular microstrip patch antenna using CPW feeding with slot for bandwidth enhancement.
8	Design of aperture coupled rectangular microstrip patch antenna with twodifferent substrates.
9	Design of proximity coupled rectangular microstrip patch antenna.
10	Design and simulation of Dielectric Resonator Antenna with a particular operating frequency, dielectric constant and substrate thickness.
11	Design and Simulation of MPA using the CST Microwave Studio Suite 2020.

Course Outcomes: After studying this course, students will be able to:

CO1: demonstrate the structure and operation of various antennas and to describe their parameters.

CO2: measure the radiation pattern of wired, aperture, planar and array antennas.

CO3: familiar with EM simulation tools to implement antenna prototypes.

CO4: to understand the various applications of antennas.

Text Books:

1. Matthew N.O. Sadiku, "Principles of Electromagnetics", Oxford University Press.

Reference Books:

1. William H. Hayt, Jr And John A. Buck, "Engineering Electromagnetics", McGraw Hill Education.
2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, McGraw Hill, 2017

SEMESTER-VII

Name of the Course	**Optical Communication**		
Course Code	**EC-7001**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion.
- To learn the various optical sources, materials.
- To learn the fiber optical receivers and noise performance in photo detector.
- To learn link budget, WDM, solitons and SONET/SDH network.

Sections	Course Content
Section A	Overview: Evolution of Basic Fiber Optic Communication System, Benefits and Disadvantages of Fiber Optics. Transmission Windows. The Laws of Reflection and Refraction, Light Rays and Light Waves, Reflection of Light From Optical Surfaces, Refraction of Light From Optical Interfaces, The Numerical Aperture (NA), The Optical Fiber, Types of Fibre.
Section B	Losses in Optical Fiber: Attenuation, Material Absorption Losses, Linear and Non Linear Scattering Losses, Fiber Bend Loss, Dispersion Viz. Inter Modal Dispersion and Intra Modal Dispersion, Overall Fiber Dispersion and Polarization, Dispersion Shifted and Dispersion Flattened Fibers, Attenuation and Dispersion Limits in Fibers, Kerr Nonlinearity, Self Phase Modulation, Combined Effect of Dispersion and Self Phase Modulation Fiber Material, Couplers and Connectors: Preparation of Optical Fiber: Liquid-Phase Techniques, Vapor Phase Deposition Techniques, Connector Principles, Fiber End Preparation, Splices, Connectors.
Section C	Optical Sources and Detectors: Sources: Basic Principle of Surface Emitter LED and Edge Emitter LED- Material Used Structure, Internal Quantum Efficiency and Characteristics, LASER Diode - Material Used Structure, Internal Quantum Efficiency and Characteristics, Working Principle and

	Characteristics of Distributed Feedback (DFB) Laser. Detectors: PIN Photodiode - Material Used, Working Principle & Characteristics, Avalanche Photodiode: - Material Used Working Principle and Characteristics.
Section D	Advanced Topics: Optical TDM, SCM, WDM And Hybrid Multiplexing Methods, Fiber Optic Networks, Trans receivers for Fiber-Optic Networks, Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers (EDFAs). Optical Networks: Elements and Architecture of Fiber-Optic Network, SONET/SDH, ATM, IP, Optical Line Terminals (OLT), Optical Add-Drop Multiplexers, Optical Cross Connects.

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

CO1: demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.

CO2: estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers.

CO3: to assess the different techniques to improve the capacity of the system.

CO4: estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers.

Text Books:

1. Fiber Optic Communications (Fifth Ed.) by J.C. Palais, Pearson Prentice Hall, 2005
2. Optical Fiber Communications (Third Ed.) by Gerd Keiser, McGraw-Hill, 2000

Reference Books:

1. Optical Networks: A Practical Perspective (Third Ed.) by R Ramaswami and K.N. Sivarajan, Morgan Kaufman Publishers

Name of the Course	**Internet of Things (IoT)**		
Course Code	**EC-7002**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Students will understand the concepts of Internet of Things and will be able to build IoT applications.
- Use real IoT protocols for communication.
- Design an IoT device to work with a Cloud Computing infrastructure.

Sections	Course Content
Section A	Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network python.
Section B	Network & Communication aspects Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination. Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges.
Section C	Domain specific applications of IoT Home automation, Industry applications, Surveillance applications, Other IoT applications.
Section D	Developing IoTs Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with Python.

Course Outcomes: After completion of the course, students will be able to:
CO1: understand the concepts of Internet of Things.
CO2: analyze basic protocols in wireless sensor network.
CO3: design IoT applications in different domain and be able to analyze their performance.
CO4: implement basic IoT applications on embedded platform

Text Books:

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice.

Reference Books:

1. Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan, "Internet of Things- Technologies and Applications for a New Age of Intelligence", 2nd Edition, Academic Press.

Name of the Course	**Data Science**		
Course Code	**IT – 7001**	Credits-3	L-3, T-0, P-0
Total Lectures	L = 39 (for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
- Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.
- Apply ethical practices in everyday business activities and make well-reasoned ethical business and data management decisions.

Section	Course Content
Section A	Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making-Looping-Loop Control statement-Math and Random number functions. User defined functions - function arguments & its types.
Section B	User defined Modules and Packages in Python-Files: File manipulations, File and Directory related methods - Python Exception Handling. OOPs Concepts- Class and Objects, Constructors – Data hiding- Data Abstraction-Inheritance. NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray - Creating ndarrays - Data Types for ndarrays - Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions Mathematical and Statistical Methods-Sorting Unique and Other Set Logic
Section C	Introduction to Pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values,Value Counts, and

	Membership. Reading and Writing Data in Text Format
Section D	Data Cleaning and Preparation: Handling Missing Data – DataTransformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and iltering Outliers-String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Course Outcomes: After the completion of the course, students will able to:

CO1: develop relevant programming abilities.
CO2: demonstrate proficiency with statistical analysis of data.
CO3: develop the ability to build and assess data-based models.
CO4: execute statistical analyses with professional statistical software.
CO5: demonstrate skill in data management.

Text Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.

Reference Books:

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python", O'Reilly, 2nd Edition, 2018.
2. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.

Name of the	**Entrepreneurship Development**		
Course Code	**HSMC-7001**	Credits-2	L-3, T-0 P-0
Total Lectures	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To develop entrepreneurial quality and motivation in students for entrepreneurship.
- To enable students to identify and create business opportunities that may be commercialized.
- To make the student understand the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Section	Course Content
Section A	Introduction to Entrepreneurship: Meaning of Entrepreneur, Types of Entrepreneur, Entrepreneurial Traits and skills, Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs, Entrepreneurship – its Barriers. Business Opportunity Identification: Business ideas, methods of generating ideas, and opportunity recognition.
Section B	Enterprises and Ownership Structure: MSME industries, Forms of Business Ownership, Advantages and the disadvantages of the three major form so of ownership: the sole proprietorship, the partnership, and the corporation. Registration of company in India.
Section C	Business: Components of macro and micro business environment. Creating and Starting the Venture Sources of new Ideas. Business Plan: The Business and scope of Business plan, Elements of Business Plan: Marketing plan, financial plan and the organizational plan, Writing Business Plan, Evaluating Business plans. Financing and Managing the new venture Sources of capital: Understanding capital requirements, identifying the sources of finance, angel investing and venture finance, managing cash flow. Break-even analysis, Project analysis. Marketing and sales controls: Marketing concept and evolution, marketing process, E-commerce, Internet advertising.

Section D	Institutional support to Entrepreneurship: Institutional support towards the development of entrepreneurship in India, DICs, IDC, SFCs, SSIDCs, KVIC, NSIC, SIDBI.

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

CO1: understand the systematic process to select and screen a business idea.
CO2: write a business plan.
CO3: create awareness about industry structure and how to start up a company.
CO4: Know the parameters to assess opportunities and constraints for new business ideas.

Text Books:

1. Khanka. S.S., "Entrepreneurial Development", S. Chand.
2. Nandan, H., "Fundamentals of Entrepreneurship", PHI.

Reference Books:

1. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", Cengage.
2. Hisrich R D, Peters M P, "Entrepreneurship", TMH.
3. Rajeev Roy, "Entrepreneurship", Oxford.

Name of the Course	Optical Communication Lab		
Course Code	EC-7051	Credits-1	L-0, T-0, P-2
Total Practical Sessions	26 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To observe and analyze various fiber optic data links when used for both digital and analog data transmission.
2	To learn proper fiber splicing techniques and to become familiar with the use of optical time domain reflectometry in characterizing optical fibers.
3	Determination of connecting losses due to lateral misalignment, longitudinal displacement, and angular misalignment of fiber cores.
4	Determination of connecting losses due to lateral misalignment, longitudinal displacement, and angular misalignment of fiber cores.
5	To determine the linear attenuation of an optical fiber at wavelengths of 650 nm and 940 nm.
6	To determine the coupling efficiency between an emitter and an optical fiber. To determine the half power beamwidth for the LED.
7	Measurement of the losses associated with a coupling connector. Also to verify the influence of the condition of fiber end surfaces, and index adaptation liquid, on connector losses.
8	Determination of the characteristic curve of a LED. Measurement of the LED electro-optic response time and of the junction and case thermal time constants.
9	Measurement of the time constants and relative sensitivities of a phototransistor and a photodiode. Measurement of the linearity of a photo detector.
10	To compare the operation and dynamic range of a pulse-width modulated and an amplitude modulated data transmission system.

