Regulation 2016 Curriculum and syllabus (ECE)

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
Semester I						
M 101	Mathematics-I	3	1	0	4	4
CH 101	Chemistry-I	3	1	0	4	4
EE 101	Basic Electrical Engineering	3	1	0	4	4
HU 101	Communicative English	2	0	0	2	2
ME 101	Engineering Mechanics	3	1	0	4	4
XC181	Extra-Curricular Activity (NSS)	0	0	2	2	1
HU191	Lang. Lab. and Seminar Presentation	0	0	2	2	1
CH 191	Chemistry Lab	0	0	3	3	2
EE 191	Basic Electrical Engineering Lab	0	0	3	3	2
ME 191	Engineering Drawing & Graphics	0	0	3	3	2
Total						26
Semester II						
M 201	Mathematics -II	3	1	0	4	4
PH 201	Physics - I	3	1	0	4	4
EC 201	Basic Electronics Engineering	3	1	0	4	4
CS 201	Computer Fundamentals & Principle of Computer Programming	3	1	0	4	4
ME 201	Engineering Thermodynamics & Fluid Mechanics	3	1	0	4	4
CS291	Computer Fundamentals & Principle of Computer Programming Lab	0	0	3	3	2
PH291	Physics -I Lab	0	0	3	3	2
EC 291	Basic Electronics Engineering Lab	0	0	3	3	2
ME 291	Workshop Practice	0	0	3	3	2
MC 281	Soft Skill Development	0	0	2	2	0
Total						28

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
Semester III						
M 301	Mathematics-III	3	1	0	4	4
M(CS) 301	Numerical Methods	3	0	0	3	3
EC 301	Solid State Devices	3	0	0	3	3
EC 302	Circuit Theory & Networks	3	1	0	4	4
CS(ECE) 301	Data Structure	3	0	0	3	3
M(CS) 391	Numerical Methods Lab	0	0	3	3	2
EC 392	Circuit Theory & Network Lab	0	0	3	3	2
CS(ECE) 391	Data Structure Lab	0	0	3	3	2
MC381	Technical Skill Development	0	0	2	2	2Units
Total						23
Semester IV						
PH(ECE)401	Physics II	3	0	0	3	3
EC 401	Signals & Systems	3	0	0	3	3
EC 402	Analog Electronic Circuits	3	1	0	4	4
EC 403	Digital Electronic And Circuits	2	2	0	4	3
EC 404	Analog Communication	3	0	0	3	3
PH(ECE) 491	Physics II Lab	0	0	3	3	2
EC 492	Analog Electronic Circuits Lab	0	0	3	3	2
EC 493	Digital Electronic And Circuits Lab	0	0	3	3	2
EC 494	Analog Communication Lab	0	0	3	3	2
HU 481	Technical Report Writing & Language Practice	0	0	2	2	1
Total						25

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
Semester V						
HU 501	Environmental Science	2	0	0	2	2
EC 501	Digital Communication Systems	2	2	0	4	3
EC 502	Microprocessor & Micro Controller	3	0	0	3	3
EC 503	Digital Signal Processing	3	0	0	3	3
EC 504 A/B/C	Power Electronics /Electrical & Electronics Measurement / Telecommunication Systems	3	0	0	3	3
EC 591	Digital Communication Systems Lab	0	0	3	3	2
EC 592	Microprocessor & Micro Controller Lab	0	0	3	3	2
EC 593	Digital Signal Processing Lab	0	0	3	3	2
EC 581	Mini Project -I	0	0	4	4	2
MC 581	Group Discussion Practice	0	0	2	2	2 Units
Total						22
Semester VI						
EC 601	EM Wave Propagation & Antenna	2	2	0	4	3
EC 602	Information Theory & Coding	2	2	0	4	3
EC 603	Control System	3	0	0	3	3
EC 604 A/B/C	Object Oriented Programming / Advanced Microcontroller & Embedded System / Optical Fiber Communication	3	0	0	3	3
EC 605 A/B/C	Engineering System Design & Analysis / Material Science & Engineering / Computer Communication & Networks	3	0	0	3	3
EC 691	EM Wave Propagation & Antenna Lab	0	0	3	3	2
EC 693	Control System Engineering Lab	0	0	3	3	2
EC 694 A/B/C	Object Oriented Programming Lab / Advanced Microcontroller & Embedded System Lab / Optical Fiber Communication Lab	0	0	3	3	2
EC 681	Mini Project -II	0	0	12	12	6
EC 682	Industrial Training (4 Weeks)	0	0	0	0	1
Total						28

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
Semester VII						
HU 705	Principles of Management	2	1	0	3	2
EC 701	RF & Microwave Engineering	3	0	0	3	3
EC 702	VLSI & Microelectronics	3	1	0	4	4
EC 703 A/B/C	Digital Image Processing / Computer Organization & Architecture / Data Base Management Systems	3	0	0	3	3
EC 704 A/B/C	Artificial Intelligence & Robotics / Biomedical Electronics & Imaging / Renewable Source & Applications	3	0	0	3	3
EC 791	RF & Microwave Engineering Lab	0	0	0	3	2
EC 792	VLSI & Microelectronics Lab	0	0	0	3	2
EC 793 A/B/C	Digital Image Processing Lab / Computer Organization & Architecture Lab / Data Base Management Systems Lab	0	0	0	3	2
EC 781	Project I	0	0		6	3
MC 782	Technical Seminar Presentation	0	0	3	3	3 Units
Total						24
Semester VIII						
HU 801	Economics for Engineers	2	1	0	3	2
EC 801	Advanced Communication Systems	3	0	0	3	3
EC 802 A/B/C	Advanced Semiconductor Devices / EMI & EMC / Mobile Communication and Network	3	0	0	3	3
EC 803 A/B/C	Software Engineering / Physical Design, Verification & Testing / Soft Computing	3	1	0	4	4
EC 891	Advanced Communication Lab	0	0	3	3	2
EC881	Project II	0	0	12	12	6
EC882	Grand Viva	0	0	0	0	2
Total						22
Total						198

Department of Electronics & Communication Engineering

Syllabus:

Paper Name:
Mathematics –I Paper
Code: M101
Total Contact
Hours: 40 Credit: 4

Prerequisite: Any introductory course on matrix algebra, calculus, geometry.

Course Objective: The purpose of this course is to provide fundamental concepts matrix algebra, Calculus of Single and Several Variables and Vector Analysis.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M 101.1: Recall the distinctive characteristics of Matrix Algebra, Several Calculus of Single and Variables and Vector Analysis.

M 101.2: Understand the theoretical concept of Matrix Algebra, Several Calculus of Single and Variables and Vector Analysis.

M 101.3: Apply the principles of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis to solve various problems.

Course contents:

MODULE I [10L]

Matrix Algebra: Elementary row and column operations on a matrix, Rank of matrix, Normal form, Inverse of a matrix using elementary operations, Consistency and solutions of systems of linear equations using elementary operations, Linear dependence and independence of vectors, Concept & Properties of different matrices (unitary, orthogonal, symmetric, skew-symmetric, hermitian, skew-hermitian), Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Characteristic polynomials, Caley-Hamilton theorem and its applications, Reduction to diagonal form (upto 3rd order).

MODULE II [10L]

Calculus-I (Functions of single variable): Rolle's theorem, Mean value theorem-Lagrange & Cauchy, Taylor's and Maclaurin's theorems, Expansion of simple functions by Taylor's and Maclaurin's Theorems, Fundamental theorem of integral calculus, Evaluation of plane areas, volume and surface area of a solid of revolution and lengths, Convergence of Improper integrals, Beta and Gamma Integrals - Elementary properties and the Inter relations.

MODULE III [12L]

Calculus-II (Functions of several variables): Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives, Total Differentiation, Derivatives of composite and implicit functions, Euler's theorem on homogeneous functions, Chain rule, Maxima and minima of functions of two variables – Lagrange's method of Multipliers, Change of variables-Jacobians (up to three variables), Double and triple integrals.

MODULE IV [8L]

Vector Calculus: Scalar and vector triple products, Scalar and Vector fields, Vector Differentiation, Level surfaces, Directional derivative, Gradient of scalar field, Divergence and Curl of a vector field and their physical significance, Line, surface and volume integrals, Green‘s theorem in plane, Gauss Divergence theorem, Stokes‘ theorem, Applications related to Engineering problems.

Text Books:

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.
4. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley, 1995.
5. G. Strang, Linear algebra and its applications (4th Edition), Thomson, 2006.

Reference Books:

6. S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India, 2000.
7. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
8. TG. B. Thomas and R. L. Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison-Wesley, 1998.
9. Hughes-Hallett et al., Calculus - Single and Multivariable (3rd Edition), John-Wiley and Sons, 2003.
10. J. Stewart, Calculus (5th Edition), Thomson, 2003.
11. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier,2006.
12. L.Rade and B.Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
13. Murray R Spiegel and Seymour Lipschutz, Schaum's Outline of Vector Analysis.
14. Richard Bronson , Schaum's Outline of Matrix Operations.

CO-PO mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M 101.1	3	2	-	-	-	-	-	-	-	-	-	1
M 101.2	3	2	-	-	-	-	-	-	-	-	-	1
M 101.3	3	2	2	-	-	-	-	-	-	-	-	1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name:
Chemistry Paper
Code: CH 101 Total
Contact Hours: 40
Credit: 4

Pre requisites: 10+2 science with

chemistry Course Objective

Understanding of the fundamental theories and applications of thermodynamics, electrochemical principles in modern electrochemical cells and to get an insight into electronic structure of crystals and nanomaterials. Learning about the Synthesis, properties and applications of polymers , fuels and alternative energy sources & their significance in petrochemical industries. Analyzing water quality for its various parameters & its significance in industries.

Course Outcome

CH101.1: Able to apply fundamental concepts of thermodynamics in different engineering applications. **CH101.2:** Able to analyze & design simple and technologically advanced electrical and energy storage devices.
CH101.3: Able to synthesize nanomaterials, composites, polymers.
CH101.4: Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries , and technical fields.
CH101.5: Able to apply the knowledge of different fuels and corrosion to different industries **CH101.6:** Able to analyse water quality parameter for its various parameters & its significance in industries.

Course contents

Module 1 [8L]

Chemical Thermodynamics –I

1.1 **Concept of Thermodynamic system**: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property. **Introduction to first law of thermodynamics**: Different statements, mathematical form. **Internal energy**: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.

2L

1.2 **Enthalpy**: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.

Heat Capacity: Definition, Classification of Heat Capacity (Cp and CV): Definition and General expression of Cp - CV. Expression of Cp - CV for ideal gas.

Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation. **3L**

1.3 **2nd law of thermodynamics**: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature (brief).

Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. **3L**

Module 2 [7L]

2.1 **Reaction Dynamics**

Reaction laws: rate and order; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration), Pseudounimolecular reaction, Arrhenius equation. **3L Mechanism and theories of reaction rates** (Content beyond the syllabus)

2.2 Solid state Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).
Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor,
photo voltaic cell, fabrication of integrated circuits. **4L**

Module 3 [8L]

Electrochemistry

3.1 Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak
electrolyte). **1L**

3.2 Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, calomel half cell (representation, cell reaction,
expression of potential, Discussion, Application). **3L**

3.3 Concept of battery

Battery and Commercial electrochemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion,
application). **2L**

3.4 Corrosion and its control

Introduction, cause and effect of corrosion, types of corrosion: dry, wet and other:
Electrochemical corrosion, galvanic corrosion, passivation and protective measure. **2L**

Module 4 [12L]

4.1 Structure and reactivity of Organic molecule

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of some addition,
eliminations and substitution reactions. **3L**

4.2 Polymers

Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg.: Theory and mathematical expression only), Poly dispersity index (PDI).
Polymerization processes: addition and condensation polymerization (mechanism not required), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm) and amorphicity (Concept of Tg) of polymer.
Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP, PMMA, Polyester, PTFE, Bakelite), rubber (natural rubber, SBR), fibre (nylon 6, nylon 6,6),
Vulcanization of rubber, Conducting polymers and bio-polymers. **7L**

4.3 Nano material

Basic principles of nano science and technology, classification, preparation, properties and
application of nano material. **2L**

Module 5 [5L]

5.1 Industrial Chemistry Fuels

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Proximate analysis of coal, Calorific value.
Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Biodiesel.
Gaseous fuels: Natural gas, water gas, Coal gas, bio gas, CNG, LPG **3L**

5.2 Water

Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards), Chlorination of Water, Types of hardness- Units, Brief Softening methods.

2L

Short overview of water treatment plants (Content beyond the syllabus)

Reference Books

1. Engineering Chemistry: Bandyopadhyay and Hazra
2. Physical Chemistry: P.C. Rakshit
3. Organic Chemistry: Finar, vol-1
4. Engineering Chemistry: B.Sivasankar, Tata Mc Graw Hill, 2008
5. A Text book of Engineering Chemistry: S.S.Dara, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.
6. Engineering Chemistry Simplified: S. Nandi and R. Bhattacharyya, Chayya Prakashani Pvt. Ltd.

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CH101.1	3	1	-	-	-	-	-	-	-	-	-	-
CH101.2	3	2	1	-	-	-	-	-	-	-	-	-
CH101.3	-	-	2	-	2	-	-	-	-	-	-	1
CH101.4	2	-	1	-	2	-	-	-	-	-	-	-
CH101.5	2	-	-	-	-	-	2	-	-	-	-	1
CH101.6	-	-	2	-	-	-	1	-	-	-	-	-

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name:
Physics -I Paper
Code: PH 101 Total
Contact Hours: 41
Credit: 4

Pre requisites: Knowledge of Physics upto 12th standard.

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

At the end of the course students' should have the

PH 101.1 : Ability to state and recall ➢ **De-Broglie hypothesis, and Heisenberg's Uncertainty Principle** ➢ **Amplitude and Velocity Resonance** ➢ **Malus's Law, Brewster's Law** ➢ **Characteristics of LASER light**	PO1 Or GA1
PH 101.2 : Ability to understand and explain ➢ **Polarizer and analyzer** ➢ **basic principles and different types of LASER and Optical Fibre** ➢ **structure of solids, Miller indices** ➢ **theory of Matter Wave, equation of motion of Matter Wave** ➢ wave function and its role in representing wave nature of matter	PO2 Or GA2
PH 101. 3 : Ability to apply the knowledge of ➢ **mechanical vibration in electrical circuits** ➢ **superposition principle in Newton's ring phenomenon, diffraction phenomenon** ➢ **quantum nature of e.m. waves for production of laser** ➢ **total internal reflection in transmitting light through optical fibres** ➢ **x-ray diffraction in crystal structure** ➢ **probability interpretation in Heisenberg's uncertainty principle**	PO3 Or GA3
PH 101.4 : Ability to analyze ➢ **grating as many slit system** ➢ **role of Q factor in a resonating circuit, conditions of different types of resonance** ➢ **minimum requirements for lasing action** ➢ **importance of light as a carrier of information** ➢ **the failures of classical physics in microscopic situation and need of quantum physics** ➢ **Einstein's A, B coefficient and predict the wavelength domain of Lasing action** ➢ **Requirement of Miller indices for describing crystallographic planes**	PO2 Or GA2
PH 101.5 : Ability to evaluate / justify / compare	PO12

	Or

X-ray production process is inverse of the process of Photoelectric Effect. ➢ **different crystallographic structures according to their Co-ordination number and packing factors** ➢ **the outcome of Photo-electric effect, Compton effect and Davission-Germer experiment to justify wave-particle duality of matter**	GA12

Course contents

Module 1 (8L):- Oscillations

1.1 **Simple harmonic motion:** Concepts with examples, Superposition of SHMs in two mutually perpendicular directions: Lissajous' figures, Engineering Applications and related Numerical problems 2L

1.2 **Damped vibration:** Differential equation and its solution, Logarithmic decrement, quality factor, Engineering Applications and related Numerical problems. 3L

1.3 **Forced vibration**: Differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance, relevant applications including LCR circuits, Numerical problems 3L

Module 2 (10L):- Classical Optics:

2.1 **Interference of light:** Wave nature of light (Huygen's principle), Conditions of sustained interference double slit as an example; qualitative idea of spatial and temporal coherence, conservation of energy and intensity distribution; Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems. 3L

Fresnel's biprism (beyond the syllabus). 1L(ext)

2.2 **Diffraction of light:** Fresnel and Fraunhofer class, Fraunhofer diffraction for plane transmission grating (elementary treatment of intensity distribution for N-slits), single slit and double slits as examples, missing order, Rayleigh criterion, resolving power of grating and microscope (Definition and formula; no deduction required). Engineering Applications, Numerical Problems. 4L

2.3 **Polarization:** Definition, plane of polarization, plane of vibration, Malus law, fundamental concepts of plane, circular and elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: ordinary and extraordinary rays, Nicol's prism, Engineering applications, Numerical problems. 3L

Module 3 (9L):- Quantum Physics:

3.1 Quantum Theory: Inadequacy of classical physics; Planck's quantum hypothesis-Qualitative (without deductions), particle concept of electromagnetic wave (example: photoelectric and Compton effect; qualitative discussions only), wave particle duality; phase velocity and group velocity; de Broglie
wave; Davisson and Germer experiment. 4L

3.2 Quantum Mechanics 1: Concept of wave function, Physical significance of wave function, Probability interpretation; wave function normalization condition and its simple numerical applications;
uncertainty principle-applications, Schrödinger equation (no mathematical derivation). 4L

Module 4 (6L):
X-ray & Crystallography

4.1 X-**rays** – Origin of Characteristic and Continuous X-ray, Bragg's law (No derivation), Determination
of lattice constant, Applications, Numerical problems. 2L

4.2 Elementary ideas of crystal structure - lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, Simple cubic, fcc and bcc, **hcp** lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor,
Applications, Numerical problems. 4L

Module 5 (8L):
Modern Optics-I:
5.1 Laser: Concepts of various emission and absorption process, working principle of laser, metastable state, Population Inversion, condition necessary for active laser action, optical resonator, ruby laser, He- Ne laser, **semiconductor laser**, Einstein A and B coefficients and equations, industrial and medical
applications of laser. 5L

5.2 Fibre optics and Applications: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, V number, Types of optical fibres (material, refractive index, mode),
Losses in optical fibre- attenuation, dispersion, bending, Numerical problems. 3L

Recommended Text Books for Physics I

(PH101//201): Oscillations:

1. Classical Mechanics- J. C. Upadhyay (Himalya Publishers)
2. Classical Mechanics-Shrivastav
3. Classical Mechanics-Takwal & Puranik (TMH)
4. Sound-N. K. Bajaj (TMH)
5. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
6. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
7. A text book of sound-M. Ghosh (S. Chand publishers)
8. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
9. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
10. R.P. Singh (Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol. II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Classical Optics & Modern Optics-I:

13. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
14. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
15. Modern Optics-A. B. Gupta (Book & Allied Publisher)
16. Optics-Ajay Ghatak (TMH)
17. Optics-Hecht
18. Optics-R. Kar, Books Applied Publishers
19. Möler (Physical Optics)
20. E. Hecht (Optics)
21. E. Hecht (Schaum Series)
22. F.A. Jenkins and H.E White
23. C.R. Dasgupta (Degree Physics Vol 3)

Quantum Physics

24. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

25. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
26. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
27. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
28. Quantum Mechanics-Bransden (Pearson Education Ltd.)
29. Perspective of Modern Physics-A. Beiser (TMH)

30. Eisberg & Resnick is published by Wiley India
31. A.K. Ghatak and S Lokenathan
32. E.E. Anderson (Modern Physics)
33 .Haliday, Resnick & Krane : Physics Volume 2 is Published by Wiley India
34. Binayak Dutta Roy [Elements of Quantum Mechanics]

X-ray & Crystallography
35. Solid state physics-Puri & Babbar (S. Chand publishers)
36. Materials Science & Engineering-Kakani Kakani
37. Solid state physics- S. O. Pillai
38. Introduction to solid state physics-Kittel (TMH)
39. Solid State Physics and Electronics-A. B. Gupta, Nurul Islam (Book & Allied Publisher)
40. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)

General Reference:
1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)
4. Engineering Physics Vol: 1-Sudipto Roy, Tanushri Ghosh, Dibyendu Biswas (S. Chand).
5. Engineering Physics Vol:1-S. P. Kuila (New Central)
4. University Physics-Sears & Zemansky (Addison- Wesley) 5.B. Dutta Roy (Basic Physics)
6. R.K. Kar (Engineering Physics)
7. Mani and Meheta (Modern Physics)
8. Arthur Baiser (Perspective & Concept of Modern Physics)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 101.1	1											
PH 101.2		2										
PH 101.3	3											
PH 101.4		1										
PH 101.5												1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electrical Engineering Paper Code: EE101
Total Contact Hours: 41 Credit: 4

Pre requisite: Basic 12st standard Physics and Mathematics

Course Objective:

Basic electrical engineering is an introductory course in electrical engineering. Students are introduced to simple applied electrical circuits, theories and practice to impart skill set to have visualization of electrical engineering applications. It is a course suitable for students pursuing electrical engineering as well as other related engineering disciplines.

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

EE 101.1: To understand and analyse basic electric and magnetic circuits.

EE 101.2: To understand and analysis the AC single phase and three phase circuit

EE101.3: To understand and analysis of the basic principles of various electrical machines

Course Contents:

DC CIRCUITS (7L)
Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems-Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

MAGNETIC CIRCUITS (3L)
Concept of Magnetic circuit, B-H curve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

AC SINGLE PHASE CIRCUITS (8L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R,L,C circuit, Combination R,L,C in AC series , parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

THREE PHASE CIRCUITS (3L)
Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

DC MACHINES (6L)
Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Torque Equation ,Speed Torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control).

SINGLE PHASE TRANSFORMER (5L)
Constructional parts, Types of transformers, Emf equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.

THREE PHASE INDUCTION MOTOR (6L)
Types, Construction, production of rotating field, principle of operation, Slip and Frequency ,rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta

starter and(DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

GENERAL STRUCTURE OF ELECTRICAL POWER SYSTEM (3L)

Power generation to distribution through overhead lines and underground cables with single line diagram, Earthing of Electrical Equipment, Electrical Wiring Practice

Text books

1. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
3. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference books

1. H. Cotton, Willey Press
2. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
3. Kothari & Nagrath, Basic Electrical Engineering, TMH

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE101.1	3	3	2	1								
EE101.2	2	2	1									
EE101.3	3	2	2									

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Basic Electronics Engineering Paper code: EC101 Total Contact Hours: 40 Credits: 4

Prerequisites

A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits , series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchoff's Law i.e. KVL,KCL, Ampere’s Law etc.

Course objectives:

Students will be able to Analyze the behaviour of semiconductor diodes in Forward and Reverse bias . To design a half wave and full wave rectifiers , Explore V-I characteristics of Bipolar Junction Transistor n CB, CE & CC configurations. To acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amps. Students will be able to explain feedback concept and different oscillators . They will also be familiar with the analysis of digital logic basics and measuring Electronic devices. Students will have knowledge about characteristics of FET.

Course Outcomes:

EC 101.1	Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.
EC 101.2	Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration,

	differentiation on electronic signals.
EC 101.3	Study the concepts of both positive and negative feedback in electronic circuits.
EC 101.4	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
EC 101.5	Learn how the primitives of Boolean algebra are used to describe the processing of binary signals.

Course contents

Module-I: Basics of semiconductor **6L**

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current .

Module-II: P-N Junction Diode and its applications **8L**

p-n junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-n junction at forward and reverse bias, V-I characteristics and current expression of diode , temperature dependencies of V-I characteristics of diode , p-n junction breakdown – conditions , avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers circuits and operation (I_{DC} , I_{rms} , V_{DC} , V_{rms}) , ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III : Bipolar junction transistor(BJT) **6L**

Formation of PNP/NPN Transistors ,energy band diagram, current conduction mechanism , CE ,CB,CC configurations , transistor static characteristics in CE ,CB and CC mode, junction biasing condition for active, saturation and cut-off modes ,current gain α ,β and γ, early effect.

Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias , D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.

BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (FET) **4L**

Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel), CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems .

Module-V: Feedback and Operational Amplifier **10L**

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.

Operational amplifier – electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op- amp – offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non- inverting amplifier , Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .

Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp to be discussed. Any other relevant problems related to topic may be discussed or assigned.

Module-VI: Cathode Ray Oscilloscope (CRO) **2L**

Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Module-VII: Digital Electronics **4L**

Binary numbers and conversion, Basic Boolean algebra, Logic gates (AND,OR,NOR,NOT,NAND,XOR) and realization of functions.

Text Books:

1. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.
4. Sedra & Smith, Microelectronics Engineering

Reference Books:

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Schilling & Belove: Electronics Circuits.

CO-PO Mapping

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC 101.1	3	-	-	-	-	-	-	-	-	-	-	-
EC 101.2	2	3	-	-	-	-	-	-	-	-	-	1
EC 101.3	1	3	-	-	-	-	-	-	-	-	-	-
EC 101.4	1	2	3	-	-	-	-	-	-	-	-	1
EC 101.5	3	1	-	-	-	-	-	-	-	-	-	-

Paper Name: Communicative English Paper Code: HU101 Total Contact Hours: 26 Credits: 2

Pre requisites:

Basic knowledge of high school English.

Course Objectives:

Designed to meet the basic survival needs of communication in the globalized workplace, including knowledge of and competency in the use of macro-skills in reading and writing proficiency, functional grammar and usage.

Course Outcomes:

At the end of this course, students will be

HU101.1: Able to comprehend and communicate in English through exposure to communication skills theory and practice.

HU101.2: Apply the basic grammatical skills of the English language through intensive practice.

HU101.3: Able to develop reading and comprehension skills.

HU101.4: Able to develop writing proficiency skills by writing Official Letters, Technical report, memo, notice, minutes, agenda, resume, curriculum vitae.

HU101.5: Able to apply/illustrate all sets of English language and communication skills in creative and effective ways in the professional sphere of their life

Course Content:

The proposed revised syllabus is as follows:

Module 1: Communication: Interface in a Globalized

World [5L] a .Definition of Communication& Scope of

Communication

b. Process of Communication—Models and Types

c. Verbal—Non-Verbal Communication, Channels of Communication

d. Barriers to Communication & surmounting them

[to be delivered through case studies involving intercultural

communication] Module 2: Vocabulary and Reading [5L]

a. Word origin—Roots, Prefixes and Suffixes, Word Families, Homonyms and Homophones

b. Antonyms and Synonyms, One-word substitution

c. Reading—Purposes and Skills

d. Reading Sub-Skills—Skimming, Scanning, Intensive Reading

e. Comprehension Practice (Fiction and Non fictional Prose/Poetry)

(iii) Ruskin Bond, ―The Cherry Tree OR ―The Night Train at Deoli

(iv) Robert Frost, ―Stopping by the Woods on a Snowy Evening.

f. Precis Writing

(Use of daily newspapers for reading practice is

recommended) Module 3: Functional Grammar and

Usage [6L]

a. Articles, Prepositions, Verbs

b. Verb-Subject Agreement

c. Comparison of Adjectives

d. Tenses and their Use

e. Transformation of Sentences (Singular-Plural, Active-Passive, Direct-Indirect, Degrees of Comparison)

f. Error Correction

Module 4: Business writing [10L]

a. Business Communication in the Present-day scenario

b. Business Letters (Letters of Inquiry, Sales Letters, Complaint and Adjustment Letters, Job Application Letters)

c. Drafting of a CV and Résumé

d. Memo, Notice, Advertisement, Agenda, Minutes of Meetings

e. E-mails (format, types, jargons, conventions)

References:

1. Raymond Murphy. *English Grammar in Use*. 3rd Edn. CUP, 2001.

2. Seidl & McMordie. *English Idioms& How to Use Them*. Oxford:OUP, 1978.

3. Michael Swan. *Practical English Usage*. Oxford:OUP, 1980.

4. Simeon Potter. *Our Language*. Oxford:OUP, 1950.

5. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking*. 8th ed. London: Longman, 2001.

6. IIT Kanpur, English Language & Communication Skills (ENG 112 C) syllabus.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	-	-	1	-	-	1	-	1	3	3	3	3
	-	-	-	-	-	2	-	-	2	3	3	3
HU 101.3	-	3	2	2	-	3	2	2	3	3	3	3
	-	-	-	2	-	2	-	-	3	3	2	3
	-	2	1	-	-	2	2	1	3	3	2	3

Paper Name: Engineering Mechanics
Paper Code: ME101
Total Contacts Hours:
45 Credit: 4

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics.

Course Objective:
1. Understand the vector and scalar representation of forces and moments.
2. Describe static equilibrium of particles and rigid bodies in two dimensions and three dimensions including the effect of Friction
3. Analyze the properties of surfaces & solids in relation to moment of inertia.
4. Illustrate the laws of motion, kinematics of motion and their interrelationship.
5. Study the concepts of engineering mechanics on deformable materials under applied loads.

Course Outcome:

Upon successful completion of the course, student should be able to:

ME 101.1. Construct free body diagram and calculate the reactions necessary to ensure static equilibrium.

ME 101.2. Study the effect of friction in static and dynamic conditions.

ME 101.3. Understand the different surface properties, property of masses and material properties.

ME 101.4. Analyze and solve different problems of kinematics and kinetics.

Course Content:

Module1: Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force is a vector; Transmissibility of a force (sliding vector). 2L

Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications.
3L+1T

Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces

4L+1T

Module2: Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations of equilibrium.
3L+1T

Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

3L+1T

Module3: Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadralateral, composite areas consisting of above figures. 4L+1T

Moments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone.
3L+1T

Principle of virtual work with simple application. 1L+1T

Module4: Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety.

2L+1T

Module5: Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs. 3L+1T

Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). 2L+1T

Module6: Kinetics of particles: Newton's second law; Equation of motion; D.Alembert's principle and free body diagram; Principle of work and energy ; Principle of conservation of energy; Power and efficiency. 3L+2T

Books
Recommended

1. Engineering Mechanics [Vol-I & II]by Meriam & Kraige, 5th ed. – Wiley India
2. Engineering Mechanics: Statics & Dynamics by I.H.Shames, 4th ed. – PHI
3. Engineering Mechanics by Timoshenko , Young and Rao, Revised 4th ed. – TMH
4. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P
5. Fundamentals of Engineering Mechanics by Debabrata Nag & Abhijit Chanda– Chhaya Prakashani
6. Engineering Mechanics by Basudeb Bhattacharyya– Oxford University Press.
7. Engineering Mechanics: Statics & Dynamics by Hibbeler & Gupta, 11th ed. – Pearson

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
ME101. 1	3	3	2	2	-	-	-	-	1	-	-	-
ME101. 2	3	3	2	2	-	-	-	-	1	-	-	1
ME101. 3	3	2	3	2	1	-	-	-	1	-	-	1
ME101. 4	3	3	3	3	-	-	-	-	1	-	1	-

Practical

Paper Name: Lang. Lab. and Seminar
Presentation Paper Code: HU191
Total Contact
Hours: 26 Credit: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focussing on skill acquisition techniques and error feedback.

Course Outcome:
HU191.1: Able to understand advanced skills of Technical Communication in English through Language Laboratory.
HU191.2: Able to apply listening, speaking, reading and writing skills in societal and professional life. HU191.3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
HU191.4: Able to analyze communication behaviors.
HU191.5: Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Contents:

Module 1: Introduction to the Language Lab

a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note taking
c. Contextualized Examples based on Lab Recordings

Module 3: Speaking

a. Speaking (Choice of words, Speech Syntax, Pronunciation, Intonation)
b. Language Functions/Speech Acts
c. Speaking using Picture Prompts and Audio Visual inputs
c. Conversational Role Plays (including Telephonic Conversation)
d. Group Discussion: Principles and Practice

Module 4: Lab Project Work

a. Keeping a Listening Log
b. Writing a Film Review/Advertisements

References:

1. IT Mumbai, **Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO-PO-Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 191.1	-	3	-	-	-	3	2	1	3	3	3	3
HU 191.2	-	3	-	2	-	3	-	-	3	3	3	3
HU 191.3	-	3	-	-	-	3	-	-	3	3	3	3
HU 191.4	-	3	2	3	-	3	2	-	3	3	3	3
HU 191.5	-	3	2	2	-	2	-	3	3	3	3	3

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Chemistry
Lab Paper Code: CH 191
Total Contact hour: 36
Credit: 2

Pre requisites: 10+2 science with

chemistry Course Objective

Acquiring knowledge on Standard solutions and the various reactions in homogeneous and heterogenous medium. Understanding the basic principles of pH meter and conductivity meter for different applications and analyzing water for its various parameters. Synthesis of Polymeric materials and Nanomaterials.

Course Outcome

CH191.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields. **CH191.2**: Able to work as an individual also as an team member
CH191.3: Able to analyse different parameters of water considering environmental issues
CH191.4: Able to synthesize nano and polymer materials.
CH191.5: Capable to design innovative experiments applying the fundamentals of chemistry

Course

contents List of

Experiments:

1. To Determine the alkalinity in given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Preparation of phenol-formaldehyde resin (Bakelite).
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n- butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen present in a given water sample.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

Innovative experiment:

Preparation of silver nano-particles.

Note: From the list of 10 (Ten) experiments a minimum of 7 (seven) experiments shall have to be performed by one student of which Sl. No. 4 (Preparation of Bakelite) has to be mandatory.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CH191.1	3	2	1	1	1	1	-	-	2	-	-	-
CH191.2	-	-	-	-	-	-	-	-	3	-	-	-
CH191.3	-	-	-	-	-	2	3	-	-	-	-	1
CH191.4	-	-	-	-	2	1	-	-	-	-	-	-
CH191.5	2	-	2	-	1	-	-	-	-	-	-	1

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Physics I

Lab Paper Code: PH 191
Total Contact Hours: 40 Credit: 4

Pre requisites: Knowledge of Physics upto 12^{th} standard.

Course Outcome of Physics-I practical

(PH 191) At the end of the course

students' should have the

PH 191.1 : Ability to define, understand and explain ✓ **Error estimation, Proportional error calculation** ✓ **superposition principle in Newton's ring, Fresnel's biprism, laser diffraction** ✓ **Basic circuit analysis in LCR circuits**	PO1
PH 191.2 : Ability to conduct experiments using ➢ **LASER, Optical fibre** ➢ **Interference by division of wave front, division of amplitude, diffraction grating, polarization of light** ➢ **Quantization of electronic energy inside an atom** ➢ **Torsional pendulum**	PO4
PH 191.3 : Ability to participate as an individual, and as a member or leader in groups in laboratory sessions actively	PO9
PH 191.4 : Ability to analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments	PO10

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 7 to be performed from the following experiments

Experiments on Oscillations & Elasticity:
1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Experiments on LCR circuit.
4. Determination of elastic modulii of different materials (Young's modulus and Rigidity modulus)

Experiments on Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fiber experiment

8. Measurement of specific rotation of an optically active solution by polarimeter.

Experiments on Quantum Physics:

11. Determination of Planck's constant using photoelectric cell.
12. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
2. Study of half-wave, quarter-wave plate (beyond the syllabus)
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poyseullie's caplillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 191.1	2											
PH 191.2	1											
PH 191.3				2								
PH 191.4									3			

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electrical Engineering
LAB Paper Code: EE191
Total Contact
Hours: 36 Credit: 2

Pre requisites:

1. Basic Physics and applied physics.
2. Basic Mathematics.
3. Basic concept of Electric Circuit

Course Objective:

1. Provide knowledge for the analysis of basic electrical circuit.
2. To introduce electrical appliances, machines with their respective characteristics.

Course Outcome:

COs	CO Statement
EE191.1	Identify common electrical components and their ratings.
EE191.2	Make Circuit connection by wires of appropriate ratings.