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

CO1: Demonstrate characteristics of various optical sources.
CO2: Measure data Rate, Numerical Aperture and Losses in Optical Link.
CO3: Sketch the characteristics of fiber optic LEDs, LDR and Laser Diode.
CO4: Calculate properties of and design modern optical fibres and photonic crystals.

Text Books:

1. A. Ghatak & K. Thyagarajan, Lasers: Theory & Applications, Macmillan India LTD. 2003
2. A. Ghatak & K. Thyagarajan, Optical Electronics, Cambridge University Press, 2004
3. Amon Yariv, Optical Electronics, Saunders College Publishing 1

Reference Books:

1. Francis T.S Yu, Shizhuo Yin (Eds), Fiber Optic Sensors, Marcel Dekker Inc., New York,2002 6 • John M senior, Optical fiber communications PHI, 1992

SEMESTER-VIII

Name of the Course	**Wireless and Mobile Communication**		
Course Code	**EC-8001**	Credits-4	L-3,T-1,P-0
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Know the characteristic of wireless channel
- Learn the various cellular architectures
- Understand the concepts behind various digital signalling schemes for fading channels
- To make students familiar with fundamentals of mobile communication systems.

Sections	Course Content
Section A	Evolution of mobile radio communication, examples of wireless comm. system, paging system, Cordless telephone system. Comparison of various wireless systems. Wireless Networking: Difference between wireless and fixed telephone networks, Development of Wireless Networks, Wireless Data Services, Common Channel Signaling, ISDN (Integrated Service Digital Network).
Section B	The Cellular concept, Frequency Reuse basic theory of hexagonal cell layout, spectrum efficiency. Handoff strategies, Interference and system capacity, Trucking and grade of service, Improving coverage and capacity in cellular systems. Wireless data services. Packet radio-Pure ALOHA, Slotted ALOHA, CSMA, Reservation ALOHA, PRMA, Capacity of cellular systems.
Section C	Radio Propagation Characteristics, Models for Path loss, Shadowing & Multipath fading-delay spread, Coherence bandwidth, Coherence Time, Doppler Spread Jake's Channel model.Introduction to Spread Spectrum Communication Multiple Access Techniques used in Mobile Wireless Communications: FDMA/TDMA/CDMA. Introduction to wireless systems and standards.

Section D	Wireless standards-GSM, IS-95, UMTS-IMT-2000, Signalling, Call Control, Mobility Management and location Tracing.

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

CO1: analyze the mobile radio propagation, fading, diversity concepts and the channel modeling.

CO2: analyze multiuser systems, CDMA, WCDMA network planning and OFDM concepts.

CO3: discuss the cellular system design and technical challenges.

CO4: summarize the principles and applications of wireless systems and standards.

Text Books:

1. Theodore S Rappaport, "Wireless Communications Principles and Practice", Prentice Hall.

Reference Books:

1. William C Y Lee, "Mobile Cellular Telecommunications, McGraw Hill.
2. Schwartz, Mobile Wireless Communications, Cambridge University Press.
3. Stallings, Wireless Communications and Networks, Prentice Hall.
4. Jochen, Schiller, "Mobile Communication", 2nd Edition, Pearson Education, 2008.

Name of the Course	**Microwave & Radar Engineering**		
Course Code	**EC-8002**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the sub parts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives: The subject aims to provide the student with:

- An understanding of microwave waveguides, passive & active devices, tubes and network analysis.
- An ability to perform microwave measurements.
- An understanding of RADARs and its applications

Sections	Course Content
Section A	Basic Concepts: Introduction. Maxwell's Equations. Constitutive Relations. Static Fields. Wave Equation. Energy and Power. Boundary Conditions. Plane Waves. Dielectric Interface. Reflection from a Conducting Plane. Potential Theory. Solutions for Vector Potential. Lorentz Reciprocity Theorem Transmission Lines Theory And Waveguides: The Quarter-Wave Transformer. Generator and Load Mismatches. Impedance Matching with Reactive Elements. Single-Stub, Double-Stub, and Triple-Stub Matching. Lossy Transmission Lines. TEM, TE, TM Waves. Parallel-Plate, Rectangular, Circular Waveguides. Coaxial Line. Surface Waves on a Grounded Dielectric Slab. Coupled Strip Lines. Microstrip Transmission Line. Wave Velocity and Dispersion
Section B	Active And Passive Microwave Devices: Diodes. Microwave Transistors. Hetero junction Bipolar Transistor. Microwave FET. Noise in Microwave Circuits. Terminations. Attenuators. Phase Shifters. Directional Couplers. Hybrid Junctions. Power Dividers. Circulators. Microwave Semiconductor Devices: Point Contact Diodes. Schottky Barrier Diodes. PIN Diodes. Varactor Diodes. Tunnel Diodes. Gunn Devices. IMPATT Diode. Parametric Devices. Detectors and Mixers.

Section C	Microwave Tubes: Introduction. Electron Beams with DC conditions: Ion-Neutralized Beam, Beam with Axially Confined Flow. Brillouin Flow. Space-Charge Waves on Beams with Confined Flow. Space- Charge Waves on Unfocused Beams. AC Power Relations. Velocity Modulation. Two-Cavity Klystron. Excitation of Cylindrical Cavity. Reflex Klystron. Magnetron. O-Type and M-Type Traveling Wave Tubes. Gyrotrons. Other Microwave Tubes Microwave Measurements: VSWR. Frequency. Power. Noise. Q-Factor. Impedance. Attenuation. Dielectric Constant
Section D	Introduction Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR Transmitter Power, PRF and Range Ambiguities, Doppler Effect CW and Frequency Modulated Radar MTI and Pulse Doppler Radar.

Course Outcomes: After studying this course, students will be able to:

CO1: explain different types of waveguides and their respective modes of propagation.

CO2: explain working of microwave passive circuits such as isolator, circulator, directional couplers, attenuators etc.

CO3: describe and explain working of microwave tubes and solid state devices.

CO4: perform measurements on microwave devices and networks.

CO5: explain the operation of RADAR systems and recite their applications.

Text Books:

1. M. Kulkarni, “Microwave devices and Radar Engineering”, 5th Edition, Umesh Publishers.
2. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson Education Publication.

Reference Books:

1. Pozar, “ Microwave Engineering”, 3rd Edition, Wiley India Edition

Program Elective-I
for
Semester-V

Name of the Course	**Information Theory and Coding**		
Course Code	**PEC-5001**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To study both circuits and system views on design together.
- Deeply understand the mathematics of Information Theory and its physical meaning.
- To understand various channel coding techniques.

Sections	Course Content
Section A	Introduction: Introduction to information theory & error control coding, Information measure, Entropy, Differential Entropy, Conditional Entropy, Relative Entropy, Information rate, Mutual Information, Channel Capacity.
Section B	Source Coding: Shannon's Source Coding Theorem, Prefix Coding, Huffman Coding, Shannon-Fano Coding, Arithmetic Coding, Lempel-Ziv Algorithm, Rate Distortion Theory. Channel Capacity & Coding: Channel Coding Theorem, Markov Sources, Discrete Channel with discrete Noise, BSC, BEC, Capacity of a Gaussian Channel, channel capacity for MIMO system, Bandwidth-S/N Trade-off.
Section C	Block Codes: Galios Fields, Hamming Weight and Hamming Distance, Linear Block Codes, Encoding and decoding of Linear Block-codes, Parity Check Matrix, and Bounds for block codes, Hamming Codes, Syndrome Decoding. Cyclic Codes: Introduction to cyclic code, Method for generating Cyclic Codes, Matrix description of Cyclic codes, Cyclic Redundancy Check (CRC) codes, Circuit implementation of cyclic codes. Convolutional Codes: Introduction to Convolutional Codes, Polynomial description of Convolutional Codes, Generating function, Matrix description of Convolutional Codes, Viterbi Decoding of Convolutional code.

Section D	Coding for Secure Communications: Introduction to Cryptography, Overview of Encryption Techniques, Secret-Key Cryptography, Data Encryption, Standard (DES), Public-Key Cryptography, RSA algorithm, Digital signature, One- way Hashing.

Course Outcomes: After completion of the course, the student is able to

CO1: Understand the basics of information and coding theories.

CO2: Discuss the various capacity reduction based coding techniques for text, audio and speech type of data.

CO3: Compare various capacity reduction based coding techniques for image and video type of data.

CO4: Illustrate various security oriented coding techniques for Block codes.

CO5 Implement various error control techniques for Convolutional codes.

Text Books:

1. Ranjan Bose, "Information Theory, Coding & Cryptography", 2nd Edition, TMH.
2. S. Haykin, "Communication Systems", 4th Edition, Wiley-Publication.

Reference Books:

1. Thomas M. Cover, J. A. Thomas "Elements of Information Theory", Wiley-Inter Science Publication.
2. Todd K. Moon "Error Correction Coding Mathematical Methods and Algorithms", Wiley India Edition.
3. William Stallings "Cryptography and Network Security", 4th Edition, Pearson.

Name of the Course	**Biomedical Engineering**		
Course Code	**PEC-5002**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Understand the fundamental principles of biomedical circuit.
- Apply knowledge of biomedical electronic circuits to solve problems in the areas of biomedical signals.
- Apply solutions for complex engineering problems and design components that meet the specific needs for public health and safety.

Sections	Course Content
Section A	Brief Introduction to Human Physiology: Human Body Cardiovascular and Respiratory systems Nervous Systems and Musculoskeletal Systems Digestive and Excretory System Special Organs and Endocrine Glands. Biomedical Sensors and Measurement Devices: Measurement system and basics of Transducer Measurement of Non-Electrical Quantities Signal Generators and Signal Analyzer Digital Data Display and Recording Systems Medical Applications of Sensors.
Section B	Medical Instrumentation: Electrodes, Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro, needle and surface electrodes, Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systems and recording methods.
Section C	Medical Imaging: Radiographic and fluoroscopic techniques, X rays, Computer tomography, Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient monitoring.
Section D	Prostheses and Aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects. Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters of biomedical equipment.

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

CO1: Apply the core concepts of biomedical engineering, its underlying sciences, and relevant technologies.

CO2: Design solutions for complex biomedical engineering problems and develop healthcare system components.

CO3: Develop processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

CO4: Create, select and apply appropriate techniques, resources, electronic components, modern engineering and IT tools including prediction and modelling to complex bioengineering activities.

Text Books:

1. Cromwell, L. and Weibell, F.J. and Pfeiffer, E.A., "Biomedical Instrumentation and Measurement, Dorling Kingsley", 2nd edition.
2. W.F. Ganong, "Review of Medical Physiology", 8th Asian Ed, Medical Publishers, 1977.
3. J.G. Websster, Houghton Mifflin, "Medical Instrumentation", 1978.

Reference Books:

1. A.M. Cook and J.G. Webster, eds., "Therapeutic Medical Devices", Prentice-Hall, 1982.

Name of the Course	**Electronic Switching**		
Course Code	**PEC-5003**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Introducing to the students the knowledge about the telecommunication industry.
- Services and market, the theoretical basis about performance (queuing theory).
- Operation (multiplexing, switching, routing, and signaling) in telecom networks.

Sections	Course Content
Section A	Evolution of switching systems: Introduction, Message switching, Circuits switching, Functions of a switching system, Register translator-senders, Distribution frames, Crossbar switch, A general trucking, Electronic switching, Reed- electronic system, Digital switching systems.
Section B	Digital Switching: Switching functions, Space Division Switching, Time Division Switching, Two-Dimensional Switching, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Telecom Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking models and Loss Estimates, Delay Systems.
Section C	Control of switching systems: Introduction, Call-processing functions, Common control, Reliability, availability and security; Stored-program control. Signalling: Introduction, Customer line signalling, Audio-frequency junctions and trunk circuits, FDM carrier systems, PCM signaling, Inter register signalling, Common-channel signalling principles, CCITT signalling system no. 6 and 7, Digital customer line signaling.
Section D	Packet Switching: Packet Switching, Statistical Multiplexing, Routing Control (dynamic routing, virtual circuit routing and fixed-path routing), Flow Control, X.25, Frame Relay, TCP/IP ATM Cells, ATM Service Categories, ATM Switching (ATM Memory Switch, Space-Memory Switch, Memory-Space Switch, Memory-Space Memory switch, Banyan Network Switch).

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

CO1: describe and apply fundamentals of telecommunication systems and associated technologies.

CO2: apply the principles of queuing theory in evaluating the performance of congested telecommunication networks.

CO3: solve problems and design simple systems related to tele-traffic and trunking efficiency.

CO4: understand and explain the reasons for switching, and the relative merits of the possible switching modes, e.g. packet and circuit switching.

CO5: understand the principles of the internal design and operation of telecommunication switches, and the essence of the key signaling systems that are used in telecommunication networks.

Text Books:

1. Thiagarajan Viswanathan & Manav Bhatnagar, "Telecommunication Switching Systems and Networks", PHI.
2. J.E. Flood, "Telecommunication Switching, Traffic and Networks", Pearson Education.

Reference Books:

1. V.E. Benes/Mathematical Theory of connecting Networks & Telephone Traffic/Academic Press, 1965.
2. G. Hebuterve / Traffic Flow in Switching Systems / Artech House, 1987. J.C. Bellamy/Digital Telephony/John Wiley 2nd Ed., 1992.
3. Anders Hellman & Gudrun Bager/ Understanding Telecommunication 1/Printed in Sweden, Student literature, Lund.
4. Ericcson Telecom AB, Competence Development centre.

Name of the Course	Computational Intelligence		
Course Code	**PEC-5004**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Make the students familiar with basic principles of various computational methods of data processing that can commonly be called computational intelligence (CI).
- Fundamentals of key intelligent systems technologies including knowledge-based systems, neural networks, fuzzy systems, and evolutionary computation.
- Practice in integration of intelligent systems technologies for engineering applications.

Sections	Course Content
Section A	Introduction to soft computing, Soft computing constituents and conventional Artificial intelligence, soft computing characteristics.
Section B	Fuzzy Sets, Fuzzy Rules and Fuzzy reasoning : Introduction, Basic definitions and terminology; Set theory operations : Fuzzy union, Intersection and Complement, Extension principal and fuzzy relations, Fuzzy IF rules, MF formulation and parameterization; Fuzzy interference System: Mamdani fuzzy models, Sugeno fuzzy models, Tsukamoto fuzzy models
Section C	Artificial Neural Network: Supervised Learning Neural Network, Preceptron, Adaline, multi- layer neural networks, back propagation algorithm, Radial basis function networks; Functional Link Artificial Neural network: update algorithms, trigonometric and power series expansions; Unsupervised Learning Neural Network : Competitive learning networks, Kohonen self-organizing networks, Hop field network.
Section D	Introduction to Neuro-Fuzzy Networks: Genetic Algorithm, Adaptive Genetic Algorithm, Ant Colony Algorithm, Bacteria Foraging Algorithm, Particle Swarm Optimization; Introduction to other soft computing technique.

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

CO1: gain a working knowledge of neural networks, fuzzy systems, and evolutionary computation.

CO2: apply intelligent systems technologies in a variety of engineering applications.

CO3: present ideas and findings effectively.

CO4: think critically and learn independently.

Text Books:

1. Neuro-Fuzzy and soft Computing –J.S.R. Jng, C.T. Sun and E. Mizutani, PHI.
2. Simon Haykin, "Neural Networks a Comprehensive foundation", Pearson Education.

Reference Books:

1. Neutral Networks, Fuzzy Logic and Genetic Algorithm Rajasekaran, G.A. Vijayalaksmi, PHI.

Name of the Course	Low Power VLSI Design		
Course Code	PEC-5005	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- This course provides the basic and design knowledge about low power VLSI which involves sources of power dissipation, power optimization techniques and power estimation.
- This course addresses a profound analysis on the development of the CMOS & Bi-CMOS digital circuits for a low voltage low power environment.
- To study the concepts of device behavior and modeling.
- To study the concepts of low voltage, low power logic circuits.

Sections	Course Content
Section A	Sources of power dissipation – Physics of power dissipation in MOSFET devices: The MIS structure, long channel MOSFET, Submicron MOSFET , gate induced drain leakage– Power dissipation in CMOS : short circuit dissipation, dynamic dissipation, load capacitance– Low power VLSI design: Limits – principles of low power design, hierarchy of limits, fundamental limit, material limit, device limit, system limit.
Section B	Power Reduction in Clock Networks: Clock Gating, Reduced Swing Clock, Oscillator Circuit for Clock Generation, Frequency Division and Multiplication, Other Clock Power Reduction Techniques - CMOS Floating Node: Tristate Keeper Circuit, Blocking Gate, Low Power Bus: Low Swing Bus, Charge Recycling Bus, Delay Balancing - Low Power Techniques for SRAM: SRAM Cell, Memory Bank Partitioning, Pulsed Word line and Reduced bit line Swing.
Section C	Transistor and Gate Sizing : Sizing an Inverter Chain, Transistor and Gate Sizing for Dynamic Power Reduction, Transistor Sizing for Leakage Power Reduction - Network Restructuring and Reorganization : Transistor Network Restructuring, Transistor Network Partitioning and Reorganization - Special Latches and Flip-flops : Self-gating Flip-flop, Combinational Flip- flop, Double Edge Triggered Flip-flop - Low Power Digital Cell Library : Cell Sizes and Spacing, Varieties of Boolean Functions, Adjustable Device

	Threshold Voltage.
Section D	Modelling of signals - signal probability calculation - Statistical techniques - estimation of glitching power- Sensitivity analysis-Power estimation using input vector compaction, power dissipation in Domino logic, circuit reliability, power estimation at the circuit level, Estimation of maximum power: test generation based approach, steepest descent, generic based algorithm based approach.