EE191.3	Understand the usage of common electrical measuring instruments
EE191.4	Understand the basic characteristics of transformers and electrical machines

Course contents

LIST OF EXPERIMENTS

1. Characteristics of Fluorescent ,Tungsten and Carbon filament lamps
2. Verification of Thevenin's and Norton's Theorem
3. Verification of Superposition Theorem
4. Calibration of Ammeter and Wattmeter
5. Study of R-L-C series circuit
6. Open circuit and short circuit test of a single phase Transformer
7. Starting, Reversing of a and speed control of D.C shunt motor
8. Test on single phase Energy Meter
9. Familiarization of PMMC and MI type Meter
10. Familiarization with house wiring practice

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE191.1	2	3		1	3				1		2	1
EE191.2	2		2	1	3				1	1		
EE191.3		3				3	2				2	1
EE191.4	3						1			2	2	2

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Basic Electronics
Engineering Lab Paper Code: EC191
Total Contact
Hours: 36 Credit: 2

Prerequisites
A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm’s law, Ampere’s law

Course objectives:
Students will become familiar with the circuit design using semiconductor diodes in Forward and Reverse bias, They will also be able to design rectifiers like half-wave, full-wave rectifiers etc. using diodes. The ability of circuit design with Bipolar Junction Transistor in CB, CE & CC configurations will be improved. The students will acquire the basic engineering technique and ability to design and analyze the circuits of Op-

Amp. Basic concepts and Circuit design with logic gates will be developed in the students. The students will be able design circuit using FET .

Course Outcomes:

EC191.1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
EC191.2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
EC191.3	Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
EC191.4	Able to know the application of Diode, BJT &OPAMP.
EC191.5	Familiarization and basic knowledge of Integrated Circuits

Course contents:

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC 191.1	3	3	-	-	-	-	-	-	-	-	-	-
EC 191.2	2	3	-	-	-	-	-	-	**1**	**1**	-	1
EC 191.3	1	3	3	-	-	-	-	-	-	2	-	-

EC 191.4	1	2	3	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	1
EC 191.5	3	1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Engineering Drawing & Graphics
Paper Code: ME 191
Total Contact Hours:
36 Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To learn basics of drafting and use of drafting tools.
2. To know about engineering scales, dimensioning and various geometric curves.
3. To Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
4. To acquire the knowledge of Computer Aided drafting using design software.

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

ME 191.1. Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.

ME 191.2. Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.

ME 191.3. Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.

ME 191.4. Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

Course contents:

List of Experiments:

1. Lines, Lettering, Dimensioning, Scales (Plain scale & diagonal Scale).

2. Geometrical Construction and Curves – Construction of Polygons, Parabola, Hyperbola & ellipse

3. Projection of Points, Lines and Surfaces – orthographic projection- first angle and third angle projection, projection of lines and surfaces- Hexagon

4. Projection of Solids – (Cube, Pyramid, Prism, cylinder and Cone

5. Sectional Views – for simple sold objects

6. Introduction to Computer Aided Drafting – using auto cad & / or similar software- Introduction to Cartesian and polar coordinate systems, absolute and relative coordinates; Basic editing commands: line, point, trace, rectangle, polygon , circle, arc, ellipse, polyline; editing methods; basic object selection methods – window and crossing window, erase, move, copy, offset, fillet, chamfer, trim, extend, mirror; display command; zoom, pan, redraw, regenerate; simple dimensioning and text, simple exercises.

CO	PO1	PO2	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
ME 191.1	2	-	1	2	-	1	-	-	1	-	-	1

ME 191.2	3	-	2	2	-	1	-	-	1	1	-	1
ME 191.3	2	2	2	1	-	1	-	-	1	-	-	1
ME 191.4	1	-	2	2	2	1	-	-	1	1	-	1

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Workshop Practice
Paper Code: ME192
Total Contact Hours:
36 Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To understand the basic knowledge of Workshop Practice and Safety.
2. To identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. To get hands on practice in various machining metal joining processes such as Welding, Brazing, Soldering, etc.

Course Outcome:

Upon successful completion of this course, the student will be able to:

ME192.1 Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
ME192.2 Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and performing operations like such as Marking, Cutting etc used in manufacturing processes.
ME192.3 Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.
ME192. 4 Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works.

Course contents

List of Activities:

Sl. No.	Syllabus	Contact Hrs
Module 1	Pattern Making	6
Module 2	Sheet Metal Work	6
Module 3	Fitting	9

Module 4	Machining in Lathe	9
Module 5	Welding	6

MODULE 1 – PATTERN MAKING.

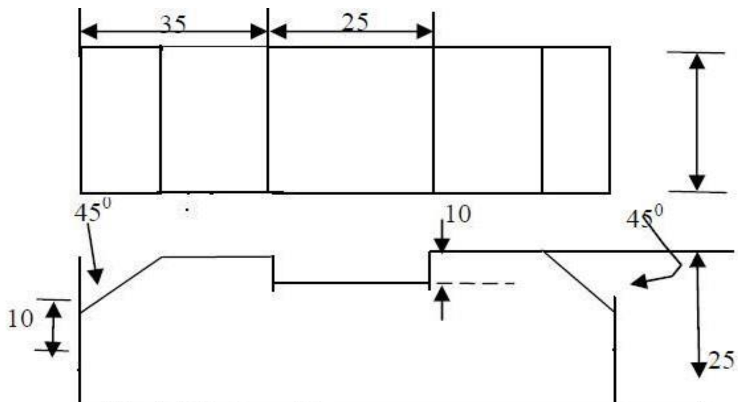
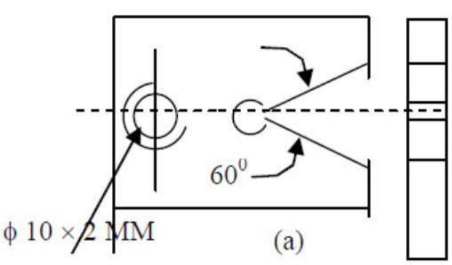
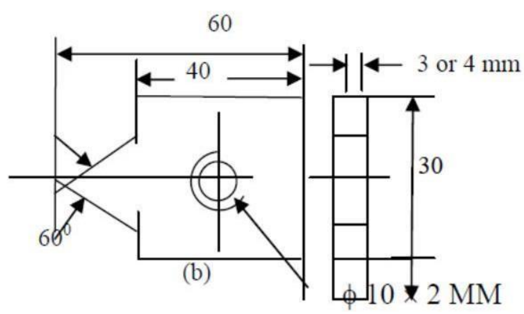


Fig.4: Job for making a pattern

MODULE 3- FITTING SHOP.



OR



MODULE 4 – MACHINING IN LATHE & SHAPING M/C

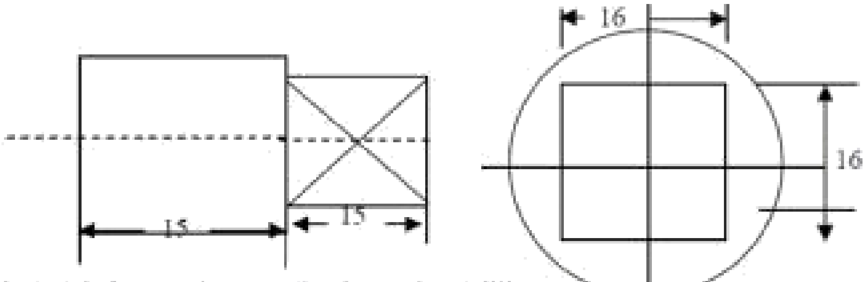
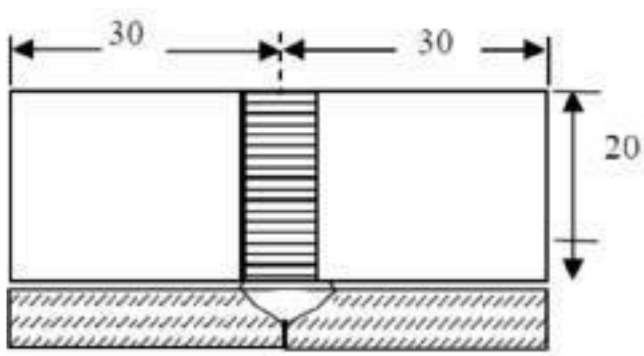


Fig.3: Job for practice on a shaping and/or milling machine

MODULE 5 – WELDING



CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
ME 192.1	2	-	-	-	-	2	-	1	-	-	1	-
ME 192.2	2	-	-	-	-	1	-	2	-	-	-	-
ME 192.3	2	-	-	-	-	1	-	1	-	-	-	-
ME 192.4	1	-	-	-	1	3	-	3	-	-	-	1

Sessional

Paper Name: Extra Curricular Activity (NSS/ NCC) Paper Code: XC 181
Total Contact hours: 20 Credit: 1

Course Objectives: The objectives of the course are as follows:

To increase student awareness about the weaker and unprivileged sections of society To expose students to environmental issues and ecological concerns

To make students self aware about their participatory role in sustaining society and the environment

Course contents List of Activities:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness ``
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities Creating awareness in social issues:
1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women's Cell of college Participating in mass education programmes 1.Adult education
2. Children's education

Proposal for local slum area development

One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

• Resource conservation – Awareness to be developed on water, energy,soil.
• Preservation of heritage monuments- Marches, poster campaigns
• Alternative energy consciousness amongst younger school-children.
• Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
• Waste disposal- Proper methods of domestic waste disposal. Production Oriented Programmes
5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution of rations, medicine, clothes etc.;

h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;

i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;

j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

Paper Name: Mathematics-II
Paper Code: M 201
Total Contact
Hours: 40 Credit: 4

Prerequisite: Any introductory course on calculus.

Course Objective: The purpose of this course is to provide fundamental concepts Ordinary Differential Equations, Graph Theory and Laplace Transform.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M 201.1: Recall the distinctive characteristics of Ordinary Differential Equations, Graph Theory and Laplace Transform.

M 201.2: Understand the theoretical workings of various algorithms related to graph theory and the theorems of differential equation and Laplace transforms.

M 201.3: Apply the principles of differential equation, graph theory and Laplace transforms to solve various problems.

Course contents:

Module I [10L]

Ordinary differential equations (First order): First order and first degree Exact equations,Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation, General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation), Applications related to Engineering problems.

Module II [10L]

Ordinary differential equations (Higher order): General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Eulerequations, Solution of simultaneous linear differential equations, Applications related to Engineering problems.

Module III [10L]

Basic Graph Theory:Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph, Walks, Paths, Circuits, Euler Graph, Cut-sets and cut-vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.Tree, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using Kruskal's and Prim's algorithm.
** Extra lecture hours may be taken for this module

MODULE IV: [10L]

Laplace Transform (LT): Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of t f (t), LT of f (t)/t , LT of derivatives of f (t), L.T. of ∫f(u) du. Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. Applications related to Engineering problems.

Beyond Syllabus:

Combinatorics: Fundamental Principles, Permutations, Combinations, Binomial Coefficients.

Text Books:

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.

ReferenceText Books:

4. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley, 2005.
5. R.K. Ghosh and K.C.Maity, An Introduction to Differential Equations, New Central Book Agency.
6. V. K. Balakrishnan,Graph Theory, Schaum's Outline, TMH.
7. J. Clark and D. A. Holton, A first course at Graph Theory,Allied Publishers LTD.
8. D. B. West, Introduction to Graph Theory,Prentice-Hall of India.
9. N. Deo, Graph Theory, Prentice-Hall of India.
10. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier, 2006.
11. L. Rade and B. Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
12. Murray R.Spiegel, Laplace Transform, Schaum's Outline Series, McGRAW-HILL.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M 201.1	3	2	-	-	-	-	-	-	-	-	-	1
M 201.2	3	2	-	-	-	-	-	-	-	-	-	1
M 201.3	3	2	2	-	-	-	-	-	-	-	-	1

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Chemistry
Paper Code: CH 201

Total Contact
Hours: 40 Credit: 4

Pre requisites: 10+2 science with

chemistry Course Objective

Understanding of the fundamental theories and applications of thermodynamics, electrochemical principles in modern electrochemical cells and to get an insight into electronic structure of crystals and nanomaterials. Learning about the Synthesis, properties and applications of polymers , fuels and alternative energy sources & their significance in petrochemical industries. Analyzing water quality for its various parameters & its significance in industries

Course Outcome

CH201.1: Able to apply fundamental concepts of thermodynamics in different engineering applications. **CH201.2:** Able to analyze & design simple and technologically advanced electrical and energy storage devices.
CH201.3: Able to synthesize nanomaterials, composites, polymers.
CH201.4: Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries , and technical fields.
CH201.5: Able to apply the knowledge of different fuels and corrosion to different industries
CH201.6: Able to analyse water quality parameter for its various parameters & its significance in industries.

Course contents

Module 1 [8L]

Chemical Thermodynamics –I
1.1 Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property. **Introduction to first law of thermodynamics**: Different statements, mathematical form. **Internal energy**: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.

2L

1.2 **Enthalpy**: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.
Heat Capacity: Definition, Classification of Heat Capacity (Cp and CV): Definition and General expression of Cp - CV. Expression of Cp - CV for ideal gas.
Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.
Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation. **3L**

1.3 **2nd law of thermodynamics**: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature (brief).
Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. **3L**

Module 2 [7L]

2.1 Reaction Dynamics

Reaction laws: rate and order; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration), Pseudounimolecular reaction, Arrhenius equation. **3L**

Mechanism and theories of reaction rates (Content beyond the syllabus)

2.2 Solid state Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor, photo voltaic cell, fabrication of integrated circuits. **4L**

Module 3 [8L]

Electrochemistry

3.1 Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). **1L**

3.2 Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, calomel half cell (representation, cell reaction, expression of potential, Discussion, Application). **3L**

3.3 Concept of battery

Battery and Commercial electrochemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). **2L**

3.4 Corrosion and its control

Introduction, cause and effect of corrosion, types of corrosion: dry, wet and other: Electrochemical corrosion, galvanic corrosion, passivation and protective measure. **2L**

Module 4 [12L]

4.1 Structure and reactivity of Organic molecule

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations and substitution reactions. **3L**

4.2 Polymers

Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg.: Theory and mathematical expression only), Poly dispersity index (PDI).

Polymerization processes: addition and condensation polymerization (mechanism not required), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm) and amorphicity (Concept of Tg) of polymer.

Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP, PMMA, Polyester, PTFE, Bakelite), rubber (natural rubber, SBR), fibre (nylon 6, nylon 6,6), Vulcanization of rubber, Conducting polymers and bio-polymers. **7L**

4.3 Nano material

Basic principles of nano science and technology, classification, preparation, properties and application of nano material. **2L**

Module 5 [5L]

5.1 Industrial Chemistry Fuels

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Proximate analysis of coal, Calorific value.

Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Biodiesel.

Gaseous fuels: Natural gas, water gas, Coal gas, bio gas, CNG, LPG **3L**

5.2 Water

Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards), Chlorination of Water, Types of hardness- Units, Brief Softening methods.

2L

Short overview of water treatment plants (Content beyond the syllabus)

<u>Reference Books</u>

1. Engineering Chemistry: Bandyopadhyay and Hazra
2. Physical Chemistry: P.C. Rakshit
3. Organic Chemistry: Finar, vol-1
4. Engineering Chemistry: B.Sivasankar, Tata Mc Graw Hill, 2008
5. A Text book of Engineering Chemistry: S.S.Dara, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.
6. Engineering Chemistry Simplified: S. Nandi and R. Bhattacharyya, Chayya Prakashani Pvt. Ltd.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CH201.1	3	1	-	-	-	-	-	-	-	-	-	-
CH201.2	3	2	1	-	-	-	-	-	-	-	-	-
CH201.3	-	-	2	-	2	-	-	-	-	-	-	1
CH201.4	2	-	1	-	2	-	-	-	-	-	-	-
CH201.5	2	-	-	-	-	-	2	-	-	-	-	1
CH201.6	-	-	2	-	-	-	1	-	-	-	-	-

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name:
Physics -I Paper
Code: PH 201 Total
Contact Hours: 41
Credit: 4

Pre requisites: Knowledge of Physics upto 12^{th} standard.

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

At the end of the course students' should have the

PH 201.1 : Ability to state and recall ➢ **De-Broglie hypothesis, and Heisenberg's Uncertainty Principle** ➢ **Amplitude and Velocity Resonance** ➢ **Malus's Law, Brewster's Law** ➢ **Characteristics of LASER light**	PO1 Or GA1
PH 201.2 : Ability to understand and explain ➢ **Polarizer and analyzer** ➢ **basic principles and different types of LASER and Optical Fibre** ➢ **structure of solids, Miller indices** ➢ **theory of Matter Wave, equation of motion of Matter Wave** ➢ wave function and its role in representing wave nature of matter	PO2 Or GA2
PH 201. 3 : Ability to apply the knowledge of ➢ **mechanical vibration in electrical circuits** ➢ **superposition principle in Newton's ring phenomenon, diffraction phenomenon** ➢ **quantum nature of e.m. waves for production of laser** ➢ **total internal reflection in transmitting light through optical fibres** ➢ **x-ray diffraction in crystal structure** ➢ **probability interpretation in Heisenberg's uncertainty principle**	PO3 Or GA3
PH 201.4 : Ability to analyze ➢ **grating as many slit system** ➢ **role of Q factor in a resonating circuit, conditions of different types of resonance** ➢ **minimum requirements for lasing action** ➢ **importance of light as a carrier of information** ➢ **the failures of classical physics in microscopic situation and need of quantum physics** ➢ **Einstein's A, B coefficient and predict the wavelength domain of Lasing action**	PO2 Or GA2

➢ **Requirement of Miller indices for describing crystallographic planes**	

PH 201.5 : Ability to evaluate / justify / compare ➢ **X-ray production process is inverse of the process of Photoelectric Effect.** ➢ **different crystallographic structures according to their Co-ordination number and packing factors** ➢ **the outcome of Photo-electric effect, Compton effect and Davission-Germer experiment to justify wave-particle duality of matter**	PO12 Or GA12

Course contents

Module 1 (8L):-
Oscillations

1.1 Simple harmonic motion: Concepts with examples, Superposition of SHMs in two mutually perpendicular directions: Lissajous' figures, Engineering Applications and related Numerical problems 2L

1.2 Damped vibration: Differential equation and its solution, Logarithmic decrement, quality factor, Engineering Applications and related Numerical problems. 3L

1.3 Forced vibration: Differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance, relevant applications including LCR circuits, Numerical problems 3L

Module 2 (10L):-
Classical Optics:

2.1 Interference of light: Wave nature of light (Huygen's principle), Conditions of sustained interference double slit as an example; qualitative idea of spatial and temporal coherence, conservation of energy and intensity distribution; Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems. 3L

Fresnel's biprism (beyond the syllabus). 1L(ext)

2.2 Diffraction of light: Fresnel and Fraunhofer class, Fraunhofer diffraction for plane transmission grating (elementary treatment of intensity distribution for N-slits), single slit and double slits as examples, missing order, Rayleigh criterion, resolving power of grating and microscope (Definition and formula; no deduction required). Engineering Applications, Numerical Problems. 4L

2.3 Polarization: Definition, plane of polarization, plane of vibration, Malus law, fundamental concepts of plane, circular and elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: ordinary and extraordinary rays, Nicol's prism, Engineering applications, Numerical problems. 3L

Module 3 (9L):-
Quantum Physics:

3.1 **Quantum Theory**: Inadequacy of classical physics; Planck's quantum hypothesis-Qualitative (without deductions), particle concept of electromagnetic wave (example: photoelectric and Compton effect; qualitative discussions only), wave particle duality; phase velocity and group velocity; de Broglie
wave; Davisson and Germer experiment. 4L

3.2 **Quantum Mechanics 1:** Concept of wave function, Physical significance of wave function, Probability interpretation; wave function normalization condition and its simple numerical applications;
uncertainty principle-applications, Schrödinger equation (no mathematical derivation). 4L

Module 4 (6L):

X-ray & Crystallography

4.1 X-**rays** – Origin of Characteristic and Continuous X-ray, Bragg's law (No derivation), Determination
of lattice constant, Applications, Numerical problems. 2L

4.2 Elementary ideas of crystal structure - lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, Simple cubic, fcc and bcc, **hcp** lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor,
Applications, Numerical problems. 4L

Module 5 (8L):
Modern Optics-I:
5.1 Laser: Concepts of various emission and absorption process, working principle of laser, metastable state, Population Inversion, condition necessary for active laser action, optical resonator, ruby laser, He- Ne laser, **semiconductor laser**, Einstein A and B coefficients and equations, industrial and medical
applications of laser. 5L

5.2 Fibre optics and Applications: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, V number, Types of optical fibres (material, refractive index, mode),
Losses in optical fibre- attenuation, dispersion, bending, Numerical problems. 3L

Recommended Text Books for Physics I

(PH101//201): Oscillations:
1. Classical Mechanics- J. C. Upadhyay (Himalya Publishers)
2. Classical Mechanics-Shrivastav
3. Classical Mechanics-Takwal & Puranik (TMH)
4. Sound-N. K. Bajaj (TMH)
5. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
6. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
7. A text book of sound-M. Ghosh (S. Chand publishers)
8. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
9. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
10. R.P. Singh (Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol. II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Classical Optics & Modern Optics-I:
13. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
14. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
15. Modern Optics-A. B. Gupta (Book & Allied Publisher)
16. Optics-Ajay Ghatak (TMH)
17. Optics-Hecht
18. Optics-R. Kar, Books Applied Publishers
19. Möler (Physical Optics)
20. E. Hecht (Optics)
21. E. Hecht (Schaum Series)
22. F.A. Jenkins and H.E White
23. C.R. Dasgupta (Degree Physics Vol 3)

Quantum Physics

24. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
25. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
26. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
27. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)

28. Quantum Mechanics-Bransden (Pearson Education Ltd.)
29. Perspective of Modern Physics-A. Beiser (TMH)
30. Eisberg & Resnick is published by Wiley India
31. A.K. Ghatak and S Lokenathan
32. E.E. Anderson (Modern Physics)
33 .Haliday, Resnick & Krane : Physics Volume 2 is Published by Wiley India
34. Binayak Dutta Roy [Elements of Quantum Mechanics]

X-ray & Crystallography

35. Solid state physics-Puri & Babbar (S. Chand publishers)
36. Materials Science & Engineering-Kakani Kakani
37. Solid state physics- S. O. Pillai
38. Introduction to solid state physics-Kittel (TMH)
39. Solid State Physics and Electronics-A. B. Gupta, Nurul Islam (Book & Allied Publisher)
40. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)

General Reference:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)
4. Engineering Physics Vol: 1-Sudipto Roy, Tanushri Ghosh, Dibyendu Biswas (S. Chand).
5. Engineering Physics Vol:1-S. P. Kuila (New Central)
4. University Physics-Sears & Zemansky (Addison- Wesley) 5.B. Dutta Roy (Basic Physics)
6. R.K. Kar (Engineering Physics)
7. Mani and Meheta (Modern Physics)
8. Arthur Baiser (Perspective & Concept of Modern Physics)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 201.1	1											
PH 201.2		2										
PH 201.3	3											
PH 201.4		1										
PH 201.5												1

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Basic Electrical Engineering Paper Code: EE 201
Total Contact Hours: 41

Credit: 4

Pre requisite: Basic 12st standard Physics and Mathematics

Course Objective:
Basic electrical engineering is an introductory course in electrical engineering. Students are introduced to simple applied electrical circuits, theories and practice to impart skill set to have visualization of electrical engineering applications. It is a course suitable for students pursuing electrical engineering as well as other related engineering disciplines.

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

EE 201.1: To understand and analyse basic electric and magnetic circuits.

EE 201.2: To understand and analysis the AC single phase and three phase circuit

EE 201.3: To understand and analysis of the basic principles of various electrical machines

Course Contents:

DC CIRCUITS (7L)
Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems-Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

MAGNETIC CIRCUITS (3L)
Concept of Magnetic circuit, B-H curve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

AC SINGLE PHASE CIRCUITS (8L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R,L,C circuit, Combination R,L,C in AC series , parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

THREE PHASE CIRCUITS (3L)
Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

DC MACHINES (6L)
Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Torque Equation ,Speed Torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control).

SINGLE PHASE TRANSFORMER (5L)
Constructional parts, Types of transformers, Emf equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and

short circuit tests, regulation and efficiency calculation.

THREE PHASE INDUCTION MOTOR (6L)

Types, Construction, production of rotating field, principle of operation, Slip and Frequency ,rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta starter and(DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

GENERAL STRUCTURE OF ELECTRICAL POWER SYSTEM (3L)
Power generation to distribution through overhead lines and underground cables with single line diagram, Earthing of Electrical Equipment, Electrical Wiring Practice

Text books

5. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
6. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
7. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH
8. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference books

4. H. Cotton, Willey Press
5. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
6. Kothari & Nagrath, Basic Electrical Engineering, TMH

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 201.1	3	3	2	1								
EE 201.2	2	2	1									
EE 201.3	3	2	2									

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electronics
Engineering Paper code: EC201
Total Contact
Hours: 40 Credits:
4

Prerequisites
A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits , series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchoff's Law i.e. KVL,KCL, Ampere's Law etc.

Course objectives:

Students will be able to Analyze the behaviour of semiconductor diodes in Forward and Reverse bias . To design a half wave and full wave rectifiers , Explore V-I characteristics of Bipolar Junction Transistor n CB, CE & CC configurations. To acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amps. Students will be able to explain feedback concept and different oscillators . They will also be familiar with the analysis of digital logic basics and measuring Electronic devices. Students will have knowledge about characteristics of FET.

Course Outcomes:

EC 201.1	Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.
EC 201.2	Learn how operational amplifiers are modeled and analyzed, and to design Op- Amp circuits to perform operations such as integration, differentiation on electronic signals.
EC 201.3	Study the concepts of both positive and negative feedback in electronic circuits.
EC 201.4	Develop the capability to analyze and design simple circuits containing non- linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
EC 201.5	Learn how the primitives of Boolean algebra are used to describe the processing of binary signals.

Course contents

Module-I: Basics of semiconductor **6L**

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current .

Module-II: P-N Junction Diode and its applications **8L**

p-n junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-n junction at forward and reverse bias, V-I characteristics and current expression of diode , temperature dependencies of V-I characteristics of diode , p-n junction breakdown – conditions , avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers circuits and operation (I_{DC} , I_{rms} , V_{DC} , V_{rms}), ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III : Bipolar junction transistor(BJT) **6L**

Formation of PNP/NPN Transistors ,energy band diagram, current conduction mechanism , CE ,CB,CC configurations , transistor static characteristics in CE ,CB and CC mode, junction biasing condition for active, saturation and cut-off modes ,current gain α ,β and γ, early effect.

Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias , D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.

BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (FET) 4L

Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel), CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems .

Module-V: Feedback and Operational Amplifier **10L**

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op- amp – offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non- inverting amplifier , Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .
Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp to be discussed. Any other relevant problems related to topic may be discussed or assigned.

Module-VI: Cathode Ray Oscilloscope (CRO) **2L**
Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Module-VII: Digital Electronics **4L**
Binary numbers and conversion, Basic Boolean algebra, Logic gates (AND,OR,NOR,NOT,NAND,XOR) and realization of functions.

Text Books:

4. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
5. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
6. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.
4. Sedra & Smith, Microelectronics Engineering

Reference Books:

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Schilling & Belove: Electronics Circuits.

CO-PO Mapping

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC 201.1	3	-	-	-	-	-	-	-	-	-	-	-
EC 201.2	2	3	-	-	-	-	-	-	-	-	-	1
EC 201.3	1	3	-	-	-	-	-	-	-	-	-	-
EC 201.4	1	2	3	-	-	-	-	-	-	-	-	1
EC 201.5	3	1	-	-	-	-	-	-	-	-	-	-

Computer Fundamentals & Principle of Computer Programming
Code: CS 201
Total No. of Lectures:
40 Credits: 4

Prerequisites:
1. Number system
2. Boolean Algebra

Course Objective(s)
1. To develop the programming skills of students
2. To know the principles of designing structured programs
3. To write basic C programs using
   i) Selection statements
   ii) Repetitive statements
   iii) Functions
   iv) Pointers
   v) Arrays
   vi) Strings

Course Outcome:

CS201.1 Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
CS201.2 Write, Compile and Debug programs in C language and use different data types for writing the programs.
CS201.3 Design programs connecting decision structures, loops and functions.
CS201.4 Explain the difference between call by value and call by address.
CS201.5 Understand the dynamic behavior of memory by the use of pointers.

Use different data structures and create / manipulate basic data files and developing applications for real world problems.

Course content

Fundamentals of Computer: (10 L)

History of Computer, Generation of Computer, Classification of Computers 1L

Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number Arithmetic – Addition and Subtraction (using 1's complement and 2's complement) 2L

Logic gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR - only truth tables, logic gate symbols and logic equations for gates only 1L

Assembly language, high level language, machine level language, compiler and assembler (basic concepts) 1L

Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX 1L

Problem solving-Algorithm & flow chart 2L

C Fundamentals: (30 L)

Variable and Data Types:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements 3L

C Operators & Expressions:

Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity.

Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields 5L

Branching and Loop Statements:

Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue 3L

Fundamentals and Program Structures:

auto, external, static and register variables

Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro 6L

Arrays, Strings and Pointers:

One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function

Character array and string, array of strings, Passing a string to a function, String related functions Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation 6L

Files handling with C:

formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function 4L

Structures and Unions:

Basic of structures, arrays of structures, structures and pointers, structures and functions 3L

Text book:

Kerninghan B.W. & Ritchie D.M. - The C Programming Language Gottfried -

Programming with C Schaum Kanetkar Y. - Let us C

Balaguruswamy - Programming in C

Recommended reference Books:

Pohl and Kelly - A Book on C

Kerninghan, B.W. - The Elements of Programming Style

Schied F.S. Theory and Problems of Computers and Programming Rajaraman V. Fundamental of Computers

M.M.Oka Computer Fundamentals,EPH Leon

Introduction to Computers,Vikas

Leon- Fundamental of Information Technology,Vikas Ram B. Computer Fundamentals, New Age International

Ravichandran D. Programming in C, New Age International Xavier C. Introduction to Computers, New Age International

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	PO9	PO10	PO11	PO12
CS201.1	3	3										
CS201.2		2										
CS201.3	3	3										
CS201.4												
CS201.5	3		3	3	3							

Paper Name: Engineering Thermodynamics & Fluid Mechanics Paper Code: ME 201
Total Contact Hours:
48 Credits: 4

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics.

Course Objective:

1. To understand the basic principles of thermodynamics, heat and work transfer.
2. To acquire the knowledge of basic concepts of Heat Engine, Entropy from Second law of thermodynamics.
3. To get the knowledge of thermodynamic properties of a pure substance and inter- relationships between key properties of a system or state possessed by the substance.
4. To understand the basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations.

Course Outcome:

Upon successful completion of this course, the student will be able to:

ME 201.1 Know about thermodynamic equilibrium, heat & work transfer, First law and its application.

ME 201.2 Understand the basic concepts of Heat Engine, Entropy from Second law of thermodynamics.

Know the thermodynamic characteristics of a pure substance and its application in power cycles (Simple Rankine cycles, Air Standard cycles)

ME 201.3

ME 201.4 Knowledge of basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations

Course content

Module 1:

8L+3T

Basic Concepts of Thermodynamics

Introduction: Microscopic and Macroscopic viewpoints

Definition of Thermodynamic systems: closed, open and isolated systems Concept of Thermodynamics state; state postulate.

Definition of properties: intensive, extensive & specific properties. Thermodynamic equilibrium
Thermodynamic processes; quasi-static, reversible & irreversible processes; Thermodynamic cycles. Zeroth law of thermodynamics. Concept of empirical temperature.

Heat and Work

Definition & units of thermodynamic work.

Examples of different forms of thermodynamic works; example of electricity flow as work. Work done during expansion of a compressible simple system

Definition of Heat; unit of Heat

Similarities & Dissimilarities between Heat & Work

Ideal Equation of State, processes; Real Gas

Definition of Ideal Gas; Ideal Gas Equations of State.

Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes.

Equations of State of Real Gases: Van der Waal's equation; Virial equation of state.

Properties of Pure Substances

p-v, T-s & h-s diagrams of pure substance like H_2O

Introduction to steam table with respect to steam generation process; definition of saturation, wet & superheated status.

Definition of dryness fraction of steam, degree of superheat of steam.

Module 2:

4L+3T

1st Law of Thermodynamics

Definition of Stored Energy & Internal Energy 1st Law of Thermodynamics for cyclic processes Non Flow Energy Equation.

Flow Energy & Definition of Enthalpy.

Conditions for Steady State Steady flow: Steady State Steady Flow Energy Equation.

Module 3:

6L+3T

2nd Law of Thermodynamics

Definition of Sink, Source Reservoir of Heat.

Heat Engine, heat Pump & Refrigerator; Thermal efficiency of Heat Engines & co-efficient of performance of Refrigerators
Kelvin – Planck & Clausius statements of 2nd Law of Thermodynamics Absolute or Thermodynamic scale of temperature, Clausius Integral Entropy
Entropy change calculation for ideal gas processes. Carnot Cycle & Carnot efficiency PMM-2; definition & its impossibility

Module 4:

6L+3T

Air standard Cycles for IC engines

Otto cycle; plot on P-V, T-S planes; Thermal efficiency Diesel cycle; plot on P-V, T-S planes; Thermal efficiency

Rankine cycle of steam

Chart of steam (Mollier's Chart)

Simple Rankine cycle plot on P-V, T-S, h-s planes Rankine cycle efficiency with & without pump work (Problems are to solved for each module)

Module 5:

9L+3T

Properties & Classification of Fluids

Ideal & Real fluids

Newton's law of viscosity; Newtonian and Non-Newtonian fluids Compressible and Incompressible fluids

Fluid Statics

Pressure at a point

Measurement of Fluid Pressure

Manometers: simple & differential

U-tube Inclined tube

Fluid Kinematics

Stream line

Laminar & turbulent flow external & internal flow Continuity equation

Dynamics of ideal fluids

Bernoulli's equation

Total head; Velocity head; Pressure head Application of Bernoulli's equation

Measurement of Flow rate: Basic principles

Venturimeter, Pilot tube, Orificemeter

(Problems are to be solved for each module)

Engineering Thermodynamics

Text:

1 Engineering Thermodynamics - P K Nag, 4th edn, TMH.

References:

1 "Fundamentals of Thermodynamics" 6e by Sonntag & Van Wylin published by Wiley India.

2 Engineering Thermodynamics – Russel & Adeliyi (Indian edition), OUP

3 Engineering Thermodynamics – Onkar Singhh, New Age International Publishers Ltd.

4 Basic Engineering Thermodynamics – R Joel, 5th Ed., Pearson

Fluid Mechanics

Text:

1 Fluid Mechanics and Hydraulic Machines - R Bansal

References:

1 Introduction to Fluid Mechanics and Fluid Machines - S.K.Som and G.Biswas. 2nd edn, TMH

2 Fluid Mechanics by A.K.Jain.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
ME201.1	3	3	2	2	-	1	1	1	1	-	1	2
ME201.2	3	3	2	2	-	1	2	-	1	-	1	2
ME201.3	2	2	1	1	-	2	1	-	-	-	-	1
ME201.4	3	3	2	2	-	1	1	-	-	-	1	1

Practical

Paper Name: Computer Fundamentals & Principle of Computer Programming Lab Paper Code: CS291
Total Contact
Hours: 36 Credit: 2

Prerequisites:
3. Basic Computer Knowledge

Course Objective(s):
1. To develop an understanding of the design, implementation, and compilation of a C program
2. To gain the knowledge about pointers, a fundamental for understanding data structure issues
3. To understand the usage of user defined data type for application development

Course Outcome:

CS291.1. Understanding the working of different operating systems like DOS, Windows, Linux.

CS291.2. Write, Compile and Debug programs in C language. **CS291.3**. Design programs connecting decision structures, loops. **CS291.4**. Exercise user defined functions to solve real time problems.

CS291.5. Inscribe C programs using Pointers to access arrays, strings, functions, structures and files.

Experiment should include but not limited to the following:

Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.

Writing C Programs on variable, expression, operator and type-casting.

Writing C Programs using different structures of if-else statement and switch-case statement.

Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.

Writing C Programs demonstrating concept of Single & Multidimensional arrays. Writing C Programs demonstrating

concept of Function and Recursion.

Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.

Writing C Programs demonstrating concept of structures, union and pointer to structure. Writing C Programs demonstrating

concept of String and command line arguments.

Writing C Programs demonstrating concept of dynamic memory allocation. Writing C Programs demonstrating

concept of File Programming.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	PO9	PO10	PO11	PO12
CS291.1	3	3										
CS291.2		2										
CS291.3	3	3										
CS291.4												
CS291.5	3		3	3	3							

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Chemistry
Lab Paper Code: CH 291
Total Contact
Hours: 36 Credit: 2

Pre requisites: 10+2 science with

chemistry Course Objective
Acquiring knowledge on Standard solutions and the various reactions in homogeneous and heterogenous medium. Understanding the basic principles of pH meter and conductivity meter for different applications and analyzing water for its various parameters. Synthesis of Polymeric materials and Nanomaterials.

Course Outcome

CH291.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields. CH291.2: Able to work as an individual also as an team member CH291.3: Able to analyse different parameters of water considering environmental issues CH291.4: Able to synthesize nano and polymer materials.
CH291.5: Capable to design innovative experiments applying the fundamentals of chemistry

Course contents

List of

Experiments:

1. To Determine the alkalinity in given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Preparation of phenol-formaldehyde resin (Bakelite).
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n- butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen present in a given water sample.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

Innovative experiment:

Preparation of silver nano-particles.

Note: From the list of 10 (Ten) experiments a minimum of 7 (seven) experiments shall have to be performed by one student of which Sl. No. 4 (Preparation of Bakelite) has to be mandatory.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CH 291.1	3	2	1	1	1	1	-	-	2	-	-	-
CH 291.2	-	-	-	-	-	-	-	-	3	-	-	-
CH 291.3	-	-	-	-	-	2	3	-	-	-	-	1
CH 291.4	-	-	-	-	2	1	-	-	-	-	-	-
CH 291.5	2	-	2	-	1	-	-	-	-	-	-	1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Physics I
Lab Paper Code: PH
291
Total Contact
Hours: 40 Credit: 4

Pre requisites: Knowledge of Physics upto 12^{th} standard.

Course Outcome of Physics-I practical

(PH 191) At the end of the course

students' should have the

PH 291.1 : Ability to define, understand and explain ✓ **Error estimation, Proportional error calculation** ✓ **superposition principle in Newton's ring, Fresnel's biprism, laser diffraction** ✓ **Basic circuit analysis in LCR circuits**	PO1
PH 291.2 : Ability to conduct experiments using ➢ **LASER, Optical fibre** ➢ **Interference by division of wave front, division of amplitude, diffraction grating, polarization of light** ➢ **Quantization of electronic energy inside an atom** ➢ **Torsional pendulum**	PO4
PH 291.3 : Ability to participate as an individual, and as a member or leader in groups in laboratory sessions actively	PO9
PH 291.4 : Ability to analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments	PO10

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 7 to be performed from the following experiments

Experiments on Oscillations & Elasticity:
1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Experiments on LCR circuit.
4. Determination of elastic modulii of different materials (Young's modulus and Rigidity modulus)

Experiments on Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fiber experiment

8. Measurement of specific rotation of an optically active solution by polarimeter.

Experiments on Quantum Physics:

11. Determination of Planck's constant using photoelectric cell.
12. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
2. Study of half-wave, quarter-wave plate (beyond the syllabus)
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poyseullie's caplillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 291.1	2											
PH 291.2	1											
PH 291.3				2								
PH 291.4									3			

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Basic Electrical Engineering LAB
Paper Code: EE 291
Total Contact
Hours: 36 Credit: 2

Pre requisites:

4. Basic Physics and applied physics.
5. Basic Mathematics.
6. Basic concept of Electric Circuit

Course Objective:

3. Provide knowledge for the analysis of basic electrical circuit.
4. To introduce electrical appliances, machines with their respective characteristics.

Course Outcome:

COs	CO Statement
EE 291.1	Identify common electrical components and their ratings.
EE 291.2	Make Circuit connection by wires of appropriate ratings.

EE 291.3	Understand the usage of common electrical measuring instruments
EE 291.4	Understand the basic characteristics of transformers and electrical machines

Course contents

LIST OF EXPERIMENTS

11. Characteristics of Fluorescent ,Tungsten and Carbon filament lamps
12. Verification of Thevenin's and Norton's Theorem
13. Verification of Superposition Theorem
14. Calibration of Ammeter and Wattmeter
15. Study of R-L-C series circuit
16. Open circuit and short circuit test of a single phase Transformer
17. Starting, Reversing of a and speed control of D.C shunt motor
18. Test on single phase Energy Meter
19. Familiarization of PMMC and MI type Meter
20. Familiarization with house wiring practice

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 291.1	2	3		1	3				1		2	1
EE 291.2	2		2	1	3				1	1		
EE 291.3		3				3	2				2	1
EE 291.4	3						1			2	2	2

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electronics
Engineering Lab Paper Code: EC291
Total Contact
Hours: 36 Credit: 2

Prerequisites
A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law

Course objectives:
Students will become familiar with the circuit design using semiconductor diodes in Forward and Reverse bias, They will also be able to design rectifiers like half-wave, full-wave rectifiers etc. using diodes. The ability of circuit design with Bipolar Junction Transistor in CB, CE & CC configurations will be improved. The students will acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amp. Basic concepts and Circuit design with logic gates will be developed in the

students. The students will be able design circuit using FET .

Course Outcomes:

EC291.1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
EC291.2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
EC291.3	Determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
EC291.4	Able to know the application of Diode, BJT &OPAMP.
EC291.5	Familiarization and basic knowledge of Integrated Circuits

Course contents:

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EC 291.1	3	3	-	-	-	-	-	-	-	-	-	-
EC 291.2	2	3	-	-	-	-	-	-	**1**	**1**	-	1

EC 291.3	1	3	3	-	-	-	-	-	-	2	-	-

EC 291.4	1	2	3	-	-	-	-	-	-	**1**	-	1
EC 291.5	3	1	**2**	-	-	-	-	-	-	-	-	-

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Engineering Drawing & Graphics
Paper Code: ME 291
Total Contact Hours:
36 Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

To learn basics of drafting and use of drafting tools.
To know about engineering scales, dimensioning and various geometric curves. To Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
To acquire the knowledge of Computer Aided drafting using design software.

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

ME 291.1. Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.

ME 291.2. Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.
ME 291.3. Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
ME 291.4. Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

Course contents:

List of Experiments:

1. Lines, Lettering, Dimensioning, Scales (Plain scale & diagonal Scale).

2. Geometrical Construction and Curves – Construction of Polygons, Parabola, Hyperbola & ellipse

3. Projection of Points, Lines and Surfaces – orthographic projection- first angle and third angle projection, projection of lines and surfaces- Hexagon

4. Projection of Solids – (Cube, Pyramid, Prism, cylinder and Cone

5. Sectional Views – for simple sold objects

6. Introduction to Computer Aided Drafting – using auto cad & / or similar software- Introduction to Cartesian and polar coordinate systems, absolute and relative coordinates; Basic editing commands: line, point, trace, rectangle, polygon , circle, arc, ellipse, polyline; editing methods; basic object selection methods – window and crossing window, erase, move, copy, offset, fillet, chamfer, trim, extend, mirror; display command; zoom, pan, redraw, regenerate; simple dimensioning and text, simple exercises.

CO	PO 1	PO 2	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
ME 291.1	2	-	1	2	-	1	-	-	1	-	-	1
ME 291.2	3	-	2	2	-	1	-	-	1	1	-	1
ME 291.3	2	2	2	1	-	1	-	-	1	-	-	1
ME 291.4	1	-	2	2	2	1	-	-	1	1	-	1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Workshop Practice
Paper Code: ME 292
Total Contact Hours:
36 Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To understand the basic knowledge of Workshop Practice and Safety.
2. To identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. To get hands on practice in various machining metal joining processes such as Welding, Brazing, Soldering, etc.

Course Outcome:

Upon successful completion of this course, the student will be able to:

ME 291.1 Gain basic knowledge of Workshop Practice and Safety useful for our daily living. **ME 291.2** Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and performing operations like such as Marking, Cutting etc used in manufacturing processes.

ME 291.3 Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.

ME 291.4 Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works.

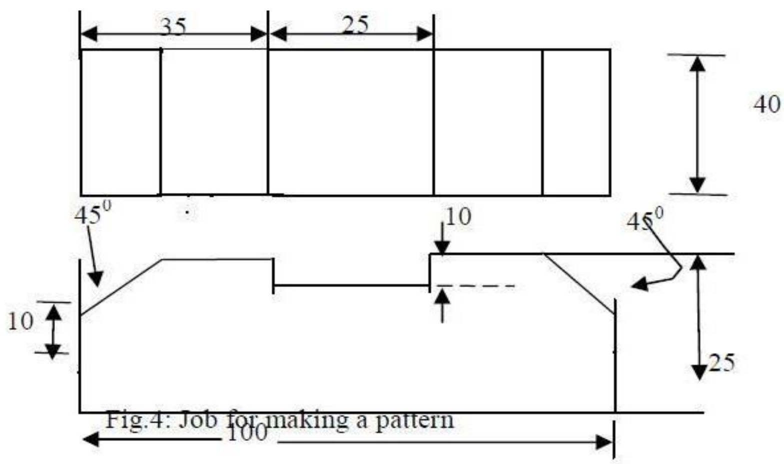
Course contents

List of Activities:

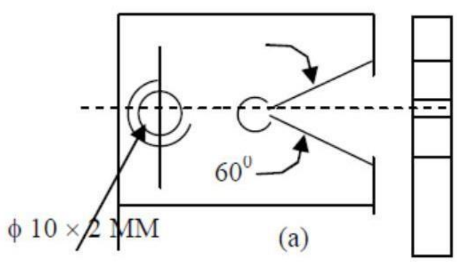
Sl. No.	Syllabus	Contact Hrs
Module 1	Pattern Making	6

Module 2	Sheet Metal Work	6
Module 3	Fitting	9
Module 4	Machining in Lathe	9
Module 5	Welding	6

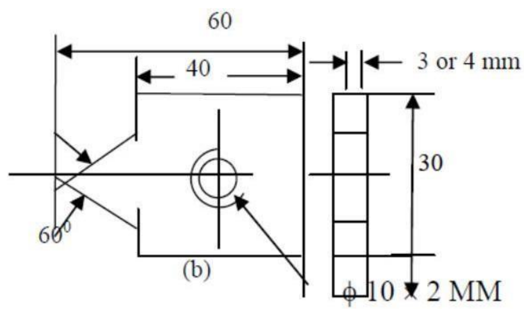
MODULE 1 – PATTERN MAKING.



MODULE 3- FITTING SHOP.



OR



MODULE 4 – MACHINING IN LATHE & SHAPING M/C

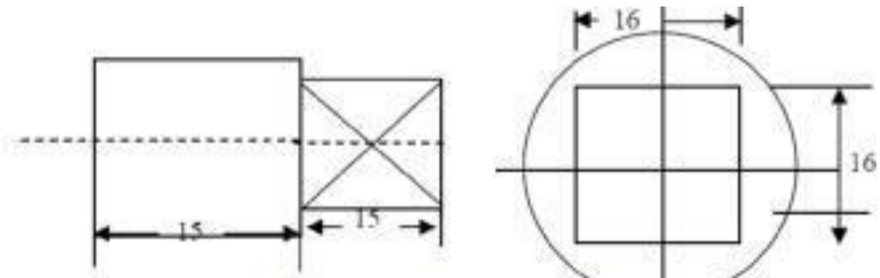
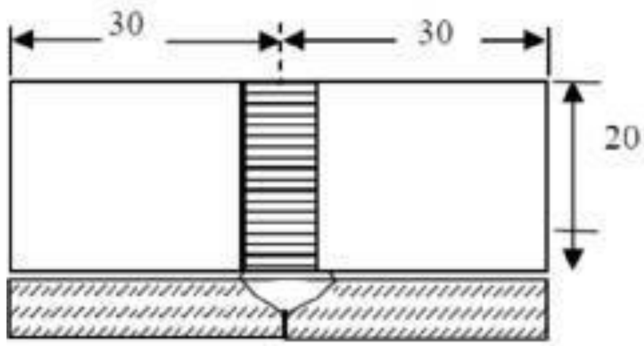


Fig.3: Job for practice on a shaping and/or milling machine

MODULE 5 – WELDING



CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
ME 292.1	2	-	-	-	-	2	-	1	-	-	1	-
ME 292.2	2	-	-	-	-	1	-	2	-	-	-	-
ME 292.3	2	-	-	-	-	1	-	1	-	-	-	-
ME 292.4	1	-	-	-	1	3	-	3	-	-	-	1

SESSIONAL

Paper Name: Soft Skills Development Paper Code: MC-281
Total Contact hours: 26

Course Objectives:

The objectives of this course are as follows:

To expose the students to different aspects of corporate life and workplace behavior To introduce workplace behavioral norms, etiquettes and standards

To equip students to face interviews, presentations and other professional interactions

MODULE	CONTENT
One	Communication Training
Two	Communication Training (Accent Neutralization)
Three	Business Etiquette
Four	CV / Resume Writing
Five	Corporate Life and Protocols
Six	Group Discussion
Seven	Leadership Skill
Eight	Team Work
Nine	Public Speaking and Interview Basics
Ten	Business Telephone Etiquette
Eleven	Reading skill

Rearrange ?

MODULE ONE – COMMUNICATION TRAINING (2L)

1. Organisational Communication and Structure.
2. Vocabulary related to Corporate Operation.
3. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.
4. Communication with Clients, Customers, Suppliers etc.
5. Verbal and Non-Verbal Communication, Proxemics and Para Language.
6. Vocabulary Building (Synonym / Antonym / One word Substitution etc.)

MODULE TWO- COMMUNICATION TRAINING (ACCENT NEUTRALISATION) (2L)

7. Mother Tongue Influence
8. Vowel Sounds and Consonantal Sounds
9. Pronunciation and Neutral Accent.
10. Intonation.
11. Rate of Speech, Pausing, Pitch Variation and Tone.

MODULE THREE – BUSINESS ETIQUETTE (2L)

12. Presenting oneself in the Business Environment.
13. Corporate Dressing and Mannerism.
14. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
15. Multi Cultural Etiquette.
16. Cultural Difference.
17. E-mail Etiquette.

MODULE FOUR – JOB APPLICATION AND CV / VIDEO RESUME (2L)

18. Format (Chronological, Skill Oriented, Functional etc.)
19. Style and Appearance.
20. Writing Tips and Video Content Presentation tips.
21. Types of Cover Letter or Job Application Letter.

MODULE FIVE - INTRODUCTION TO CORPORATE LIFE AND PROTOCOLS (2L)

22. Introduction of Companies (Domain Specific)
23. Opportunities and Growth Plan.
24. Performance and Corporate Behaviour.
25. Service Level Agreement and Corporate Jargon.
26. Networking and Adapting to Culture, Technology and Environment.

MODULE SIX – GROUP DISCUSSION (2L)

27. Introduction, Definition and Purpose.
28. Types of Group Discussion.
29. Strategies and Protocols of Group Discussion.
30. Skills and Parameters of Evaluation.

31. Practice Session and Video Viewing Task.

MODULE SEVEN – LEADERSHIP SKILL (2L)

32. Leadership Theories.
33. Traits and Skills of the Leader.
34. Roles, Duties and Responsibilities.
35. Case Study of Leaders.
36. Interpersonal relationship with Team.

MODULE EIGHT – TEAM WORK (2L)

37. Concept of Team Culture.
38. Stages of Team Development (Forming, Storming, Norming, Performing, Adjourning)
39. Team Working Agreement (Participation, Decision Making, Problem Solving.
40. Conflict Management, Flexibility, Negotiation Skill.
41. Team Building (Assess, Plan, Execute and Evaluate)

MODULE NINE – PUBLIC SPEAKING AND INTERVIEW BASICS (2L)

42. Extempore.
43. JAM.
44. Interview Skill
45. Interview over Telephone, Video Conference Interview etc.

MODULE TEN – BUSINESS TELEPHONE ETIQUETTE (2L)

46. Five Phases of a Business Call.
47. Pitch, inflection, Courtesy and Tone.
48. Understanding, Rate of Speech, Enunciation.
49. Hold Procedure.
50. Cold and Hot Transfer protocols.
51. Dealing with Different Types of Customers (Irate, Talkative, Turnaround etc.)

MODULE ELEVEN- READING SKILL

52. Vocabulary from context, speed reading, skimming, inferring, comprehension test etc.

ASSESSMENT		
1.	**Viva**	**10**

2.	**Personal Skill Enhancement Log**	**25**
3.	**Movie Making: Video Resume**	**25**

4.	**Term End Project**	**4 0**

LIST OF REFERENCE:

1. Effective Communication and Soft-Skills: Strategies for Success, Nitin Bhatnagar and Mamta Bhatnagar, Pearson, 2012.

2. Soft Skills: Know yourself and know the World, Dr. K.Alex, S Chand, 2009.

3. Soft Skills at Work: Technology for Career Success, Beverly Amer, Course Technology, 2009.

4. The Pronunciation of English, Daniel Jones, Cambridge University Press, 1998.

5. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger, 2012.

6. The CV Book: Your Definitive Guide to Writing the Perfect CV, James Innes, Pearson.

7. Understanding American Business Jargon: A Dictionary, W. Davis Folsom, Greenwood Press, 2005.

8. Navigating Corporate Life, Stanley Tyo.

9. Group Discussion: A Practical Guide to Participation and Leadership, Kathryn Sue Young, Julia T. Wood, Gerald M. Phillips and Douglas J. Pedersen, Waveland Press Inc., 2007.

10. The Leadership Skills Handbook, Jo Owen, KoganPage, 2006.

11. Teamwork Training, Sharon Boller, ASTD Press, 2005.

12. Public Speaking for Success, Dale Carnegie, Penguin, 2005.

13. Effective Interviewing Skills, Tracey A. Swift and Ivan T. Robertson, BPS Books, 2000.

14. Telephone Etiquette: Making Lasting First Impressions, Theo Gilbert-Jamison, Performance Solutions, 2013.

15. Reading Comprehension Strategies: Theories, Interventions and Technologies, Danielle S. McNamara, Lawrence Earlbaum Associates, 2007.

16. www.mindtools.com.

Paper Name: **Mathematics III**
Paper Code: **M 301**
Contact: **44**

Credit: 4

Pre requisites: Any introductory course on Calculus and Combinatory.

Course Objective:

The purpose of this course is to provide fundamental concepts of Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equation, Partial Differential Equations.

Course Outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M 301.1: Recall the distinctive characteristics of mathematical approaches like Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equation, Partial Differential Equations.

M 301.2: Understand the theoretical workings of mathematical approaches like Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equations, and Partial Differential Equations to evaluate the various measures in related field.

M 301.3: Apply various principles of Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equations, Partial Differential Equations to solve various problems.

Course contents:

MODULE I:

Fourier Series and Fourier Transform:

Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period , Dirichlet's conditions, Sum of Fourier series. Examples. Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only).Examples.

Fourier Transform:

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform:

Linearity, Shifting, Change of scale, Modulation. Examples.Fourier Transform of Derivatives.Examples.Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.

Discussions on application of the topic related to ECE

10L

MODULE II:

Probability Distributions: Definition of random variable.Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof).Examples. Definitions of Expectation & Variance, properties & examples. Some important discrete distributions: Binomial, Poisson. Continuous distributions: Normal. Determination of Mean, Variance and standard deviation of the distributions. Correlation &Regression analysis, Least Square method, Curve fitting.

Discussions on application of the topic related to ECE

10L

MODULE III:

Calculus of Complex Variable

Introduction to Functions of a Complex Variable, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems.

Complex Integration.

Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples.Cauchy's theorem (statement only).Cauchy-Goursat theorem (statement only).Examples.Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function.Examples.Taylor's series, Laurent's series. Examples.

Zeros and Singularities of an Analytic Function & Residue Theorem.

Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, Introduction Conformal transformation, Bilinear transformation, simple problems.

Discussions on application of the topic related to ECE

12L

MODULE IV:

Basic concepts of Partial differential equation (PDE):

Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transform methods.

Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

PDE I: One dimensional Wave equation. PDE II: One dimensional Heat equation. PDE III: Two dimensional Laplace equation.

Introduction to series solution of Ordinary differential equation (ODE): Validity of the series solution of an ordinary differential equation. General method to solve $P_0 y''+P_1 y'+P_2 y=0$ and related problems to Power series method**.** Brief review on series solution of Bessel & Legendre differential equation. Concepts of generating functions.

Discussions on application of the topic related to ECE

12L

Text Books:

1.Rathor, Choudhari,:Descrete Structure And Graph Theory.

2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics - Sultan Chand & Sons. **3.**Lipschutz S: Theory and

4. Spiegel M R: Theory and Problems of Probability and Statistics (Schaum's Outline Series) - McGraw Hill Book Co.

5. Goon A.M., Gupta M K and Dasgupta B: Fundamental of Statistics - The World Press Pvt. Ltd.

6. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill Book Co.

7. Bronson R: Differential Equations (Schaum's Outline Series) - McGraw Hill Book Co.

8. Ross S L: Differential Equations - John Willey & Sons.

10. West D.B.: Introduction to Graph Theory - Prentice Hall

11. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.

12. Grewal B S: Higher Engineering Mathematics (thirtyfifthedn) - Khanna Pub.

13. Kreyzig E: Advanced Engineering Mathematics - John Wiley and Sons.

14. Jana- Undergradute Mathematics

15. Lakshminarayan- Engineering Math 1.2.3

16. Gupta- Mathematical Physics (Vikas)

17. Singh- Modern Algebra

18. Rao B: Differential Equations with Applications & Programs, Universities Press

19. Murray: Introductory Courses in Differential Equations, Universities Press

Reference Books:

1. Delampady, M: Probability & Statistics, Universities Press

2. Prasad: Partial Differential Equations, New Age International

3. Chowdhury: Elements of Complex Analysis, New Age International

4. Bhat: Modern Probability Theory, New Age International

5. Dutta: A Textbook of Engineering Mathematics Vol.1 & 2, New Age International

6. Sarveswarao: Engineering Mathematics, Universities Press

7. Dhami: Differential Calculus, New Age International

CO- PO Mapping:

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
M 301.1	3	2	-	-	-	-	-	-	-	-	-	1
M 301.2	3	2	-	-	-	-	-	-	-	-	-	1
M 301.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: **Numerical Methods** Paper Code: **M(CS) 301** Contact: 32
Credit: 3

Pre requisites: Concept of Calculus and Algebra.

Course Objective: The purpose of this course is to provide basic understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

Course Outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M(CS) 301.1: Recall the distinctive characteristics of various numerical techniques and the associated error measures.

M(CS) 301.2: Understand the theoretical workings of various numerical techniques and to solve the engineering problems.

M(CS) 301.3: Apply the principles of various numerical techniques to solve various problems.

Course contents:

MODULE I: NUMERICAL METHOD I

Approximation in numerical computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic. (2L)

Interpolation: Newton forward/backward interpolation, Stirling & Bessel's Interpolation formula, Lagrange's Interpolation, Divided difference and Newton's divided difference Interpolation. (7L)

Numerical integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Romberg Integration, Expression for corresponding error terms. (5L)

Numerical solution of a system of linear equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method. (6L)

MODULE II: NUMERICAL METHOD II

Solution of polynomial and transcendental equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method. (5L)

Numerical solution of ordinary differential equation: Taylor series method,Euler's method, Euler's modified method, fourth order Runge- Kutta method and Milne's Predictor-Corrector methods.

(6L)

Numerical solution of partial differential equation: Finite Difference method, Crank– Nicolson method.

(2L)

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, Iyengar ,& Jain: Numerical Methods (Problems and Solution).New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books

Reference Books:

1. Balagurusamy: Numerical Methods, Scitech. TMH
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. SoumenGuha& Rajesh Srivastava: Numerical Methods, Oxford Universities Press.
5. Srimanta Pal: Numerical Methods, Oxford Universities Press.
6. Numerical Analysis, Shastri, PHI
7. Numerical Analysis, S. Ali Mollah. New Central Book Agency.
8. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI
9. NumericalAnalysis,G.S.Rao,New Age International
10. Programmed Statistics (Questions – Answers),G.S.Rao,New Age International
11. Numerical Analysis & Algorithms, PradeepNiyogi, TMH
12. Computer Oriented Numerical Mathematics, N. Dutta, VIKAS
13. NumericalMethods,Arumugam,ScitechPublication
14. Probability and Statisics for Engineers,Rao,ScitechPublication
15. Numerical Methods in Computer Application,Wayse, EPH

CO- PO Mapping:

PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M(CS) 301.1	3	2	-	-	-	-	-	-	-	-	-	1
M(CS) 301.2	3	2	-	-	-	-	-	-	-	-	-	1
M(CS) 301.3	3	2	2	-	-	-	-	-	-	-	-	1

EC301: SOLID STATE DEVICES
Contact:
3P
Credits: 3
Lectures: 40

COURSE OBJECTIVES:
1. To understand the fundamentals of semiconductor behavior and the operation of basic semiconductor devices.
2. Understanding of a 'top-down' view of traditional electronic device.
3. Understanding of a vast array of other more advanced semiconductor devices.
4. Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.
5. Develop the basic tools with which newly developed devices and other semiconductor applications can be studied.

COURSE OUTCOME:

CO1: Able to describe the Energy band diagram, charge carrier transport phenomenon and recombination-generation process of different types of semiconductor materials.

CO2: Able to study the Characteristics & Current flow of semiconductor devices like BJT, JFET, MOSFET, MESFET, HEMT & Metal-Semiconductor Junction & Hetero Junction Devices.

CO3: Able to analyze the design parameters of MOSFET i.e- Channel length & width, depletion width, surface field and potential, ON resistance, trans conductance, equivalent circuits, amplification factors, capacitances, noise margins, scaling & short channel effects MOSFET .

CO4: Able to Illustrate rectifying properties of different types of junction diode, Importance of reverse current in optical detectors, photodiodes, solar cells, Tunnel diode, LED & Thyristors.

Prerequisites: Conductors, Semiconductors and Insulators, electrical properties, band diagrams. Intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P type and N-type semiconductors, drift and diffusion carriers, Diodes and Diode Circuits Formation of P-N junction, energy band diagram, built-in potential, Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics, Biasing and Bias stability, Concept of Field Effect Transistors (channel width modulation),Gate isolation types, JFET Structure and characteristics and CS, CG, CD configurations.

Module I: Energy Band Theory, Charge Carriers in

Semiconductors: [13L] Energy Band Theory:
Crystalline, non-crystalline and poly crystalline structure with example; direction of planes-Miller
Indices (concept only); [1L]
Concept of Schrodinger's equation in formation of energy bands in crystal, Bloch theorem, Bloch functions, Review of the Kroning-penney model, Brillouin zones, Number of states in the band, Band gap in the nearly free electron model, the tight binding model, Formation of allowed and forbidden energy
bands. [3L]

Effective mass, Wave vector, Energy-band (E-k) diagram, Relation between E-K diagram & Effective
mass, Debye length. Direct & indirect band-gap semiconductors; Compound Semiconductor. [2L]

Charge Carriers in Semiconductors:
Intrinsic & extrinsic semiconductor. Effect of temperature and energy gap on intrinsic concentration , effect of temperature on extrinsic semiconductor , derivation of equilibrium electron and hole concentration in terms of effective density of states and intrinsic level, derivation of electron and hole

concentration in a compensated semiconductor ,basic concept on optical absorption ,photoluminescence, carrier life time , carrier generation and recombination , continuity equation (expression and significance only).Degeneracy and non- degeneracy of semiconductor. [3L]

Carrier concentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept of Fermi level, Fermi Level shift with doping & temperature, invariance of Fermi level at equilibrium, intrinsic carrier concentration expression (no derivation). [2L] Non-equilibrium condition: Effect of temperature and doping concentration on mobility, Effective mobility due to scattering effect, Drift & diffusion of carriers with simple expressions, High field effect on drift velocity, Hall Effect and piezo electric effect, Generation and re combination, quasi-Fermi energy level (concept only). [2L]

Module II: Junction Physics in Semiconductor Devices: [11L]

Semiconductor-Semiconductor Junction: Homo Junction

P-N Junction Diode: Energy band diagram, creation of depletion region; plotting of junction voltage, depletion layer charge and junction field ;current components in forward and reverse biased junction ; derivation of inbuilt potential and depletion width; junction capacitance , Varactor diode ; derivation of diode current equation ; Zener break down principle , static and dynamic resistance of rectifier diode , dynamic resistance of Zener diode, effect of temperature on breakdown voltage. [3L]

Photo Devices: Solar cell – photo-voltaic effect, constructional features of solar cell, conversion efficiency and fill factor; LED; [2L]

Special Diodes: PiN Diode-basic operating principle only, Gunn Diode and IMPATT diode. Tunnel Diode- Energy band diagram & Negative resistance property. [3L]

Semiconductor-Semiconductor Junction: Hetero Junction

Energy band diagram, Classification of Hetero Junction, 2D Electron Gas (Isotype Heterojunction), Anisotype Heterojunction, I-V Characteristics. Numerical Problems. [2L]

Metal-Semiconductor Junction:

Metal-Semiconductor Contact: Ohmic and non-Ohmic contact and explanation using energy band diagram; Schottky diode and its application. [2L]

Module III: Device Physics of Bipolar Junction Transistor: [8L]

Physical mechanism, carrier distribution in forward active mode , terminal current equations, common base current gain (α) , common emitter current gain (β),controlling parameters for β, punch-through and avalanche effect , expression for punch through voltage and avalanche breakdown voltage (no derivation) , Solution of continuity equation and Poisson’s equation for BJT, Eber's Moll model for Static behavior & Charge controlled model (without derivation) for dynamic behavior, equivalent circuits, Basic idea about Photo-transistors & Power transistors (only their features Vis-à-vis the ordinary transistors), origin of parameters in hybrid-pi model, time delay factors in BJT , alpha and beta cut-off frequency ,idea of photo transistor. Numerical Problems. [8L]

Module IV: Field Effect Transistors: [8L]

Junction Field Effect Transistor (JFET):
Construction, field control action and characteristics (recapitulation), pinch-off voltage derivation.
Numerical Problems. [2L]

Metal Oxide Field Effect Transistor (MOSFET):
Types of MOSFET , structure of E-MOSFET, MOS structure under external bias - accumulation, depletion and inversion phenomenon with energy band diagram ,threshold voltage and flat band voltage ; working of E-MOSFET with characteristics ;drain current equation for linear and saturation region with

condition (expression only); channel length modulation ;derivation of threshold voltage of ideal and non- ideal MOSFET;
MOSFET Capacitance- Different types of MOSFET Capacitances, MOS capacitance variation with gate to source voltage under low frequency & High Frequency; large and small signal model of MOSFET
(explanation with diagram). Numerical Problems. [6L]

Text Books :
Streetman & Banerjee - Solid State Electronic Devices, PHI S.M. Sze, Physics of semiconductor devices, Wiley

Reference Books :
Milman, Halkias–Integrated Electronics – TMH Sedra & Smith-Microelectronic Circuits- Oxford
Neamen-Semiconductor Physics and Devices TMH
S.M. Kang and Y. Leblebici. -CMOS Digital Integrated Circuits,Tata McGraw-Hill

CO- PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC301.1	3	2	2	1	2	-	-	-	-	-	-	2
EC301.2	3	3	3	2	2	-	-	-	-	-	-	2
EC301.3	3	3	3	2	1	-	-	-	-	-	-	3
EC301.4	3	3	2	3	2	-	-	-	-	-	-	3

Paper Name: **Circuit Theory & Networks** Paper Code: EC302
Contact:(3L+1T)/Week(Total=42)
Credit: 4
Pre requisites: Properties of series and parallel connections, concept of KCL,KVL , complex algebra , current-voltage phasor diagram ,DC and AC , Charging and discharging of capacitor , Energizing and decaying of inductor

Course Objective: Electrical Circuit is essential everywhere in Electronic and Communication engineering whether it is core electronics applications or communication applications . Therefore objective of this course is to learn circuit analysis technique with the help of networks theorem and methods both for DC and AC consideration .

Course Outcomes (COs):

COs	CO Statement
CO	Students able to analyse series and parallel resonance circuit based on parameters : resonance frequency , band-width , upper & lower cut-off
CO2	frequency , quality factor and impedance different branch for DC and AC circuit using various networks theorems and methods
	Students able to solve branch current and branch
CO4	Students able to apply Laplace Transform technique for the determination of current , voltage
	and power in a magnetically coupled and

Course contents:

MODULE I: Resonance - Series and Parallel resonance, Impedance & Admittance Characteristics, Properties of resonance, Quality Factor, Half Power Points, Bandwidth, Phasor diagrams, Transform diagrams, Practical resonant circuits, Solution of Problems. [5]

MODULE II: Network Analysis - Node Voltage Analysis: Kirchoff's Current law, Formulation of Node equations and solutions,Solution of problems with DC and AC sources.

Mesh Current Analysis: Kirchoff's Voltage law, Formulation of mesh equations , Solution of mesh equations by Cramer's rule and matrix method , Solution of problems with DC and AC sources **Network Theorems**: Definition and Implication of Superposition Theorem , Thevenin's theorem, Norton's theorem , Reciprocity theorem, Compensation theorem , maximum Power Transfer theorem, Millman's theorem, Star delta transformations, Tellegen's Theorem, Solutions and problems with DC and AC sources, driving point admittance, transfer Admittance, Driving point impedance, Transfer impedance. [12]

MODULE III: Graph Theory - Concept of Tree, Branch, Tree link, Incidence Matrix, Cut Set Matrix, Tie Set Matrix, Formation of incidence, tie set, cut set matrices of electric circuits [4]

MODULE IV: Magnetically Coupled Circuit - Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Solution of problems. [4]

MODULE V: Laplace Transform - Concept of Complex frequency, Properties of Laplace Transform, transform of-step, gate, impulse, exponential, periodic functions, over damped surge, critically damped surge, damped and un-damped sine functions, transfer function, poles, zeroes, Initial value theorem and final value theorem, Inverse Laplace Transform using partial fraction method, circuit analysis in s-domain [7]

MODULE VI: Transient Analysis -Transient analysis of RC, RL, RLC circuit with DC & AC sources, Application of Laplace Transform to transient analysis. [5]

MODULE VII: Two Port Network - Open circuit Impedance & Short circuit Admittance parameter, Transmission parameter, Hybrid Parameter, Conditions of Reciprocity and Symmetry, Interrelation between different parameters, Ladder Network & General Network, Solution of Problems. [5]

Text Book:

1. A.Chakrabarti - Circuit Theory: Analysis and Synthesis , Dhanpat Rai & Co.
2. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./Pearson Education
3. Hayt "Engg Circuit Analysis" 6/e Tata McGraw-Hill
4. D. Roy Chowdhury -Networks And Systems, New Age International

Reference Books:

1. B.L. Thereja and A.K. Thereja - A Textbook of Electrical Technology : Basic Electrical Engineering in S.I. Units (Volume - 1) , S-Chand
2. Sudhakar: Circuits & Networks:Analysis & Synthesis" 2/e TMH
3. D.A.Bell- Electrical Circuits- Oxford
4 P.Ramesh Babu- Electrical Circuit Analysis- Scitech

5. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
6. Skilling H.H.: “Electrical Engineering Circuits”, John Wiley & Sons.
7. Edminister J.A.: “Theory & Problems of Electric Circuits”, McGraw-Hill Co.
8. Kuo F. F., “Network Analysis & Synthesis”, John Wiley & Sons.
9. Sivandam- Electric Circuits and Analysis, Vikas

CO- PO Mapping:

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC302.1	Students able to analyse series and parallel resonance circuit based on parameters : resonance frequency , band-width , upper & lower cut-off freque	3	2	2	1	2	-	-	-	-	-	-	2

	n cy , qualit y factor												

	and imped a nce												
EC302 .2	Stude nt s abl e to deter mi ne curre nt , voltag e and power at differe nt branc h for DC and AC circuit using variou s netwo r ks theore ms and metho	3	3	3	2	2	-	-	-	-	-	-	2

	d s												
EC302 .3	Stude nt s able to solve branc h curren t	3	3	3	2	1	-	-	-	-	-	-	3

	and branc h voltage with the help of graph theory												
EC302 .4	Stude nt s able to apply Lapla c e Transf o rm techni q ue for the deter mi nation of curre nt , voltag e and power in a magn et	3	3	2	3	2	-	-	-	-	-	-	3

	ically coupl e d and transie												

	nt circuit												
EC302 .5	Stude nt s abl e to estim at e param e ters of two port netwo r k throu gh open circuit & short circuit test	3	3	3	3	2	-	-	-	-	-	-	3
EC302		3	3	2	2	-	-	-	-	-	-	-	3

Name of the Paper: Data Structures
Paper Code: CS(ECE)301
Contact (Periods/Week): L-T-P=3-0-0 Credit Point: 3
No. of Lectures: 36 Hours

Prerequisite:

Familiarity with the fundamentals of C or other programming language. A solid background in mathematics, including probability, set theory.