Course Outcomes: After completion of the course, students will be able

CO1: acquire the knowledge about various CMOS fabrication process and its modeling.

CO2: infer about the second order effects of MOS transistor characteristics.

CO3: analyze and implement various CMOS static logic circuits.

CO4: learn the design of various CMOS dynamic logic circuits.

Text Books:

1. Kaushik Roy and S.C.Prasad, "Low power CMOS VLSI circuit design", Wiley, 2000 7
2. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995
3. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998

Reference Books:

1. Dimitrios Soudris, Christians Pignet, Costas Goutis, "Designing CMOS Circuits for Low Power", Kluwer, 2002.
2. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley 1999
3. Abdelatif Belaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995
4. James B.Kulo, Shih-Chia Lin, "Low voltage SOI CMOS VLSI devices and Circuits", John Wiley and sons, inc. 2001.
5. Steven M.Rubin, "Computer Aids for VLSI Design", Addison Wesley Publishing

Program Elective-II
for
Semester-VI

Name of the Course	Nanoelectronics		
Course Code	**PEC-6001**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Fundamentals of key intelligent systems technologies including knowledge-based systems, neural networks, fuzzy systems, and evolutionary computation.
- Practice in integration of intelligent systems technologies for engineering applications.

Sections	Course Content
Section A	Overview: Nanodevices, Nanomaterials, Definition of Technology node, Basic CMOS Process flow, MOS Scaling theory, Issues in scaling, Short channel effects, Description of a typical 65 nm CMOS technology, Requirements for Non classical MOS transistor, MOS capacitor, Role of interface quality and related process techniques, Gate oxide thickness scaling trend, SiO2 vs High-k gate dielectrics. Integration issues of high-k, Interface states, bulk charge, band offset, stability etc.
Section B	Metal Gate Transistor: Motivation, requirements, Integration Issues, Transport in Nano MOSFET, velocity saturation, ballistic transport, injection velocity, velocity overshoot, SOI - PDSOI and FDSOI., Ultra thin body SOI - double gate transistors, Vertical transistors - FinFET and Surround gate FET, Metal source/drain junctions-Properties of schotky junctions on Silicon, Germanium and compound semiconductors–Work function pinning, Germanium Nano MOSFETs: strain, quantization, Advantages of Germanium over Silicon.
Section C	PMOS versus NMOS, Compound semiconductors - material properties, MESFETs Compound semiconductors MOSFETs in the context of channel quantization and strain, Hetero structure MOSFETs exploiting novel materials, strain, and quantization. Synthesis of Nanomaterials: CVD, Nucleation and Growth, ALD, Epitaxy, MBE. Compound semiconductor hetero-structure growth, emerging nanomaterials: Nanotubes, nanorods and other nanostructures, LB technique, Soft lithography etc.

	Microwave assisted synthesis, Self assembly etc.
Section D	Characterization: Quantum wells and Thickness measurement techniques: Contact - step height, Optical - reflectance and ellipsometry, AFM, Nano materials Characterization techniques: FTIR, XRD, AFM, SEM, TEM, EDAX and interpretation of results.

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

CO1: Understand the underlying concepts of nanotechnology in terms of Nano-devices, nanomaterial and CMOS Technology.

CO2: To understand the concept of transport in Nano-MOSFET and to understand the concept of Silicon on Insulator Devices (SOI): SOI - PDSOI and FDSOI.

CO3: To understand the concept and properties of Schottky junctions on Silicon, Germanium and compound semiconductors.

CO4: To understand the concept and properties of PMOS versus NMOS, Compound semiconductors and to aware about Synthesis of Nano-materials: methods and techniques.

CO5: To understand the concept and working of various Characterization techniques used for nanotechnology such as FTIR,XRD, AFM, SEM, TEM, EDAX.

Text Books:

1. Y. Taur and T.Ning, "Fundamentals of Modern VLSI Devices", Cambridge University Press.
2. Plummer, Deal, Griffin, "Silicon VLSI Technology", Pearson Education India.
3. "Encyclopedia of Materials Characterization", Edited by: Brundle, C.Richard; Evans, Charles A. Jr.; Wilson, Shaun; Elsevier.

Reference Books:

1. Nanoelectronics , Karl Goser, "Nanoelectronics and Nanosystems," Springer, 2004.
2. Camarata, R.C, Nanomaterials synthesis, properties and application. Institute of Physics Publication.
3. Madou, Fundamentals of microfabrication, Mcgraw Hill.
4. Sibelia, J.P, A Guide to material characterization, Prentice Hall.
5. K. Schroder, Semiconductor Materials and Device Characterization, Wiley-Interscience, New York, 1990.

Name of course	**Speech and Audio Processing**		
Course code	**PEC-6002**	Credits -3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)	Max Marks: 50		

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objective:

- Fundamentals in speech and audio analysis using digital filters.
- Time & frequency domain methods for speech processing.
- Different coding techniques for audio & speech.

Sections	Course Content
Section A	Mechanics of speech and audio: Introduction - Review of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Non simultaneous Masking - Perceptual Entropy - Basic measuring philosophy - Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.
Section B	Frequency analysis-Filter banks and transforms: Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree- Structured QMF and CQF M-band Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Preecho Control Strategies.

Section C	Audio coding and transform coders: Lossless Audio Coding- Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advanced, 4Audio Coding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder - Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution-DCT with Vector Quantization-MDCT with Vector Quantization.
Section D	Time and frequency domain methods for speech processing:Time domain parameters of Speech signal – Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods Homomorphic Speech Analysis: Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

Course Outcomes: After the completion of the course the students will be able to:

CO1: learn nature and production of speech signals and its classification

CO2: design and implement algorithms for processing audio and speech signals.

CO3: estimate the effect of the signal representations on sound quality.

CO4: explain the main principles of common audio signal processing operations (equalization, dynamic control, perceptual audio coding)

CO5: explain the main principles of common audio signal processing control operations and equalization.

Text Books:

1. Digital Audio Signal Processing, Second Edition, UdoZölzer, A John Wiley& sons Ltd Publications.
2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, Kluwer Academic Publishers New York, Boston, Dordrecht, London.

Reference Books:

1. Digital Processing of Speech signals – L. R. Rabiner and R.W. Schaffer - Prentice Hall – 1978.

Name of the Course	**Embedded System**		
Course Code	**PEC-6003**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives: After completion of the course, students will be able to:

- To understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
- Get familiarized with programming environment to develop embedded solutions.
- Program ARM microcontroller to perform various tasks.
- Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.

Sections	Course Content
Section A	Introduction To Embedded Systems: Embedded system, Processor embedded into a system, Embedded hardware units and devices in the system, Embedded software in the system, Examples of embedded systems, Embedded systems on chip (Soc) and use of VLSI circuit design technology, Design process in embedded system.
Section B	Advance Processor Architectures: Basic processor Architecture, Real world interfacing, Introduction to advanced architectures, Processor and memory organization, Instruction level parallelism, Performance metrics.
Section C	RTOS Fundamentals-I: Interrupts: Basics, Interrupt request, Role of Interrupt handler, Interrupt vector table, Context switching during Interrupts, Nesting of Interrupts, Shared-Data problem, Device Driver Programming Atomic and Critical Section of the code, Interrupt latency, Solving shared-data problem with and without disabling Interrupts. Software Architectures: Round-robin architecture without and with Interrupts, Function-Queue-Scheduling architecture. RTOS Fundamentals-II: Real-Time Operating System(RTOS): Basic concepts: Task and task states, Role of scheduler, Preemptive and Non-preemptive RTOS, Task control block, Concept of Reentrancy, Concept of Shared-Data problem and Semaphores, Semaphore types: binary, counting

	and mutex, Problem of priority inversion and priority inheritance protocol. Basic RTOS Services: Message queue, Mailbox and Pipes, Timer functions, Events, Signals.
Section D	Devices and Communication Buses for Embedded Networks: I/O types and examples, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication network using ISA,PCI,PCI-X, and advanced buses.

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

CO1: acquire a basic knowledge about fundamentals of microcontrollers.

CO2: acquire a basic knowledge about programming and system control to perform a specific task.

CO3: acquire knowledge about devices and buses used in embedded networking.

CO4: gain knowledge in various processor scheduling algorithms and basics of real time operating system.

Text Books:

1. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 2nd Edition, Third Edition, McGraw Hill Education.
2. David E Simon, "An Embedded Software Primer" Pearson.

Reference Books:

1. Shibu KV, "Introduction to Embedded Systems", McGraw Hill Education.

Name of the Course	**Satellite Communication**		
Course Code	**PEC-6004**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

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For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course objectives:

- To introduce various aspects in the design of systems for satellite communication.