Objective(s)

To learn the basics of abstract data types.
To learn the principles of linear and nonlinear data structures. To build an application using sorting and searching.

Outcome(s)

On completion of the course students will be able to

CS301.1: Differentiate how the choices of data structure & algorithm methods impact the performance of program.
CS301.2: Solve problems based upon different data structure & also write programs. CS301.3: Identify appropriate data structure & algorithmic methods in solving problem.
CS301.4: Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
CS301.5: Compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

<u>Module I: Linear Data Structure</u>

[10L] Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code **(1L)**
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations **(1L)**

Array (2L):
Different representations – row major, column major **(1L)**
Sparse matrix - its implementation and usage, Array representation of polynomials **(1L)**

Linked List (6L):
Singly linked list – operations, Doubly linked list – operations **(4L)**
Circular linked list – operations, Linked list representation of polynomial and

applications **(2L)** **<u>Module II: Linear Data Structure</u>** **[6L]**

Stack and Queue (4L):
Stack and its implementations (using array and linked list) **(1L)**
Applications (infix to Postfix, Postfix Evaluation) **(1L)**
Queue, circular queue, de-queue **(1L)**
Implementation of queue- linear and circular (using array and linked list) **(1L)**

Recursion (2L):
Principles of recursion - use of stack, tail recursion. **(1L)**
Applications - The Tower of Hanoi, Eight Queens

Puzzle **(1L)** **Module III: Nonlinear Data**

structures **[12L]**

Trees (8L):
Basic terminologies, forest, tree representation (using array and linked list) **(1L)**
Binary trees - binary tree traversal (pre-, in-, post- order) **(1L)**
Threaded binary tree **(1L)**
Binary search tree- operations (creation, insertion, deletion, searching) **(1L)**
Concept of Max-Heap and Min-Heap **(**creation, deletion) **(1L)**
Height balanced binary tree – AVL tree (insertion with examples only) **(1L)**
Height balanced binary tree – AVL tree (deletion with examples only) **(1L)**
m –Way Search Tree, B^+ Tree – operations (insertion, deletion with examples only) **(1L)**

Graphs (4L):
Graph theory review **(1L)**
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) **(2L)**
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) **(1L)**

Module IV: Searching, Sorting **[8L]**

Sorting Algorithms (4L):
Bubble sort, Insertion sort, Selection sort – with notion of complexity **(1L)**
Quick sort, Merge sort – with complexity **(2L)**
Radix sort – with complexity **(1L)**

Searching (2L):
Sequential search – with complexity **(1L)**
Binary search, Interpolation Search– with complexity **(1L)**

Hashing (2L):
Introduction to Hashing and Hashing functions **(1L)**
Collision resolution techniques **(1L)**

Recommended books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed
3. "Data Structures in C" by Aaron M. Tenenbaum
4. "Data Structures" by S. Lipschutz
5. "Data Structures Using C" by Reema Thareja
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE)402.1	3	3	2	2	3	2	2	3	3	3	2	3
CS(EE)402.2	3	2	2	2	2	2	3	2	2	3	3	2
CS(EE)402.3	3	3	3	2	3	3	3	2	2	3	3	2
CS(EE)402.4	3	3	3	3	3	3	3	3	3	3	3	3
CS(EE)402.5	3	3	3	3	3	3	3	3	3	3	3	3
CS(EE)402	3	3	3	2	3	3	3	3	3	3	3	3

Paper Name: **Numerical Methods Lab**

M(CS) 391

Paper Code:

Contact

Credit: 4

Pre requisites: Any introductory course on C/ Matlab.

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course Outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M(CS) 391.1: Apply the programming skills to solve the problems using multiple numerical approaches.

M(CS) 391.2: Analyze if the results are reasonable, and then interpret and clearly communicate the results.

Course contents:

1. Assignments on Newton forward /backward, Lagrange's interpolation, Sterling & Bessel's Interpolation formula, Newton's divided difference Interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule and Romberg Integration.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula- Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.
6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.
7. Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group)/Python.

Text Book

Reference Books

CO- PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M(CS) 391.1	2	1	-	-	3	-	-	-	-	-	-	1
M(CS) 391.2	2	1	-	-	3	-	-	-	-	-	-	1

Paper Name: **Circuit Theory and Networks Lab**
Paper Code: EC392
Contact:3P/Week
Credit: 2
Pre requisites: Theoretical concept on series and parallel connections, concept of KCL,KVL , circuit with electrical components ,DC and AC source.

Course Objective: Objective of this course to acquire hands on experience for designing, development and analysis of electrical circuit using AC and DC source .Also to use modern tools to solve problems on circuit theory and electrical networks .

Course Outcomes (COs):

COs	CO Statement
CO1	Students able to analyse series & parallel resonance circuit and transient response in RC,RL and RLC circuit using MATLAB tools
CO 2	Students able to validate networks theorems
	Students able to test the effect of inductance on speed of system
CO4	Students able to determine two port parameters , Laplace transform of different time domain functions and partial fraction expansion in s domain
CO5	Students able to originate periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB

Course contents:

List of Experiments

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware.
4. Study the effect of inductance on speed of system response; simulation/Hardware
5. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
6. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
7. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
8. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s domain and cascade connection of second-order systems using MATLAB
9. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
10. Transformation using MATLAB Note: An Institution / college may opt for some other hardware or software simulation wherever possible in place of MATLAB

CO- PO Mapping:

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC392.1	Student s able to analyse series & parallel resonan ce circuit and transie nt respons e in RC,RL and RLC circuit	3	3	3	2	3	-	-	1	2	2	-	3
.2													

	s able to validate networks theorems												
EC392 .3	Student to test the effect of inductance on speed of system response	3	3	3	2	3	-	-	1	2	2	-	3
EC392 .4	Student to determine two port parameters ,	3	3	3	3	3	-	-	1	2	2	-	3

	Laplace transform of												

	different time domain functions and partial fraction expansi on in s domain												

EC392 .5	Stude nt s able to originat e perio di c, expon e ntial, sinus oi dal, damp e d sinus oi dal, step, impul s e, and ramp signal s using MATL AB	3	3	3	3	3	-	-	1	2	2	-	3

EC392		3	3	3	2	3	-	-	1	2	2	-	3

Name of the Paper: Data Structures Lab
Paper Code: CS(ECE) 391
Contact (Periods/Week): L-T-P=0-0-3 Credit Point: 2
No. of Lab: 11

Prerequisite:

Familiarity with the fundamentals of C or other programming language. A solid background in mathematics, including probability, set theory.

Objectives:

To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.

To write and execute write programs in C to implement various sorting and searching methods.

Course Outcome:

On completion of the course students will be able to

CS(EE)492.1	Choose appropriate data structure as applied to specified problem definition. Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.
CS(EE)492.2	Have practical knowledge on the applications of data structures.
CS(EE)492.3	Able to store, manipulate and arrange data in an efficient manner.
CS(EE)492.4	Able to implement queue and stack using arrays and linked list.
CS(EE)492.5	Implementation of queue, binary tree and binary search tree.

Course content:

Module 1

1. Write a C program that uses functions to perform the following:
   a. Create a singly linked list of integers.
   b. Delete a given integer from the above linked list.
   c. Display the contents of the above list after deletion.

2. Write a C program that uses functions to perform the following:
   a. Create a doubly linked list of integers.

b. Delete a given integer from the above doubly linked list.
c. Display the contents of the above list after deletion.

3. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.

4. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.

5. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.

Module 2

6. Write a C program that uses functions to perform the following:
   a. Create a binary search tree of characters.
   b. Traverse the above Binary search tree recursively in Postorder.

7. Write a C program that uses functions to perform the following:
   a. Create a binary search tree of integers.
   b. Traverse the above Binary search tree non recursively in inorder.

Module 3

8. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Insertion sort
   b. Merge sort

9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Quick sort
   b. Selection sort

10. Write C programs for implementing the following searching methods:
    a. Linear Search
    b. Binary Search

Write a C program to implement all the functions of a dictionary (ADT) using hashing.

Module 4

11. Write C programs for implementing the following graph traversal algorithms:
    a. Depth first search
    b. Breadth first search

TEXT BOOKS:

1. C and Data Structures, Third Edition, P.Padmanabham, BS Publications.
2. C and Data Structures, Prof. P.S.Deshpande and Prof. O.G. Kakde, Dreamtech Press.
3. Data structures using C, A.K.Sharma, 2nd edition, Pearson.
4. Data Structures using C, R.Thareja, Oxford University Press.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand.
6. C Programming and Data Structures, P.Radha Krishna, Hi-Tech Publishers.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE)492.1	3	3	2	2	2	2	1	1		1		
CS(EE)492.2	3	2	2		2	2	1			1		2
CS(EE)492.3	2	1	1					1				
CS(EE)492.4	3	2		2		1	1		1		1	
CS(EE)492.5	1		2	1	2			1	1		1	2
CS(EE)492	3	2	2	2	2	2	1	1	1	1	1	2

Paper Name: Physics –
II Paper Code: PH
(ECE) 401 Total
Contact Hours: 33
Credit: 3

Pre requisites: Knowledge of Physics up B. Tech. 1^{st} year Physics-I course

Objective of the Physics-II Course:

The Physics-II course will provide

- exposure to the physics of materials that are applied in electronics devices.
- an insight into the science & technology of next generation and related technicalities through quantum mechanics
- exposure to nanoelectronic devices
- concept of fundamental particles and associated applications in semiconductors

Course Outcome
CO1: Able to understand basic laws of electromagnetism using

vector calculus. CO2: Able to apply Schrodinger equation to solve

quantum mechanical problems. CO3: Able to explain the behaviour

of electromagnetic waves.

CO4 Able to discriminate between different statistics.

Course contents

Module 1: Electricity and

Magnetism (15L) Module 1.01:

Vector Calculus

Vector operators, Gradient, Divergence, Curl-Physical significance, Scalar and Vector field, Gauss's divergence theorem (statement only), Stoke's theorem (statement only), expression of gradient,
divergence, curl in spherical and cylindrical coordinate system. 3L

Module 1.02: Electrostatics

Coulomb’s law in vector form, Electrostatic field and its curl, Gauss’s law in integral form and conversion into differential form, Equation of continuity, Extend to Poisson’s & Laplace’s equation,
Application to parallel plate, spherical and cylindrical capacitors (equivalent 1D problem). 4L

Module 1.03: Magnetostatics

Biot-Savart law (non existence of magnetic monopole)-application, Magnetic vector and scalar potential. Ampere’s circuital law, force on a small current element placed in a magnetic field. force due to parallel and anti-parallel current carrying wire and definition of Ampere, Lorentz force (concept in Hall effect). 5L

Module 1.04: Electro-magnetism & Electromagnetic theory

Faraday's law-integral and differential form, Concept of displacement current, Maxwell's field equations with physical significance, wave equation in free space, transverse nature of electromagnetic wave. 3L

Module 2: Quantum Mechanics-II (7L)

Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation. 4L

Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum
tunnelling (solve only $E<V_0$). 3L

Module 3: Statistical Mechanics (4L) (SSR)

Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)-physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature,
Concept of Fermi level. 4L

Module 4: Physics of Organic semiconductors &

Nanomaterials (7L) Module 4.01: Physics of Organic

semiconductors:
Exciton, bi-exciton, polaron, bipolaron, soliton, organic semiconductors (qualitative discussions)-
comparison with silicon based semiconductor electronics, 3L
applications.

Module 4.02: Physics of Nanomaterials (RB)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, grapheme, electronic,
environment, medical). 4L

Reference Books

1. Insulating Materials:Principles, Materials,Applications, Margit Pfundstein, Roland Gellert,Martin Spitzner& AlexanderRudolphi: BirkhauserVerlag AG; 1 edition (1 April 2008)

2. High Voltage and Electrical Insulation Engineering, RavindraArora, Wolfgang Mosch: Online ISBN:
9780470947906 DOI:10.1002/9780470947906, Series Editor(s): Mohamed E. El-Hawary

3.Physics of Oscillations and Waves, N.K. Bajaj ,Publisher: McGraw-Hill Education –Europe
4.Waves and oscillations, Dr.P.K Mittal & Prof Jai DEV ,AnandHarAnand publications

5. Fundamental of Statistical Mechanics: B Laud

6. Introduction to statistical mechanics : .Pathria

7. Fundamental of Statistical and Thermal Physics: .F. Reif

8. Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward M Purcell

9. Introduction to Electrodynamics- Griffiths David J.

10. The Feynman Lectures on Physics. 2 (2nd ed.)Feynman, Richard P, Addison-Wesley. 11.Etching of Crystals-Theory, Experiment and Application, K Sangwal

12. Nanostructure and Nanomaterials, B.K. Parthasarathy

13. Introduction toNanotechnology, B.K. Parthasarathy

14. Essentials of Nanotechnology, RishabhAnand

15. Nanomaterials Handbook(Advanced Materials and Technologies)-YuryGogotsi (Editor)

16. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH (ECE) 401.1	3	1	-	-	-	-	-	-	-	-	-	1
PH (ECE) 401.2	3	1	-	-	-	-	-	-	-	-	-	1
PH (ECE) 401.3	3	2	-	-	-	-	-	-	-	-	-	1
PH (ECE) 401.4	2	3										-
PH (ECE) 401.5	2	3										1
PH (ECE) 401	2.6	2	-	-	-	-	-	-	-	-	-	1

Stream: ECE

Paper Name: Signals &Systems

Paper Code: EC 401 **Contacts: 3L** **Credits: 3** **Total Contact: 35**

Semester: 4th

Course Objectives:

1. To understand the basic properties of signal & systems and the various methods of classification.
2. To learn Fourier series and Fourier transform and their properties
3. To know Z transform & DTFT and their properties
4. To characterize LTI systems in the Time domain and various Transform domains

Course Outcome:

1. Able to identify the classification of signals in terms of periodic-aperiodic, even – odd, energy-power, Deterministic-random, complex exponential, sinusoidal signals, unit impulse and unit step.
2. Able to determine the mathematical operation on signals and systems using time scaling, time shifting, linearity, causality, time invariance, stability, convolution theorem and Fourier series coefficient with Dirichlet's conditions.
3. Able to discriminate different spectrum analysis techniques and its analysis and characteristics on LTI system using Fourier transform.
4. Able to analyze the Z-transform with the help of properties of ROC, Poles and Zeros , inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion.
5. Able to understand the application of sampling theorem, types of sampling, reconstruction of a signal from its samples, aliasing effect and the effect of random variable with its properties like distribution & density functions, mean values & moments, concepts of correlation, random processes.

Prerequisite:

The candidates should learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks. **Module I**

Introduction to signals and systems: [13]

Continuous and discrete time signals: Definition and example of continuous signal, Representation of continuous time signals by its sample, Types of sampling, Sampling theorem, Reconstruction of a Signal from its samples, concept of discrete signal, Definitions and Numerical on Unit step, Unit Impulse, Unit Ramp, Exponential and Sinusoid both for continuous and discrete, Representation of signals using graphical, tabular and sequential form. [6]

Classification and convolution of Signals : Definitions and numerical of Periodic & Aperiodic signals, Even & Odd signals, Energy & Power signals, Deterministic & Random signals, Causal, Anti causal and Non causal signals, Complex exponential and sinusoidal signals, convolution of two signals using graphical and matrix method. [4]

Some operations on signals: Time reversal, Time shifting, Time scaling. [1]

Systems and its classifications: Definition of systems and its representation, Definition and numerical of Linear & Non linear system, Causal & non causal system, Time variant & invariant system, Stability of the system, Systems with memory and without memory, Invertible and noninvertible Systems. [2]

Module –II
Fourier Series of Continuous-time and Discerete–time Signals [5]

Fourier series analysis & Derivation of Fourier Coefficients Equation(Exponential form only), Fourier Series Properties ,Symmetry Properties of the Fourier Series, Diminishing of Fourier Coefficients, Dirichlet Conditions, Gibbs's Phenomena, Parseval's relation (statement only), Problems on Fourier series & Basic concept of Discrete time Fourier series. [5]

Module III

Signal Transformation [6]

Introduction to Continuous time Fourier Transform (CTFT): Definition, Importance, Relation with Fourier series, Examples. [1]
Computation of Fourier transform of different signals: Exponential, unit step function, Impulse function, sine and cosine wave, rectangular wave and other different waveforms. Computation of magnitude and phase spectrum. [2]

Properties of Fourier Transform

Linearity, Time shifting, Conjugation, Differentiation, Integration, Time scaling, Parseval's theorem, Duality, Convolution. [1]

Discrete time Fourier Transform(DTFT):

Introduction, Definition, Computation of DTFT of different sequences. [1]

Properties of DTFT: Linearity, Time shifting, Frequency shifting, Conjugacy, Time Reversal, Parseval's, Convolution, Multiplication. [1]

Module IV

Z-Transforms [8]

Introduction to Z-Transforms: Definition, Relationship between Fourier transform and Z- transform, Region of convergence (ROC), Properties of ROC, Properties of Z-transform, transfer function, concept of Poles and zeros, Z-transform of different sequences. [5]

Inverse Z-transform:

Inverse Z -transform using residue theorem, power series expansion and partial fraction method. [3]

Module V

Introduction to Random Variables [3]

Definition of Random Signal, Random Variables and Probability Distributions,Examples. [1]

Statistical Properties of Random Signal: Independent and conditional random variables,Standard Deviation,mean,variance,Examples. [1]

Independent and Dependent Random Variables, Arithmetic Mean. [1]

Text Books:

1. Linear Signals and Systems by B.P.Lathi-OXFORD university Press
2. Signals &Systems by A.V.Oppenheim, A.S.Willsky and S.H.Nawab - Pearson
3. Signals and Systems by P.Ramesh Babu & R.Anandanatarajan - Scitech

References:

1. Signals &Systems by A.Anand Kumar-PHI
2. Signals and Systems by S.Haykin & B.V.Veen-John Wiley
3. Signals and Systems by A.Nagoor Kani- McGraw Hill
4. Signals and Systems by S Ghosh- Pearson
5. Digital Signal Processing by M.H.Hays- TMH

6. Signals and Systems by Salivahanan
7. Signals and Systems with MATLAB by Wŏn-yŏng Yang-Springer
8. Signals and Systems by A. Nagoor Kani- McGraw Hill
9. Digital Signal Processing by P.Ramesh Babu & R.Anandanatarajan - Scitech

Mapping of CO with PO:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	3	3	3	1	3	1	1	1	-	-	-	3
	3	3	3	1	3	1	1	1	-	-	-	3
3	3	3	3	3	3	2	2	1	-	-	-	3
	3	3	3	3	3	2	2	1	-	-	-	3
	3	3	3	3	3	1	2	1	-	-	-	3

Paper Name: Analog Electronic Circuits Paper Code: EC 402

Contact:

3L+1T

Credit: 4

Pre requisites: Basic knowledge about electronic components(R,L,C). Network Theorems (Kirchoffs law, Thevenin's theorem, Norton's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices (Diode, Transistor, JFET, MOSFET, etc.),Basic idea of integrated circuit, Voltage current equations. Basic knowledge of Differentiation, Integration, Differential equation, matrix etc.

Course Objective: Students will be able to design, test and examine simple circuits with diode, transistor, op-amp, etc. They will have clear knowledge of basic circuit analysis and its functions and their limitations. Most importantly they will be able to understand, modify and repair majority of circuits used in professional equipment design. They will also be able to take- up new design exercise.

Course Outcome:

CO1: Students will be able to design D.C power supplies.

CO2: Students will be able to analyze transistor amplifier circuit.

CO3: Students will be able to understand effects of different feedback mechanism in amplifier circuit.

CO4: Students will be able to analyze signal generator Circuit.

CO5: Student will be able to design power amplifier circuit.

CO6: Students will be able to understand linear and nonlinear applications of OPAMP (I.C-741).

Course contents:

Module-1:

a) PASSIVE FILTERS & VOLTAGE REGULATORS: Capacitor filter, π-section filter, estimation ripple factor, series and shunt voltage regulator, percentage regulation, 78xx and 79xx series, concept of SMPS, idea of DC power supplies. [4]

b) SINGLE STAGE TRANSISTOR AMPLIFIER: Biasing techniques, Q-point & its Stability, Self Bias-CE configuration, Bias Compensation techniques, h-parameter model of transistors. Expression for voltage gain, current gain, input and output impedance, power gain, Emitter follower circuit. [4]

Module-2:

a) MULTISTAGE AMPLIFIER: Different coupling techniques, RC coupled amplifier, functions of all components, derivation of voltage gain, current gain, input impedance and output impedance, High frequency model of transistors (hybrid-π model), frequency response characteristics, Expression for lower and upper half frequencies, bandwidth, and concept of wide band amplifier. [5]

b) FEEDBACK AMPLIFIERS & OSCILLATORS: Feedback concept, negative & positive feedback, Transconductance Amplifiers, Transresistive Amplifiers, Barkhausen criterion, RC Oscillators-Phase shift and Wien bridge oscillators, LC Oscillator-Colpitts, Hartley's, and crystal oscillators. [5]

Module-3:

a) POWER AMPLIFIERS: Class A, B, AB, C, Conversion efficiency, Tuned amplifier. [3]

b) FET AMPLIFIERS: Equivalent circuit of JFET and MOSFET, Common-source, Common gate and source follower amplifiers. [4]

c) DIFFERENTIAL AMPLIFIERS: BJT and MOS differential amplifiers, Small signal and large signal operations of differential amplifiers, Differential amplifier with active load and current mirror. [3]

Module-4:

a) **OPERATIONAL AMPLIFIER & IT'S APPLICATIONS:** Ideal & Non Ideal OPAMP- Electrical equivalent circuit and transfer characteristics, internal circuit of Operational Amplifier, adder & subtractor circuit, practical integrator & practical differentiator circuit, Instrumentation Amplifier, Log & Anti-log amplifiers, multipliers, Precision Rectifier, Comparator& Schmitt Trigger, voltage to current and current to voltage converters, Low pass and high pass active filters. [9]

b) MULTIVIBRATORS: Astable ,Monostable, Bistable multivibrators; Astable and Monostable operation using I.C-555 timer.Voltage Controlled Oscillaor. [3]

Text Books:

1. Sedra & Smith-Microelectronic Circuits-Oxford Up
2. Millman & Halkais- Integrated Electronics, McGraw Hill.
3. Boylested & Nashelsky-Electronic Devices and Circuit Theory-Pearson/PHI
4. Rashid-Microeletronic Circuits-Analysis and Design- Thomson (Cenage Learning).
5. Franco- design with Operational Amplifiers & Analog Integrated Circuits, 3/e, McGraw Hill.

Reference Books:

1. Razavi- Fundamentals of Microelectronics-Wiley
2. J.B. Gupta- Electronic Devices and Circuits- S.K. Kataria & Sons
3. Malvino- Electronic Principles, 6/e, McGraw Hill
4. Gayakwad R.A – OpAmps and Linear

IC's, PHI CO- PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**
	3	3	3	3	2	-	2	-	3	-	-	3
CO 2	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2		2		3			3

EC 403: DIGITAL ELECTRONIC & CIRCUITS
Contacts: 3L +1T
=4 Credits: 4
Lectures: 40 hours

COURSE OBJECTIVES:

a. To perform decimal, octal, hexadecimal, and binary conversions.
b. To apply Boolean algebra to solve logic functions.
c. To analyze pulse and logic switching circuits.
d. To analyze digital decoding & multiplexing circuits.
e. To analyze logic family interfaces.
f. To analyze memory storage devices
g. To prepare Arithmetic Logic Unit
h. To apply logic design circuits with Programmable Logic Devices

COURSE OUTCOME:

The students will be able to:
CO1: Acquired knowledge about solving problems related to number systems conversions and Boolean algebra and design logic circuits using logic gates to their simplest forms using De Morgan's Theorems; Karnaugh Maps.
CO2: Design of combinational circuits
CO3: Design of various synchronous and asynchronous sequential circuits using State Diagrams & Tables.
CO4: Understand DAC & ADC technique and corresponding circuits
CO5: Analyze logic family interfaces, switching circuits & memory storage devices to Plan and execute projects.

COURSE CONTENT:

Module1.

Binary, Octal and Hexadecimal number system representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Hamming Code. Signed binary number representation with 1's, 2's, 9's and 10's complement methods, Binary arithmetic.
Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method, Quine-McCluskey minimization technique (Tabular Method). [12]

Module-2:

Combinational circuits- Half Adder, Full Adder, Serial & Parallel Adder, Carry Look Ahead Adder, BCD Adder, Half Subtractor, Full Subtractor circuits, Adder-Subtractor Circuit. Encoder, Decoder, Multiplexer, De Multiplexer, Adder & Subtractor Design using decoder & multiplexer, Comparator and Parity Generator-Checker. [11]

Module-3:

Sequential Circuits- latch & Flip Flops-S-R, J-K, D and T, Conversion of Flip Flops, Various types of Shift Registers-SISO, PISO, SIPO, PIPO, Bidirectional & Universal Shift. Modulus Counters- Synchronous, Asynchronous, Irregular, Self Correcting Ring & Johnson Counter. Application of Counter (Stepper motor control) [11]

Module-4:

Parameters of D/A & A/D Converters. Different types of A/D -Flash Type, Successive Approximation and Dual Slope and D/A -R-2R Ladder & Binary Weighted Resistor Type.
Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. TTL Equivalent Circuit.

[6]

Textbooks:

1. A.Anand Kumar, Fundamentals of Digital Circuits-PHI
2. Morries Mano- Digital Logic Design- PHI
3. S.Salivahanan & S.Arivazhagan, Digital Circuit & Design- Bikas Publishing
4. A.K.Maini- Digital Electronics- Wiley-India

Reference:

1. Floyed & Jain- Digital Fundamentals-Pearson.
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Kharate- Digital Electronics- Oxford
6. Tocci, Widmer, Moss- Digital Systems, 9/e- Pearson

Mapping of CO with PO:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	3	3	3	1	3	1	1	1	1	1	1	3
	3	3	3	1	3	1	1	1	1	1	1	3
3	3	3	3	3	3	2	2	1	1	1	2	3
	3	3	3	3	3	2	2	1	1	2	1	3
	3	3	3	3	3	1	2	1	2	2	2	3

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

Theory

Paper Name: Analog Communication Paper Code: EC 404
Total Contact Hours: 40 Credit: 4

Pre requisites:

Periodic signal and trigonometric Fourier series Exponential Fourier series
Parsevel's Theorem for Fourier series Fourier transform and its properties Energy and power signal

Course Objective:

To introduce the concepts of analogue communication systems, and to equip students with various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.

Course Outcome (CO):

Sem.	Course Title	CO Codes	Course Outcomes
	Analog Communication EC 404	EC404 .1	**Understand** the generation of amplitude modulation and its representation in time and frequency domain.
		EC404 .2	**Identify** the effect of DSB-SC, SSB and VSB in terms of modulation index and bandwidth efficiency.
		EC404 .3	**Describe** the demodulation techniques of amplitude modulated signal.
		EC404 .4	**Understand** the generation and detection of frequency modulation techniques.
		EC404 .5	**Estimate** the noise performance AM and FM signals.
		EC404 .6	**Classify** the performance of PAM, PWM and PPM techniques.

Course contents:

MODULE-I

Introduction to Analog Communication: (13L)

Elements of communication system - Transmitters, Transmission channels & receivers, Concept of modulation, its needs [1L].
Review Fourier Transform and its properties [1L], Concept of Hilbert Transformation and its properties [3L].
Continuous Wave Linear Modulation:

a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone and multi tone messages), modulation index [2L], frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; [1L]

Calculation of Transmitted power & sideband power & Efficiency; concept of under, over and critical modulation of AM-DSB-FC.[1L]

b) Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. [1L] Single side band modulation (SSB) SC, VSB, Filter Transfer function, Spectra and band-width. [3L]

MODULE-II

Generation & Detection of Amplitude Modulation: (9L)

a) Generation of AM: Concept of i) Gated (switching and collector modulation methods) and

ii) Square law modulators, Balanced Modulator. [2L]

b) Generation of SSB: Filter method, Phase shift method and the Third method [2L] Demodulation for Linear Modulation:

Demodulation of AM signals: Detection of AM by envelope detector [1], Concept of squaring synchronizer, Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. [2L]

Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. [2L]

MODULE-III

Angle Modulation: (9L)

a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions (2L); Phasor diagram (1L);

b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator (2L)

c) Demodulation of FM and PM: Concept of frequency discriminators (1), Phase Locked Loop (2L) Ratio Detector (1L)

MODULE-IV

Noise (7L)

Random Signals and Noise in Communication System:

i) Noise in Communication systems – Internal & External noise, Noise Temperature, Signal-to- Noise ratio, White noise, thermal noise, Figure of Merit. (2L)

iii) Noise performance in Analog Communication systems: SNR calculation for DSB/FC, DSB-SC, SSB-FC, SSB-SC & FM. (3L)

MODULE-V

Pulse Modulation (2L)

Sampling theorem, Generation and detection of PAM/PWM/PPM, Aliasing effects (2L)

Text Books:

1. Taub and Schilling , "Principles of Communication Systems", 2nd ed., Mc-Graw Hill
2. B.P.Lathi -Communication Systems- BS Publications
3. V Chandra Sekar – Analog Communication- Oxford University Press

References:

1. Carlson—Communication System,4/e , Mc-Graw Hill
2. Proakis & Salehi Fundamentals of Communication Systems- Pearson
3. Singh & Sapre—Communication Systems: 2/e, TMH
4. P K Ghosh- Principles of Electrical Communications- University Press
5. L.W.Couch Ii, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
6. Blake, Electronic Communication Systems- Cengage Learning
7. S Sharma, Analog Communication Systems- Katson Books

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
						PO1PO	2PO3PO	4PO5P	O6PO7P	O8PO9	PO10PO	11PO12		
4th	Analog Communication	EC404 .1	3	3	3	-	1	1	-	-	2	-	-	3
		EC404 .2	3	3	-	3	3	-	2	-	-	1	2	3
		EC404 .3	3	3	3	3	2	2	-	-	1	-	-	3
		EC404 .4	3	3	3	2	3	-	2	-	-	2	2	3
		EC404 .5	3	3	-	3	3	2	-	-	-	-	-	3
		EC404 .6	3	3	3	-	-	2	2	3	1	2	-	3

Paper Name: Physics –II
Lab Paper Code: PH
(ECE) 491 Total Contact
Hours: 33 Credit: 2

Pre requisites: Knowledge of Physics up B. Tech. 1^{st} year Physics-I course

Objective of the Physics-II Course:

The Physics-II course will provide

- exposure to the physics of materials that are applied in electronics devices.
- an insight into the science & technology of next generation and related technicalities through quantum mechanics
- exposure to nanoelectronic devices
- concept of fundamental particles and associated applications in semiconductors

Course Outcome

CO1: Able to understand the motion of electrons in crossed electric and

magnetic field. CO2: Able to explain the photoelectric effect.

CO3: Able to demonstrate the Hall effect in conductors and semi-

conductors. CO4: Able to measure the band gap for

semiconductors.

CO5: Able to understand the motion of electrons in crossed electric and magnetic field.

Course contents

***At least 7 experiments to be performed during the semester**

Experiments on Module 1: Electric and Magnetic properties of materials (8L)
1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent)/Measurement of losses in a dielectric using LCR circuits.

Experiments onModule 2: Quantum Mechanics-II (6L)

6. Determination of Stefan's radiation constant.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
8. Measurement of specific charge of electron using CRT.

Experiments onModule 4:Solid state physics (9L)

9. Determination of band gap of a semiconductor.
10. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor
In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:
1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH (ECE) 491.1	3	2	-	-	-	-	-	-	-	-	-	1
PH (ECE) 491.2	1	2	-	3	-	-	-	-	-	-	-	1
PH (ECE) 491.3	1	2	-	-	-	-	-	-	3	-	-	1
PH (ECE) 491.4	1	2	-	-	-	-	-	-	-	3	-	1
PH (ECE) 491.5	1.5	2	-	3	-	-	-	-	3	3	-	1

Paper Name: ANALOG ELECTRONIC CIRCUITS LAB

Paper Code: EC-492

Any 8 Experiments has to be done

1. Study of voltage regulator circuit using zener diode.
2. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
3. Design of RC coupled amplifier & study of it's gain & Bandwidth using BJT.
4. Design of RC Phase shift oscillator using BJT.
5. Design of wien bridge oscillator using BJT.
6. Study of class A & class B power amplifiers.
7. Design of differential amplifier circuit using BJT.
8. Study of Integrator using OPAMP IC 741
9. Study of Differentiator using OPAMP IC 741
10. Design of low pass and high pass active filter using OPAMP and study of its frequency response.
11. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
12. Study of voltage controlled oscillator.
13. Design a simple function generator using IC.

Course Outcome:

CO1: Students will be able to construct half wave, full wave and bridge rectifier circuits and voltage regulator circuit.

CO2: Students will be able to design transistor based single stage R-C coupled voltage amplifier, differential amplifier and different classes of power amplifier circuit with given specification.

CO3: Students will be able to design transistor based RC oscillator (Wien bridge and RC phase shift oscillator) circuit.

CO4: Students will be able to construct astable and mono-stable mode timer circuit using IC 555.

CO5: Students will be able to design Integrator, differentiator and low pass & high pass active filter circuit using Op-Amp (I.C-741)

CO- PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2
	3	3	3	3	2	-	2	-	3	-	-	3
CO 2	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2	-	2	-	3	-	-	3
	3	3	3	3	2	-	2	-	3	-	-	3

EC493: DIGITAL ELECTRONIC & CIRCUITS LABORATORY
Contacts: 3P
Credits: 2

Prerequisites: Knowledge in Electronics and Communication

COURSE OBJECTIVE:

a. To provide the basic skills required to understand, develop, and design of various engineering applications involving Digital Electronic & Circuits.
b. To provide basic laboratory exposures for Digital Circuits and applications.

COURSE OUTCOME:

CO1: Able to understand the fundamental concepts and techniques used in digital electronics.
CO2: Able to understand and examine the structure of various number systems, De-Morgan's law, Boolean algebra and its application in digital design.
CO3: Able to understand, analyse the timing properties (input setup and hold times, minimum clock period, output propagation delays) and design various combinational and sequential circuits using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.
CO4: Able to understand different digital circuits using Programmable Logic Devices. CO5: Able to know how to interface digital circuits with ADC & DAC.