Sections	Course Content
Section A	Introduction to Satellite Communication: History, Overview of Satellite Communication, Types of Satellite, Types of Orbit, Satellite services, Advantages & Applications of Satellite communication, Satellite Life phases, Introduction to Geo-synchronous and Geo-stationary satellites.
Section B	Orbital Mechanics: Orbital Mechanics, Kepler's Three laws of Planetary Motion, Developing the Equations of the orbit, Look Angle Determination, Earth Stations, Orbital Perturbations, Orbital effects in Communication system performance.
Section C	Satellite Sub-systems: Seven segments of Satellite communication, Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system. Satellite Link Design: Basic transmission theory, System noise temperature and G/T ratio, Design of down link and uplink, Design of satellite links for specified C/N.
Section D	Introduction to Various Satellite Systems: VSAT, Direct broadcast satellite television and radio, Satellite navigation and the Global positioning systems. Indian Satellite Systems: History and Overview of Indian Satellite System, Achievements, GSLV, PSLV, Advanced Technology Vehicle.

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

CO1: understand the orbital and functional principles of satellite communication systems.
CO2: learn the design of satellite links.
CO3: study the design of earth station and tracking of the satellite.
CO4: learn various satellite system navigation and positioning.

Text Books:

1. D.C. Agrawal, "Satellite Communication", Khanna Publishers; 7th Edition.
2. B. Pratt, A.Bostian, "Satellite Communications", Wiley India, 2nd Edition, 2006.

Reference Books:

1. D. Roddy, "Satellite Communications", McGraw-Hill, 4th Edition, 2001.

Name of the Course	**Electronic Device Simulation**		
Course Code	**PEC-6005**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

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For Candidates

Candidatesarerequiredtoattemptfivequestioninallselectingonequestionfromeach of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- This course builds the knowledge- base on the physics of semiconductors as related to the characteristics and design of solid-state electronic devices.
- It provides an introduction to the device electronics for integrated circuits, a foundation for the use of device models in circuit analysis and design tools and motivation for life-long learning.

Sections	Course Content
Section A	Metal-Semiconductor Contacts and P-N Junctions: Metal-Semiconductor junctions, Current-Voltage Characteristics, Surface Effects. The PN junction, Step Junction, Linearly Graded Junction, Hetero-junctions, Reverse-Biased p-n junctions and break down mechanism. Generation and Recombination.
Section B	Field-Effect Transistors (MOSFETs): Physical effects and models: MOS Capacitor, Oxide and Interface Charge: Origin and Experimental Determination Charge Coupled Devices, non-volatile memory. Basic MOSFET behaviour, MOSFET scaling and short channel model. Devices: Complementary MOSFETs (CMOS), electric fields and velocity-saturation, basic leakage currents, channel length modulation, body bias effect, threshold adjustment, sub-threshold conduction.
Section C	Device Modeling Limitation of long channel analysis, short-channel effects: velocity saturation, device degradation, channel length modulation, body bias effect, threshold adjustment, mobility degradation, hot carrier effects, MOSFET scaling goals, gate coupling, velocity overshoot, high field effects in scaled MOSFETs, substrate current and effects in scaled MOSFETS. Moore law, Technology nodes and ITRS, Physical & Technological Challenges to scaling, Nonconventional MOSFET – (FDSOI, SOI, Multi-gate MOSFETs).
Section D	Numerical Simulation: Numerical simulation, basic concepts of simulations, grids, device simulation and challenges. Importance of semiconductor device simulators - Key elements of physical device simulation, historical development of the physical device modeling. Introduction to the TCAD

	Simulation Tool, Examples of TCAD Simulations –MOSFETs and SOI.

Course Outcomes: After completing the course, the students will be able to:

CO1: understand the basic semiconductor physics/solid-state physics needed for modeling of electronic devices.

CO2: understand the fundamentals of device modeling and numerical simulation techniques.

CO3: understand the physical and technological challenges of scaling.

CO4: know the key elements of physical device modeling.

Text Books:

1. S. M. Sze and M.K. Lee, "Semiconductor devices- Physics and Technology", 3rd Edition, John Wiley & Sons, 2012.
2. Muller and Kammins, "Device Electronics for Integrated Circuits".
3. Dr. Vagica Vasileska and Stephen M. Goodnick, "Computational Electronics: Semi classical and Quantum Device Modeling and Simulation".
4. Shundri Oda & David Ferry, "Silicon Nanoelectronics", CRC Press.

Reference Books:

1. S. M. Sze and Kwok K. Ng "Physics of Semiconductor Devices", 3rd Edition, John Wiley & Sons, 2002.
2. Ben G. Steetman and Sanjay Banerjee, "Solid State Electronic Devices", 6th Edition, Prentice Hall, 2005.

Program Elective-III
for
Semester-VII

Name of the Course	Wireless Sensor Network		
Course Code	PEC-7001	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

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For Candidate

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To understand the basic concepts of wireless sensor networks, sensing, computing and communication tasks and internet of things.
- To understand the architectures, features, and performance for wireless sensor network systems and platforms
- To analyze the specific requirements of applications in wireless sensor networks for energy efficiency, computing, storage and transmission.

Sections	Course Content
Section A	Introduction & Applications of Wireless Sensor Networks: Introduction, basic Overview of the Technology, Applications of Wireless Sensor Networks. Architecture of WSN: Single node architecture, Hardware components, Sensor Node Technology, Sensor Taxonomy, WN operating environment, WN Trends, Network architecture, sensor network scenarios, optimization goals and figures of merit, Gateway concepts.
Section B	Networking Sensors: Physical layer, Wireless channel and communication fundamentals, frequency allocation, modulation and demodulation, wave propagation effects and noise, Wireless Transmission Technology and Systems, Radio technology primer, available wireless technologies, Medium Access Control Protocols for Wireless Sensor Networks, Fundamentals of MAC protocols, MAC protocols for WSNs, Sensor MAC case study, IEEE 802.15.4 LR-WPANs Standard Case Study, Naming & Addressing, Fundamentals, Address and name management in wireless sensor networks, assignment of MAC addresses. Routing Protocols: Routing protocols for Wireless Sensor Networks, routing challenges and design issues in wireless sensor networks, Routing strategies

	in wireless sensor networks, Flooding and its variants, Sensor protocols for information via negotiation, low energy adaptive clustering hierarchy, Power efficient gathering in sensor information systems, directed diffusion, Geographical routing.
Section C	Infrastructure Establishment: Introduction to time synchronization problem, Properties of localization and positioning, possible approaches, Topology control, Controlling topology in flat networks-power control, Hierarchical networks by dominating sets, Hierarchical networks by clustering.
Section D	Operating System for WSN: Operating system design issues, examples of operating systems, Node level software platform, node level simulators, State centric programming, Xbee platform.

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

CO1: understand the concepts of wireless sensor networks and internet of things.

CO2: analyze basic protocols in wireless sensor network.

CO3: describe and explain the hardware, software and communication for wireless sensor nodes.

CO4: adapt the wireless sensor network with sensor nodes which have limitations in power consumption, processing power and bandwidth.

Text Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor networks: Technology, Protocols & Applications", Wiley India Pvt. Ltd.
2. Holger Karl & Andreas Willig, "Protocols & Architectures for Wireless Sensor Networks', John Wiley, 2005

Reference Books:

1. Fundamentals of Wireless Sensor Networks: Theory and Practice by Waltenegus Dargie and Christian Poellabaue, Wiley India Pvt. Ltd.

Name of the Course	Introduction to MEMS		
Course Code	**PEC-7002**	Credits-3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To gain knowledge of micro electro mechanical systems (MEMS).
- To learn the state-of-the-art technology in fabrication and materials of MEMS.

Section	Course Content
Section A	Introduction to Microsystems: Overview of microelectronics manufacture and Microsystems technology. MEMS materials: Silicon, Silicon Dioxide, Silicon Nitride, Polysilicon, Silicon Carbide, Polymers, thin metal films, Graphene: The wonder material.
Section B	Micro Sensors and Actuators: Working principle of Microsystems-micro actuation techniques, microsensors-types, Microactuators and types, micropump, micromotors, micro-valves, microgrippers, micro-accelerometers.
Section C	Fabrication Process Substrates - single crystal silicon wafer formation, Clean room practices, Photolithography, Ion implantation, Diffusion, Oxidation, CVD-Physical vapor deposition, epitaxial-etching process.
Section D	Micro System Manufacturing Bulk Micro manufacturing-surface micro machining – LIGA Microsystem packages materials-dielevel-device level-system level- packaging techniques–diepreparation–surface bonding wire bonding-sealing. Introduction to assembly, Introduction to Micro-system design.

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

CO1: be introduced to the field of micro/nanosystems.
CO2: gain knowledge of basic approaches for micro/nanosystem design.
CO3: learn new materials, science and technology for micro/nano system applications.
CO4: understand state-of-the-art micromachining and packaging technologies

Text Books:

1. Tai-Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw-Hill Publishing Company Ltd.
2. Chang Liu, "Foundation of MEMS" Pearson Education.
3. Mohamed Gad – el – Hak "MEMS Handbook", CRC Press, 2002.

4. Rai - Choudhury P., "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 2009.
5. Sabrie Solomon, "Sensors Handbook," McGraw Hill, 1998.

Reference Books:

1. Francis E.H. Tay and Choong .W.O, "Micro fluidics and Bio MEMS application", IEEE Press New York, 1997.
2. Trimmer William S., Ed., "Micromechanics and MEMS", IEEE Press New York, 1997.
3. Maluf, Nadim, "An introduction to Micro electro mechanical Systems Engineering", AR Tech house, Boston 2000.
4. Julian W. Gardner, Vijay K.Varadan, Osama O. Awadel Karim, "Micro sensors MEMS and Smart Devices", John Wiby & sons Ltd., 2001

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Name of course	**Cloud Computing**		
Course code	**PEC-7003**	Credits -3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To expose the students to frontier areas of Cloud Computing and information systems.
- To provide knowledge of computer networking and distributed computing.
- To become an expert in designing, planning, and scaling cloud implementations.

Sections	Course Content
Section A	Cloud Computing Overview: Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.
Section B	Cloud Insights :Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.
Section C	Cloud Architecture- Layers and Models: Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

Section D	Cloud Simulators- CloudSim and GreenCloud: Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud Module-V: Introduction to VMW are Simulator Basics of VMW are, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Course Outcomes: After successfully completion, you should be able to:

CO1: articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.

CO2: identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.

CO3: explain the core issues of cloud computing such as security, privacy, and interoperability.

CO4: choose the appropriate technologies, algorithms, and approaches for the related issues.

Text Books:

1. Cloud computing a practical approach - Anthony T.Velte, Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008

Reference Books:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011.

Name of the Course	**VLSI for CAD**		
Course Code	**PEC-7004**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- This course deals with the fundamentals of Computer-Aided Design (CAD) tools for the design, analysis, synthesis, test, verification, routing and placement of digital Very Large Scale Integration (VLSI) systems.

Sections	Course Content
Section A	Introduction to Hierarchical and Structured Design: Role of CAD Tools in the VLSI design process, CAD Algorithms for switch level and circuits simulation, Techniques and algorithms for symbolic layout, Algorithms for physical design – Placement and routing Algorithms, Compaction, Circuit extraction and Testing.
Section B	Specification of Combinational Systems Using HDL: Introduction to HDL, Basic language element of HDL, Behavioral Modeling, Data flow modeling, Structural modeling, Subprograms and HDL description of gates, Barrel shifters, arithmetic and logic units, Binary decoder, Binary encoder, Multiplexers applications, Floating Point arithmetic-representation of floating point number, Floating point multiplication, Adders, Multipliers.
Section C	Language Constructs and their Hardware Synthesis: Digital hardware modeling: logic and system level modeling, Hardware description languages, RTL simulation, Synchronous and asynchronous system design. Design of Sequential Circuits: Shifters, Design of a Serial adder, Serial multiplier, Booth's multiplier, Sequential detectors, Vending machines, Signed and unsigned multipliers, Design of a binary divider.

Section D	Data Subsystems: Storage modules, Functional modules, Data paths, Control subsystems, Micro programmed controller, Memory subsystem, static timing analysis, Processors, Operation of the computer and cycle time. FPGA based synthesis: Multilevel logic synthesis, Logic optimization, Logic simulation, Compiled and event simulators, Relative advantages and disadvantages, Xilinx Zynq FPGA architecture, Features and applications, Design considerations of SoC and FPGA synthesis, Introduction to testing and DFT.

Course Outcomes: After the completion of the course the students will be able to:

CO1: Design advanced electronics systems.

CO2: Evaluate and analyze the systems in VLSI design environments.

CO3: Conduct an organized and systematic study on significant research topic within the field of VLSI and its allied field.

Text Books:

1. A VHDL Primer by J. Bhaskar, Addison Wesley, 1999
2. Verilog HDL by Joseph Yiu, Samir Palnitkar (Second Ed.), Pearson Education, 2004.
3. Digital System Design using VHDL by H. Roth, PWS Publishing.
4. Synthesis and Optimization of Digital Circuits by G. DeMicheli, McGraw Hill.

Reference Books:

1. Digital Design-Principles and Practices by J.F. Wakerly, PHI
2. VHDL by Douglas Perry, McGraw Hill.

Name of the Course	**Computer Organization and Architecture**		
Course Code	**PEC-7005**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which willcovertheentiresyllabusandwillcarry20%ofthe total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To understand the structure, function and characteristics of computer systems.
- To understand the design of the various functional units and components of computers.
- To identify the elements of modern instructions sets and their impact on processor design.
- To explain the function of each element of a memory hierarchy.
- To identify and compare different methods for computer I/O.

Sections	Course Content
Section A	Computer Organization Computer types, Structure with basic computer components, Function in brief with instruction fetch and execute, Interrupts and I/O communication, Interconnection structure, bus interconnection, Multiple Bus hierarchies, Elements of bus design Performance metrics and measurement
Section B	Computer Memory System Characteristics of memory system, Memory hierarchy, Cache Memory- Cache memory principles, Elements of cache design- cache address, size, mapping functions, replacement algorithms, write policy, Internal Memory- semiconductor memory, External Memory- Hard Disk organization, RAID
Section C	Input and Output System I/O modules- Module function and I/O module structure, Programmed I/O , Polling I/O, Interrupt driven I/O , DMA function, Synchronous and Asynchronous serial data communication, Computer peripherals like keyboard, mouse, printer, scanner and display devices
Section D	Processor Organization Evolution of Intel processor architecture- 4 bit to 64 bit, Control unit Hardwired and microprogrammed, concept of pipelining, Study of microprocessor 8085, Functional pins and Register organization, Memory mapped I/O and I/O mapped I/O schemes.

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

CO1: demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.

CO2: analyze the performance of commercially available computers.

CO3: to develop logic for assembly language programming.

CO4: to learn about the processors used in computers.

Text Book:

1. William Stallings, "Computer Organization and Architecture", Prentice Hall of India, Sixth Edition.
2. A. Tannenbaum, "Structured Computer Organization", Pearson Education, 2002.
3. Patterson & Hennessy, "Computer Organization and Design", Morgan Kaufmann, 2007.

Reference Book:

1. Ramesh S. Gaonkar, "Microprocessor, Architecture, Programming, and Applications with the 8085", Penram International Publication, 5/e

Program Elective-IV
for
Semester-VIII

Name of the Course	**Cryptography and Network Security**		
Course Code	**PEC-8001**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Learn fundamentals of cryptography and its application to network security.
- Understand network security threats, security services, and counter measures.
- Understand vulnerability analysis of network security.

Sections	Course Content
Section A	Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.
Section B	Mathematics Of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclid‟s algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 – Key distribution.
Section C	Public Key Cryptography: Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing –Factorization – Euler‟s totient function, Fermat‟s and Euler‟s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

Section D	Message Authentication And Integrity: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS-Entity Authentication: Biometrics, Passwords, Challenge Response protocols-Authentication applications – Kerberos, X.509 Security Practice And System Security: Electronic Mail security – PGP, S/MIME – IP security – Web Security – System Security: Intruders – Malicious software – viruses – Firewalls.

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

CO1: Understand various Cryptographic Techniques.
CO2: Apply various public key cryptography techniques.
CO3: Implement Hashing and Digital Signature techniques.
CO4: Understand the various Security Applications.
CO5: Implement system level security applications

Text Books:

1. Cryptography And Network Security Principles And Practice Fourth Edition, William Stallings, Pearson Education.
2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR.
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

Reference Books:

1. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

Name of the Course	**IoT Sensor and Actuator**		
Course Code	**PEC-8002**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things.
- IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronic.
- Apply advanced techniques and tools of sensing and computation to solve multi-disciplinary challenges in industry and society

Sections	Course Content
Section A	Introduction: Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device.
Section B	Seven Generations Of IoT Sensors To Appear: Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap.
Section C	Technological Analysis: Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module.
Section D	Iot Development: ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks -Focus on Wearable Electronics.

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

CO1: Competent and innovative with a strong cognizance in the area of sensors, IoT, data science, controllers and signal processing through the application of acquired

knowledge and skills.

CO2: Apply advanced techniques and tools of sensing and computation to solve multi-disciplinary challenges in industry and society.

CO3: Having computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning.

CO4: Having an ability to use techniques, skills, resources and modern engineering and IT tools necessary for engineering practice.

Text Books:

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, "Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 – 2024",Yole Development Copyrights ,2014
2. Peter Waher, "Learning Internet of Things", Packt Publishing, 2015
3. Editors Ovidiu Vermesan Peter Friess, "Internet of Things – From Research and Innovation to Market".

Reference Books:

1. Deployment', River Publishers, 2014 5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

Name of the Course	**Optoelectronics and Photonics**		
Course Code	**PEC-8003**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To develop an in-depth knowledge about major building blocks of optoelectronics and photonics.
- To introduce students to a broad range of modern optoelectronic devices and applications.