LIST OF EXPERIMENTS:

1. Realization of basic gates using Universal logic gates.
2. Realization of logic gates using TTL.
3. Design the circuit of Grey to Binary and vice versa.
4. Design a circuit for BCD to 7-segment display.
5. Four-bit parity generator and comparator circuits.
6. Construction of simple Encoder & Decoder circuits using logic gates.
7. Construction of simple Multiplexer & De Multiplexer circuits using logic gates.
8. Design of Half Adder & Full Adder Circuit using Logic Gates.
9. Design Half Subtractor & Full Subtractor Circuit using Logic Gates.
10. Realization of RS,D, JK and T flip-flops using logic gates.
11. Realization of Register using flip-flops and logic gates.
12. Realization of Up/Down counters.
13. One Innovative design of Digital Circuits.

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	3	3	3	1	3	1	1	1	-	-	1	3
	3	3	3	1	3	1	1	-	1	1	1	3
3	3	3	3	3	3	2	2	1	-	1	2	3
	3	3	3	3	3	2	2	1	-	2	1	3
	3	3	3	3	3	1	2	1	2	2	2	3

Paper Name: Analog Communication
Lab Paper Code: EC 494
Total Contact Hours: 30
Credit: 2

Prerequisites: Knowledge in Electronics and Communication

Course Objective:
To provide the basic skills required to understand, develop, and design of various engineering applications involving analog communication theory. To provide basic laboratory exposures for communication principles and applications.

Course outcome:

Sem.	Course Title	CO Codes	Course Outcomes
	Analog Communication Lab EC494	EC494 .1	**Analyse** the effect in terms of power efficiency and modulation index of DSB-WC, DSB-SC, SSB modulation techniques.
		EC494 .2	**Evaluate** the performance in terms of BW of the demodulated signals.
		EC494 .3	**Compare** the power and bandwidth efficiency of FM signal
		EC494 .4	**Design** the PLL using VCO to measure the capture and locking range.
		EC494 .5	**Measure** selectivity, sensitivity and fidelity of a superhetrodyne receiver.
		EC494 .6	**Compare** modulation and demodulation of PAM, PWM technique.

List of experiments:

1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a PLL using VCO & to measure the lock frequency.
6. Design a FM demodulator using PLL.
7. Measurement of selectivity, sensitivity and fiedility of a superhetrodyne receiver.

8. Study of pulse amplitude modulation (PAM) and demodulation.

9. Study of pulse width modulation (PWM) and demodulation.

10. One innovative experiment.

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
						PO1PO	2PO3PO	4PO5P	O6PO7P	O8PO9	PO10P	)11PO12		
	Analog	EC494.1	3	3	3	-	1	1	-	-	2	-	-	3
		EC494.2	3	3	-	3	3	-	2	-	-	1	2	3
		EC494.3	3	3	3	3	2	2	-	-	1	-	-	3
		EC494.4	3	3	3	3	3	-	2	-	-	2	2	3
		EC494.5	3	3	-	3	3	2	-	-	-	-	-	3
		EC494.6	3	3	3	-	-	2	2	3	1	2	-	3

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: **ENVIRONMENTAL SCIENCE**
Paper Code: **HU 501** Contact : 24 hours Credit: 2

Pre requisites: qualified B.Tech 1st year

Course Objective(s)

Be able to understand the natural environment and its relationships with human activities.
Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome(s)

To understand the natural environment and its relationships with human activities. To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
Acquire skills for scientific problem-solving related to air, water, noise & land pollution.
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SYLLABUS

1. General **6L**

1.1 Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy

1.2 Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography

1.3 Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)

1.4 Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web,

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

1.5 Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

2. Air pollution and control 7L

2.1 Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant

2.2 Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

2.3 Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

2.4 Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion

2.5 control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury),

3. Water Pollution 7L

3.1 Classification of water (Ground & surface water)

3.2 Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.

3.3 Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD

Lake: Eutrophication [Definition, source and effect].

3.4 Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)

3.5 **Quality of Boiler fed water:** DO, hardness, alkalinity, TDS and Chloride

3.7 **Layout of waste water treatment plant** (scheme only).

4. Land Pollution **2L**

4.1 Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic,
hazardous solid wastes (bio-medical), E-waste

4.2 Solid waste disposal method: Open dumping, Land filling, incineration, composting,
recycling (Advantages and disadvantages).

4.3 Waste management: waste classification, waste segregation, treatment & disposal

5. Noise Pollution **2L**

5.1 Definition of noise, effect of noise pollution on human health,

5.2 Average Noise level of some common noise sources

5.3 Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L10$ (18 hr Index) .

5.4 Noise pollution control.

Text Books

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited

References/Books

1. Environmental Studies, Dr. J P Sharma, University Science Press
2. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO- PO Mapping

Mapping with CO with PSO

	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	1	3	3
CO3	1	2	3
CO4	1	1	3

AVG OF CH 401	1	2	3

Mapping of CO with PO

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	Able to understand the natural environment and its relationships with human activities	2	2	3	-	-	2	3	3	.	.	1	2
	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk	3	3	3	1	1	2	3	3	.	.	1	2
	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues	3	3	3	2	1	2	3	3	.	.	1	2
	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.	1	1	1	1	2	2	3	3	.	.	1	2
CH 401(AVERAGE)		2	2	2	1	1	2	3	3	.	.	1	2

EC501 Syllabus proposal for Autonomy

Stream: ECE

Subject Name: Digital Communication

systems Subject Code: EC501

Contact hour:

2L+2T Total

contact hour- 40

Credits: 3

Prerequisite: Analog Communication, Probability &

Statistics Course Objective:
To present the fundamentals of modern digital communication system design and to evaluate the performance of digital signaling schemes on realistic communication channels. Emphasis is placed on physical layer digital communications, including waveform analysis, transmitter design and receiver design. The student will learn about theoretical bounds on the rates of digital data transportation systems.

Module-I

Probability Theory and Random Processes:

Probability definition, axioms, histogram, Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function, –Uniform, Binomial, Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density, Binary Symmetric Channel. **8L**

Module-II

Signal Vector Representation: Analogy between signal and vector, distinguishability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point , signal constellation, geometric interpretation of signals, Rayleigh's energy theorem, Parseval's theorem, Fourier transform pair Power spectral density vs Autocorrelation likelihood functions, Schwartz inequality, Gram- Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and
Type-II errors. **8L**

Module-III

Sampling theorem and Pulse Modulation: Concept of sampling, Pulse Amplitude Modulation

(PAM), Sample and hold circuit, aliasing effect, interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, A-Law and μ -law companding,

Predictor circuit design, differential PCM, delta modulation and adaptive delta modulation. **5L**

Module-IV

Digital Data Transmission:

Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Optimum (Matched) Filter design and Probability of error calculation, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction and the synchronization. **5L**

Module-V

Digital Modulation Techniques: Types of Digital Modulation, coherent and non-coherent ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. DPSK and DEPSK, Concept of M- ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset (OQPSK) vs. Non-offset (NOQPSK) Quadrature Phase shift keying, Coherent Frequency Shift Keying(FSK),Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Quadrature Amplitude Shift keying (QASK), Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying (GMSK), basic concept of OFDM, constellation diagram. **10L**

Module-VI

Performance issues for different digital modulation techniques: Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA). **4L**

Course outcome:

Sem.	Course Title (Code)	CO Codes	Course Outcomes
5th	Digital Communication systems (EC501)	CO.EC501.1	Apply the knowledge of probability and statistical calculations on random signal analysis.
		CO.EC501.2	Analyse signal vector representation of various digitally modulated signals by creating signal constellation
		CO.EC501.3	Demonstrate the concepts of sampling, Pulse Modulation techniques and their comparison.
		CO.EC501.4	Design Optimum (Matched) filter, demonstrate the effects of Inter Symbol Interference (ISI) and compare Eye pattern analysis
		CO.EC501.5	Illustrate various types of coherent and non-coherent digital modulation techniques, analyse immunity parameters and calculate their error probabilities

			CO.EC501.6	Inspect recent trend and performance issues for different digital modulation techniques

TEXT BOOKS:

1. Digital Communications, S. Haykin, Wiley India.
2. Principles of Communication Systems, H. Taub and D .L.Schilling, TMH Publishing Co.
3. Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
4. Communication Systems, A. Bruce Carlson, Paul B. Crilly TMH Education.

REFERENCE BOOKS:

1. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.
2. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
3. Digital Communication, A. Bhattacharya, TMH Publishing Co.
4. Digital Communications by Dr. Sanjay Sharma S K Kataria and Sons
5. Digital Communications, J.G.Proakis, TMH Publishing Co.

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
				PO1 P	O2PO 3	PO4 P	O5PO 6		PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
5th	Digital Communication	CO.EC501.1	H	H	H		L	L			M			H
		CO.EC501.2	H	H		H	H		M			L	M	H
		CO.EC501.3	H	H	H	H	M	M			L			H
		CO.EC501.4	H	H	H	M	H		M			M	M	H
		CO.EC501.5	H	H		H	H	M						H
		CO.EC501.6	H	H	H			M	M	H	L	M		H

EC591 DIGITAL COMMUNICATION SYSTEMS LAB

Contact:
3P
Credits: 2
Prerequisites: knowledge of digital electronics and communication system

Course Objective:
To provide the basic skills required to understand, develop, and design various engineering applications involving digital communication theory. To provide basic laboratory exposure to communication principles and applications.

List of Experiments:
1. Study of PAM and demodulation.
2. Study of PCM and demodulation.
3. Study of delta modulator and demodulator
4. Study of adaptive delta modulator and demodulator
5. Study of ASK modulator and demodulator
6. Study of BPSK modulator and demodulator
7. Study of BFSK modulator and demodulator.
8. Study of QPSK modulator and demodulator.
9. Innovative project: Breadboard realization of digital communication circuit for voice communication

Course Outcome:

Sem No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
	DIGITAL COMMUNICATION SYSTEMS LAB (EC591)	CO.EC591.1	Analyse the concept of digital communication techniques and their applications.
		CO.EC591.2	Demonstrate to the practical methods of the use of generating communication signals.
		CO.EC591.3	Evaluate practical methods of the use of demodulation communication signals.
		CO.EC591.4	Distinguish the significance of signal constellation and spectral width.
		CO.EC591.5	Develop insight into the relations between the input and output signals in various stages of a transmitter and a receiver.
		CO.EC591.6	Clearly distinguish between contemporary digital communication techniques.

CO-PO Mapping:

Sem.			Program Outcomes (POs)											
														12
	DIGITAL COMMUNICATION SYSTEMS LAB (EC591)	CO.EC591.1	H	M			L			H		H		L
		CO.EC591.2	H	M		L			M	L	M		H	H
		CO.EC591.3	H	H	M	H		H			H		H	L
		CO.EC591.4	H	M		H	L			H		M		H
		CO.EC591.5	H	M	M	M			H	M			M	H
		CO.EC591.6	H	H	M	L	L				H		L	L

Syllabus formation for Autonomy

Stream: ECE
Paper Name: Microprocessor and Microcontroller Paper Code: EC502
Contact:
3P
Credits: 3
Prerequisites: Knowledge in Digital Electronics

Course Objective:

To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

Course Outcome:

CO	Statement
CO1	Able to correlate the architecture , instructions, timing diagrams, addressing modes, memory interfacing, interrupts, data communication of 8085
CO2	Able to interprete the 8086 microprocessor-Architecture, Pin details, memory segmentation, addressing modes, basic instructions, interrupts
CO3	Recognize 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts
CO4	Apply instructions for assembly language programs of 8085, 8086 and 8051
CO5	Design peripheral interfacing model using IC 8255, 8253, 8251 with IC 8085, 8086 and 8051.

Course Contents:

Module 1:

8085 Microprocessor: Introduction to Microcomputer based system, Evolution of Microprocessor and microcontrollers and their advantages and disadvantages, Architecture of 8085 Microprocessor, Address / Data Bus multiplexing and demultiplexing, Status and Control signal generation, Instruction set of 8085 Microprocessor, Classification of instructions, addressing modes, timing diagram of the instructions, Memory interfacing , IO interfacing, ADC / DAC interfacing, Stack and Subroutine, Delay Calculation, Interrupts of 8085 processor, classification of interrupts, Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD

pins of 8085. 12L

Module 2:

Assembly language programming with 8085: Addition,Subtraction,Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, Look-up table etc. Programming using interrupts (programming using INTR is not required). 2L

Module 3:

8086 Microprocessor: 8086 Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts, Memory interfacing, ADC / DAC interfacing. 5L

Module 4:

Assembly language programming with 8086: Addition, Subtraction, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number etc. 2L

Module 5:

8051 Microcontroller: 8051 architecture, hardware, input/output pins, ports, internal and external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts, Memory interfacing, ADC / DAC interfacing. 4L

Module 6:

Assembly language Programming using 8051: Moving data: External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges; Logical operations: Byte-level, bit-level, rotate and swap operations; Arithmetic operations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and returns. 3L

Module 7:

Support IC chips: 8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format. Interfacing of support IC chips with 8085, 8086 and 8051. 6L

Module 8:

Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout. 1L

Text Books:

1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2. The 8051 microcontroller - K. Ayala ,Thomson
3. Microprocessors & interfacing – D. V. Hall ,Tata McGraw-hill
4. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH

5. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley, Pearson
6. An Introduction to Microprocessor and Applications –Krishna Kant,Macmillan

References:

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan,Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. The 8051 microcontrollers – Uma Rao and Andhe Pallavi ,Pearson

CO-PO Mapping:

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC502.1	Able to correlate architecture, instructions, timing diagrams, addressing modes, memory interfacing, interrupts, data communication of 8085.	3	3	2	2	-	2	-	-	-	-	-	3
EC502.2	Able to interprete microprocessor-Architecture, Pin details,	3	3	2	2	-	2	-	-	-	-	-	3

	memory segmentation, addressing modes, basic instructions, interrupts.												

EC502 .3	Recognize 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts.	3	3	2	2	-	2	-	-	-	-	-	3
.4	Apply instructions assembly language programs of 8085, 8086 and 8051.	3	3	3	3	-	2	-	-	-	-	-	3
.5	Design peripheral model using IC 8255, 8253, 8251 with IC 8085, 8086 and 8051.	3	3	3	3	-	2	-	-	-	-	-	3
		3	3	2	2	-	2	-	-	-	-	-	3

Comparative Analysis:

Module No.	Syllabus for Autonomy	Content deleted/inserted from MAKAUT	Remarks/Justification	Number of lectures
1	8085 Microprocessor: Introduction to Microprocessor based Microcomputer system, Evolution of Microprocessor and microcontrollers and their advantages and disadvantages, Architecture of 8085 Microprocessor, Address / Data Bus multiplexing and demultiplexing, Status and Control signal generation, Instruction set of 8085 Microprocessor, Classification of instructions, addressing modes, timing diagram of the instructions, Memory interfacing, IO interfacing, ADC / DAC interfacing, Stack and Subroutine, Delay Calculation, Interrupts of 8085 processor, classification of interrupts, Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085	Stack and Subroutine, Delay Calculation, IO interfacing.	Stack,subroutine,delay concept are essential to understand interrupts and also some programs. To make a comparative analysis between memory and IO interfacing ,IO interfacing is required.	12
2	Assembly language programming with 8085:	Subtraction	It is required as a basic arithmetic operation	2

	Addition,Subtraction,Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, Look-up table etc. Programming using interrupts (programming using INTR is not required)			
3	8086 Microprocessor: 8086 Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts, Memory interfacing, ADC / DAC interfacing			5
4	Assembly language programming with 8086: Addition, Subtraction, Multiplication, Block Transfer, Ascending order, Descending order,			2

	Finding largest & smallest number etc.			
5	8051 Microcontroller: 8051 architecture, hardware, input/output pins, ports, internal and external memory, counters and	Internal memory	Internal memory organization is required to know the operation of 8051 and	4
6	timers, instruction set, addressing modes, serial data i/o, interrupts, Memory interfacing, ADC / DAC interfacing Assembly language Programming using 8051: Moving data: External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges; Logical		also to write program	3
	operations: Byte-level, bit-level, rotate and swap operations; Arithmetic operations: Flags, incrementing and decrementing, addition,			
7 8	subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and returns Support IC chips: 8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format. Interfacing of support IC chips with 8085, 8086 and 8051. Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout.			6 1

Stream: ECE

Paper Name: Digital Signal Processing

Paper Code: EC503 Contacts: 3L Credits: 3 Total Contact: 35

Semester: 5th

Course Objectives:

To study the z-transform, convolution, correlation and applications of z -transform.

To introduce students with transforms for analysis of discrete time signals and systems. To understand the digital signal processing, sampling and aliasing.
To use and understand implementation of digital filters. To study filter design techniques.
To study Discrete Fourier Transforms. To study Fast Fourier Transforms.
To study fixed point and floating point digital signal processors.

COURSE OUTCOMES:

1. Able to analyse discrete time systems in frequency domain and their region of convergence using Z Transforms.
2. Able to define discrete systems in the Frequency domain using Fourier analysis tools like DFT, FFT.
3. Able to interpret the properties of discrete time signals in frequency domain.
4. Able to analyse discrete time signals and systems in frequency domain.
5. Able to describe the digital signal processing, sampling and aliasing.
6. Able to implement digital filters.

PREREQUISITE:

Prerequisites for Digital signal Processing are required a thorough understanding of various signals, systems, and the methods to process a digital signal and also the knowledge of arithmetic of complex numbers and a good grasp of elementary calculus. The questions reflect the kinds of calculations that routinely appear in Signals. The candidates are expected to have a basic understanding of discrete mathematical structures.

The candidates required the concept of Z-transform, Relation between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Initial value theorem and final value theorem, stability considerations for LTI systems using Z-transform, Perseval's relation, Inverse Z-transform by Residue method, power series & partial-fraction expansions.

MODULE – I

Discrete Fourier Transform and Fast Fourier Transform:

Definition of DFT and IDFT, Twiddle factors and their properties, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, aliasing error, filtering of long data sequences using Overlap-Save and Overlap-Add methods.

Difference between DFT and FFT. Radix-2 algorithm, Decimation-In-Time, Decimation-In- Frequency algorithms, signal flow graphs Butterflies, Bit reversal.

MODULE – II

Filter Design:

Basic concepts of IIR and FIR filters, difference equations, Realization of Filters using Direct form –I, II & Cascade Form Design of IIR Filter using impulse invariant and bilinear transforms, approximation & Design of analog Butterworth Filter, Design of linear phase FIR filters, Concept of Symmetric & anti- Symmetric FIR Filter , Various kinds of Window :Rectangular, Hamming and Blackman windows.

MODULE – III

Finite word Length Effects in Digital Filters:

Input Quantization error, Product Quantization error, Coefficient, Quantization error, Zero- input Limit cycle Oscillations, Dead band, limit cycle Oscillations.

MODULE – IV

Application of DSP:

Introduction to DSP Hardware TMS320C 5416/6713 processor. Concept of Sub-band coding, Speech analysis etc.

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.

2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.

REFERENCE BOOKS:

1. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
2. Texas Instruments DSP Processor user manuals and application notes.

CO-PO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	1	1	-	2	-	2	2	2	2	3
CO2	3	2	2	1	2	3	-	2	2	1	2	3
CO3	3	3	1	3	2	3	1	2	2	1	2	3
CO4	3	2	1	3	-	3	1	3	1	1	1	3
CO5	3	2	-	1	-	-	1	1	1	2	2	1
CO6	3	3	3	-	3	3	2	3	3	2	3	2

Module No	Module Name	Syllabus as per MAKAUT	Proposed syllabus for autonomy	Topic Inserted or deleted	Remarks
	Transform matrices, Fourier	**Transform:** DFT/IDFT **Fast Fourier Transform:** Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.	**The Discrete Fourier Transform (DFT)** by graphical, DFT/IDFT	Inserted: Definition of DFT/IDFT	
MODULE – II	Filter Design	**Filter Design:** Basic concepts of IIR and FIR filters, difference	Basic concepts of IIR and FIR filters, difference	Inserted: Realization of	

			Design of linear phase FIR filters, Concept of Symmetric & anti- Symmetric FIR Filter , Various kinds of Window :Rectangular, Hamming and Blackman windo ws .		
MODULE – III	Finite word Effects		Input Quantization error, Product Quantization band, limit cycle Oscillations.	Inserted: Module IV	
MODULE –	Applicati	**Digital Signal Processor:** Elementary idea about	Introduction to DSP	Inserted:	

Paper Name: POWER ELECTRONICS
Paper Code: EC 504A

Contacts: 3L Credits: 3 Total:

34 hrs

Course Objective:

1. To provide the students a deep insight in to the working of different switching devices with respect to their characteristics
2. To analyze different converters and control with their applications.
3. To study advanced converters and switching techniques implemented in recent technology

Pre requisites: Introductory physics, Electric networks, Basic electronics devices.

Syllabus:

Module-1: [10L] Introduction, Applications of power electronics,Power electronics devices: Characteristics of power devices – characteristics of SCR, diac, triac, GTO, PUJT, power transistors – power FETs – LASCR – two transistor model of SCR Protection of thyristors against over voltage – over current, dv/dt and di/dt. Power Semiconductor Switches: Rectifier diodes, fast recovery diodes.

Module-2 [9L] Triggering techniques: Turn on circuits for SCR – triggering with single pulse and train of pulses synchronizing with supply – Thyristor turn off methods, natural and forced commutation, self-commutation series and parallel operations of SCRs. Rectifiers: Single phase and three phase controlled Rectifiers with inductive loads, RL load.

Module-3[9L] INVERTERS Voltage and current source inverters, resonant, Series inverter, PWM inverter. AC and DC choppers – DC to DC converters – Buck, boost and buck – boost.

Module-4:[6L] AC Voltage Controllers, Single phase and three phase Cyclo-conveters Industrial applications DC and AC Drives DC Motor Speed control Induction Motor Speed Control.

TEXT BOOKS:

1. P.S.Bhimbra , "Power Electronics ", Khanna publications.

2. M. D. Singh & K. B. Kanchandhani, Power Electronics, Tata Mc Graw – Hill Publishing company, 1998.

3. M. H. Rashid, Power Electronics : Circuits, Devices and Applications,– Prentice Hall of India, 2nd edition, 1998

REFERENCE BOOK:

1.Mohan Ned, Undeland Tore M and Robbins William P, Power Electronics: Converters, Applications and Design, 3rd Edition, John Wiley, 2003. (TK7881.15.M697 2003)

2.Krein Philip T, Elements of Power Electronics, 1st Edition, Oxford University Press, 1998. (TK7881.15.K92)

3. Erickson Robert Warren and Maksimovic Dragan, Fundamentals of

Power 3Electronics, 2nd Edition, Kluwer Academic/Springer, 2001.

(TK7881.15.E68 2001)

Couse Out Come:

1. Articulate the basics of power electronic devices
2. Express the design and control of rectifiers, inverters.
3. Design of power electronic converters in power control applications
4. Ability to express characteristics of SCR, BJT, MOSFET and IGBT.
5. Ability to express communication methods.
6. Ability design AC voltage controller and Cyclo Converter.
7. Ability to design Chopper circuits.

CO-PO Mapping:

P-Outcomes / C-Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
1		X						X				
2		X										X
3			X		X							
4	X	X										
5	X										X	X
6	X		X									X
7	X		X									X

EC504B : ELECTRICAL & ELECTRONICS MEASUREMENT
Contact:
3P
Credits: 3
Lectures: 34

Prerequisites: Basic analog and digital **electronic** circuits and principles. Basic electronics engineering, Basic electrical engineering,

Course objectives:

The objective of this course is to acquire knowledge about the construction and working of Bridges to measure resistance , capacitance, inductors , analog and electronic measuring instrument , Sensor-transducer system , telemetry system ,data acquisition system and some advance instruments like Like OTDR , virtual instrument and PLC

Course Outcomes (COs)

COs	CO Statement
CO1	Students able to explain the characteristics , construction and working principle analog instruments like : PMMC , MI , Electrodynamometer type and Energy meter
CO2	Students able to demonstrate the principle to measure resistance , capacitance , inductance with the help of Bridge balancing technique
CO3	Students able to describe the construction and working principle of electronic instrument like : DSO , DMM , spectrum analyzer ,distortion meter
CO4	Student able to illustrate the functionality of sensor and transducer element
CO5	Student able to demonstrate the principle of working of Telemetry System ,Display device ,Interface Standard , Data Acquisition system , Advanced Instruments Like OTDR , virtual instrument and PLC

Module	Topi c	No of Lect u re
Module 1	**Characteristics of Instruments ,Errors in Measurement,** **Units** : Measurement Methods : Direct and Indirect Characteristics of Instrument &Measurement System:Static and dynamic, accuracy, precision, sensitivity, resolution, dynamic range, linearity,Hysteresis , repeatability ,loading effect . Types of Error (concept): Gross Errors ,Systematic Errors, Random Error Units and Standard in measurements– Concept of Calibration	3
Module 2	**Analog Instruments**: Construction and operation of PMMC and Moving Iron type Instrument:Its application to measure current, voltage and resistance. Basic Construction and operation of Electrodynamometer type , rectifier type, thermocouple type instrument Construction and operation of Electrodynamometer type wattmeter and single phase induction type energy meter	6
Module 3	**Measurement of resistance and AC Bridges**: Wheatstone bridge, Kelvin double bridge ,measurement of high resistance , Earth resistance measurement , localizing ground and	6

	short circuit fault . Potentiometer A.C. Bridges : Maxwell's Bridge –inductance , inductance – capacitance, Anderson's Bridge ,De Sauty's Bridge ,Schering Bridge ,Wien's Bridge		
Module 4	**Electronic Instrument** : Construction and operation of DMM,Function Generator , DSO , Frequency Counter ,L-C-R	6	

	and Q-Meter ,Distortion Meter ,Spectrum Analyser ,resolution,sensitivity and accuracy specification of digital meters	
Module 5	**Sensing Element and Transducer** : Components of transducer , Classification of electrical transducer with example , Working and application : Strain Gauges ,Pirani Gauges , Semiconductor strain gauges , Thermistors,Thermocouple ,IC temperature sensor ,Inductive transducer ,LVDT ,Capacitive transducer , Piezo-electric transducer ,LDR	4
Module 6	**Telemetry System ,Display ,Interface Standard** : block diagram –land and R.F telemetry.,Display Devices -Application of LED in display system ,Fourteen Segment Display , Dot Matrix Display-3×5 dot ,27 dot ,5×7 dot ,Application LCD in display system, ,Bus interface standard –GPIB interface bus(IEEE488)	4
Module 7	**Data Acquisition and Advanced Instruments** :Components of modern digital data acquisition system, Basic concept of PLC & Virtual Instrument , Fibre Optic Measurement –Splicing , OTDR ,end to end loss measurement	5

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC504B.1	3	1	2	2	2	-	-	-	1	1	1	2
EC504B.2	3	2	1	2	1	-	-	-	1	2	1	2
EC504B.3	3	3	3	2	3	-	-	-	1	2	2	3
EC504B.4	3	3	3	3	3	2	2	2	2	2	1	3
EC504B.5	3	2	2	2	3	2	2	2	3	2	3	3
EC504	3	2	2	2	2	2	2	2	2	2	2	2

Text Book :

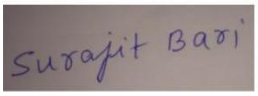
1. A.k. Sawhney, Electrical and Electronic Measurements and Measuring Instruments ,DhanpatRai& Sons

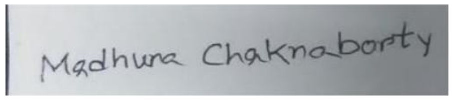
2. Helfrick, Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI Publication

Reference Book :

1. J.B. Gupta ,Electrical & Electronics Measurement and Instrumentation ,SK KatariaSons

2. Kalsi ,EllecttronicInsttrumenttattiion , Tatta McGraw-Hill





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Mr. Surajit Bari
NIT

…………………………………………
Ms. Madhura Chakraborty
JISCE

…………………………
Dr. Sunipa Roy
GNIT

Paper Name: TELECOMMUNICATION ENGINEERING
Paper Code:
EC504C Contact:
3P
Credits: 3
Lectures: 35

Prerequisites: EC404(Analog Communication),Students should have prior knowledge of basic Modulation techniques and Signal Digitization

Course Objectives:

1. To provide students with basic knowledge of components of telecommunication system.
2. To understand basic operation and techniques of telecommunications switching systems and transmission systems.
3. To develop knowledge and problem solving ability in the field of traffic engineering areas.
4. To understand telephone network and optical network.
5. To understand the basic concepts of Broadband and IP telephony .

Course Outcome:

After completion of this course the students will be able :

CO1:To develop a fundamental understanding of elements of telecommunication system.

CO2:To develop ability to define and distinguish electromechanical, electronic, digital and analog switching systems.

CO3:To Understand and analyze traffic engineering, transmission systems and telephone network .

CO4:To Make use of the parameters in designing telephone switches

CO5:To analyze Time Division Multiplexing Services, Broadband, IP telephony and Optical Network.

Course Contents:

Module No.	Topic	Periods/ Classes
1	Signal Characteristics,Introduction to Telephone Systems- Bandwidth Requirement of Various Applications,Components and Examples of Telecommunication systems; Carbon Microphone and Headphone, Tone dialing; Telephone Instruments - push button types.	4L
2	Telecommunication Transmission Lines:- Copper, Co-axial, and Fiber optic cables; Transmission Bridge - Hybrid circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers; American and European standards of carrier channels.	4L
3	Switching System: Electro-mechanical switching- Basic idea of Strowger, Crossbar(Multi Stage Switching);Circuit Switching & Packet Switching, Digital Switching systems – Concept of Speech Digitisation & Transmission, Time division	8L

	Time switch, Time multiplexed Space switch, Time multiplexed Time switch, Hybrid switching, ; TS, ST, STS, TST systems;		

4.	Telephone Network-Subscriber Loop Systems: BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in channel & common channel signaling, SS7.(onlyBasic Idea) ,Numbering Plan	3L
5	Stored Program Control: Software architecture, Application software;. Electronic Exchanges Digital PABX	3L
6	Traffic Engineering: Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C congestion formulas	4L
7	Broad band transmission ISDN, DSL and ADSL, ISDN and B- ISDN	4L
8	IP Telephony: Voice over IP, Session initiation protocol	3L
9	Optical Network – SONET , SDH (Basic Idea , Transmission Media and Calculation of Speed)	2L

Text Book:

a) T.Viswanathan, "Telecommunication Switching Systems & Networks",PHI

b) J.C Bellany "Digital Telephony"-Wiley India

1. O.Hersent, D Gurle, J P Petit "IP Telephony" Pearson
2. J.E Flood " Telecommunication Switching,Traffic and Networks",Pearson
3. R L Freeman " Telecommunication System Engineering" Wiley India
4. A Gokhle "Introduction To Telecommunication", Cengage Learning
5. P. Gnanasivam "Telecommunication Switching & Networks" New Age International Publishers
6. Martin P. Clark " Network And Telecommunications" Wiley Publisher.
7. David Gurle, Olivier Hersent "IP Telephony: Deploying Voice Over IP Protocols"Wiley Publisher

CO –PO MAPPING: Telecommunication Engineering

Course Code	Course Title	Program Outcomes (POs)											
		a	b	c	d	e	f	g	h	i	j	k	l
EC 504 C	CO1	3		2					1				
	CO2	3		2									
	CO3	2	3										
	CO4			3									
	CO5	2	3	1									

Comparison Sheet:

Module Number	No of Lectures	Syllabus formed for Autonomy	Content Delete / Insert from MAKAUT	Remarks & Justification
1.	4L	Signal Characteristics,Introduction to Telephone Systems- Bandwidth Requirement of Various Applications,Components and Examples of Telecommunication systems; Carbon Microphone and Headphone, Tone dialing; Telephone Instruments - push button types.	1.Inserted: Signal Characteristics,Bandwidth Requirement of Various applications 2.Deleted:Pulse dialling and rotary dial	1.To give basic idea about signal and make the subject application oriented. 2. Pulse Dialling and rotary dial is used with Strowger which is almost obsolete now
2.	4L	Telecommunication Transmission Lines:- Copper, Co-axial, and Fiber optic cables; Transmission Bridge - Hybrid circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers; American and European standards of carrier channels.	No deletion or insertion	
3.	8L	Switching System: Electro-mechanical switching- Basic idea of Strowger,	1.Inserted: Speech	1.Students will be able

		Crossbar(Multi Stage Switching);Circuit Switching & Packet Switching, Digital Switching systems –Concept of Speech Digitisation & Transmission, Time division Time switch, Time multiplexed Space switch, Time multiplexed Time switch, Hybrid switching, ; TS, ST, STS, TST systems;	Digitization and Transmission included 2. Deleted:Details of Strowger deleted	to understand digital switching better 2. Strowger is almost obsolete now
4.	3L	Telephone Network-Subscriber Loop	1. Inserted:	1.To make

		Systems: BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in channel & common channel signaling, SS7.(onlyBasic Idea) ,Numbering Plan	Numbering Plan	student understand international numbering plan in Telecomm. Eng
5.	3L	Stored Program Control: Software architecture, Application software;. Electronic Exchanges Digital PABX	1. Introduction to cordless telephone deleted	
6.	4L	Traffic Engineering: Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C congestion formulas	1. Case studies deleted	Due to shortage in study period
7.	4L	Broad band transmission ISDN, DSL and ADSL, ISDN and B-ISDN	1.Modems and Their Standards: RS 232C; DTE and DCE deleted	This will be taught in details in Computer oriented subjects
8	3L	IP Telephony: Voice over IP, Session initiation protocol	Deleted: H.323 signaling, IP multimedia service	Due to shortage in study period
9.	2L	Optical Network – SONET , SDH (Basic Idea , Transmission Media and Calculation of Speed)	This new module is included	Students should have knowledge of optical fibre network to make them

					industry oriented .

EC591 DIGITAL COMMUNICATION SYSTEMS LAB

Contact:
3P
Credits: 2
Prerequisites: knowledge of digital electronics and communication system

Course Objective:

To provide the basic skills required to understand, develop, and design various engineering applications involving digital communication theory. To provide basic laboratory exposure to communication principles and applications.

List of Experiments:

1. Study of PAM and demodulation.
2. Study of PCM and demodulation.
3. Study of delta modulator and demodulator
4. Study of adaptive delta modulator and demodulator
5. Study of ASK modulator and demodulator
6. Study of BPSK modulator and demodulator
7. Study of BFSK modulator and demodulator.
8. Study of QPSK modulator and demodulator.
9. Innovative project: Breadboard realization of digital communication circuit for voice communication

Course Outcome:

Sem	Course Title (Code)	CO Codes	Course Outcomes
	DIGITAL COMMUNICATION SYSTEMS LAB (EC591)	CO.EC591.1	Analyse the concept of digital communication techniques and their applications.
		CO.EC591.2	Demonstrate to the practical methods of the use of generating communication signals.
		CO.EC591.3	Evaluate practical methods of the use of demodulation communication signals.
		CO.EC591.4	Distinguish the significance of signal constellation and spectral width.
		CO.EC591.5	Develop insight into the relations between the input and output signals in various stages of a transmitter and a receiver.
		CO.EC591.6	Clearly distinguish between contemporary digital communication techniques.

CO-PO Mapping:

Sem.			Program Outcomes (POs)											
	DIGITAL COMMUNICATION SYSTEMS LAB	CO.EC591.1	H	M			L			H		H		L
		CO.EC591.2	H	M		L			M	L	M		H	H
		CO.EC591.3	H	H	M	H		H			H		H	L
		CO.EC591.4	H	M		H	L			H		M		H
		CO.EC591.5	H	M	M	M			H	M			M	H
		CO.EC591.6	H	H	M	L	L				H		L	L

Syllabus formation for Autonomy

Stream: ECE
Paper Name: Microprocessor and Microcontroller
Lab Paper Code: EC592
Contact:
3P
Credits: 2
Prerequisites: Knowledge in Digital Electronics

Course Objective:

To apply ALP Programming for arithmetic-logical solutions and also to interpret the interfacing programming by conducting experiments.

Course Outcome:

CO	Statement
CO1	Able to solve small assignments using the 8085 basic instruction sets and memory mapping through trainer kit and simulator.
CO2	Able to write 8085 assembly language programs like Addition, Subtraction, Multiplication, Square, Complement, Look up table, Copying a block of memory, Shifting ,Packing and unpacking of BCD numbers, Ascending order, Descending order etc. using trainer kit.
CO3	Able to validate the interfacing technique using 8255 trainer kit through subroutine calls IN/OUT instructions like glowing LEDs and accordingly, stepper motor rotation etc.
CO4	Able to test fundamental of 8051 programs using the trainer kit.

Course Contents:

1. Familiarization with 8085 register level architecture, the basic instruction sets (data transfer, arithmetic, logical, branching) and the trainer kit components including the memory map.
2. Familiarization with the process of storing, executing and viewing the contents of memory as well as registers in the trainer kit 8085 and simulator through small assignments.
3. Programming using 8085 kit and simulator for:

   Addition, Subtraction, Multiplication by repeated addition method, Square, Complement, Look up table, Copying a block of memory, Shifting ,Packing and unpacking of BCD numbers, Addition of BCD numbers, Binary to ASCII conversion, Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.

4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display.
5. Program for serial communication between two trainer kits.
6. Interfacing of 8255: Keyboard, Stepper motor rotation.
7. Study of 8051 Micro controller kit and writing programs.

CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
. 1	Able to solve small s using the 8085 basic instruction sets and memory mapping through trainer kit and simulator.	2	2	1	1	1	1	1	1	3	1	1	3
. 2	Able to write 8085 language programs like Addition, Subtraction, Multiplication, Square, Complement, Look up table, Copying a bloc of	3	3	3	3	2	1	1	1	3	2	2	3

	k memory, Shifting ,Packing and												

	unpacking of BCD numbers, Ascending order, Descending order												
.3	validate the interfacing technique using 8255 trainer kit through subroutine calls and IN/OUT instructio motor rotation			3	3	2	2	1	1	3	2	2	3
.	etc. Able to programs using th	3	3	2	2	2	1	1	1	3	1	2	3
		3		2	2	2	1	1	1	3	1	2	3

Module No.	**Syllabus for Autonomy**	**Content deleted/inserted from MAKAUT**	**Remarks/Justification**	**Number of lectures**
1	Familiarization with 8085 register level architecture, the basic instruction sets (data			3

	transfer, arithmetic, logical,				

	branching) and the trainer kit components including the memory map.			
2	Familiarization with the process of storing, executing and viewing the contents of memory as well as registers in the trainer kit 8085 and simulator through small assignments.			3
3	Programming using 8085 kit and simulator for: Addition, Subtraction, Multiplication, Square, Complement, Look up table, Copying a block of memory, Shifting, Packing and unpacking of BCD numbers, Addition of BC	Addition, Subtraction, Multiplication, Square, Complement, Smallest and Largest number from an array of numbers inserted, booth's algorithm deleted	These inserted programs are required to grow the basic knowledge, booth's algorithm is not relevant to this course	12

	n D numbers, Binary to ASCII conversion, Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method.			
4	Program using subroutine calls and IN/OUT instructions using	glowing of seven segment display	In place of multidigit display, glowing of seven segment display will be more effective	3

	8255 on PPI the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, glowing of seven segment display		as one can interlink the digital circuit experiment with microprocessor	
5	Program for serial communication between two trainer kits.			3
6	Interfacing of 8255: Keyboard, Stepper motor rotation	Stepper motor rotation	One can relate the real time interpretation with peripheral device	3
7	Study of 8051 Micro controller kit and writing programs.			3

Stream: ECE

Paper Name: Digital Signal Processing Lab.

Paper Code: EC593 Contacts: 3L Credits: 3 Total Contact: 35

Semester: 5th

Course Objectives:

To develop and Implement DSP algorithms in software using a computer language such as MATLAB.
To analyze and Observe Magnitude and phase characteristics of different signals.

To analyze and observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.

Course Outcomes:

1. Able to compute the system output using convolution method with MATLAB Software package.
2. Able to verify the system characteristics.
3. Able to Calculate DFT, FFT,IDFT using MATLAB.
4. Able to analyze Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR Butterworth.
5. Able to Develop and Implement DSP algorithms in software using a Computer language such as C with TMS320C6713 floating point Processor.

List of Experiments:

1. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.

2. Systems (Causal and Non_causal, Time-Invarient and Time-varient etc.) verification using MATLAB.

3. Z-transform of various sequences – verification of the properties of Z-transform.

4. DFT using twiddle factors.

5. DFTs / IDFTs using matrix multiplication and also using commands.

6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.

7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.

8. Butterworth filter design with different set of parameters.

9. FIR filter design using rectangular, Hamming and Blackman windows.

10. Frequency responses of anti-imaging and anti-aliasing filters.

11. Develop and Implement DSP algorithms in software using a computer language such as C with TMS320C6713 floating point Processor, TMS 5416 kit and ASM along with C.

CO-PO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	3	2	1	1	1	-	1	-	1	-	-
CO2	2	2	3	1	1	-	-	1	-	-	-	-
CO3	1	3		2	1	-	-	1	-	-	-	1
CO4	3	1	3	2	2	1	2	2	3	1	-	2
CO5	3	1	3	3	2	1	2	2	3	1	-	2

Comparison table:

Syllabus as per MAKAUT	Proposed syllabus for autonomy	Topic Inserted or deleted	Remarks
Sampled sinusoidal signal, various sequences and different arithmetic operations. Convolution of two sequences using graphical methods and using commands- verification of	1. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution. 2. Systems (Causal and	Inserted: Develop and Implement DSP algorithms in software using TMS 5416 kit and ASM along with C. Deleted:	

the properties of	Non_causal, Time-		

convolution. Z-transform of various sequences – verification of the properties of Z-transform. Twiddle factors – verification of the properties. DFTs / IDFTs using matrix multiplication and also using commands. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods. Butterworth filter design with different set of parameters. FIR filter design using rectangular, Hamming and Blackman windows. Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA: Writing & execution of	Invarient and Time-varient etc.) verification using MATLAB. 3. Z-transform of various sequences – verification of the properties of Z-transform. 4. DFT using twiddle factors. 5. DFTs / IDFTs using matrix multiplication and also using commands. 6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions. 7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods. 8. Butterworth filter design with different set of parameters. 9. FIR filter design using rectangular, Hamming and	Sampled sinusoidal signal, various sequences and different arithmetic operations. Writing of small programs in VHDL and downloading onto Xilinx FPGA. Mapping of some DSP algorithms onto FPGA.	

small programs related to arithmetic operations and	Blackman windows. 10. Frequency responses of anti-imaging and anti-aliasing filters. 11.Develop and Implement DS P algorithms in software		

convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction. Writing of small programs in VHDL and downloading onto Xilinx FPGA. Mapping of some DSP algorithms onto FPGA.	using a computer language such as C with TMS320C6713 floating point Processor, TMS 5416 kit and ASM along with C.		

Mini Project-I (EC581) Syllabus proposal for Autonomy

Stream: ECE

Subject Name: Mini

Project-I Subject Code:

EC 581 Contact hour:

4P

Total contact

hour- 40 Credits:

2

Prerequisite: knowledge of analog, digital electronics and communication system

Course Objective:
Prepare students with foundation knowledge in a project domain through surveying, designing, implementing, observing and reporting.

Methodology:

1. Thinking: Discussion on innovative idea.
2. Exploring: Survey of recent research.
3. Implementing: Project guidance to basic prototype implementation.
4. Documenting: Guidance on reporting and conference paper writing.

Each Mini Project –I group should submit the following under their semester project report submission

1. Title, certificates, declaration by student, acknowledgement, Table of Contents, abstract, keywords, Introduction, Literature Survey, System Analysis (if applicable), System Design (if applicable), Coding, Testing (if applicable), Conclusion, Future Scope of work),reference

Course outcome:

Sem.	Course Title (Code)	CO Codes	Course Outcomes
		CO.EC581.1	Apply the knowledge acquired through survey of recent research to set the project goal.
		CO.EC581.2	Distinguish the way of implementation of prototype

5th	Mini Project-I (EC581)	CO.EC581.3	Identify the fault issue through various case study
		CO.EC581.4	Implement the prototype using modern tools
		CO.EC581.5	Demonstrate the project design to share the idea through conference/workshop/seminar etc.
		CO.EC501.6	Modify the project design for the benefit to societal issues

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
				PO1 P	O2PO 3	PO4P 0	5PO 6		PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
	Mini Project-I	CO.EC501.1	H	H	H	M	L	L	H		L	L		H
		CO.EC501.2	H	H	H	H	H			H	H		M	H
		CO.EC501.3	M		H	H	M	M	H	H	M	M		H
		CO.EC501.4	L	H	H	M	H		H	M	H		M	H
		CO.EC501.5	H		M	H	H	M		H	H	M		H
		CO.EC501.6	H	H	H	M		M	H			M		H

Stream: ECE

Paper Name: **EM WAVE PROPAGATION & ANTENNA**

Paper Code: EC 601 Contacts: 3L Credits: 3 Total Contact: 33

Semester: 6th

Course Objectives:

1. To understand the basic properties of Plane wave propagation in different medium.
2. To learn EM wave propagation in transmission line.
3. To know the fundamentals of antenna and its characteristics.
4. To understand radio wave propagation phenomena in communication system.

Course Outcome:

After successful completion of this course, students should be able to:

CO1 To understand in-depth study of transmission lines which play an important role in high-speed digital design and signal integrity of PCBs.

CO2 To analyze the fundamentals of antenna theory.

CO3 Understand the different types of antennas and the radiation mechanism.

CO4 Identify the atmospheric and terrestrial effects on radio wave propagation

Prerequisite:

The candidates should learn basic knowledge of vector calculus, electrostatic, magnetostics from Physics-II

Module I [6]

Maxwell equation, Boundary between media interface, Helmholtz's equation, Plane Wave in lossy dielectric, loss-less dielectric, good conductor, free-space; Poynting theorem, power flow, Poynting Vector, Spin Depth, Surface Resistance.

Module II [11]

Concept of lumped parameters, Transmission line equation & their solution, Propagation constant, characteristic Impedance, wavelength, velocity of propagation for distortion less line and loss-less line; Reflection and Transmission coefficients, Standing Wave, VSWR, Input Impedance; Smith Chart; Some impedance techniques- Quarter wave matching, Single stub matching; Reflection in miss-matched load; T-line in time domain, Lattice diagram calculation, Pulse propagation on T-line.

Module III [11]

a) Antenna Characteristics: Radiation Pattern, Beam width, Radiation resistance, Directivity, Gain, Efficiency, Impedance, Polarization, Noise temperature; Friis transmission equation.

b) Radiation characteristics of Herzian dipole antenna; Duality principle.

c) Properties and Typical application:- Half-wave Dipole, Mono pole, Loop antenna, Parabolic & Corner Reflector antenna, Helical antenna, Pyramidal Horn antenna, Micro-Strip patch antenna, Array: Yagi-Uda, Log-Periodic.

Module IV [5]

Reflection of plane wave at Normal and Oblique incidence; Diffraction and Scattering Phenomena, multipath fading and its characteristics.

Text Books

1. Principles of Electromagnetics, 6th Edition, Matthew O H Sadiku, Oxford University Press.
2. Antenna Theory: Analysis & Design, Constantinc A. Balanis; Willcy, 4th Edition.
3. Antenna and Wave Propagation, 1st Edition, S. K. Das and A. Das, Tata-McGraw-Hill Education Pvt. Ltd 2013.

Reference Books

1. Electromagnetics with applications, 5th ed, J. D. Kraus and D. Fleisch, McGraw Hill, 1999.
2. Engineering Electromagnetics, Hayt and Buck, 7th edition, McGraw Hill.
3. Fields & Wave in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, John Wiley.
4. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.
5. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India.
6. Elements of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.

CO-PO Mapping of course code EC601

Course Outcome	**Programme Outcome**											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**
CO1	X	X							X		X	
CO2		X			X			X	X		X	X
CO3	X		X		X	X		X	X			X
CO4			X		X	X		X	X		X	X

Stream: ECE

Subject Name: INFORMATION THEORY & CODING

Subject Code:

EC602 Contact

hour: 2L-2T Total

contact hour- 40

Credits: 3

Course Objective:

This course provides a basic understanding of the fundamental theories and laws of information theory and coding theory and the construction of both source codes and error-detection-correction codes and application in digital communication systems

Course outcome:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
6th	**INFORMATION THEORY & CODING** **EC602**	CO.EC602.1	Understand the concepts of information, mutual information and entropy and various source coding techniques.
		CO.EC602.2	Analyse the need for error control techniques in a digital communication system channel models, channel capacity and channel coding techniques.
		CO.EC602.3	Apply linear algebra, concept of Galois field, conjugate roots, minimal polynomial in channel coding techniques for error control.
		CO.EC602.4	Generate different error control codes like linear block codes, cyclic codes, BCH codes, and perform error detection and correction.
		CO.EC602.5	Design the circuit for different error control coding techniques.

Module 1 **[6]**
Source Coding
Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes. Shannon - Fano Coding

Module 2 **[6]**

Channel Capacity and Coding
Channel models, channel capacity, channel coding, Kraft Inequality, information capacity theorem, The Shannon limit

Module 3 **[5]**
Linear And Block Codes For Error Correction
Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block , Standard array and syndrome detection code, perfect codes, Hamming codes.

Module 4 **[7]**
Cyclic Codes
Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Decoding cyclic codes, Encoding and Decoding circuit, Golay codes.

Module 5 **[8]**
BCH Codes
Set, group, fields, Galois field Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials , examples of BCH codes.

Module 6 **[8]**
Convolutional Codes : Encoding, state diagram,
Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, Viterbi decoding, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

TEXT BOOKS:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Error Control Codes - Salvatore Gravano, Oxford

REFERENCE BOOKS:
1. Information and Coding - N Abramson; McGraw Hill.
2. Introduction to Information Theory - M Mansurpur; McGraw Hill.
3. Information Theory - R B Ash; Prentice Hall.
4. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
5. Todd K Moon,- Error Correction Coding: Mathematical Methods and Algorithms, John Wiley & Sons

Stream: ECE
Paper Name: Control Systems
Paper Code: EC 603 Contacts: 3L Credits: 3 Total Contact: 36
Semester: 6^{th}

Pre requisite:
(1) Concepts in electrical circuits (Studied in Basic Electrical).
(2) Fundamental concepts on Laplace Transformation (studied in Mathematics)

Course Objectives:

- To familiarize the students with concepts related to the operation analysis and stabilization of control systems.
- To understand feedback systems (open loop and closed loop) and system modelling.
- To understand time domain and frequency domain analysis of control systems required for stability analysis.
- To understand the recompense technique that can be used to stabilize control systems.

Module I INTRODUCTION TO CONTROL SYSTEMS & MODELLING
Basic Elements of Control System, Linear, Non-Liner and Discrete Time System (Introduction & Concept) Open loop and Closed loop systems – Differential equation – About transfer function and its generation technique, Modelling of Electrical and mechanical systems - Block diagram reduction Techniques - Signal flow graph, mason's gain formula. [**7L]**

Module II TIME RESPONSE ANALYSIS
Time response analysis –Different input deterministic test response – Order and Type of the systems incorporation with time response-First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors and others characteristics – P, PI, PD and PID Compensation. [**7L]**

Module III STABILITY ANALYSIS
Routh -Hurwitz Criterion, Root Locus Algorithm, Construction of Root Locus, Effect of addition of pole and zero on the root locus, Application of Root Locus Diagram. **[6L]**

Module IV FREQUENCY RESPONSE ANALYSIS
Concept of Frequency Response of a system, Bode Plot Computational Algorithm, Construction of Bode diagram, Polar Plot, Phase and gain margin Nyquist Plot, Interpretation of Bode and Nyquist plot, Frequency Domain specifications from the plots and Computational Algorithm - Lead, Lag, and Lead Lag Compensators. [10L]

Module V STATE SPACE ANALYSIS OF CONTINUOUS TIME SYSTEMS
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability. Concept of state feedback. [6L]

Course Outcome
EC603

Control System

EC603.1	Explain open loop, closed loop control systems and system modelling.
EC603.2	Determine the time responses of different systems to different inputs.
EC603.3	Analyze the Stability of control system using root-locus, bode plot and Nyquist technique .
EC603.4	Able to examine the absolute and relative stability of different system.
EC603.5	Able to design different controller ,compensator to meet the desired specifications and analyze nonlinear control system using state variable .

Program outcome

1.**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2.**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,natural sciences and Engineering sciences.

3.**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.**Modern tool usage :**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6.**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

10.**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Mapping of POs with COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EC603.1	3	3	2	-	-	-	-	-	**1**	**1**	-	**1**
EC603.2	3	2	2	-	-	-	-	-	**2**	**1**	-	1
EC603.3	3	2	1	2	**1**	**1**	-	-	**2**	**1**	-	-
EC603.4	3	1	-	-	**1**	**1**	-	-	**2**	**1**	-	1
EC603.5	1	1	3	2	**1**	**1**	-	-	**2**	**1**	-	1
EC603avg	3	2	2	1	**1**	**1**	**0**	**0**	**2**	**1**	**0**	1

Text Books:

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.
3.Control Systems –by Ramesh Babu

Reference Books:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

Program outcome

Paper Name: Object Oriented Programming using Java Paper Code: EC 604A
Total Contact Hours: 40
Credit: 3

Pre requisites: Basic knowledge of computers, basic knowledge of programming

Course Objective: The Objective of the course is Understand basic of Object Oriented Programming Understanding the features of Java
Enable students to write Java program and develop projects.

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

EC 604A.1:Understand the key concepts of object oriented programming and have an ability to design OO programs and appreciate the techniques of good design;
EC 604A.2: Understand advanced features of Java .
EC 604A.3: Analyze complex programming problems and optimize the solutions.
EC 604A.4: Apply an understanding of ethical principles to problems which commonly arise in the Information Technology Industry.

Course Content:

MODULE I[3L]:
Object oriented design
Concepts of object oriented programming language, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation

MODULE II[3L]:
Object oriented concepts
Class, object, message passing, inheritance, encapsulation, polymorphism
Difference between OOP and other conventional programming – advantages and disadvantages.

MODULE III[2L]:
Understanding Java programming language : History of Java Programming languages, Purpose of invention of Java. Structure of a basic Java Program, Component of Java Development Kit-API, JRE, Understanding the steps to run a complete Java Program.

MODULE IV[2L]:
Basic Components of Java Program : Java Tokens-Literals, identifier, keywords, operator, separator, Data types, variables, constant, Type casting-defining type casting, requirement of type casting, implicit and explicit type casting. Control structure. Access specifier.

MODULE V[6L]:
Class & Object proprieties : Defining class and object, Class Members-Local variable, instance variable, class variable, Primitive and Reference variable, Constructor, this keyword, finalize and garbage collection, Array- Declaring and defining array, accessing array elements, length properties, 2D array, anonymous array, array of Objects. Understanding method- method returning object, passing objects, method passing and returning arrays, use of method overloading. Static-Static block and non static block, static variable, static method. nested & inner classes.

MODULE VI[6L]:
Reusability properties: Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member
access for packages.

MODULE VII[2L]:

String Handling: basic string handling concepts- String (discuss charAt() , compareTo(),equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() ,trim()
, valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods),concept of mutable and immutable string, command line arguments

MODULE VIII[5L]:
Exception handling & Multithreading Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

MODULE IX[3L]:
Basic IO Operation and File Handling Understanding unformatted and formatted IO. Reading and writing files.

MODULE X[4L]:
Swing Programming: Swing Origins, Components and containers, Difference between AWT and swing, small swing programs, swing apps, concept of delegation event model and listener.

MODULE XI[4L]:
Applet Programming (using swing) : Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC 604A.1	3	3	2	1								
EC 604A.2		2	2	2	3							
EC 604A.3	3	3	3	3	2							
EC 604A.4	3	3	3	2	3	2			3		3	

Stream: ECE

Paper Name: Advanced Microcontroller and Embedded system

Paper Code: EC 604B   Contacts: 3L   Credits: 3   Total Contact: 36

Semester: 6th

Pre requisite:

(1) Concepts in 8085 ,8086 Microprocessor

(2) concept of MCS51 series of Microcontroller.

Course Objectives:

- To familiarize the students with concepts related to the fundamental principles embedded systems design, explain the process and apply it .
- To understand knowledge of the advanced microcontroller technology both for hardware and software.
- Student will able to understand Hardware/Software design techniques for microcontroller- based embedded systems and apply techniques in design problems.
- Student will able to develop microcontrollers programming in C and assembly language using Integrated Development Environments and using debugging technique.

Module I INTRODUCTION TO PIC MICROCONTROLLER : PIC 18F4550

Microcontroller – Hardware Architecture & GPIOs ((Pin Diagram, Memory Organization, SFRs description, Program Counter, Accumulator (or Working Register), Reset, Clock Cycle, Machine Cycle, Instruction Cycle, Interrupts, SFRs & GPRs, Stack, Stack Pointer, Stack Operation, Timers and serial communication in PIC 16F877A). Microcontroller PIC Assembly Language, Programming in Embedded C, Introduction to programming software, Examples programs for PIC.

Module II: INTERFACING PIC 16F877A WITH INPUT OUTPUT DEVICES : LED Display,7-Segment, DIP Switch, Intelligent LCD Display, Matrix Keyboard, Stepper Motors and Types of Stepper Motors, Serial Communication Concepts, Practices on interfacing circuits, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, USB, Bluetooth, Practices of ICP, ADC, EEPROM, Opto-Isolators, Relay, I2C, SPI Protocol, Serial Memory, On chip Peripherals PWM.

Module III: ARM ARCHITECTURE AND PROGRAMMING: Introduction of ARM Processors, Evolution of ARM, 32 - bit Programming.ARM7 Architecture, Instruction Set Architecture, LPC21xx Description, Memories & Peripherals. ARM Processor Programming in C, Using ARM Programming Tools.

Module IV: INTRODUCTION TO EMBEDDED SYSTEM: Basics of Embedded computer Systems, Microprocessor and Microcontroller difference, Hardware architecture and software components of embedded system List of various applications [Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc.], Difference between embedded computer systems and general-purpose computer Systems. Characteristics of embedded systems, Classifications of embedded system.

Module V: HARDWARE SOFTWARE CO- DESIGN: Co-Design Types: Microprocessors/Microcontrollers/DSP based Design, FPGA / ASIC /pSOC based Design, Hybrid Design. Methodology: i) System specifications ii)) co-specifications of hardware and software) iii)) System Design Languages (capturing the specification in a single Description) iv) System modeling
/simulation v) Partitioning (optimizing hardware/software partition) vi) Co-verification (simulation interaction between custom hardware and processor) f) Co-implementation vii) Embedded Systems Design development cycle. Programming concepts and embedded programming in C.

MODULE VI: - REAL TIME OPERATING SYSTEM (RTOS): - Introduction, Types, Process Management, Memory Management, Interrupt in RTOS, Task scheduling, Basic design using RTOS; Basic idea of Hardware and Software testing in Embedded Systems

Text Books:

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley
2. Microchip's PIC microcontroller is rapidly becoming the microcontroller of choice throughout the world, Myke Predco
3. Embedded system Design: Peter Marwedel, Springer
4. Embedded Systems - Raj Kamal
5. PIC Microcontroller – Mazidi and

Mazidi Reference books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.

3. ARM Architecture Reference Manual

Course outcome

EC604B.1. Analyze the performance of PIC microcontroller.

EC604B.2. Design and develop the systems based on ARM controllers.

EC604B.3. an ability to use the techniques, skills, and modern engineering tools in embedded system.

Program outcome

1.**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2.**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,natural sciences and Engineering sciences.

3.**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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5.**Modern tool usage :**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Mapping of POs with COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC604B.1	3	3	2	-	1	-	-	-	1	1	-	1
EC604B.2	3	2	2	-	-	-	-	1	2	1	-	1
EC604B.3	3	2	1	2	1	1	-	-	2	1	-	-
EC603avg	3	2	2	1	1	1	0	1	2	1	0	1

Stream : ECE
Paper Name : Optical Fiber Communication
Paper Code: EC 604C Contacts: 3L Credits: 3 Total contact: 35 L

Pre-requisite

Basic Concepts of communication, basic concepts of solid state device and band theory (direct-indirect semiconductor, degenerate semiconductor), basics of Physics, Photodiode, LEDetc.

Course Objective

1. The students should be familiar with the basic Blocks and principles of communication system, advantages of Optical Fiber communication and current industrytrends
2. The student should have knowledge about optical fibre waveguide
3. The students should be familiar about the optical sources and detectors; structure , efficiency ,gain etc.
4. Students should have basic knowledge about WDM , different optical amplifiers and networks
5. Students should be able to understand the fibre optical measurement system
6. Students should know how to perform Refractive Index Profile Measurements, NA measurements, Polarization Depression Measurements, BER Measurements .

Syllabus

Stream : ECE
Paper Name : Optical Fiber Communication
Paper Code: EC 604C Contacts: 3L Credits: 3 Total contact:

35 L Module I: Introduction to Optical Fibre Communication System [7 L]

Introduction to communication systems: Principles, components Different forms of communications in brief, advantages of optical fiber communication, spectral characteristics. Brief about current Industry trends in optical communication system

Optical Fibre wave guide: Structure, Single and Multimode operation: basic concept with mathematical expression (no derivation is needed). Attenuation, Material and wave guide dispersion.

Module II: Optical Sources & Optical Detectors [8 L]

Optical Sources: Light Emitting Diode; principle, structures, power and efficiency, coupling to fibres. Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers. *Quantum Well Lasers;* Modes and narrow linewidth lasers. Modulation; Bandwidth for modulation, Optical transmitters: components.

Optical Detectors: Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio.

Module III: Optical Network [11 L]

Point-to-point link and Wavelength Division Multiplexing: Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier. Dispersion compensation and management.

Optical Network: LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking: SDH/SONET.

Different forms of access networks:

Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC, FTTH and FTTN networks.

Module IV: Fiber Optics measurements [9 L]

Correlation of NA aperture measurements and mode field diameter. Measurements of distance using phase measurement, Displacement measurement, Optical disks, recording of audio & video signals on optical disks, mass replication by optical disk, direct read after write (DRAW), data read out, erasable optical disk, Holography, Attenuation measurements, Dispersion measurements, Refractive Index Profile Measurements, NA measurements, Polarization Depression Measurements, BER Measurements

Course Outcome

- C EC 604C-1: Recognize and classify the structures of Optical fiber and types.
- C EC 604C-2: Discuss the channel impairments like losses and dispersion.
- C EC 604C-3: Classify the Optical sources and detectors and to discuss their principle.
- C EC 604C-4: Familiar with Design considerations of fiber optic systems. To define the Wavelength Division Multiplexing. (WDM) principles and concepts. To perform characteristics of optical fiber, sources and detectors
- C EC 604C-5: To analyse optical fibre measurement systems

CO-PO Mapping

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
C EC 604C-1	3	3	2	2	2	1	-	-	-	-	-	-
C EC 604C-2	3	2	3	1	2	-	-	-	-	-	-	1
C EC 604C-3	3	3	2	1	1	-	-	1	-	1	-	-
C EC 604C-4	3	3	2	1	2	1	1	-	1	-	1	-
C EC 604C-5	3	2	3	1	2	1	-	1	-	1	2	1
AVG.	**3**	**2.6**	**2.4**	**1.2**	**1.8**	**0.6**	**0.2**	**0.4**	**0.2**	**0.4**	**0.6**	**0.4**

Text Book

1. Optical Networks –Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication : John M. Senior (Pearson)
3. Optical Communications: N. Bala Saraswathi, I. Ravi Kumar (Laxmi Publications)

Reference Books

1. Optical Communication Systems : John Gawar (PHI)
2. Optical Fibre Communication : Gerd Kaiser (TMH)
3. Fiber optics communication by G.P Agrawal.
4. Raman Amplifiers for communications by M.N. Islam (Ed).

Paper Name: Engineering for System Analysis and Design

Paper Code: EC605A

Contacts: 3:0:0

Credit: 3

Total hrs: 34

Course Objective:

This subject aims to as to introduce variety of new software used by analysts, designers to manage projects, analyze and document systems, design new systems and implement their plans.

Course Outcome:

1. Student will be able to understand the principles and tools of systems analysis and design and Understand the professional & ethical responsibilities of practicing the computer professional including understanding the need for quality.

2. Students will be able to solve a wide range of problems related to the analysis, design and construction of information systems & analysis and design of systems of small sizes.

3. Students will be able to Plan and undertake a major individual project, prepare and deliver coherent and structured verbal and written technical reports

Syllabus:

Module 1: Introduction- Systems, Elements of a system, Types of systems, Subsystems, Super systems, Need for system analysis and design, CASE tools for analysis and its limitations. [5]

Module 2: System Analysis-Methods of system analysis, system development life cycle, structured approach, development tools, data base and networking techniques. [6]

Module 3: Mathematical and Statistical Models- Probability concepts, Queuing Models, Methods for generating random variables and Validation of random numbers. [5]

Module 4: System design- Design technologies, Design principles, Design tools and methodologies, feasibility survey, conversion and testing tools, design management and maintenance tools . [6]

Module 5: Experiments-Simulation of different systems, Analysis, validation and verification of input and output simulated data, study of alternate techniques.

[6]

Module 6: Case study-Developing simulation model for information centers, inventory systems and analysis of maintenance systems. [6]

Text books:

1. Silver and Silver, System Analysis and Design, Addison Wesley, Last Edition

2. Systems Analysis and Design Author(s): Kenneth E. Kendall and Julie E. Kendall Publisher: Prentice Hall PTR, 5th Edition, 2001

Stream: ECE

Paper Name: Material Science & Engineering

Paper Code: EC605 B **Contacts: 3LCredits: 3**

Total Contact: 36 Semester: 6^{th}

Course Objectives:

The objective of this course is to provide students a fundamental understanding of electrical, magnetic and optical properties of materials and to apply those fundamentals for selecting and developing materials for different engineering applications.

PREREQUISITE :

Knowledge of Engineering Chemistry, Physics, Thermodynamics, Basic electronics, Solid state devices.

MODULE – I

Structure of Solids : Atoms and their binding, Bonds, Crystal Systems, Bravais LatticeMiller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Technologically important properties of materials - Physical, chemical, mechanical, thermal, optical, environmental and electrical properties of materials, Material properties and Engineering Design parameters; Lattice defects- Qualitative ideas of point, line, surface and volume defects. [6]

MODULE – II

Electrical and Dielectric Materials: Review of electrical conduction - resistivity and dielectric phenomena - Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric Materials and its Applications.[5]

MODULE – III

Magnetic Properties: Introduction to dia, para, ferri and ferro magnetism ,antiferromagnetic and Ferrimagnetic behaviour of materials; soft and hard magnetic materials- applications of hard and soft magnetic materials - Giant magneto resistance,Magnetic Domains, SQUID. [3]
Optical properties : Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photorefractive effects, color of materials, applications of optical phenomena-luminescence, photoconductivity, lasers, optical fibers in communications, LED and Laser Materials, Optical Fibre. [4]

MODULE – IV

Semiconducting and Superconducting Materials: Review of semiconducting materials - concept of doping - simple and compound semi conductors - amorphous silicon, oxide semiconductors; amorphous semiconductors
- FER, MOSFET and CMOS - Concept of super conductivity, Transition temperature, Meissner effect High-T superconductors [5]

MODULE – V

Electronic Materials: Review of electronic materials - methods of crystal growth for bulk single crystals - zone melting-refining, leveling - synthesis of epitaxial films by VPE, PVD, MBE and MOCVD techniques - lithography; production of silicon - starting applications. [4]

Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magnetoelectronic Materials, CD, DVD, CCD.
Materials for Display Devices : CRT, LED, LCD, TFT, Plasma Display.[4]

MODULE – VI
Advanced Materials: Metallic Glasses, Nanomaterials: scale / dimensional aspects, Top-down and bottom-up approaches for preparing nano materials Advantages and limitations at the nano level – thermodynamic aspects at the nano level,health and environmental issues.[5]

TEXT BOOKS:

1. Electrical Engineering Materials – A. J. Dekker (PHI)
2. Material Science and Engineering–A First Course – V. Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices – S. Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics - Charles Kittel (John Wiley & sons)
5. An Introduction to Electronic Materials for Engineers – W. Kao, Z. Lee and N. Sannes (World Scientific)
6. Pradeep fuley, Electrical, magnetic, and Optical Materials, 1st edition, CRC press, 2010 .
7. Dekker A.J, Solid State Physics, MacMillan India, 1995

REFERENCE BOOKS:

7. J W Mayer and S S Lau – Electronic Materials Science - Maxwell Macmilan International Editions, Singapore
8. R E Hummel – Electronic Properties of Materials – Narosa Publishing House, New Delhi.

COURSE OUTCOMES:

After the completion of this course, the student will be able to:

1. Understand the conducting, semiconducting, superconducting, dielectric, ferro-eleletric and piezoelectric behavior of materials
2. Differentiate between diamagnetic, paramagnetic, ferromagnetic, ferromagnetic, and anti- ferromagnetic behavior of materials
3. Synthesis and processing of semi-conducting materials for engineering applications
4. Study the effect of composition, structure and temperature on the properties of the materials.
5. Describe the interactions of light with materials and its effects at the interface
6. Understand the working principles of different Electronic Materials, Nanomaterials,solid state devices,

CO-PO Mapping:

COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO

	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	2	1	1	-	2	-	2	2	2	2	3
CO2	2	2	2	1	2	2	-	2	2	1	2	2
CO3	3	3	-	3	2	2	1	2	1	1	2	3
CO4	2	2	1	1	-	3	1	3	1	1	1	1
CO5	3	2	-	1	-	-	1	1	1	2	2	1
CO6	2	3	3	-	3	2	2	3	2	2	3	2

Computer Communication and

Networking EC605C

Contacts: 3L Credits: 3

Course Objective:
1. An understanding of how devices like Hub, Switch, Router and Bridge are used in network.
2. An understanding of how securely data can be transmitted from one place to remotely place using various protocols.

Module I Overview of Data Communication and Networking: [2L]

Introduction; network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level: [4L]

Transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus

Module II Data link Layer: [5L]

Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC

Medium Access sub layer: [4L]

Point to Point Protocol, Token Ring; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);

Module III Network layer: [6L]

Internetworking & devices: Repeaters, Hubs, Bridges(Basic Idea), Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Source and Hop-by-Hop routing (Dijkastra, Bellman Ford Algorithm),Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6

Transport layer:
[3L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets (Concept); Leaky bucket algorithm, Token bucket algorithm,

Module IV Application Layer [6L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Modern topics: ATM, DSL technology, Architecture & Operation in brief Wireless LAN: IEEE 802.11(WSN), Introduction to blue-tooth, Zigbee

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.

Course Outcome:

After the course, student will be able to

1. Analyze various protocols used in data communication
2. Design networking structure in data communication.
3. Transmit data securely from one place to another.

CO – PO Mapping :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	H	H			M	L						
2		M		H	H							
3	M	H	M		M							

Stream: ECE
Paper Name: **EM WAVE PROPAGATION & ANTENNA lab**
Paper Code: EC 691 Contacts: 3P Credits: 2
Semester: 6th

Course Objectives:
1. To learn EM wave propagation in transmission line.
2. To know the fundamentals of antenna and its characteristics.

Course Outcome:
After successful completion of this course, students should be able to:

CO1 To understand theory of transmission lines in which EM wave propagates.

CO2 To analyze the fundamentals of antenna theory.

CO3 Understand the different types of antennas and the radiation mechanism.

CO4 Identify the different signals in hardware setup.

Prerequisite:
The candidates should learn basic knowledge of vector calculus, electrostatic, magnetostatics from Physics-II

[At least THREE experiments from Module I and FOUR experiments from Module II]

Module I:

1. Familiarization of basic elements of Transmission Line.

2. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.

3. Unknown load Impedance of a terminated transmission line using shift in minima technique.

4. Study of application of Smith chart by using characteristic of transmission line.

5. Study Single stub impedance matching technique.

Module II:

6. Familiarization of basics of Antennas.

7. Radiation Pattern of dipole antenna and Mono-pole with ground plane.

8. Radiation Pattern of a folded-dipole antenna.

9. Radiation pattern of a Log-Periodic Antenna.

10. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna – Comparative study.

11. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.

12. Measurement of signal power, bandwidth, harmonics, Adjacent channel power ratio using Spectrum Analyzer.

CO-PO Mapping of course code EC691

Course Outcome	Programme Outcome											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**
CO1	X	X							X		X	
CO2		X			X			X	X		X	X
CO3	X		X		X	X		X	X			X
CO4			X		X	X		X	X		X	X

Control System
Lab Code:
EC693 Contact:
3P Credits: 2

SL. No.	Name of the Experiment	Periods
1.	Familiarization with MATLAB and Control System tool Box.	3
2.	Introduction to SIMULINK tool box.	3
3.	Determination of step response for 1st order, 2nd order & 3rd order system with unity feedback & calculation of control system specifications (Evaluation of steady-state error, peak time, rise time, setting time, percentage peak overshoots) – using MATLAB programming and SIMULINK tool box.	3
4.	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB.	3
5.	Determination of root locus and effect of addition of poles and zeros to the systems.	3
6.	Determination of Bode-plot and computation of gain crossover frequency, phase cross over frequency, gain margin and phase margin using MATLAB.	3
7.	Study of closed loop stability using Nyquist plot and computation of gain crossover frequency, phase cross over frequency, gain margin and phase margin.	3
8.	Determination of PI, PD, and PID controller action on 1st order simulated process.	3
9.	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin and phase margin with addition of lead compensator in forward path transfer function using MATLAB.	3
10	Study of position control system using servomotor	3
11.	Study Tuning of controller.	3
12	Project implementation of control system.	3

Course Outcome:

CO1	Able to apply Laplace transform, transfer function and state variable to analyze different types of electrical, mechanical electromechanical systems.
CO2	Determine Transient and Steady State behavior of different types of systems using standard test signals.
CO3	Able to determine the importance of gain, location of poles and zeros to design a system.
CO4	Able to check the absolute and relative stability of the systems using the concept of different stability criterion.
CO5	Gain experience using modern software tools to design the systems according to the desired specifications or requirements using different types of controller and compensator.

Paper Name: **Object Oriented**
Programming Lab Paper Code: EC 694A
Total Contact Hours: 30
Credit: 2

Pre requisites: Basic concepts to handle
computers Keyword familiarization
May be known how to write code.

Course Objective: The objective of the course is to
Enable students to use basic object oriented
features in coding Enable students to develop
small projects

Course Outcomes: After the completion of the course students will be able to
EC 694A.1: Apply object oriented programming concepts in designing programs
EC 694A.2 : Analyze different dimensions of a problem and provide optimal solutions.
EC 694A.3: Apply the advance features of JAVA in designing of projects

Course Content:
MODULE I:
Writing simple java program, compiling and
running. Understanding the main() method.

MODULE II:
Using basic java token, control structurtes.

MODULE III:
Illustrating class objects, constructor, final,
finalize. Understanding Arrays and hands on
application using array. Understanding and
writing methods.
Static and non static concepts.

MODULE IV:
Class
Relationship.
Using
inheritance
Creating abstract classes, interfaces.

MODULE V:
String Handling

MODULE VI:
Illustrating exception handling
Illustrating multi threading
applications.

MODULE VII:
Basic IO and File IO operation

MODULE VIII:
AWT and Swing applications

MODULE IX:
Applet programming.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT494.1	3	2	2		1	1						
IT494.2	2	3	2		3	1						
IT494.3	3	3	2		3	2						

Subject Name: Advanced Microcontroller and Embedded System Lab

Subject Code: EC 694B

PIC based experiment (Any Five)

Familiarization of PIC kit.

Interface and control a LED, LCD, Keyboard, ADC & DAC using PIC.

Connect two PIC kit and transfer data serially.

Design a Digital watch based on PIC.

Control a stepper motor and display temperature from a temperature sensor on a LCD.

ARM based experiment (Any Four)

Familiarization with ARM evaluation system

Familiarization with Raspberry Pi

Interfacing with a real time clock using a serial port to display time.

Interface a Keyboard and display the keystrokes on a LCD, LED.

Familiarization of image processing using ARM

FPGA based experiment

Design a 3 to 8 decoder circuit.

Design an UP/DOWN counter and display the count on a 7-segment display.

Designing an ALU and verify with mathematical operations.

Innovative Project.

Paper Name: :Optical Fiber Communication Laboratory
Paper Code : EC 694C

Credits :3
Total contact hour 30

Perform any four out of eight experiments:

1. Demonstrate and study of different types of Optical fibres and connectors.
2. To establish and study of a 650nm fibre optic analog link and digital link.
3. Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre
4. To calculate attenuation constant, bending loss.
5. I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.
6. P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.
7. To measure propagation loss in optical fibre using optical power meter.
8. To measure the Numerical Aperture (NA) of the fibre

Course objectives:

1. Determination of the input/output characteristics of long optical fibre
2. To learn and obtain attenuation constant, bending loss and numerical aperture of optical fibre
3. To observe the current -voltage characteristics of optical fibre
4. To observe the P-I characteristics of optical fibre
5. To gain knowledge about fibre optic analog and digital link.

Course Outcome:

CO1	Basic knowledge about the input output characteristics
CO2	Able to define and analyse the attenuation constant , bending loss
CO3	Able to define ,analyze and draw V-I characteristics of optical fibre
CO4	Able to define ,analyze and draw P-I characteristics of optical fibre

CO-PO Mapping of course code EC 694C

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CEC 694C .1	3	2	-	-	2	-	-	-	-	**3**	-	-
CEC	3	2	2	-	-	**2**	-	-	**2**	-	**3**	-

694C.2												
CEC 694C.3	3	2	2	-1	-	**-**	**2**	**2**	**-**	**-**	**3**	**-**
CEC694C.4	2	2	2	-	-	**-**	**-**	**-**	**-**	**3**	**3**	**1**

EC 701: RF & MICROWAVE ENGINEERING
Contact: 3L
Credits: 3
Lectures: 34

Course Objective:

1. Distinguish the RF & Microwave spectrum, Planar transmission lines and High frequency circuit elements.
2. Determine the Microwave passive components and Scattering matrix representation.
3. Illustrate the Microwave tubes, Semiconductor Microwave Devices.
4. Justify the microwave applications and typical microwave test bench.

Module I:

Introduction RF & Microwave Spectrum, Typical applications of RF and Microwave-RADAR & Missile, Safety considerations. [1+2]

Microwave W aveguide and W aveguide Resonator Rectangular Waveguide- Design consideration, TE & TM modes, TE10 mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, power transmission, attenuation, waveguide excitation, wall current; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor, excitation. [6]

P lanar Transmission line Micro-strip lines, Coplanar waveguide, Slot line- design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines. [3] **Module II:**

High frequency Circuit Elements Difference in High frequency and relatively low frequency behavior of Lumped circuit components. Miniaturization and Design of Lumped components at High RF. Realization of reactive elements as Waveguide and Planar Circuit components. [4]

Waveguide Passive Components and their S-matrix Representation N-port networks-Properties of S matrix, Transmission matrix & their relationships; Microwave passive components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole coupler, Magic tee, hybrid ring, Circulators, Isolators; Design procedure of filter (maximally flat and equal ripple) using insertion loss method-specification, lowpass prototype design, scaling and conversion, implementation. [8]

Module III:

Microwave Tubes Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and non-resonant (TWT &BWO) microwave active devices: Typical characteristics & applications (only physical explanation is required, no mathematical derivation required). [4]

Semiconductor M icrowave devices TED (Gunn diode) & Avalanche Transit Time (IMPATT) device, Schottky diode, PIN diode characteristics & applications; Microwave bipolar transistor, Microwave field effect transistor (MESFET). [5]

Microwave Amplifier Design Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network, noise figure;

Matching network design using lumped elements and L-Section. Brief introduction to NBA, LNA. [4]

Module IV:

Typical Microwave Test Bench & measurement VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer, Measurement of VSWR – low, medium and high, Measurement of power: low, medium and high, Frequency measurement. [4]

Course Outcome:

The students will be able to:

- Understand the Microwave Frequency range and their application.
- Develop fundamental understanding of the Two –port RF network and matching techniques.
- Learn the Scattering matrix for microwave passive components.
- Understand the Microwave tubes and devices along with their fundamental principle of operation.
- Learn the microwave measurements techniques.

Course Code	Course Title	Program Outcomes (POs)											
		a	b	c	d	e	f	g	h	i	j	k	l
EC 701	**RF & MICROWAVE ENGINEERING**												

Text Books :

1. Annapurna Das and Sisir
   K Das, “Microwave Engineering”, Tata Mc GrawHill Inc., 3rd Edn.2015.
2. Samuel Y Liao, “Microwave Devices & Circuits” , Prentice Hall of India, 2006.
3. D.M.Pozar, “Microwave Engineering.”, John Wiley & sons, Inc., 2006.

Reference Books :

1. Robert E.Colin, 2ed “Foundations for Microwave Engineering”, McGraw Hill, 2001M.
2. M.Radmanesh, RF & Microwave Electronics Illustrated, PearsonEducation, 2007.

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Paper Name: Principles of Management Code: HU

705

Credits: 2

Total Contact Hours: 24

Course objectives:

1. To understand and apply management principles in to manufacturing organization.

2. To understand concepts of work study, method study, and time study to improve productivity of any manufacturing organization.

Outcomes:

1. Summarize the contribution of peoples to management.

2. Differentiate between two employees on the basis of productivity.

3. Prepare time schedule to complete the task.

Unit I Evolution of Management Practices: Characteristics, objectives Functions, Principles and Types of Management., Scientific Management-Contribution of F. W. Taylor, Henry Fayol Gantt, Maynard and Indian contributors to the Management thought. Organization: Definition, Principles, Function and Types of organization structure, Managerial Functions

Unit II Motivation: Human Needs and Types of Motivation, Theories of Motivations- Maslow's theory, McGregor's Theory of X and Theory of Y, Herzberg's Theory of two factor, David C.McCelland's Theory of Achievement, Expectance/valence Theory of Victor Vroom, Porter & Lawler's Model. Group dynamics: Types, characteristics, objectives of Group Dynamics Leadership: Definition, styles & functions of leadership, qualities for good leadership, role of the leader, Theories of leadership, Managerial grid, professional and business ethics.

Unit III Entrepreneurship development: Characteristics of successful entrepreneurs, communications skill, problem solving skill and process, Basic element of Business plans, Sources of finance, Selection of Business location, Record keeping system, Analysis financial performance, Break even analysis, Technology and Business, Strategies for Business Growth, Concept related to start-up and Intellectual Property Rights (IPR).

Unit IV Wages and incentives: Concept of wages, factors affecting wages, Job evaluation, merit rating.

Unit V Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives, Terminology & Tools, Use of stopwatch procedure in making Time Study. Time Study Forms, Performance rating, allowances and its types. Calculation of Standard Time. Work sampling

CO-PO MAPPING:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.EC704C.1	H	H	H	L	-	M	H	-	-	-	H	H
CO.EC704C.2	H	L	M	M	-	M	H	-	-	-	M	M
CO.EC704C.3	M	M	M	-	-	M	H	-	-	-	M	M

Autonomy Syllabus

Course Name: VLSI & Microelectronics

Paper/ Course Code: EC702

Total Contact Hours: 3L+1T /Week, (Total :45)

Credit: 4

Prerequisite:

Concept of courses Solid State Devices (EC301) , 3rd Sem ; Analog Electronic Circuit (EC402) , 4th Sem ; Digital Electronic and Circuit (EC403),4th Sem.

Course Objective: Objective of the course VLSI & Microelectronics, Code : EC702 is to motivate students to design VLSI circuits in the area of digital , analog and also to encourage for the design of IC with low power and high speed .

Course Content: VLSI & Microelectronics (EC702)

Module –I: Introduction to IC (8L)

Integrated Circuits – Advantages, disadvantages , limitations ; Scale of Integration – SSI , MSI ,LSI,VLSI ,ULSI ; Moor's Law ; Scaling of MOSFET-Constant field scaling and constant voltage scaling , Short Channel Effects; VLSI design flow, Y-Chart , IC Classification –Standard IC and ASIC , PAL ,PLA , FPGA Architecture .

Module-II : Digital VLSI Circuit Design (5L+8T)

Inverter Characteristics (2L):Resistive load inverter – Voltage transfer characteristics(VTC

, significance of parameters(only expression , no derivation) –V_{IL} , V_{IH} , V_{OL} , V_{OH} , V_{th} ; CMOS inverter - VTC , Noise margin and aspect ratio of symmetric CMOS inverter.

Combinational Logic Circuit Design (3L+5T): Circuit design using Static CMOS style – basic gates , design of circuit for product of sum(POS) and sum of product (SOP) expression, Complex logic circuit , full adder ; Circuit design using pseudo NMOS logic , DCVSL Logic , TG Logic , Pass Transistor Logic , Complementary pass transistor logic , Dynamic logic , domino logic , NORA logic .

Sequential Circuit and Semiconductor Memory Design (3L+2T) : Bistable Circuit - Design of CMOS S-R & J-K Latch, CMOS Clocked SR & JK Latch /Master –slave JK Flip-flop, CMOS D Flip-flop ; 6T SRAM cell and 3T DRAM cell design .

Module-III: Analog VLSI Circuit Design (10L+2T)

Small Signal model of MOSFET; Analog sub-circuits -MOS Switch , Active resistors/MOS Diode , Current source and Sink ,Current Mirror ; Current and voltage references-voltage divider , MOS equivalent of P-N junction Voltage reference , Threshold voltage reference , Band gap reference (Basic Principle) ; Switch-Capacitor Circuit – resistance emulation of series , parallel and series-parallel circuit , Switch capacitor integrator and filter (1^{st} order only) ;CMOS differential amplifier – design parameters ;Output amplifier (basic circuit) ; Two-Stage CMOS OP-AMP design .

Module –IV: Layout Design Rules and Fabrication Steps of ICs (6L+2T)

Micron and lambda design rules ; Stick diagram and Layout - CMOS Inverter , NAND and NOR gate ; Fabrications steps of IC – Wafer preparation , Oxidation , photolithography , etching , diffusion , ion-implantation , metallization and packaging . CMOS N-Well Process, overview of P-well and twin-tub process .

Module-V: Introduction to Low Power and High Speed VLSI Circuit Design (4L) Dynamic power, short circuit power and leakage power in CMOS Inverter; Timing parameters(concept pnly) –Critical path ,arrival time , slack , skew ,set-up time ,hold time , gate delay and path delay, delay time expression of CMOS inverter(expression only) ,Adiabatic logic (basic concept)

Text Books:

1. Digital Integrated Circuit , J.M.Rabaey, Chandrakasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuits Analysis and Design , S.M.Kang & Y.Leblebici,TMH.
3. CMOS Analog Circuit Design , Allen & Holberg , Oxford
4. Design of Analog CMOS Integrated Circuits , Behzad Razavi , TMH .

Reference Books:

1. Microelectronic Circuits , Sedra & Smith , Oxford
2. Introduction to VLSI Circuits and System , Uyemura , Wiley
3. VLSI Design , Debaprasad Das , Oxford
4. VLSI Design and EDA Tools , Angsuman Sarkar , Swapnadip De , C.K. Sarkar , Scitech

5. VLSI Design Techniques for Analog and Digital Circuits , Geiger , Allen , Strader , TMH

Course Outcome:

Course Name	COs	CO Statement
VLSI & Microelectronics (EC702)	EC702.CO1	Able to describe scale of integration – SSI ,MSI,LSI,VLSI, Moor's Law , scaling , short channel effect ,VLSI design flow, FPGA architecture and construct gate level circuit with PAL & PLA concept.
	EC702.CO2	Able to analyze CMOS inverter voltage transfer characteristics with the parameters – V_{IL} , V_{IH} , V_{OL} , V_{OH} , V_{th} and based on the knowledge of digital circuit design methodology like – CMOS , Pass transistor , TG , DCVSL , dynamic logic , NORA , able to construct schematic of combinational , sequential circuit , SRAM , DRAM cell using MOSFET
	EC702.CO3	Based on the fundamental concept of MOSFET characteristics and model , able to calculate value of resistance of current source ,MOS diode , current of current mirror circuit , voltage of references (voltage divider , threshold voltage and band gap), emulate resistance of switch capacitor circuit , gain of switch capacitor integrator and 1st order switch capacitor filter .
	EC702.CO4	With the help of MOS transistor model, able to calculate the value of parameters to design CMOS differential amplifier and two stage OP-AMP .
	EC702.CO5	Able to describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on lambda and micron design rules.
	EC702.CO6	Able to calculate gate delay, dynamic power, short circuit power and leakage power and total power consumption across CMOS inverter circuit based on the derived expression of delay and power.

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC702.CO1	2	2	3	1	1	-	-	1	2	1	1	1
EC702.CO2	3	3	3	3	1	-	-	1	2	1	1	3
EC702.CO3	3	3	3	2	1	-	-	1	2	1	1	3
EC702.CO4	3	3	3	1	1	-	-	1	2	1	1	3
EC702.CO5	3	3	3	1	1	-	-	1	2	1	1	3
EC702.CO6	3	3	3	2	1	-	-	1	2	1	1	2
EC702.C	3	3	3	2	1	-	-	1	2	1	1	3

O												

N.B. : 3 = Highly Mapped, 2=Moderately Mapped , 1=Slightly Mapped , Not Mapped = '-'

Stream: ECE

Subject Name: Digital Image

Processing Subject Code: EC 703

A

Contact hour: 3P

Total contact

hour- 35 Credits:

3

Course Objective:

- To become familiar with digital image fundamentals
- To learn Transform of Digital Images and its applications.
- To get familiar with simple image enhancement techniques in both spatial and frequency domain.
- To become familiar with image compression and recognition methods
- To learn concepts of image restoration techniques and image segmentation and representation techniques.
- To study the Edge detection in Digital Image Processing.
- To become familiar with basics of Security in Digital Image Processing

Course Content:

Module No.	**Topics**	**No. of Lectures Required**
1	**Digital Imaging Fundamentals:** Basic idea of Digital image, Image formation in human eye, Pixel, Mathematical operation of Digital Image, Sampling, Quantization, application of digital Image Processing **Transform of Digital Images:** Importance of Digital Image Transform, Fourier Transform of Digital Image (DFT), Inverse Fourier Transform (IDFT), Fast Fourier Transform, Inverse Fast Fourier Transform, Application of Digital Image Transform in different area	3 4

2	**Digital Image Enhancement:** Importance of Digital Image enhancement, enhancement in spatial and frequency domain, Bit plane slicing, Histogram, Histogram Equalization , Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images – LPF, HPF and BPF	6
3	**Digital Image Compression:** Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression	6
4	**Digital Image Restoration :** Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering **Segmentation of Digital Images:** Importance and applications of Digital Image Segmentation, Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Watershed algorithm,	3 5
5	**Edge detection in Digital Image Processing:** Importance of Edge detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator. **Security in Digital Image Processing :** Importance of Digital Image Security, Watermarking, Image encryption in spatial and frequency domain, Steganography	4 4

Course Outcome:

Sem No.	**Course Title (Code)**	**CO Codes**	**Course Outcomes**
7^{th}	Digital Image Processing (EC 703 A)	CO.EC703A.1	Have a clear idea on Digital Imaging fundamentals and Importance of Digital Image Transform.
		CO.EC703A.2	Understanding the importance of Digital Image enhancement in spatial and frequency domain and filtering techniques
		CO.EC703A.3	Explaining the requirements and types of Image Compression and its standards.
		CO.EC703A.4	Demonstrate the basic concepts of Digital Image Restoration and Segmentation of Digital Images

		CO.EC703A.5	Familiarize with Edge detection techniques and concepts on security in Digital Image Processing

TEXT BOOK:

- Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.
- S. Annadurai,R. Shanmugalakshmi, “Fundamentals of Digital Image Processing”, Pearson Education, 2006

REFERENCES:

- Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
- Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
- Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
- Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

DIGITAL IMAGE PROCESSING Syllabus Committee.

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Computer Organization and

Architecture Code: EC703B

Contact:

3L

Credits: 3

Pre-requisite: Basic Electronics, Introduction to Computing, Digital Electronics & Integrated Circuits, Microprocessor and Microcontroller.

Course Objective:

- Enrich the knowledge of the students on basic components of a computing systemand their working principles.
- Obtain a basic level of Digital Electronics knowledge and set the stage to perform the analysis and design of complex digital electroniccircuits.

Module 1: Introduction to Computer Organization & Architecture: Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration], Harvard & Von Neumann architecture, BUS architecture fundamentals, ALU designs, IEEE-754 format for floating point numbers, truncation technique, Instruction set: Instruction format & types. [9L]

Module 2: Memory Organization: Memory system overview, Cache memory organizations and Cache misses, Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, RAM (static and dynamic) and ROM architecture.

[7L]

Module 3: CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing diagram], Instruction cycle, RISC & CISC based architecture. [4L]

Module 4: Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Flynn's classification –SISD, SIMD, MISD, MIMD architectures [5L]

Module 5: Instruction-level parallelism: basic concepts, techniques for increasing ILP, Basics of superscalar and VLIW processor architectures, Array and Vector processors, Systolic Array.

[5L]

Module 6: Overview of HDL: VHDL basics programming concept, Structural, dataflow, behavioral & mixed style modeling techniques. [6L]

Course Outcome:

	CO Serial Number	CO Statements
Computer Organization and Architecture (EC703B)	EC703B.1	The students will be able to know about basic of computer architecture, existing architectures and design related computing systems.
	EC703B.2	The students will be able to design about basic of computer memory structures and RAM, ROM architecture.
	EC703B.3	The students will be able to know about different CPU architecture & Processor- memory communication technique.
	EC703B.4	The students will be able to know about pipelining techniques and design related architectures.
	EC703B.5	The students will be able to know about ILP, Superscaler, VLIW architectures.
	EC703B.6	The students will be able to know the basic concepts of VHDL.

Mapping between C.O. and P.O.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-703B.1	H	H		M	M	L						H
CO-703B.2			H		M	L						H
CO-703B.3	H		M		L							H
CO-703B.4	H	H	M		L	L						H
CO-703B.5	H			M	L							H
CO-703B.6	H	M	M	L	H							H

Text & Reference books:

1. William Stallings -- “Computer Organization & Architecture Designing for performance”, 8/e, Pearson

2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky -- “Computer Organization”, 5/e, MGH

3. M. M. Mano -- “Computer System Architecture”, 3/e, Pearson

4. Kai Hwang and Naresh Jotwani -- “Advanced Computer Architecture Parallelism, Scalability, Programmability”, 2/e, MGH

5. Pedroni -- “Circuit Design And Simulation With VHDL”, 2/e, PHI

6. J. Bhaskar -- “A VHDL Primer”, P. T. R. Prentice Hall

7. Charles Roth -- “Digital Systems Design using VHDL”, PWS Publishing Company

DATABASE MANAGEMENT SYSTEM
EC 703C
Contact:
3L
Credits: 3

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure.

Module 1:
Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:
Entity-Relationship and Relational Database Model [11L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

Module 3:
SQL and Integrity Constraints [6L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:
Relational Database Design [8L]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF , Case Study

Module 5:
Internals of RDBMS [9L]
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling

Module 6:

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Reference:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
4. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Course Outcomes(COs)

On completion of the course students will be able to

1. Apply the knowledge of Entity Relationship (E-R) diagram for an application.
2. Create a normalized relational database model
3. Analyze real world queries to generate reports from it.
4. Determine whether the transaction satisfies the ACID properties.
5. Create and maintain the database of an organization.

CO-PO MAPPING

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EE)705D.1	2	2	2	2	3	2	1	1	2	2	3	3
CS(EE)705D.2	2	3	3	3	3	1	1	1	2	2	3	3
CS(EE)705D.3	3	3	2	3	3	2	2	2	3	3	3	3
CS(EE)705D.4	3	3	2	2	2	1	1	1	1	1	2	3
CS(EE)705D.5	3	3	3	3	3	2	2	2	3	3	3	3
CS(EE)705D(average)	3	3	2	3	3	2	1	1	2	2	3	3

3=HIGH, 2= MEDIUM, 1=LOW

Artificial Intelligence and Robotics
Code: EC 704A
Semester:
7th
Credits: 3
Total lecturers: 37

Prerequisites:
Linear algebra and probability theory. Basic understanding of control systems and computing.

Module-I
Introduction: Foundations and History of Artificial Intelligence & Robotics, Turing Test, Intelligent Agents, classification and usage of robots. [2]

Module-II
Searching and Problem Solving: Problem formulation with suitable examples, -8 puzzle problem, Tower of Hanoi, Data driven and goal driven search, Uninformed search strategies -Breadth-first search, Depth first search, Bidirectional search, Hill climbing, simulated annealing. [5]

Module-III
Knowledge Representation and Reasoning: Introduction to data, information and Knowledge, Propositional logic, first order predicate logic (FOPL), Rule of inference, Inference engine, knowledge representation technique, Forward and Backward reasoning, Bayes' rule and Bayesian Networks. [5]

Module-IV
Learning: General model of learning agents, Inductive learning, Learning decision trees, decision trees as performance elements, induction decision trees from example, Neural Networks (Network structures, Single layer feed-forward neural network, Multilayer feed-forward neural network, learning weights), classification & clustering concept. [6]

Module-V
Elements of robots: Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo motors, Purpose of sensors– tachometers, strain gauge based force-torque sensors, proximity sensors and vision. [6]

Module-VI
Kinematics of robots: Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Degrees- of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators. [8]

Module-VII
Motion planning and control: Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes. [5]

TEXT BOOKS:
1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall.
2. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, OXFORD University Press.
3. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.

REFERENCE BOOK:

1. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishers
2. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.

Stream: ECE
Paper Name: Biomedical Electronics and Imaging

Paper Code: EC 704B **Contacts: 3L** **Credits: 3** **Total Contact: 36**
Semester: 7th

Pre requisite:

(1) Concepts in Analog Electronics (Studied in Basic Electronics Engineering).
(2) Fundamental concepts on mathematics.
(3) Concepts in Digital signal Processing

Course Objectives:

- To familiarize the students with concepts related to medical electronics and imaging.
- To understand medical measurement systems and system modelling.
- To understand time domain and frequency domain analysis of real time biomedical signals like ECG,EEG etc.
- To understand the different medical imaging techniques like CT Scan, PET, ultrasound and understand the different types of data acquisition electrodes and amplifiers.

Module I: Introduction of Medical Electronics:

Origins of Bioelectric signals , Electrocardiogram (ECG),Electromyogram (EMG) ,Recording Electrodes-Silver-silver Electrodes ,Electrodes for ECG, EEG and EMG ,Physiological Transducers- Pressure Transducers, Temperature sensors, Pulse sensors; Sources of bioelectric potential, resting potential, action potential, propagation of action potentials in nerves, Rhythmic excitation of heart. [6L]

Module II: Medical Measurement systems :

Specifications of instruments, static & dynamic characteristics, classification of errors, statistical analysis. Introduction to reliability, accuracy, fidelity, speed of response, linearization of technique, data acquisition system. Detection of physiological parameters using impedance techniques: Impedance and current distribution, bipolar and tetra polar circuits, skin impedance, galvanic skin response measurement, total body impedance, cardiac output, neural activity, respiratory activity, impedance plethysmography - resistance and capacitance type. [8L]

Module III: Bio-amplifier and Bio-potential electrodes

Need for bio-amplifier -single ended bio-amplifier, differential bio-amplifier –right leg driven ECG amplifier. Band pass filtering, isolation amplifiers –transformer and optical isolation -isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference. Origin of bio potential and its propagation. Electrode-electrolyte interface ,electrode–skin interface, half cell potential, impedance, polarization effects of electrode Non polarizable electrodes. Types of electrodes -surface, needle and micro electrodes and their equivalent circuits. Recording problems -measurement with two electrodes.[8L]

Module IV: Medical Signal Processing

Biomedical signal origin & dynamics (ECG), Biomedical signal origin & dynamics(EEG, EMG etc.), Filtering for Removal of artifacts Statistical Preliminaries; Time domain filtering (Synchronized Averaging, Moving Average) Illustrations ofproblem with case studies Morphological Analysis of ECG Correlation coefficient The Minimum phase correspondent and Signal Length.[8L]

Module V :Medical Imaging Techniques

CT scan, ultrasound, NMR and PET ,Experiments are based on acquisition of biomedical signals, Implementation of algorithms covered in the course to characterize these signals. [6L]

Reference Books:

1. Wavelets and Time frequency methods for Biomedical signal Processing- M. Akay, IEEE Press,
2. Digital Processing of speech signals- L. Rabinar, Pearson Education
3. Biomedical Instrumentation and Measurements-Cromwell, Weibell and Pfeiffer, PHI

Course Outcome
EC704B

Biomedical Electronics and Imaging

EC704B.1	Explain Bioelectric signals ,human physiological system and different types of transducers.
EC704B.2	Understand different types of medical measurement system.
EC704B.3	Able to understand deferent types of biomedical signal acquisition electrodes and different types of signal amplification techniques and able to design the amplifiers .
EC704B.4	Able to examine the data handling ,filtering techniques of bio-medical signals and able to analysis of time and frequency domain.
EC704B.5	Able to understand medical imaging techniques and implement different algorithems to feature extract the signals.

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Mapping of POs with COs:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC704B.1	3	3	2	-	**2**	**1**	**-**	**-**	**1**	**1**	**-**	**1**
EC704B.2	3	2	2	-	**-**	**-**	**-**	**-**	**2**	**1**	**-**	1
EC704B.3	3	2	1	2	**1**	**1**	**-**	**-**	**2**	**1**	**-**	-
EC704B.4	3	1	-	-	**1**	**1**	**-**	**-**	**2**	**1**	**-**	1
EC704B.5	1	1	3	2	**1**	**1**	**-**	**-**	**2**	**1**	**-**	1
EC704B avg												

Stream: ECE

Paper Name: Renewable Source & Applications

Paper Code: EC704C

Total Contact Hours: 42

Credit: 3

Prerequisite: Renewable energy resources, Technical applications, Advantage and Disadvantage.

Course Objective:

The purpose of this course is to provide knowledge on different renewable energy sources for energy production in details for understanding the need & role of renewable energy sources for future growth and development.

Course Contents:

MODULE 1 **2L**

INTRODUCTION TO ENERGY SOURCES : Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development & economic growth; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.

MODULE 2 **10L**

SOLAR ENERGY :

SOLAR ENERGY : Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length.

SOLAR THERMAL COLLECTORS & HEATING : Flat plate collectors, Concentrating collectors, Solar air heaters- types, storage of solar energy-thermal storage, solar water heaters, solar distillation, solar cooker, solar heating & cooling of buildings,

SOLAR PHOTOVOLTAIC SYSTEMS : Theory of solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Concept of module, array. Classification of PV systems, Advantages and disadvantages. Efficiency and cost of PV systems & its applications.

MODULE 3 **6L**

WIND ENERGY: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output from wind turbine; wind data and importance of site selection, characteristics of different types of wind generators used with wind turbines. Merits & demerits.

MODULE 4

HYDEL ENERGY: **2L**

Electricity generation from micro hydel plants, location, auxiliaries and associated problems. Advantages & disadvantages.

MODULE 5 5L

BIOMASS ENERGY :

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructionaldetails, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas, Biodiesel.

MODULE 6 3L

GEOTHERMAL ENERGY :

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

MODULE 7 4L

ENERGY FROM OCEAN :

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC inIndia. Ocean Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages,limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

MODULE 8 3L

MAGNETO HYDRODYNAMIC POWER GENERATION :

Principle of MHD power generation, Classification of MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.

MODULE 9 3L

HYDROGEN ENERGY :

Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.

MODULE 10 2L

FUEL CELL :

Introduction, principle of operation of fuel cell. Types of fuel cells, efficiency of fuel cell, application of fuel cells, limitations.

MODULE 11 2L

HYBRID SYSTEMS :

Introduction to hybrid systems, Need for Hybrid Systems, Different type of Hybrid systems like Diesel-PV, Wind- PV, Microhydel-PV, Biomass-Diesel systems.

COURSE OUTCOME:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes On completion of the course students will be able to
7th	Renewable Source & Applications	CO.EC704C.1	Understand the importance of Renewable energy over conventional process and learn different methods of Power generation from the Non- conventional sources like Solar, Wind Energy, Biomass, Geothermal energy, OTEC, Tidal energy ,MHD Power generation schemes.
		CO.EC704C.2	Analyze the different techniques of grid integration of the power generated from renewable energy sources with the initiation of power electronic converters and drives.
		CO.EC704C.3	Design different hybrid energy systems and energy storage systems

CO-PO MAPPING:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.EC704C.1	H	H	H	L	-	M	H	-	-	-	H	H
CO.EC704C.2	H	L	M	M	-	M	H	-	-	-	M	M
CO.EC704C.3	M	M	M	-	-	M	H	-	-	-	M	M

Text Books

1. Non Conventional Energy Resources by S Hasan Saeed, D K Sharma, S.k. Kataria & Sons

2. NON CONVENTIONAL RESOURCES OF ENERGY, G. S. SAWHNEY, Eastern Economy Edition
3. Non Conventional Energy Resources, B.H Khan, McGraw Hill Education(Chennai)
4. Non Conventional Energy Resources, N.K.Bansal , Vikas.

Reference Books

1. Non Conventional Energy Resources, Shobh Nath Singh , PEARSON.
2. Non Conventional Energy Resources AndUtilisation. Er R.K Rajput, S Chand Publishers.
3. Rai G.D., "Non – Conventional Energy Sources", Khanna Publishers, 1993.
4. Rai G.D., "Solar Energy Utilisation", Khanna Publishers, 1993.

EC 791: RF & MICROWAVE ENGINEERING LAB
Contact: 3P
Credits: 2

Experiments

1. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [ω−β Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
3. Study of the characteristics of a Reflex Klystron oscillator
4. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.
6. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
7. Experimental/Simulation Study of filter (LPF, HPF, BPF) response.
8. Measuring of dielectric constant of a material using waveguide test bench at X-band.

Reference Books

1. ML Sisodia & GS Raghuvanshi Basic Microwave Techniques and Laboratory Manual; Wiley Eastern Limited 1987
2. EL Gintzton Microwave Measurements, McGraw-Hill Book Co.
3. M Sucher and J Fox, Handbook of Microwave Measurements, Vol I, Wiley-Interscience Inc.

Autonomy Syllabus

Course Name: VLSI & Microelectronics
Lab Course Code: EC 792
Contacts:
3P/Week
Credit: 2

Course Objective : Objective of the course VLSI & Microelectronics Lab , Code EC792 is to motivate students for the design and analyze circuit performance in the domain of digital , analog using SPICE tools. Also to mentor students to design layout and design using VHDL for FPGA based system design .

List of Experiments:

1. SPICE simulation of CMOS inverter to plot voltage transfer characteristics(VTC) for different values of $\frac{k_n}{k_p}$ ratio for V_{DD}=1 V and nano dimensional channel length

a) Measurement of critical voltages V_{IL} , V_{IH}, V_{OL} , V_{OH} from VTC .

b) Calculation of noise margin from critical voltages. [3P]

2. Functional verification, gate delay and average power consumption analysis of CMOS inverter circuit for $V_{DD} \leq 1.2$ V and with the nano dimensional channel length of MOS transistor through SPICE simulation . [3P]

3. Design and testing of functionality of the following gate and combinational circuit with the help of SPICE tools at schematic level .

a) CMOS AND/NAND, OR/NOR, XOR/XNOR gate

b) CMOS full adder circuit [6P]

4. Layout design and functional verification of CMOS inverter, CMOS NAND , CMOS NOR gate using layout design tools of SPICE based on design rules . [6P]

5. Design and examination of functionality of the sequential circuits - CMOS SR latch, clocked SR latch & D flip-flop at schematic level using SPICE tools .

[6P]

6. Design and simulation with the help of VHDL applying suitable modelling style (structural ,behavioral , dataflow , mixed) for the following combinational circuits

a) Logic gates b) Full adder using half adder c) 4:1 MUX using 2:1 MUX [6P]

7. Design using VHDL for the following Sequential circuits

a) S-R Flip-Flop

b) 8 bit synchronous counter

c) 8 Bit bi-directional register with tri-stated input output [6P]

8. Familiarity with FPGA based system design and realization of 4:1 Mux using FPGA.

[3P]

9. Design of CMOS differential amplifier with active load and biased with current mirror for given specification using SPICE tools at the level of schematic. [3P]

10. Innovative experiment.

Course Outcomes (COs)

Course Name	COs	CO Statement
VLSI & Microelectronics Lab (Code:EC792)	EC792.CO1	Able to simulate VTC of CMOS inverter , measure V_{IL} , V_{IH}, V_{OL} , V_{OH} and calculate noise margin
	EC792.CO2	Able to measure and analyze gate delay and average power consumption of CMOS inverter for $V_{DD} \leq 1.2$ V and with the nano dimensional channel length of MOS transistor through transient analysis
	EC792.CO3	Able to design combinational circuit - CMOS AND/NAND, OR/NOR, XOR/XNOR gate , CMOS full adder circuit , sequential circuit -CMOS SR latch, clocked SR latch & D flip-flop at schematic level for functional verification with the help of SPICE tools .
	EC792.CO4	Able to construct layout of CMOS inverter, CMOS NAND , CMOS NOR gate using layout design tools of SPICE based on design rules .
	EC792.CO5	Design of combinational circuits - logic gates , Full adder using half adder , 4:1 MUX using 2:1 MUX , Sequential circuits-S-R Flip-Flop , 8 bit synchronous counter , 8 Bit bi- directional register with tri-stated input output using VHDL and 4:1 MUX using FPGA
	EC792.CO6	Design of CMOS differential amplifier with active load and biased with current mirror for given specification using SPICE tools at schematic level .

Mapping of COs with POs

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
EC792.CO1	3	3	3	3	3	-	-	1	2	1	1	3
EC792.CO2	3	3	3	3	3	-	-	1	2	1	1	3
EC792.CO3	3	2	3	3	3	-	-	1	2	1	1	3
EC792.CO4	3	3	3	3	3	-	-	1	2	1	1	3
EC792.CO5	3	2	3	3	3	-	-	1	2	1	1	3

EC792.CO6	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**1**	**2**	**1**	**1**	**3**

EC792.CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**1**	**2**	**1**	**1**	**3**

N.B. : 3 = Highly Mapped, 2=Moderately Mapped, 1=Slightly Mapped , Not Mapped = '-'

- **Stream: ECE**
- **Subject Name: Digital Image Processing Lab**
- **Subject Code: EC 793 A**
- **Contact hour: 3P**
- **Credits:**

2 Course

Objective:

- To prepare the students to have a basic knowledge with digital image fundamentals and Transformation of Digital Images.
- To build knowledge on simple image enhancement techniques in both spatial and frequency domain.
- To become familiar with image compression and recognition methods
- To understand characteristics of image restoration and image segmentation techniques.
- To build ideas on Edge detection in Digital Image Processing.
- To provide Security in Digital Image using cryptography or watermarking technique

Course Outcome:

Sem No.	Course Title (Code)	CO Codes	Course Outcomes
7th	Digital Image Processing (EC 793 A)	CO.EC793A.1	Build knowledge on Digital Imaging fundamentals and Digital Image Transform.
		CO.EC793A.2	Understanding Digital Image enhancement techniques in spatial and frequency domain
		CO.EC793A.3	Explaining the requirements and types of Image Compression and its standards.
		CO.EC793A.4	Demonstrate the Digital Image Restoration and Segmentation of Digital Images
		CO.EC793A.5	Build ideas on Edge detection techniques and concepts on Digital

			Image security

List of Experiments:

1. Convert RGB Digital Images into Grayscale Images and show result.
2. Transform a grayscale image into frequency domain and show its magnitude and phase angle.
3. Display histogram of a digital image and equalized the image.
4. Apply LPF and HPF in a Grayscale Digital Image and display result.
5. Apply Mean and Median filtering in a Grayscale Digital Image and display result.
6. Compress and reconstruct a Grayscale Digital Images in spatial domain.
7. Compress and reconstruct a Grayscale Digital Image in frequency domain.
8. Apply segmentation technique (any one) in a Digital Image and display result.
9. Apply Edge detection technique in a Digital Image and display result.
10. Apply any cryptography or watermarking technique for image encryption and display result.
11. Innovative experiment

DIGITAL IMAGE PROCESSING Syllabus Committee.

1. **Sangita Roy, NIT, 9831402007, sangita.roy@nit.ac.in**
2. **Koushik Pal, GNIT, 9830162393, koushik.pal@gnit.ac.in**
3. **Anirban Patra, JISCE, 9830510470, anirban.patra@jiscollege.ac.in**

Computer Organization and

Architecture Lab Code: EC793B

Contact:

3P

Credits: 2

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

Pre-requisite: Digital Electronic & Integrated Circuits

1. Introduction to HDL programming (includes different modeling styles and programming structure)

2. Programming of basic gates (AND, OR, NAND, NOR, XOR, XNOR) with HDL

3. Design of half adder, half subtractor, full adder and full subtractor

4. 8-bit Adder (Parallel Adder), Subtraction (Parallel Subtractor/ 1's complement/ 2's complement technique)

5. Multiplication (Array based design/ Radix-2 Booth's algorithm/ Karatsuba technique), Division (Restoring/ Non-Restoring algorithm)

6. Design of flipflops (D, T and JK)

7. 8-bit Register design (with left and right shift feature)

8. 8 bit RAM design with opcode fetching and data fetching

9. 8-bit simple ALU design

10. 8-bit simple CPU design

Course Outcome:

Computer Organization and Architecture Lab (EC793B)	CO Serial Number	CO Statements
	EC793B.1	The students will be able to design different digital circuits using HDL.
	EC793B.2	The students will be able to design different sub-systems of the computer using HDL.
	EC793B.3	The students will be able to design simple as well as complex CPU architecture.

Mapping between C.O. and P.O.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-703B.1	M	H	M	M	H	L						H
CO-703B.2	M	H	H	M	H	L						H
CO-703B.3	M	M	M	H	H	L						H

DATABASE MANAGEMENT SYSTEM LAB
EC 793C
Contact:
3P
Credits: 2

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

- Structured Query Language

1. Creating
   Database
   Creating a
   Database
   Creating a Table Specifying Relational Data Types
   Specifying Constraints Creating Indexes
2. Table and Record
   Handling INSERT
   statement
   Using SELECT and INSERT together
   DELETE, UPDATE, TRUNCATE
   statements DROP, ALTER statements
3. Retrieving Data from a
   Database The SELECT
   statement
   Using the WHERE clause
   Using Logical Operators in the WHERE clause
   Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using
   Aggregate Functions
   Combining Tables Using
   JOINS Sub-queries
4. Database
   Management
   Creating Views
   Creating Column Aliases
   Creating Database Users
   Using GRANT and
   REVOKE

- PL/SQL
- Database design using E-R model and Normalization
- Design and implementation of some on line system [Library Management System]

Text Book:

1) SQL, PL/SQL by Ivan Bayross, BPB Publications
2) Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

Course Outcome(s)

On completion of the course students will be able to

1. Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.
2. Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.
3. Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.
4. Analyze database system concepts and apply normalization to the database.
5. Apply and create different transaction processing and concurrency control applications.

CO/PO Mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS(EE)795D.1	2	2	2	2	3	2	1	1	2	2	3	3	2	2	1
CS(EE)795D.2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CS(EE)795D.3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CS(EE)795D.4	3	3	2	2	2	1	1	1	1	1	2	3	2	1	3
CS(EE)795D.5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2
CS(EE)795D (average)	3	3	2	3	3	2	1	1	2	2	3	3	2	2	2

3=HIGH, 2= MEDIUM, 1=LOW

Course: VLSI Design

Course code: CS801D

Contracts: 3L

Credits- 3

Total: 36L

Module	Content	Lecture hour
I	Introduction to VLSI Design: VLSI Design Flow, 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, Structural, Physical), Y-Chart, Digital VLSI Design Steps.	6L
II	Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photolithography - Positive & Negative photo-resist Basic CMOS Technology - (Steps in fabricating CMOS), CMOS inverter, Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator	8L
III	**VLSI CIRCUIT DESIGN PROCESSES:** Simple Combinational Gates - NAND gate and NOR Gate using CMOS , MOS Layers, Layout Design Rule (Stick diagram with examples, Layout rules), Design Rules and Layout, 2 m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams	8L

	for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.	
IV	**COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN USING HARDWARE DESCRIPTION LANGUAGE:** Logic gates, Adders, Subtractor, Mux, Decoder, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Subsystem Design, Flip-flops, Shifters, Counters, High Density Memory Elements	14L

TEXTBOOKS :

1. CMOS Digital Integrated Circuits: Sung-Mo Kang, Yusuf Leblebici, Mcgraw Hill Education
2. VLSI Design – Debaprasad Das, Oxford University Press
3. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

REFERENCES :

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.
6. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.

Stream: ECE

Subject Name: Advanced Communication

systems Subject Code: EC801

Contact hour: 2L-2T

Total contact hour- 45

Credits: 3
Prerequisite: Analog Communication and Digital Communication, Probability & Statistics

Course Objective:

To present the fundamentals of modern communication system aspects like Mobile communication, Satellite communication, AdHoc networks, the technology applied , modulation techniques and their performance analysis. Emphasis is placed on physical layer aspects of a communication system and their performance over the channel effected by fading and noise.

Wireless Communication:

Module-I
Probability Theory:
Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels. Statistical Modelling of Signal & Noise.

Module-II

Cellular Systems and Infrastructure-based Wireless Networks: Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Similarities and differences between wireless and wired communication systems and application Cellular architecture design, Frequency reuse, Dynamic resource allocation, Area spectral efficiency, Interference model, Power control impact on interference, Mobile Ad Hoc Networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks, Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand)

Module-III
Spread spectrum communication:

Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SS systems.

Module-IV
PHY Layer Issues in Wireless Communication: Path-loss and Shadowing: Radio wave propagation, Transmit and receive signal models, Free-space path loss, Ray tracing, Simplified and empirical path loss model, Shadow fading. Combined path loss

and shadowing, Outage probability under path loss and shadowing.

Module-V

Statistical Multi-path Channels:
Time-varying channel impulse response, Narrowband fading models, Wideband fading models, Discrete-time model, Spatio-temporal models.

Module-VI

Performance of Digital Modulation over Wireless Channels:
AWGN channels: Error probability for BPSK, QPSK, MPSK, MPAM, MQAM, FSK, CPFSK, Doppler spread, Inter-symbol interference.

Module-VII
Multi-Carrier Modulation and Spread-Spectrum:
OFDM, Discrete implementation of OFDM, Spread spectrum modulation, Pseudorandom (PN) sequences (Spreading codes), Direct sequence spread spectrum, RAKE receivers, Frequency-hopping.

Module-VIII : Satellite communication:
Satellite orbits, Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geostationary and non geostationary orbits Look angle determination Limits of visibility, eclipse sub-satellite point - sun transit outage.

Module-IX :
Space segment and satellite link design. Spacecraft Technology-Structure, Primary Power, Attitude And Orbit Control, Thermal Control And Propulsion, Communication Payload And Supporting Subsystems, Telemetry, Tracking And Command. Satellite Uplink And Downlink Analysis And Design, Link Budget, E/N Calculation- Performance Impairments-System Noise, Inter Modulation And Interference, Propagation Characteristics And Frequency Considerations- System Reliability And Design Lifetime.

Course outcome:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
8th	Digital Communication systems (EC801)	CO.EC801.1	Apply the knowledge of probability and statistical calculations to analyse the performance of a digital communication system.
		CO.EC801.2	Develop insight on the various spread spectrum techniques and their application.
		CO.EC801.3	Evaluate the various physical layer issues in the mobile and wireless communication systems
		CO.EC801.4	Understand the concepts of satellite communication systems

		CO.EC801.5	Analyse and design the satellite uplink and downlink and link budget

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
8th	**Advanced Communication systems (EC801)**	CO.EC801.1	H	H	H		L	L			M			H
		CO.EC801.2	H	H	H	H	H	L	M			L	M	H
		CO.EC801.3	H	H	H	H	M	M			L			H
		CO.EC801.4	H	H	H	M	H	L	M			M	M	H
		CO.EC801.5	H	H	H	H	H	M						H

Text books:

1. K. Pahalvan and P. Krishnamurthy, "Principles of Wireless Networks: A Unified Approach", Pearson Education.
2. W. Stallings, "Wireless Communications and Networking", Pearson Education.
3. A. Goldsmith, Wireless Communications, Cambridge University Press.
4. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2006.
5. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
6. Upena Dalal, "Wireless Communication and Networks", Oxford.
7. S. Haykin and M. Moher, "Modern Wireless Communication", Pearson Education.
8. T Pratt, "Satellite Communication " ,John Wiley and Sons
9. T T Ha, "Dgtal Satellte Commncaton", Tata McGraw-Hill Education-2009.

Paper Name: Economics for Engineers Paper Code: HU801

Credit: 2
Contact Hours: 36

Pre-requisites: MATH – College Algebra, Pre-Calculus Algebra and Trigonometry.

Course Objective: This course emphasizes the strong correlation between engineering design and manufacturing of products/systems and the economic issues they involve.

Course Outcome:

1. Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.
2. Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.
3. Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems.
4. Evaluate the profit of a firm, carry out the break even analysis and employ this tool to make production decision.
5. Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

Course Content:

MODULE I Introduction[4L]

Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis.

MODULE II Demand and Supply Analysis[7 L]

Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function- Supply Elasticity.

MODULE III Cost Analysis [7L]

Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – PV ratio,

MODULE IV Elementary economic Analysis [8 L]

Inflation-Meaning of inflation, types, causes, measures to control inflation. National Income-Definition, Concepts of national income, Method of measuring national income.

MODULEV: Financial Accounting [5 L]

Concepts and Definition of Accounting,Journal,Ledger,Trial Balance. TradingA/C,Profit & Loss A/C and Balance Sheet.

MODULE VI : Investment Decision[5L]

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Text Books:

1. Riggs, Bedworth and Randhwa, “Engineering Economics”, McGraw Hill Education India
2. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.

Reference Books:

1. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
2. R.Paneer Seelvan, “ Engineering Economics”, PHI
3. Ahuja,H.L., “Principles of Micro Economics” , S.Chand & Company Ltd
4. Jhingan,M.L., “Macro Economic Theory”
5. Macro Economics by S.P.Gupta, TMH
6. Haniff and Mukherjee,Modern Accounting,Vol-1,TMG
7. Modern Economic Theory – K.K. Dewett (S.Chand)

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU402.1											2	
HU402.2				3								
HU402.3											3	
HU402.4									3			
HU402.5											1	

Paper Name: ADVANCED SEMICONDUCTOR DEVICES

Paper Code: EC 802A

Total Contact Hours:

Credit:

Prerequisite: EC 301 Solid State Devices ,Physics of semiconductors and properties of SiGe and Group III-V compound semiconductors.

Course Objective:

Students should be able to:

• Distinguish the basic physics underlying the operation of various device architectures

• Critique chief technical challenges and critical materials issues for modern devices

• Examine the state of the art of modern semiconductor device technology

• Use engineering tools to predict the incorporation of candidate materials and the specific properties required for electronic devices

Course Outcome:

After successful completion of this course, students should be able to:

CO1 To understand all the aspects of operation and design for modern semiconductor devices, highlighting traditional, nanoscale and excitonic/organic device physics

CO2 To analyze the semiconductor physics and the development of devices, with an interest in how they have changed to accommodate novel materials: organic semiconductors, graphene and layered materials, and quantum dots..

CO3 To expand their understanding of fundamental principles of modern electronic devices, while gaining exposure to cutting edge technology.

CO4 To gain updated knowledge in the most advanced development of low dimensional semiconductor heterostructures and their applications.

Course contents:

MODULE I

Advanced HBT Devices: SiGe, GaAs, InP, GaN

MODULE II

Advanced Field Effect Devices: Heterostructure Field Effect Transistors (HFETs), Modulation Doped Field Effect Transistors (MODFETs), High Electron Mobility Transistors (HEMTs)- Structure and Principle of Operation; Resonant Tunneling Devices (RTDs)

MODULE III

Emerging semiconductor devices: Single Electron Transistors (SETs),TFT(Thin Film Transistors); Strained layer super lattices and quantum well devices ; Photo Diodes ,LED, Semiconductor Laser; Fin Field-effect transistor (**FinFET**)- Structure and Principle of Operation

MODULE IV

Applications and Device Simulation: RF and digital applications; Noise Characteristics; HBT Modelling; Heterojunction device simulation

Reference books:

(1) S. M. Sze and Kwok K. Ng, “Physics of Semiconductor Physics (3rd)”, Wiley, 2007

(2) Supriyo Datta, “Quantum Transport Atom to Transistor”, Cambridge University Press, 2005

CO-PO Mapping

Course Outcome	**Programme Outcome**											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**
CO1	X	X							X		X	
CO2		X			X			X	X		X	X
CO3	X		X		X	X		X	X			X
CO4			X		X	X		X	X		X	X

Electromagnetic Interference and Compatibility(EMI/EMC)

EC 802B

Contacts: 3L Credits: 3 Total: 30

Pre-requisites: Electrical and Electronic Circuits, Time varying Electromagnetic Fields, Electrostatics, Antennas and Propagation

Course Objectives:

1. Introduction to the concepts of undesired signal coupling through circuit parasitic and radiation of electromagnetic waves.
2. Estimation of EMI level and frequencies and remedial measures.
3. EMC design guidance to meet International Standards.

Module I Introduction [6]

Concept of EMI phenomena, sources of EMI, victims of EMI; Intra-system and inter-system EMI and examples; Conducted and radiated EMI Emission and Susceptibility and examples; Transients EMI-Surge, EFTand ESD phenomena and examples; Concept of EMC and examples.

Module II EMC Standards [4]

International EMC Stadards, Civilian Standards -CISPR,FCC,IEC, EN for CE and CS, Military Standards brief, Indian Standards.

Module III Conducted EMI Coupling and Mitigation [10]

Common mode and Differential mode EMI Couplings; Common impedance coupling ; EMC by Design-Component selection, Filtering, Bonding, Grounding, Isolation Transformers; PCB Design for EMC.

Module IV Radiated EMI Coupling and Mitigation [10]

Cross-talk Interference; Radiated Coupling, Ground loop; EMC by Design- Shielding E field and H field, Shielding effectiveness.

Books

1. V. P. Kodali, *Engineering Electromagnetic Compatibility*", IEEE Publication, S. Chand & Co. Ltd., New Delhi, 2000.

2. C. R. Paul, *Introduction to Electromagnetic Compatibility*. John Wiley & Sons, Inc., 1992.

3. Henry W. Ott, *Electromagnetic Compatibility Engineering,* John Wiley & Sons, Inc., *2009*

Course Outcome (CO): EC802B

CO1. Understanding EMC problems .

CO2. Awareness of International EMC Standards for equipment design.

CO3, Analyze Conducted EMI Coupling and Designing electronic systems for EMC CO4. Analyze Radiated EMI Coupling and Design for EMC

CO-PO mapping:EC802B

PO	a	b	c	d	e	f	g	h	i	j	k	l
CO												

Stream: ECE

Paper Name: MOBILE COMMUNICATION AND NETWORK

Paper Code: EC 802C **Contacts: 3L** **Credits: 3** **Total Contact: 36**

Semester: 8th

Course Objectives:

- To understand the basic principles of mobile communication systems.
- To familiarize the students with concepts of the basic principles of modern mobile and wireless communication systems.
- To understand the operation of mobile communications systems and their generation divisions.

Module I: INTRODUCTION - Evolution of mobile radio communications, mobile radio systems around the world, trends in cellular radio and personal communication, first generation (1G), second generation (2G), third generation (3G) mobile cellular networks.–[2L]

Module II: CELLULAR CONCEPT – Limitations of conventional mobile system, Introduction to mobile cellular communication, concept of frequency reuse, cluster size, cellular system architecture, channel assignment strategies, call handoff strategies - hard handoff and soft handoff, prioritizing handoff; interference and system capacity, improving capacity in cellular systems – cell splitting, sectoring, microcell zone concept, Co-channel interference, Propagation effects - scattering, ground reflection, fading – [10L]

Module III: DIFFERENT MOBILE COMMUNICATION SYSTEMS – GSM services and features, system architecture, GSM radio subsystem, GSM channel types, location updating and call setup, WAP, SCSD, GPRS, EDGE, 3G W-CDMA; CDMA digital cellular standard, comparison between GSM and CDMA, 3G cdma2000, IMT-2000, [8L]

Module IV: WIRELESS NETWORKS – Advantages and applications of Wireless LAN, WLAN technology – RF and IR wireless LAN, diffuse, quasi-diffuse and point-to point IR wireless LAN, IEEE802.11, IEEE802.11 architecture, Introduction to WI-FI, HIPERLAN2, Bluetooth – Bluetooth architecture. –[8L]

Module V: MOBILE NETWORK-– Introduction to Mobile IP, requirements, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimization, Reverse tunneling; Mobile ad-hoc networks – Routing, Destination sequence distance vector, Dynamic source routing and Alternative metrics, Future of mobile communication – 3G to 4G. 4G Introduction and vision, Multi antenna Technologies: MIMO; software defined radio, adaptive multiple antenna techniques, radio resource management, QOS requirements – [8L]

Course Outcome

EC802C

MOBILE COMMUNICATION AND NETWORK

EC802C.1	Describe the evolution and History of Wireless Technology.
EC802C.2	Explain cellular concept for mobile communication.
EC802C.3	Learn radio signal propagation issues and different technological advancement of mobile communication.
EC802C.4	Define Wireless and Radio channels.
EC802C.5	Compare 3G Cellular telephone data transfer rates with those over Wireless LAN and core networks associated with 3G Cellular networks.
EC802C.6	Describe mobile IP allocation and function of the station roaming.

Mapping of POs with COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EC802C.1	3	2	-	-	1	3	2	2	2	3	2	1
EC802C.2	2	-	2	-	3	2	2	2	3	2	3	2
EC802C.3	2	-	3	3	3	2	1	2	3	1	3	1
EC802C.4	2	2	1	-	2	3	2	2	3	2	3	-
EC802C.5	2	-	3	3	3	2	2	2	3	1	3	1
EC802C.1	2	-	2	3	3	2	2	2	3	2	3	2

Text & Reference Books:

1. Theodore S. Rappaport, Wireless communications: principles and practice, PHI / Pearson education.
2. J. Schiller, Mobile communications, Addison-Wesley.
3. William C. Y. Lee, Mobile cellular telecommunication – analog and digital systems, McGraw Hill, 2nd ed.
4. Wang, Wireless communication System, Pearson Education
5. Talukdar, Mobile computing, TMH
6. J.W.Mark, W. Zhuang, Wireless Communication and Networking, PHI
7. A. Santamaria et al, Wireless LAN systems, Artech House.
8. Stallings, Wireless Communication & Networks, Pearson Education.

<u>**FOR AEIE**</u>

Course: VLSI & Microelectronics

Course code: EC(EI)802B

Contracts: 3L

Credits- 3 Total:

34L

Module	Content	Lecture hour
I	**Introduction to VLSI Design:** 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, Structural, Physical), Y-Chart, Digital VLSI Design Steps.	8L
II	**MOS structure:** E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flatband voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect. Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation). Scaling in	10L

	MOSFET, General scaling, Constant Voltage & Field scaling.] CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.	
III	**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.	10L
IV	**Hardware Description Language:** VHDL or Verilog Combinational & Sequential Logic circuit Design.	6L

TEXTBOOKS :

1. CMOS Digital Integrated Circuits: Sung-Mo Kang, Yusuf Leblebici, Mcgraw Hill Education
2. VLSI Design – Debaprasad Das, Oxford University Press
3. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

REFERENCES :

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson

Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.
6. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.

STREAM : **ECE**
SUBJECT NAME : **SOFTWARE ENGINEERING**
SUBJECT CODE : **EC803A**
YEAR : **Fourth**
SEMESTER : **8th Semester**
CONTACT HOURS : **3L + 1T**
CREDITS : **4**

Module I
Introduction: Definition of SE, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs SE, Human cognition mechanism, SE principle- abstraction and decomposition.
3

L

Module II
Software life-cycle models: Water fall model, V Model, Prototyping Model, Spiral Model, RAD Agile Model
4L

Module III
Software Project Management: Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning.
10

L

Module IV
Requirement analysis and specification: SRS, Requirement gathering and specification, Functional requirement, Traceability, 4GL. **4L**

Module V
Software Design: Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Object oriented design- class and relationship, Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements
7L

Module VI
Coding and Testing: Coding Standard, software documentation, Testing- unit testing, black box testing- equivalence class partitioning, boundary value analysis, white box testing- McCabe's Cyclomatic Complexity, Mutation Testing, Debugging, Program analysis tool, Integration Testing, Grey box testing, System testing- Smoke and performance testing.
10L

Module VII
Software Reliability and Quality Management: Reliability, Hazard, MTTF, Repair and Availability, Software quality, SEI CMM and ISO-9001. Software reliability and fault-tolerance, Six sigma **5L**

Module VIII
Computer-aided software engineering (CASE)-environment and benefit, Function point methods (FSM, ISO, OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 9001
4

L

Text Books: (Atleast 2-3 Books)

1. Rajib Mall: Software Engineering, PHI
2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition.

Reference Books: (Atleast 3 Books)

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

Course outcome:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes
			On completion of the course students will be able to
8th	Software Engineering (EC804A)	CO.EC804A.1	Understand the structure and behavior a software system the UML class diagrams and state diagrams.
		CO.EC804A.2	Understand common lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches.
		CO.EC804A.3	Apply software testing and quality assurance techniques at the module level, and understand these techniques at the system and organization level.
		CO.EC804A.4	Work collaboratively in a small team environment to develop a moderate-sized software system from conceptualization to completion, including requirements elicitation, system modeling, system design, implementation, unit and system testing, integration, source code management configuration management, and release management
		CO.EC804A.5	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery).
		CO.EC804A.6	Design a solution to a given problem using one or more design patterns and implement the design in a programming language.

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
8th	Software Engineering (EC804A)	CO.EC804A.1	H	H	H		L	L						H
		CO.EC804A.2	H	H		H			M		L	M	M	H
		CO.EC804A.3	H	H	M	H	H	M				H	H	H
		CO.EC804A.4	H	H	L	M					M		M	H
		CO.EC804A.5	H	H		L	M		L			L	H	H
		CO.EC804A.6	H	H	H		M	M						H

Physical Design, Verification &

Testing EC 803B

Contacts: 3L Credits: 3 Total: 30

Pre-requisites: Digital Design**,**

Algorithm

Course Objective: This course covers introduction to the concepts and techniques of VLSI (Very Large Scale Integration) design verification and testing. Details of test economy, fault modeling and simulation, defects, Automatic Test Pattern Generation (ATPG), design for testability, and built-in self-test (BIST) also covered.

Module

I

Design:

Introduction: Introduction to Digital VLSI Design Flow Specification, High level Synthesis, RTL Design,
Logic Optimization, Verification and Test Planning, Design Representation, Hardware Specific Transformations [2]

Problem Specification: Scheduling, Allocation and Binding, Basic Scheduling Algorithms (Time constrained and Resource Constrained) [2]

Allocation Steps: Unit Selection, Functional Unit Binding, Storage Binding, Interconnect Binding [2]

Allocation Techniques: Clique Partitioning, Left-Edge Algorithm, Iterative Refinement. Heuristic Minimization of Two-Level Circuits: Espresso, Finite State Machine Synthesis, Multi-Level Logic Synthesis, Multi-Level Minimization, Technology Mapping [4]

Module II

Verificatio

n:

Introduction: Why verify? What is a test bench? [1]

What is being verified: Formal verification, equivalence checking, model checking, and functional verification, different approaches to verification, black box, white box, grey box, design verification and reuse. [2]

Verification tools: Linting tools, simulators, verification intellectual propety (VIP) – art of making VIP, waveform viewers, code & functional coverages. [2]

Languages: Outline of e and Vera, temporal models & assertions, Linear Time Temporal Logic (LTL), Computation Tree Logic (CTL), assertion. [2]

Verification plan: Role of verification plan, levels of verification, dircted testbench approach, coverage-based random-based approach (CDV), generators, monitors & checkers. Verification practices & architecture: overview of reference verification methodology (RVM) & verification methodology manual (VMM). [3]

Module

III

Testing:

Introduction: Why test? Difference between testing & verification.

Physical faults & their modelling: Fault equivalence, dominance & collapsing. [1]

Design for testability, Scan design, Test interface and boundary scan. System testing and test for SOCs. Delay fault testing. [2]

Test pattern generation for combinational circuits: Boolean difference, D-algorithm, Podem, etc, exhaustive, random, weighted test pattern generation, aliasing and its effects on fault coverage. [2]

Test pattern generation for sequential circuits: ad-hoc and structures techniques scan path and LSSD, boundary scan. [2]

Built-in self test techniques: Introduction to BIST architecture
BIST Test Pattern Generation, Response Compaction and Response
Analysis, Memory BIST
March Test, BIST with MISR, Neighborhood Pattern Sensitive Fault Test, Transparent Memory BIST [3]

Books:

1. 1. D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, High-Level Synthesis: Introduction to Chip and System Design, Springer, 1st edition, 1992.
2. 2. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall, 2nd edition, 2003.
3. 3. G. De Micheli. Synthesis and optimization of digital circuits, 1st edition, 4. 1994.
5. 4. M. Huth and M. Ryan, Logic in Computer Science modeling and reasoning about systems, Cambridge University Press, 2nd Edition, 2004.
6. 5. Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000.

Course Outcome (CO):

1. Able to Design, Verification and Test a VLSI circuit pertaining to these three phases.
2. Aims to cover the important problems/algorithms/tools so that students get a comprehensive idea of the whole digital VLSI design flow.
3. able to understand High level Synthesis, Verilog RTL Design, Combinational and Sequential Synthesis Logic Synthesis (for large circuits) through VLSI Design.
4. Able to analyze Hardware Verification and methodologies, Binary Decision Diagrams (BDDs) and algorithms over BDDs through Verification Techniques.
5. Able to check Combinational equivalence checking, Temporal Logics, Modelling sequential systems and model checking, Symbolic model checking through Verification Techniques.
6. Able to locate Fault models, Fault Simulation, Test generation for combinational circuits, Test generation algorithms for sequential circuits and Built in Self test through VLSI Testing.

CO-PO mapping:

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC 804 B	✓	✓	✓	✓	✓				✓			

STREAM	:	**ECE**
SUBJECT NAME	:	**Soft Computing**
SUBJECT CODE	:	**EC 803C**
YEAR	:	**FOURTH**
SEMESTER	:	**8th Semester**
CONTACT HOURS	:	**3L + 1T**
TOTAL LECTURE	:	**38**

Module I : Introduction to soft computing, neural network , Genetic Algorithm, fuzzy logic [2L]

Module II : Introduction to Neural Networks [14L]

Biological Neurons and Artificial neural network; model of neuron-activation function

Learning methods: Supervised ,Unsupervised,Reinforcement learning, - Error Correction learning, Hebbian learning, Competitive learning networks, gradient descent learning, Regression, Active and Passive machine learning

Neural Network models: McCulloch-Pitts model, Feed forward & Feedback network,Perceptron, Adaline and Madaline networks; single layer network, multi layer networks. Back-propagation Network, Radial Basis function networks Logical AND, OR. Nonlinear separability: XOR problem, solving XOR Applications of Neural Networks: Pattern Recognition and classification

Module III : Fuzzy Logic [10L]

Fuzzy membership functions,Operations on Fuzzy sets , Fuzzy relations,Fuzzy proposition,Fuzzy implications, Fuzzy Rule based Systems,Fuzzy inference system, Defuzzyfication Techniques

Applications of Fuzzy Logic: Application of Fuzzy logic in Home Appliances, General Fuzzy Logic controllers

Module IV : Genetic Algorithms: [10L]

Biological background, Encoding: Binary, Simple GA, Roulette wheel and Tournament selection, elitism, crossover and mutation

Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition

Module V : Other Soft Computing Techniques: [2L]

Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

Text Books:

1) S. N. Sivanandam, S.N. Deepa: Principles of Soft Computing ,Wiley India
2) Simon Heykin : Neural Networks – A Comprehensive Foundation (2nd Edition),PHI
3) Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
4) Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.

Reference Books:

1) Samir Roy,Udit Chakraborty:Soft Computing (Pearson)
2) S. Rajsekaran, G.A. Vijaylakshmi Pai: Neural Networks, Fuzzy Logic and Genetic Algorithm
3) Amit Konar: Artificial Intelligence and Soft Computing (CRC Press, Indian Edition Available)
4) J.S. Jang, C.T. Sun, E. Mizutani: Neuro-Fuzzy and Soft Computing (PHI)
5) Satish Kumar: Neural Networks – A Classroom Approach (Mc Graw Hill Ed.)
6) Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall

Stream: ECE

Subject Name: Advanced Communication

Lab Subject Code: EC891

Contact hour: 3P

EC891 **Advanced Communication Lab**

Prerequisites: knowledge of fundamentals of Wireless and Mobile communication system

Course Objective:

To provide the basic skills required to understand, develop, and design various engineering applications involving a wireless communication system. To provide basic laboratory and software based development exposure to satellite communication principles, Mobile Communication systems and applications.

List of Experiments:

1. Studies on GSM: Understanding of GSM Technology Signal like its network, network commands: Modem Commands, Simcard hardware commands, Network registration commands, Phone book commands, Message handling commands.

2. Satellite Communication: To set up passive satellite communication link, and use different combinations of Uplink and Downlink frequencies to check the communication link

3. To set up passive satellite communication link to transmit and receive various waveforms from a function generator through a satellite link

4. Setup an experiment to generate a digitally modulated QPSK signal and measure ts performance in a channel with AWGN noise.

5. Write a MATLAB code to study the QPSK performance subjected to Rayleigh fading and AWGN. Plot the SNR vs BER graph.

6. Write a MATLAB code or SIMULINK model to generate a digitally modulated 16 QAM signal and measure its performance in a channel with AWGN noise

7. Setting up a fiber optic Data link and study of TDM.

8. Study of different routing protocols.

9. Write a MATLAB code to perform simulation of large scale path loss

10. Write a MATLAB code to perform Simulation of small scale fading and multi-path (Any one model)

11. Simulation of DS spread spectrum transmitter and receiver

12. Simulation of channel equalizer for mobile channel

Course Outcome:

Sem. No.	Course Title (Code)	CO Codes	Course Outcomes On completion of the course students will be able to
8th	ADVANCED COMMUNICATION LAB (EC891)	CO.EC891.1	Analyze the concept of Mobile, wireless and satellite communication techniques and their applications.
		CO.EC891.2	Demonstrate practically the use of satellite communication, link setup and the frequencies used.
		CO.EC891.3	Evaluate practically the modulation and demodulation techniques applied in communication signals.
		CO.EC891.4	Analyze the performance of a communication system under the effect of noise and fading.
		CO.EC891.5	Evaluate the various routing algorithms applied in the ad hoc networks

CO-PO Mapping:

Sem. No.	Course Title (Code)	CO Codes	Program Outcomes (POs)											
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
8th	ADVANCED COMMUNICATION LAB (EC891)	CO.EC891.1	H	H	H		L	H	M	L	M	H		L
		CO.EC891.2	H	H	H	L	L	H	M	L	M		H	H
		CO.EC891.3	H	H	M	L	L	H	M		H		H	L
		CO.EC891.4	H	H	H	L	H	H	M	L	M	M		H
		CO.EC891.5	H	H	M	M	L	H	H	L	M		M	H