Sections	Course Content
Section A	Laser fundamentals- Einstein's coefficients, gain coefficient, laser rate equations, optical resonator, Q-factor and stability of optical resonator-modes of laser resonator, Q-switching and mode locking. Properties of lasers-coherence, line width and divergence.
Section B	Photo detectors and display devices, photodiodes, Photo transistor, APD, PMT, CCD, PIN photo diodes, liquid crystal display, Photo voltaic cells. Optical modulators-acousto-optics, electro-optics and magneto-optics. Physical origin of nonlinear optical coefficients, Second order optical nonlinearity, Propagation of EMW through NLO medium, optical second harmonic generation, phase matching conditions, Third order NLO, intensity dependent refractive index, Four wave mixing and optical phase conjugation.
Section C	Fibre Optics- classification of fibres- step index, graded index fibres, Numerical aperture, modes in optical fibre, single mode and multimode fibre, V Parameter, evanescent modes, losses in fibres- bending and coupling losses, dispersion in fibres, Special fibres-polarization maintaining fibres, holey fibre, PC fibres, DC Flattened and dispersion shifted fibre.
Section D	Fibre optic sensors- advantages of FOS, intensity modulated sensors, interferometric sensors, rotation sensors, bio sensors. Optical communication – advantages, modulation, time division and wave length multiplexing**.**

Course Outcomes:

CO1: To enable the student to understand the wave nature of light, study the quantum mechanical treatment of light.

CO2: Analyze mechanism of operation of lasers, photo detector, photo conductors, photo diodes, amplifier, modulators, phototransistor and their performance.

CO3: To enable the student to explore effects of noise, distortion and optimal detection methods.

CO4: Calculate properties of and design modern optical fibres and photonic crystals.

Text Books:

1. A.Ghatak & K. Thyagarajan, Lasers: Theory & Applications, Macmillan India LTD. 2003
2. A.Ghatak & K. Thyagarajan, Optical Electronics, Cambridge University Press, 2004
3. Amon Yariv, Optical Electronics, Saunders College Publishing 1991

Reference Books:

1. Francis T.S Yu, Shizhuo Yin (Eds), Fiber Optic Sensors, Marcel Dekker Inc., New York,2002 6 • John M senior, Optical fiber communications PHI, 1992

Name of the Course	**DSP System Design**		
Course Code	**PEC-8004**	Credits-3	L-3,T-0,P-0
Lectures to be delivered	39 (1 Hr Each) (L=39 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To study the design techniques for FIR and IIR digital filters.
- To impart Digital Signal Processor basics, DSP Architecture, programming skills and application.
- To study the finite word length effects in signal processing.

Sections	Course Content
Section A	Introduction to the DSP Systems: Typical DSP algorithms, DSP applications demands and scaled CMOS technologies. DSP Architecture: Single Core and Multicore; Digital Signal Processors and the associated interface hardware and software systems.
Section B	Pipelining and Parallel Processing; Pipelining of FIR digital filters, Parallel Processing, Pipelining and Parallel Processing for low power.
Section C	DSP algorithms: Convolution, Correlation, FIR/IIR filters, FFT, adaptive filters, sampling rate converters, DCT, Decimator, Expander and Filter Banks.
Section D	DSP applications: in wireless and mobile communication, multimedia technology and communication, control systems, power electronics and power systems, measurement and instrumentation.

Course Outcomes:

CO1: Acquired knowledge about Fundamentals of DSP Processors.
CO2: Ability to understand the DSP Architecture.
CO3: Foster ability to understand memory architecture for DSP.
CO4: Foster ability to understand the need of different types of instructions for DSP.

Text Books:

1. Rulph Chassaing, Digital signal processing and applications with C6713 and C6416 DSK, Wiley, 2005
2. Keshab K Parhi, VLSI Digital Signal Processing Systems: Design and Implementation, student Edition, Wiley, 1999.

Reference Books:

1. Nasser Kehtarnavaz, Digital Signal Processing System Design: LabVIEW-Based Hybrid Programming, Academic Press, 2008

OPEN
Electives

Name of the Course	**Non-Conventional Energy Resources**		
Course Code	**OE-1001**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	(L=39, for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional test (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To provide a survey of the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of simple to state- of -the-art energy systems.

Sections	Course Content
Section A	Introduction to Energy Sources: World energy futures, Conventional energy sources, Non-conventional energy sources, Prospects of Renewable energy sources.
Section B	Solar Energy: Introduction to solar radiation and its measurement, Introduction to Solar energy Collectors and Storage, Solar thermal electric conversion, Thermal electric conversion systems, Solar electric power generation, Solar photo-voltaic, Solar Cell principle, Semiconductor junctions, Conversion efficiency and power output, Basic photo- voltaic system for power generation.
Section C	Wind Energy and Wind Energy Conversion: Introduction to wind energy conversion, the nature of the wind, Power in the wind, Wind data and energy estimation, Site Selection considerations, basic Components of a Wind energy conversion system, Classification of WEC Systems.
Section D	Energy conservation-principles, technologies, waste heat utilization, heat regenerators, energy storage, devices, instruction and control.

Course Outcome: After completion of the course, students will be able to:

CO1: Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells.

CO2: Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.

CO3: Explore the concepts involved in wind energy conversion system by studying its components, types and performance.

CO4: Illustrate ocean energy and explain the operational methods of their utilization.

Text Books:

1. Renewable energy sources and conversion technology by N.K. Bansal, M. Kleemann, & M. Heliss, Tata McGraw-Hill.
2. Renewable Energy by S. Bent, Academic Press.

Reference Books:

1. Renewable Energy: Power for a Sustainable Future by G. Boyle, Oxford University Press.
2. Explore the concepts involved in wind energy conversion system by studying its components, types and performance.

Name of the Course	**Indian Financial System**		
Course Code	**OE-1002**	Credits-3	L-3, T-0,P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- This course aims at providing the students the intricacies of Indian financial system for better financial decision making.

Section	Course Content
Section A	Introduction – Meaning – Classification of Financial System. Financial Markets –Functions and Significance of Primary Market, Secondary Market, Capital Market, & Money
Section B	Financial institutions: Introduction – Meaning – Classification of Financial System. FinancialMarkets–FunctionsandSignificanceofPrimaryMarket,SecondaryMarket,Capital Market, & amp; Money Market.
Section C	Commercial banks Introduction – Role of Commercial Banks – Functions of Commercial Banks – Primary Functions and Secondary Functions – Investment Policy of Commercial Banks. Narasimaham committee report on banking sector reforms.
Section D	Regulatory institutions:ReserveBankofIndia(RBI)–Organization–Objectives–RoleandFunctions.TheSecurities Exchange Board of India (SEBI) – Organization and Objective Financial services: Meaning & amp; Definition – Features – Importance. Types of Financial Services – factoring, leasing, venture capital, Consumer finance – housing & amp; vehicle finance.

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

CO1: Outline the structure and functions of the Indian financial system.

CO2: Illustratethefunctioningoffinancialmarketandgovernmentsecuritymarketing the development of Indian financial system.

CO3: Evaluate the functioning of different financial institutions.

Text Books:

1. Vasantha Desai: The Indian Financial System, HPH Electric Drive by M. Chilikin, Medtech.
2. G. Ramesh Babu; Indian FinancialSystem.HPH
3. Dr. Bharatish Rao, B.R. Bharghavi – Indian Financial System, VBH

Reference Books:

1. Meir Kohn: Financial Institutions and Markets, Tata McGraw Hill

Name of the Course	**Total Quality Management**		
Course Code	**OE- 1003**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	L=39, (for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional test (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed

Course Objectives:

The main objectives of this course are:

- To introduce the importance of quality in improving competitiveness
- To develop competency in assessment of Cost of Poor Quality
- To sensitize students in role of leadership & employee engagements in building quality culture in organization

Sections	Course Content
Section A	Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM. Quality Control and Improvement Tools: Check Sheet, Histogram, Pareto Chart, Cause and Effect diagram, Scatter diagram, Control chart, Graph, Affinity diagram, Tree diagram, Matrix diagram, Process decision program chart, Arrow diagram, Acceptance Sampling, Process capability studies, Zero defect program (POKA-YOKE).
Section B	TQM PRINCIPLES: Leadership – Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention -Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.
Section C	TQM TOOLS & TECHNIQUES: The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM –

	Concepts, improvement needs – Cost of Quality – Performance measures.
Section D	Quality Management System & Quality Audit: Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits, Audit objectives, types of quality audit, Quality Auditor. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward- Introduction to software quality.

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

CO1: To realize the importance of significance of quality.
CO2: Manage quality improvement teams.
CO3: Identify requirements of quality improvement program.

Text Books:

1. Dale H. Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 3rd Edition,
2. Indian Reprint.
3. Ross, J.E.: Total Quality Management, Vanity Books International.

Reference Books:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", South- Western (Thomson Learning).
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford.
3. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India)Pvt. Ltd.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd.
5. Goetsch, D.L. &Davis,S.: Introduction to Total Quality, Prentice Hall.
6. Juran, J.M. &Gryna, F.M.: Quality Planning and Analysis, Tata McGraw Hill Publishing Co. Ltd., New Delhi
7. Charantimath, P.M.: Total Quality Management, Pearson Education.

Name of the Course	Applied Fuzzy Electronic System		
Course Code	**OE-1004**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	(L=39, for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

ThequestionpaperwillconsistoffivesectionsA,B,C,D&E.SectionEwillbecompulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objectives: Students undergoing this course are expected:

- To understand Fuzzy Sets, Possibility Distributions.
- To analysis Fuzzy Rule.
- To be aware of uncertainty in information.
- To learn approximate method of Extension.
- Analysis Fuzzy Logic in Control Engineering.

Sections	Course Content
Section A	History of Fuzzy Logic, Fuzzy Sets, Possibility Distributions, Fuzzy Rules, Fuzzy Sets, Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory, Fuzzy Relations and their Compositions, Fuzzy Graphs, Fuzzy Numbers, Functions with Fuzzy Arguments, Arithmetic Operations of Fuzzy Numbers.
Section B	Fuzzy Rules: Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models: Mamdani Model, TSK Model, Standard Additive Model, Fuzzy Implications and Approximate Reasoning: Propositional Logic, First Order Predicate Calculus, Fuzzy Implications, Approximate Reasoning, Criteria and Family of Fuzzy Implications, Possibility vs. Probability, Probability of Fuzzy Event, Probabilistic Interpretations of Fuzzy Sets, Fuzzy Measure.
Section C	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 Defuzzification 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.

Section D	Fuzzy Logic in Control Engineering: Fundamental Issues in Control Engineering, Control Design Process, Semiformal Aspects of Design Process, Mamdani Architecture of Fuzzy Control, The Sugeno-Takagi Architecture. Fuzzy Logic in Hierarchical Control Architecture, Historical Overview and Reflections on Mamdani`s Approach, Analysis of Fuzzy Control System via Lyapunov`s Direct Method, Linguistic Approach to the analysis of Fuzzy Control System, Parameter Plane Theory of Stability, Takagi-Sugeno-Kang Model of Stability Analysis.

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

CO1: Understand the Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory.

CO2: Design Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models.

CO3: Realization of Fuzzy Sets and their properties; Cardinality of Classical Relations and their properties.

CO4: Understand Fundamental Issues in Control Engineering, Control Design Process, Semiformal Aspects of Design Process, Mamdani Architecture of Fuzzy Control, The Sugeno-Takagi Architecture.

Text Books:

1. John Yen, Reza Langari, "Fuzzy Logic: Intellegent Control and Information", Pearson Publication.
Ahmad M. Ibrahim, "Introduction to Applied Fuzzy Electronics", Prentice Hall Publication

Reference Books:

1. Ahmad M. Ibrahim, "Fuzzy Logic for Embedded Systems Applications", Newnes Publications.
2. Witold Pedrycz, Fernando Gomide, "Fuzzy Systems Engineering: Toward Human-Centric Computing", John Wiley Publications.

Name of the Course	**Artificial Neural Networks**		
Course Code	**OE-1005**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	(L=39, for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

The question paper will consist of five sections A, B, C, D and E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will convert the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates

Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- Understand the basic building blocks of artificial neural networks(ANNs)
- Understand the role of neural networks in engineering and artificial intelligence modeling
- Provide knowledge of supervised/unsupervised learning in neural networks Provide knowledge of single layer and multi-layer perceptrons.

Sections	Course Content
Section A	Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process
Section B	Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection
Section C	Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning
Section D	Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

Text Books:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition**.**

Reference Books:

1. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India PLtd2005.
2. Neural Networks in Computer Inteligance, Li Min Fu MC GRAW HILLEDUCATION2003.
3. Neural Networks -James A Freeman David M S Kapura PearsonEducation2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing HouseEd.2006.

Name of the Course	**Artificial Intelligence and Machine Learning**		
Course Code	**OE-1006**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	(L=39, for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters: ThequestionpaperwillconsistoffivesectionsA,B,C,DandE.SectionEwill be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which willcovertheentiresyllabusandwillcarry20%ofthe total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates: Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Course Objectives:

- To impart knowledge about Artificial Intelligence and concepts of machine learning
- To enable the students to understand the basic principles of Artificial Intelligence and machine learning in various applications

Sections	Course Content
Section A	Background and overview: Over view of terminology, formulations and concepts, Introduction of maintasks, error and performance metrics, data preparation/annotation, Components of learning, data representation, linear classification, formulation of ML problem.
Section B	Learnability: Hoeffding's inequality, over fitting, performance/complexity, bias/variance trade-off, End- to End Machine Learning Project, Feature selection, Feature transformation, model selection and validation, regularization.
Section C	Regression: Linear Regression, Polynomial Regression, Logistic Regression, Regularized Linear Models, Logistic Regression SVM and kernels Hyper plane, separation with hard margin, soft margin, support vector classification, kernel methods, support vector regression.
Section D	Unsupervised learning: Clustering, k-means algorithm, PCA, Neural Networks, Logistic regression, gradient descent, Perceptron, MLP, back propagation.

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

CO1: Solve basic AI based problems.
CO2: Apply AI techniques to real-world problems to develop intelligent systems.
CO3: Select appropriately from a range of techniques when implementing intelligent systems
CO4: Develop an understanding what is involved in learning models from data.

Text Books:

1. J.Gabriel,ArtificialIntelligence:ArtificialIntelligenceforHumans(ArtificialIntelligence,MachineLearning), Create Space Independent Publishing Platform, Firstedition,2016
2. Jeff Heaton, Introduction to the Math of Neural Network, Heaton Research

Reference Books:

1. S.S.V. Chandra, Artificial Intelligence and Machine Learning, Prentice Hall India Learning Private Limited, First edition, 2014.
2. Shai Shalev –Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University, 2014.

Name of the Course	**Cyber Law and Ethics**		
Course Code	**OE-1007**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	(L=39, for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instructions

For Paper Setters

ThequestionpaperwillconsistoffivesectionsA,B,C,DandE.SectionEwill be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates

Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed

Course Objectives:

- To introduce the cyber world and cyber law in general and to explain the various facets of cyber crimes
- To understand, explore, and acquire a critical understanding cyber law.
- To develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cybercrimes that is taking place via the internet.

Sections	Course Content
Section A	Introduction to Security: Security principles, threats and attack techniques, Cryptographic mechanisms, Classical Encryption Techniques Symmetric and Asymmetric cryptography. Introduction to Cyber Crime and Cyber Offences: Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names,Internetasatoolforglobalaccess.Cybercrimeandinformationsecurity,Classifications of cybercrimes, How criminals plan the attacks? Botnets -The fuel for cybercrime. Phishing, Password cracking, key loggers and sql injection, attacks on wireless networks. Cyber crime: Illustrations, Examples and mini cases, Illustrations of financial frauds in cyber domain, digital signature related crime scenarios.
Section B	Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Section C	Cost of Cyber Crimes and IPR Issues: lessons for organization, web threats for organization, security and privacy implications from cloud computing, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations, protecting people's privacy in the organization, organizational guidelines for internet usage, safe computing guidelines and computer usage policy, incident handling: an essential component of cyber security.
Section D	Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Course Outcomes: After completing the course, students will be able to:

CO1: Concepts related to cyber world and cyber law in general.

CO2: Intellectual property issues in the cyber space and the growth and development of the law.

CO3: Regulation of cyber space at national and international level.

CO4: Information technology act and legal frame work of right to privacy, data security and data protection.

Text Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security", Wiley India Pvt. Ltd.
2. Dieter Gollmann, , "Computer Security", John Wiley & Sons

Reference Books:

1. William Stallings, Network Security Essentials, 4th Edition, Pearson Publication
2. Bruce Schneier, Applied Cryptography, Wiley & Sons; Edition2001.

Name of the Course	Energy Assessment and Auditing		
Course Code	**OE-1008**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	L=39, (for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 Hrs
Internal Assessment (based on sessional tests-50%, Tutorials/ Assignments-30%, Quiz/Seminar-10%, Attendance-10%)			Max Marks: 50

Instruction

For Paper Setters

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examinationforthecourse.

For candidates

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To facilitate the students to achieve a clear conceptual understanding of technical and commercial as energy conservation and energy auditing.
- To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding energy conservation and energy auditing.

Sections	Course Content
Section A	Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, re- structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act- 2001 and its features. Basics of Energy and its various forms: Electricity basics- DC & AC currents, electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.
Section B	Energy Management & Audit: Definition ,energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Section C	EnergyActionPlanning:Keyelements,forcefieldanalysis,Energypolicypurpose, perspective, contents, formulation, ratification, Organizing - location of energy management,topmanagementsupport,managerialfunction,rolesandresponsibilities of energy manager, accountability. Motivating-motivation of employees: Information system-designing barriers, strategies; Marketing and communicating-training and planning. Financial Management: Investment-need, appraisal and criteria, financial analysis techniques simple pay-back period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of ESCOs.
Section D	Project Management: Definition and scope of project, technical design, financing, contracting, implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification. Energy Monitoring, Targeting and Global environmental concerns: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques -energy consumption, production, cumulative sum of differences (CUSUM). United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

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

CO1: Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing.

CO2: Ability to analyze the viability of energy conservation projects.

CO3: Capability to integrate various options and assess the business and policy environment regarding energy conservation and energy auditing.

CO4: Advocacy of strategic and policy recommendations on energy conservation and energy auditing

Text Books:

1. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths,London.
2. W.C. turner, "Energy Management Hand book" Wiley, NewYork.
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths,London.
4. Handbook of Energy Audits by Albert Thuman – FairmanPressInc.
5. Energy basis for man and nature by Howard T.Odum&Elisbeth. C.Odum.

Reference Books:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford.