Electronics and Communication Engineering (ECE) Department

B.TECH. PROGRAMME

CURRICULUM

RELEASE DATE:

July, 2023

June, 2024

(Applicable from 2023 admitted batch)

Preamble

We, the members of the Electronics and Communication Engineering Department, dedicate ourselves to the advancement of knowledge and innovation in the fields of electronics and communication engineering. Guided by the principles of excellence, integrity, and collaboration, we strive to cultivate a dynamic learning environment where creativity thrives and boundaries are constantly challenged.

The curriculum for the B. Tech. in Electronics and Communication Engineering program has been modified as per the guidelines of AICTE and MAKAUT, and considering the new education policy (NEP) under Academic Regulation 2022 from the academic session 2023 - 2024. In addition, this outcome-based curriculum (OBC) is created with a choice-based credit system (CBCS), which enables students to develop professional competency through a multidisciplinary approach that satisfies the requirements of industry, academics and the different Accreditation bodies like NBA and NAAC. Courses such as Introduction to Machine Learning, Artificial Intelligence, Wireless Communication : 5G and beyond, Internet of Things, Design Thinking and Idea Lab etc. are included in the syllabus keeping in mind the industry demand, as well as the suggestions given by the NBA experts in the very recent visit. Basic mathematical courses like Algebraic structures, linear algebra, and optimization theory are included to strengthen students' mathematical skills that enables them to learn latest developments of computer science and be more innovative. Students are being motivated to select and study MOOC subjects of their choice towards attaining the degree with honors. Apart from this, the course code is now changed from 4 letters to 3 letters from the session 2023 – 2024 as per the suggestions came from the office of the controller of examinations. This will help to distinguish the new courses from the old ones. In accordance with this, the curriculum and syllabi are revised in a structured manner by implementing Feedback Mechanism on Curriculum from various stakeholders, including potential employers, alumni, and parents.

In pursuit of our vision, we embrace continuous learning and adaptation, remaining agile and responsive to the evolving needs of our students, our discipline, and society at large. Together, we aspire to be leaders in education, research, and innovation, shaping the future of electronics and cmmunication engineering and making a lasting impact on the world.

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Institutional Vision & Mission

VISION:

To prepare dynamic and caring citizens to meet the challenges of global society while retaining their traditional values.

MISSION:

- To prepare students with strong foundation in their disciplines and other areas of learning.
- To provide an environment for critical and innovative thinking, and to encourage life-long learning.
- To develop entrepreneurial and professional skills.
- To promote research and developmental activities and interaction with industry.
- To inculcate leadership qualities for serving the society.

Departmental Vision & Mission

VISION

To produce graduates with firm foundation in electronics and Communication engineering, who will cater to the dynamic needs of the industry and who will provide a stimulating environment for higher education and quality research. They will be sensitive to the needs of the country and society and will prove themselves to be caring citizens.

MISSION

- To harmonize the teaching-learning process and also to provide basic foundation to the students of the department so that they can adapt to the changing market needs in electronics and communication domains.
- To empower the students to enrich themselves with the state-of-the-art developments through seminars, workshops, participation in technical competitions, interaction with industry experts and paper presentations in conferences.
- To enhance collaborative activities with academic institutions and industries for evolving indigenous technological solutions that address societal and dynamic market needs in the Electronics and Communication domains and interdisciplinary areas.
- To create research oriented mindset to help solve myriad challenges of the future which will come before society and nation.
- To help the students to develop leadership qualities, and mentoring qualities. It will ensure that they will be well-rounded and complete individuals.

Credit Summary for B Tech Programmesin ECE with effect from 2023-2024

Sl. No.	Course Type	ECE
1.	Humanities and Social Sciences including Management Courses	12
2.	Basic Science Courses	22
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	24
4.	Program Core Courses	62.5
5.	Program Elective Course Courses relevant to chosen Specialization / Branch	12
6.	Open Subjects – Electives from other Technical and/or Emerging Subjects	12
7.	Project Work, Seminar and Internship in industry or elsewhere	18.5
8.	Mandatory course Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	0
	Total	**163**
9	Honours Courses	20
	Grand Total	**183**

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

- ✓ A total of 163 credits will be necessary for a student to be eligible to get B Tech degree.
- ✓ A student will be eligible to get B Tech degree with Honours if he/she completes an additional 20 credits.
- ✓ These could be acquired through MOOCs.
- ✓ Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.
- ✓ For any additional information, the student may contact the concerned HODs.

Curriculum Structure

1st Year 1st Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Basic Science course	**CHM1001**	Chemistry I	3	0	0	3	3
2	Basic Science course	**MTH1101**	Mathematics I	3	1	0	4	4
3	Engineering Science course	**CSE1001**	Programming for Problem Solving	4	0	0	4	4
4	Engineering Science course	**ELE1001**	Basic Electrical Engineering.	3	1	0	4	4
5	Humanities and Social Sciences including Management courses	**HUM1001**	English for Technical Writing	2	0	0	2	2
			TOTAL	15	2	0	**17**	**17**

B. Practical								
1	Basic Science Course	**CHM1051**	Chemistry I Laboratory	0	0	2	2	1
2	Engineering Science course	**CSE1051**	Programming for Problem Solving Laboratory	0	0	3	3	1.5
3	Engineering Science course	**ELE1051**	Basic Electrical Engineering Laboratory	0	0	2	2	1
4	Humanities and Social Sciences including Management courses	**HUM1051**	English for Technical Writing Laboratory	0	0	2	2	1
Total Practical				0	0	9	**9**	**4.5**
Total of Semester				15	2	9	**26**	**21.5**

1st Year 2ndSemester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Basic Science course	**PHY1001**	Physics I	3	0	0	3	3
2	Basic Science course	**MTH1201**	Mathematics II	3	1	0	4	4
3	Program Core Course	**ECE1001**	Introduction to Electronic Devices and Circuits	3	0	0	3	3
4	Humanities and Social Sciences including Management courses	**HUM1002**	Universal Human Values and Professional Ethics	2	1	0	3	3
Total Theory				11	2	0	13	**13**

B. Practical								
1	Basic Science course	**PHY1051**	PhysicsI Laboratory	0	0	2	2	1
2	Program Core Course	**ECE1051**	Introduction to Electronic Devices and Circuits Laboratory	0	0	2	2	1
3	Engineering Science course	**MEC1051**	Workshop/ Manufacturing Practices	1	0	3	4	2.5
4	Engineering Science course	**MEC1052**	Engineering Graphics & Design	1	0	3	4	2.5
Total Practical				2	0	10	**12**	**7**
Total of Semester				13	2	10	**25**	**20**

2nd Year 1st Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Program Core Course	**ECE2101**	Analog Circuits	3	0	0	3	3
2	Program Core Course	**ECE2102**	Digital Systems Design	3	0	0	3	3
3	Program Core Course	**ECE2103**	Signals and Systems	3	0	0	3	3
4	Program Core Course	**ECE2104**	Network Theory	3	0	0	3	3
5	Basic Science course	**MTH2101**	Introduction to Complex and Fourier Analysis	2	0	0	2	2
6	Engineering Science course	**CSE2004**	Data Structure and Basic Algorithms	3	0	0	3	3
Total Theory				17	0	0	**17**	**17**

B. Practical								
1	Program Core Course	**ECE2151**	Analog Circuits Laboratory	0	0	2	2	1
2	Program Core Course	**ECE2152**	Digital Systems Design Laboratory	0	0	2	2	1
3	Program Core Course	**ECE2156**	Signals and Networks Laboratory	0	0	2	2	1
4	Engineering Science course	**CSE2054**	Data Structure and Basic Algorithms Laboratory	0	0	2	2	1
Total Practical				0	0	8	**8**	**4**

C. Sessional								
1	Project	**ECE2196**	Micro Project: Design Thinking & Idea Lab (ECE)	0	0	2	2	1
Total Sessional				0	0	2	**2**	**1**
Total of Semester				**17**	**0**	**10**	**27**	**22**

2nd Year 2nd Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Program Core Course	**ECE2201**	Introduction to Analog& Digital Communication	3	0	0	3	3
2	Program Core Course	**ECE2202**	Control Systems	3	0	0	3	3
3	Program Core Course	**ECE2203**	EM Theory & Transmission Lines	3	0	0	3	3
4	Program Core Course	**ECE2204**	Digital Signal Processing	3	0	0	3	3
5	Program Core Course	**ECE2205**	Electronic Devices	3	0	0	3	3
6	Basic Science Course	**MTH2202**	Advanced Numerical Methods	3	0	0	3	3
Total Theory				18	0	0	**18**	**18**

B. Practical								
1	Program Core Course	**ECE2251**	Introduction to Analog & Digital Communication Laboratory	0	0	2	2	1
2	Program Core Course	**ECE2252**	Control Systems Laboratory	0	0	2	2	1
3	Program Core Course	**ECE2253**	EM Theory & Transmission Lines Laboratory	0	0	2	2	1
4	Program Core Courses	**ECE2254**	Digital Signal Processing Laboratory	0	0	2	2	1
5	Basic Science courses	**MTH2252**	Advanced Numerical Methods Laboratory	0	0	2	2	1
Total Practical				0	0	10	**10**	**5**

C. Mandatory course Course(non-credit)								
1	Mandatory Course	**EVS2016**	Environmental Sciences	2	0	0	2	0
Total of Semester				**20**	**0**	**10**	**30**	**23**

3rdYear1stSemester

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Program Core Course	**ECE3101**	Mobile Communication and Networks	3	0	0	3	3
2	Program Core Course	**ECE3102**	Microwave Engineering	3	0	0	3	3
3	Program Core Course	**ECE3103**	Processor Fundamentals and Microcontrollers	3	0	0	3	3
4	Program Core Course	**ECE3104**	Microelectronic Devices and Analog VLSI design	3	0	0	3	3
5	Program Elective Course-1	**ECE3131**	Artificial Intelligence	3	0	0	3	3
		ECE3132	Computer Networks					
		ECE3133	Introduction to Optical Communication					
		ECE3134	Computer Organization					
6	Open Elective course- 1	**i)ECE3121**	i)Digital Image Processing & Pattern recognition	3	0	0	3	3
		ii) AEI3122	ii) Fundamentals of Sensors & Transducers					
		iii) CSE3121	iii) Fundamentals of OS					
		iv) MEC3123	iv) Total Quality Management (TQM)					
		v) MTH3122	v) Statistics and Information Theory					
Total Theory				18	0	0	**18**	**18**

B. Practical								
1	Program Core Course	**ECE3151**	Mobile Communication and Networks Laboratory	0	0	2	2	1
2	Program Core Course	**ECE3152**	Microwave Engineering Laboratory	0	0	2	2	1
3	Program Core Course	**ECE3153**	Processor Fundamentals and Microcontrollers Laboratory	0	0	2	2	1
4	Program Core Course	**ECE3154**	Microelectronic Devices and Analog VLSI design Laboratory	0	0	2	2	1
5	Program Core Course	**ECE3155**	Introduction to Machine Learning using Python Laboratory	1	0	3	4	2.5
Total Practical				1	0	11	**12**	**6.5**

C. Mandatory course Course(non-credit)								
1	Mandatory Course	**INC3016**	Indian Constitution and Civil Society	2	0	0	2	0
Total of Semester				**21**	**0**	**11**	**32**	**24.5**

Open Elective course - 1	**i)ECE3121** **ii) ECE3122** **iii) ECE3123** **iv) ECE3124**	i) Digital Image Processing & Pattern recognition ii)Introduction to Machine Learning iii) Error Control Coding for Secure Data Transmission iv) Introduction to VLSI Design

Open Elective course -1 (to be offered by ECE Department)

3rd Year 2nd Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Program Core Course	**ECE3201**	Digital VLSI Design	3	0	0	3	3
2	Engineering Science Course	**CSE3208**	Object Oriented Programming Concept using JAVA	3	0	0	3	3
3	Humanities and Social Sciences including Management courses	**HUM3201**	Economics for Engineers	3	0	0	3	3
4	Program Elective Course-2	**ECE3231**	Trends in Wireless Networks	3	0	0	3	3
		ECE3232	Information Theory and Coding					
		ECE3233	Fundamentals of Cognitive Radio& Network					
		ECE3234	Wireless Sensor Networks and security					
5	Program Elective Course-3	**ECE3241**	Internet of Things	3	0	0	3	3
		ECE3242	Wireless Communication: 5G and beyond					
		ECE3243	Intelligent Radio Design					
		ECE3244	Satellite Communication & Remote Sensing					
6	Open Elective course -2	**ECE3221**	Artificial Intelligence in Radio Communication	3	0	0	3	3
Total Theory				18	0	0	**18**	**18**

B. Practical								
1	Program Core Course	**ECE3251**	Digital VLSI Design Laboratory	0	0	2	2	1

2	Engineering Science Course	**CSE3258**	Object Oriented Programming Concept using JAVA Laboratory	0	0	3	3	1.5
3	Program Core Course	**ECE3253**	Embedded System Laboratory	1	0	2	3	2
Total Practical				1	0	7	**8**	**4.5**

C. Sessional								
1	Seminar	**ECE3293**	Seminar	0	0	4	4	2
2	Project	**ECE3294**	Mini Project: Fundamental System Design and Development Laboratory	0	0	3	3	1.5
3	Project	**ECE3295**	Project Stage – I	0	0	2	2	1
Total Sessional				0	0	9	**9**	**4.5**
Total of Semester				**19**	**0**	**16**	**35**	**27**

Open Elective course - 2	**i) ECE3221** **ii) ECE3222** **iii) ECE3223** **iv) ECE 3224**	i) Artificial Intelligence in Radio Communication ii) Designing with Processors and Controllers iii) Analog and Digital Communication iv) Optical Fiber Communication

Open Elective course -2 (to be offered by ECE Department)

4thYear 1stSemester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Program Elective Course-4	**i) ECE4131**	i) Introduction to MEMS	3	0	0	3	3
		ii)ECE4132	ii) Application of Green Energy					
		iii)ECE4133	iii) Network Security					
		iv)ECE4134	iv)Nanoelectronics & Nanophotonics					
		v) ECE4135	v) Electromagnetic Interference and Compatibility					
2	Open Elective course- 3	**i)ECE4121**	i) Principles of Radar	3	0	0	3	3
3	Open Elective course- 4	**i) BTC4124**	i) Biology for Engineers	3	0	0	3	3
		ii) BTC4126	ii) Bioenergy and other Non-conventional Energy					
		iii) ECE4125	iii) Bio sustainable solar energy					
		iv) ECE4126	iv) Introduction to RF Biosensor					
4	HU	**HUM4101**	Principles of Management	3	0	0	3	3
Total Theory				12	0	0	**12**	**12**

B. Sessional								
1	Industrial Training/ Internship	**ECE4191**	Industrial Training/Internship	-	-	-	-	2
2	Project	**ECE4195**	Project Stage – II	0	0	8	8	4
Total Sessional				0	0	8	**8**	**6**
Total of Semester				12	0	8	**20**	**18**

Open Elective course -3	i)**ECE4121** **ii)ECE4122** **iii) ECE4123** **iv) ECE4124**	i) Principles of Radar ii) Evolution of Mobile Communication: 1G to 5G iii) Introduction to Software Defined Radio iv) Ad Hoc Wireless Networks

Open Elective course3 (to be offered by ECE Department)

4thYear 2ndSemester:

A. Sessional								
1	Project Work	**ECE4295**	Project Work III& Dissertation	0	0	10	10	5
2	Viva Voce.	**ECE4297**	Comprehensive Viva Voce	-	-	-	-	2
Total Sessional				0	0	10	**10**	**7**
Total of Semester				0	0	10	**10**	**7**

1ST YEAR 1ST SEMESTER

Course Title : Chemistry I					
Course Code :CHM1001					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course outcomes:

The subject code CHM-1001 corresponds to Chemistry Theory classes (Chemistry-1) for the first year B. Tech students, offered as Chemistry for Engineering and is common to all Branches of Engineering Disciplines. The course provides basic knowledge of theory and applications in the subjects like Thermodynamics, Quantum mechanics, Electrochemistry, & Energy conversion, Structure and reactivity of molecules. Spectroscopic techniques and their applications, Synthesis & use of Drug molecules. The Course Outcome for the subject code CHM1001, is furnished below:

CHM1001.1. Knowledge acquisition of bulk properties of materials and understanding of reaction processes using thermodynamic considerations.

CHM1001.2.Conception of energy conversion and its importance in clean energy scenario, the operating principles for batteries, fuel cells and the materials and reactions involved there in, their applications as sustainable energy devices, particularly in automobiles sectors to reduce environmental pollution.

CHM1001.3. Analytic view of microscopic chemistry in terms of atomic structure, molecular orbital and intermolecular forces to reinforce strong background on materials science and engineering.

CHM1001.4. Rationalize periodic trends of elements to explain various physico - chemical properties.

CHM1001.5. Understanding of the spectrum of electromagnetic radiation used for exciting different molecular energy levels in various spectroscopic techniques.

CHM1001.6. Knowledge of stereochemistry and conception of the mechanism of major chemical reactions involved in synthesis of drug molecules.

MODULE 1

Thermodynamics

The 1st and 2nd laws of thermodynamics and thermodynamic functions like free energy, work function and entropy; Carnot cycle, Joule-Thomson effect, Gibbs-Helmholtz equation; Chemical Potential, Gibbs- Duhem Equation and Clausius-Clapeyron Equation. 5L

Electrochemical Cell

Generation of electromotive force in electrochemical cells and application of Nernst equation; Electrode potentials and the redox reactions; Cell configuration and half cell reactions; Standard Hydrogen Electrode, Reference electrode, evaluation of thermodynamic functions; Electrochemical corrosion.

Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells. 4L

MODULE 2

Molecular Structure

Molecular geometry, Hybridization, Ionic, dipolar and van Der Waals interactions; Molecular Orbital Theory and its application in diatomic molecule; Pi-molecular orbital of unsaturated system; Band

structure of solids, intrinsic and extrinsic semiconductors and the role of doping on band structures. 5L

Periodic Properties

Effective nuclear charge, penetration of orbitals; variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes; ionization energies, electron affinity and electro-negativity, polarizability, oxidation states, coordination numbers and geometries; hard-soft acid base theory. 4L

MODULE 3

Atomic structure and Wave Mechanics

Brief outline of the atomic structure, wave particle duality, Heisenberg uncertainty principle; Introduction to quantum mechanics, Schrodinger wave equation for particle in one dimensional box. 5L

Spectroscopic Techniques & Applications

Electromagnetic spectrum: Interaction of EMR with matter; Principle and applications of

Fluorescence & Phosphorescence, UV-Visible, , Infrared and NMR spectroscopy

4L

MODULE 4

Stereochemistry

Representations of 3- dimensional structures, structural isomers and stereo-isomers; configurations, symmetry and chirality; enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. 5L

Organic reactions and synthesis of drug molecules

Introduction to reaction mechanism: substitution, addition, elimination and oxidation, reduction reactions. Synthesis of commonly used drug molecules. 4L

TEXT BOOKS

1. Atkins' Physical Chemistry, P.W. Atkins (10th Edition)
2. Organic Chemistry, I. L. Finar, Vol-1 (6th Edition)
3. Engineering Chemistry, Jain &Jain,(16th Edition)
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2nd Edition)
5. Engineering Chemistry -I, GourkrishnaDasmohapatra, (3rd Edition)

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar
2. Physical Chemistry, P. C. Rakshit, (7th Edition)
3. Organic Chemistry, Morrison &Boyd , (7th Edition)
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4th Edition)

5. Physical Chemistry , G. W. Castellan, (3rd Edition)
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1st Edition)

Course Title : Chemistry I Laboratory					
Course Code : CHM1051					
Contact hrs per week :	L	T	P	Total	Credit points
	0	0	2	2	1

Course outcomes:

The subject code CHM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratoryequipment. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field. The course outcomes of the subject are

CHM1051.1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.

CHM1051.2. Estimation of ions like Fe^{2+}, Cu^{2+} and Cl^{-} present in water sample to know the composition of industrial water.

CHM1051.3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.

CHM1051.4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conduct meter.

CHM1051.5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.

CHM1051.6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

List of Experiments:

1. Estimation of iron using KMnO4: self indicator.
2. Iodometric estimation of Cu^{2+}.
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentio-metric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethylacetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Course Title : Mathematics-I					
Course Code: MTH1101					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Course Outcomes

1. MTH 1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.
2. MTH 1101.2 Develop the concept of eigen values and eigen vectors.
3. MTH 1101.3 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.
4. MTH 1101.4 Analyze the nature of sequence and infinite series
5. MTH 1101.5 Choose proper method for finding solution of a specific differential equation.
6. MTH 1101.6 Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus.

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Module I [10L]

Matrix:

Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II [10 L]

Vector Calculus:

Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems onthese topics,

Infinite Series:

Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III [10 L]

First order ordinary differential equations:

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders:

General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV [10L]

Calculus of functions of several variables

Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables,

Multiple Integration

Concept of line integrals, Double and triple integrals. Green's Theorem, Stokes Theorem and Gauss Divergence Theorem.

Suggested Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
8. Vector Analysis(Schaum's outline series): M.R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
9. Engineering Mathematics: S. S. Sastry (PHI)
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP),Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)

Course Title: Programming for Problem Solving					
Course Code: CSE1001					
Contact Hours per week	L	T	P	Total	Credit Points
	4	0	0	4	4

Course outcome:

CSE1001.1: Remember and understand the functionalities of the different hardware and software components present in a computer system, the standard representations of various types of data in a computer system.

CSE1001.2: Illustrate how a computer system with one way of representation can be converted to one another equivalent representation.

CSE1001.3: Construct flow charts for any arithmetic or logical problems in hand.

CSE1001.4: Remember and understand the C programming development environment, writing, compiling, debugging, linking and executing a C program using that development environment, basic syntax and semantics of C programming language and interpret the outcome of any given C program.

CSE1001.5: Use loop constructs, conditional branching, iteration, recursion to solve simple engineering problems.

CSE1001.6: Apply pointers, arrays, structures, files to formulate simple engineering problems.

Learning Objectives: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Module I: [10L] Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX How to write algorithms & draw flow charts.

Module II: [10L] Basic Concepts of C

C Fundamentals:
The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions:
Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III: [10L]

Program Structures in C

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes -
auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables. C preprocessor (macro, header files), command line arguments.

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.
String and character arrays; C library string functions and their use.

Module IV: [10L]

Data Handling in C

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell();

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books

1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

Course Title: Programming for Problem Solving Lab					
Course Code: CSE1051					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcomes:

After completion of this course the students should be able:

CSE1051.1. To write simple programs relating to arithmetic and logical problems.

CSE1051.2. To be able to interpret, understand and debug syntax errors reported by the compiler.

CSE1051.3. To implement conditional branching, iteration (loops) and recursion.

CSE1051.4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.

CSE1051.5. To use arrays, pointers and structures effectively in writingprograms.

CSE1051.6. To be able to create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors

Topic 2: Basic Problem Solving

Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)

Topic 4: Loops - Part I (for, while, do-while)

Topic 5: Loops - Part II

Topic 6: One Dimensional Array

Topic 7: Array of Arrays

Topic 8: Character Arrays/ Strings Topic

9: Basics of C Functions

Topic 10: Recursive Functions

Topic 11: Pointers

Topic 12: Structures

Topic 13: File Handling

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Course Title: Basic Electrical Engg.					
Course Code : ELE1001					
Contact Hours per week	L	T	P	Tota l	Credit Points
	3	1	0	4	4

Course Outcomes

After attending the course, the students will be able to

ELE1001.1 Analyze DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.

ELE1001.2 Analyze DC Machines; Starters and speed control of DC motors.

ELE1001.3 Analyze magnetic circuits.

ELE1001.4 Analyze single and three phase AC circuits.

ELE1001.5 Analyze the operation of single phase transformers.

ELE1001.6 Analyze the operation of three phase induction motors

Module-I: [11 L]

DC Network Theorem: Kirchhoff's law, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Star-Delta conversion. [6L]

Electromagnetism: Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet. [5L]

Module-II[10L]

AC single phase system: Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit. [10L]

Module-III [11 L]

Three phase system: Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method. [4L]

DC Machines: Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor. [7L]

Module-IV [10L]

Transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency, Introduction to three phase transformer.[6L]

Three-phase induction motor: Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.[4L]

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Hughes
4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand& Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H.Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai
5. Basic Electrical Engineering, Nath & Chakraborti
6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Course Title: Basic Electrical Engg. Laboratory					
Course Code : ELE1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes: The students are expected to

ELE1051.1 Get an exposure to common electrical apparatus and their ratings.

ELE1051.2 Make electrical connections by wires of appropriate ratings.

ELE1051.3 Understand the application of common electrical measuring instruments.

ELE1051.4 Understand the basic characteristics of different electrical machines.

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

Course Title :English for Technical Writing					
Course Code : HUM1001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	2

Course Outcome:

Students will be able to

HUM1001.1. Communicate effectively in an official and formal environment

HUM1001.2. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment

HUM1001.3. Use various techniques of communication for multiple requirements of globalized workplaces

HUM1001.4. Learn to articulate opinions and views with clarity.

HUM1001.5. Write business letters and reports.

HUM1001.6. Apply various communication strategies to achieve specific communication goals.

Module- I (6hrs.)

Introduction to Phonology and Morphology

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation)
- Word- stress, stress in connected speech
- Intonation (Falling and Rising Tone)
- Vocabulary Building-The concept of Word Formation

Module- II (6hrs.)

Communication Skills

- The Basics of Business Communication- Process, types, levels
- Barriers to Communication Common obstacles to effective communication
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections
- Identify common audiences and design techniques for communicating with each audience

Module- III (6hrs.)

Organizational Communication

- Business Letters
- Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular
- Organizing e-mail messages, E-mail etiquette
- Techniques for writing precisely: Creating coherence, organizing principles –accuracy, clarity, brevity. Different styles of writing: descriptive, narrative, expository.

Module- IV (6hrs.)

Principles, techniques and skills for professional writing

- Logic in writing, thinking and problem-solving; applying deductive and inductive reasoning; Use of infographics in writing.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies. Interpreting data and writing reports
- Writing proposals and Statement of purpose

Text Books:

1 Kumar,S.&Lata, P. Communication Skills, OUP, New Delhi2011

2 Rizvi,Ashraf,M. Effective Technical Communication, Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018

3 Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

Reference Books:

1. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
2. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.

Course Title: English for Technical WritingLaboratory					
Course Code: HUM1051					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

Students will be able to

HUM1051.1. Communicate in an official and formal environment.

HUM1051.2. Effectively communicate in a group and engage in relevant discussion.

HUM1051.3. Engage in research and prepare presentations on selected topics.

HUM1051.4. Understand the dynamics of multicultural circumstances at workplace and act accordingly.

HUM1051.5. Organize content in an attempt to prepare official documents.

HUM1051.6. Appreciate the use of language to create beautiful expressions

Detailed Syllabus

Module- I (6hrs.)

The Art of Speaking

- Techniques for Effective Speaking
- Voice Modulation: Developing correct tone
- Using correct stress patterns: word stress, primary stress, secondary stress. Rhythm in connected speech
- Encoding Meaning Using Nonverbal Symbols,
- How to Improve Body Language
- Eye Communication, Facial Expression, Dress and Appearance
- Posture and Movement, Gesture, Paralanguage
- Encoding meaning using Verbal symbols: How words work and how to use words
- Volume, Pace, Pitch and Pause
- Structuring content for delivery in accordance with time, platform, and audience.

Module- II (6hrs)

Group Discussion

- Nature and purpose and characteristics of a successful Group Discussion
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure

Module- III (6hrs)

- Interviewing
  Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
- Cover Letter & CV
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module- IV (6hrs.)

Professional Presentation Skills

- Nature and Importance of Presentation skills
- Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.
- Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides
- Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, and provide closure.
- Improving Delivery: Choosing Delivery methods, handling stage fright
- Post-Presentation discussion: Handling Questions-opportunities and challenges.

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. R. Anand, Job Readiness For IT & ITES- A Placement and Career Companion, , McGraw Hill Education.2015
5. Malhotra, A., Campus Placements, McGraw Hill Education.2015

1ST YEAR 2ND SEMESTER

Course Title : Physics I					
Course Code :PHY1001					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

After successfully completing this course the students will be able to:

PHY1001.1. Understanding physical systems in terms of their modeling of time evolution.

PHY1001.2. Comprehending wave interpretation of natural phenomena and implications of allied observations.

PHY1001.3. Understanding theoretical backgrounds associated to some experiments based on wave phenomena.

PHY1001.4. Grasping an analytic view of micro and macroscopic world.

PHY1001.5. Accessing the knowledge of the behavior of a particle under the influence of different potential.

PHY1001.6. Understanding conservative systems based on their particle and wave nature.

Module –I **[10L]**

Mechanics:

Plane-polar coordinate system-velocity and acceleration of a particle-trajectory under central force-conservation principle-Kepler's laws -Rotating frame of reference-Five point acceleration formula-Coriolis effect-deflection of a moving particle.

Module – II **[10L]**

Oscillation:

Constitutive equation of damping-nature of solutions for large, critical and weak damping-relaxation time, logarithmic decrement, energy decay (qualitative discussion) -Forced oscillation-transient and steady state-amplitude and velocity resonance---power transfer theorem-quality factor-series LCR circuit with AC source.

Module –III **[10L]**

Optics:

Plane Progressive Wave-phase/wave-length/frequency-qualitative description of light as an electromagnetic wave-Huygens principle-polarization (state of polarization, general equation of ellipse, transformation of polarized lights)-interference (basic theory from superposition principle)-Division of wave front (Young's double slit experiment)-Division of amplitude (thin film, wedge, Newton's ring)-Diffraction (single slit, double slit, grating, Resolving Power).

Module – IV **[10L]**

Quantum Mechanics:

An informal discussion from Planck to de Broglie as the historical context of quantum mechanics-Quantum Mechanics of a particle-operator-eigenvalue problem- Unitary-Hermitian frame work-position and momentum operator-Canonical Commutation Relations (CCR)- Schrodinger equation-time dependent/time independent

Schrodinger equation-wave function-stationary states-probability density-probability current density-normalization-expectation value-uncertainty-Bound state problem-particle in a one dimensional box- scattering state problem-potential step-reflection and transmission coefficients- tunneling.

BOOKS

1. Theoretical Mechanics : M R Spiegel (Schaum Series) McGrow-Hill Book Company
2. Classical Mechanics: N C Rana and P S Joag Tata- McGrow-Hill Publishing Company Limited.
3. Vibrations and Waves : A P French, W W Norton and Company,
4. The Physics of Waves and Oscillations: N K Bajaj, Tata- McGrow-Hill Publishing Company Limited.
5. Optics : A Ghatak, Tata McGraw-Hill Publishing Company Limited.
6. Optics : E. Hecht, Addison Wesley
7. Fundamentals of Optics : F A Jenkins and H E White, McGrow-Hill Higher Education.
8. Atomic Physics (Modern Physics): S N Ghosal, S. Chand and Company.
9. Practical Quantum Mechanics : S Flugge, Springer (Reprint of the 1994 Edition)
10. Concepts of Modern Physics : A Baiser, Tata McGraw-Hill Publishing Company Limited.
11. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora.

Course Title: Physics I Laboratory					
Course Code: PHY1051					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

After successfully completing this course the students will be able to:

PHY1051.1 Understanding the usage of electrical and optical systems for various measurements.
PHY1051.2 Applying the analytical techniques and graphical analysis to the experimental data.
PHY1051.3 Understanding measurement technology, usage of new instruments and real time applications in engineering studies.
PHY1051.4 Evaluating intellectual communication skills and discuss the basic principles of scientific concepts in a group.
PHY1051.5 Construct the new idea by compiling their knowledge and can develop the new or improve the methodology.

MINIMUM OF SIX EXPERIMENTS TAKING ATLEAST ONE FROM EACH OF THE FOLLOWING FOUR GROUPS:

Optics Group

1. Determination of dispersive power of the material of a prism.
2. Determination of wavelength of a monochromatic light by Newton's ring.
3. Determination of specific rotation of sugar solution by using a Polarimeter.
4. Determination of wavelength of the given laser source by diffraction method.

Electricity & Magnetism Group

1. Determination of the magnetic field using circular current carrying coil.
2. Determination of dielectric constant of a given dielectric material.
3. Determination of Hall coefficient of a semiconductor by four probe method.
4. Determination of unknown resistance using Carey Foster's bridge

Quantum Physics Group

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Rydberg constant by studying Hydrogen spectrum.
4. Determination of Band gap of semiconductor.

Miscellaneous Group

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of modulus of rigidity of the material of a rod by static method
3. Determination of rigidity modulus of the material of a wire by dynamic method
4. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Course Title: Mathematics II					
Course Code: MTH1201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcomes

1. MTH 1201. 1. Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.
2. MTH 1201. 2. Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.
3. MTH 1201. 3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.
4. MTH 1201. 4. Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.
5. MTH 1201. 5. Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.
6. MTH 1201. 6. Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

The objective of this course is to familiarize the students with numerical techniques, integral transforms, graph theory and probability. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Module-I Fundamentals of Probability [10L)

Random experiment, Sample space and events

Classical and Axiomatic definition of probability

Addition and Multiplication law of probability

Conditional probability

Bayes' Theorem

Random variables

General discussion on discrete and continuous distributions

Expectation and Variance

Examples of special distribution: Binomial and Normal Distribution

Module-II Numerical Methods [10L]

Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method.

Solution of linear system of equations: Gauss elimination method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method.

Solution of Ordinary differential equations: Euler's and Modified Euler's Method, Runge-Kutta Method of 4th order.

Module-III Basic Graph Theory [10L]

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

Definition and properties of a 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 DFS, BFS, Kruskal's and Prim's algorithms

Module-IV Laplace Transformation [10L]

Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations.

Introduction to integral transformation

Functions of exponential order, Definition and existence of Laplace Transform (LT) (statement of initial and final value theorem only)

LT of elementary functions, Properties of Laplace Transformations, Evaluation of sine, cosine and exponential integrals using LT

LT of periodic and step functions

Definition and properties of inverse LT

Convolution Theorem (statement only) and its application to the evaluation of inverse LT

Solution of linear ODEs with constant coefficients (initial value problem) using LT

Suggested Books:

1. Advanced Engineering Mathematics ,E.Kreyszig, Wiley Publications
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier
3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India
5. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

Course Title :Introduction to Electronic Devices and Circuits					
Course Code : ECE1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

ECE1001.1. Categorize different semiconductor materials based on their energy bands and analyze the change in characteristics of those materials due to different types of doping.

ECE1001.2. Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode.

ECE1001.3. Design different application specific circuits using diodes.

ECE1001.4. Analyze various biasing configurations of Bipolar Junction Transistor.

ECE1001.5. Categorize different field-effect transistors and analyze their behavior.

ECE1001.6. Design and implement various practical electronic circuits.

Module I [10 L]
Basic Semiconductor Physics:
Crystalline materials, energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi energy level, intrinsic and extrinsic semiconductors, mass action law, drift and diffusion currents in semiconductor, Einstein relation.
Diodes and Diode Circuits:
Formation of p-n junction, energy band diagram, forward & reverse biased configurations, V-I characteristics, DC load line, breakdown mechanisms - Zener and avalanche breakdown, voltage regulation using Zener diode.

Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency, rectifier output without and with filters. Light emitting diode.

Module II [8 L]
Bipolar Junction Transistors (BJT):

pnp&npn BJT structures, different operating modes of BJT, current components in BJT, dc current gains in CE & CB configurations and their interrelation, input&output V-I characteristics of CE & CB configurations. Concept of Biasing: DC load line, Q-point, basic concept of amplification using BJT.

Module III [9 L]
Field Effect Transistors (FET):

Classification of FET, basic structure and operation of Junction Field Effect Transistor (n-channel) along with its V-I characteristics.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.

Module IV [9 L]
Feedback in amplifiers:

Concept of feedback, different feedback topologies using block diagram only, effects of negative feedback (qualitative), Barkhausen criteria for sustained oscillation.

Operational Amplifier:

Usefulness of differential amplifier over single ended amplifier, ideal OPAMP characteristics, transfer characteristics of OPAMP, CMRR, slew rate, offset error voltages and current, concept of virtual ground

Basic circuits using OPAMP:Comparator, inverting and non-inverting amplifiers, voltage follower, adder, subtractor, integrator, differentiator.

Text Books:

1. Boylestad&Nashelsky:Electronic Devices & Circuit Theory
2. R.A Gayakwad:Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications

Reference Books:

1. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
2. Millman & Halkias: Integrated Electronics.
3. Salivahanan: Electronics Devices & Circuits.
4. Albert Paul Malvino: Electronic Principle

Course Title :Introduction to Electronic Devices and Circuits Laboratory					
Course Code : ECE1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcomes:

ECE1051.1. The students will correlate theory with diode behavior.

ECE1051.2. They will design and check rectifier operation with regulation etc.

ECE1051.3. Students will design different modes with BJT and FET and check operations.

ECE1051.4. They will design and study adder, integrator etc. with OP-AMPs.

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, multi-metersetc.
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 in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

Course Name: Universal Human Values and Professional Ethics					
Course Code : HUM1002					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	1	0	3	3

Course Outcome:

Students will be able to

HUM1002.1. Appreciate the essential complementarily between 'values and 'skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

HUM1002.2. Develop a Holistic perspective towards life and profession

HUM1002.3. Develop a correct understanding of the Human reality and the rest of existence

HUM1002.4. Appreciate the relationship of values in terms of ethical human conduct.

HUM1002.5. Understand the importance of trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

HUM1002.6. Differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them.

Detailed Syllabus

Module 1 – Introduction to Value Education (6hrs.)

Understanding Values: Historical perspective to the development of values and its importance for the integration and harmony of the self and body
Understanding Human being as the Co-existence of the Self and the Body
Exploring Harmony of Self with the Body
Distinguishing between the Needs of the Self and the Body
Understanding and appreciating basic human aspirations-Maslow's Hierarchy of Needs Theory
Strategies, Methods toFulfil the Basic Human Aspirations
Continuous Happiness and Prosperity – the Basic Human Aspirations

Module 2 – Harmony in the Family and Society (10hrs.)

The self as a social being starting with the family as the smallest unit—the process of socialisation.
Development of the self in relation to the society – Cooley's and Mead's theories of socialization.
Self and Integrated personality-Morality, Courage and Integrity
Conflict of interest at home and society and its resolution through the implementation of the Human Values
Societal Values – Justice, Democracy and Rule of law

Establishing harmony in the society with the help of ethical conduct based on values- Ethics of Rights and Duties, Ethics of care, Ethics justice and Fairness, Work Ethics and quality of life at work.
Value crisis- disharmony in relationships, understanding harmony in the society
Solutions - contribution of the individual in establishing harmony in the society.
'Trust' and 'Respect'--the Foundational Values in Relationship
Exploring the Feeling of Trust and Respect

Module 3 – Implications of the Holistic Understanding – a Look at Professional Ethics (10hrs.)

Ethics and Ethical Values

Principles and theories of ethics--Consequential and non-consequential ethics, Utilitarianism, Kant's theory and other non-consequential perspectives

Professional Ethics- Right understanding of Professional Ethics

Canons of professional Ethics

Technology – various perspectives-its use, overuse and misuse

Privacy, data security and data protection, Artificial intelligence-harmony or disharmony, misinformation, deep fake, cyber-crime - a sociological perspective.

Code of Ethics, Violation of code of ethics, Whistle blowing, Institutionalising Ethics

Vision for the Universal Human Order, Exploring Systems to fulfil Human Endeavours

Module 4 – Harmony in the Nature/Existence (10hrs.)

Understanding Harmony in the Nature -Ecological Ethics
Sustainable development- Definition and Concept

Strategies for sustainable development- Small is beautiful, slow is Beautiful Sustainable Development--- The Modern Trends

Sustainable Development Goals- Case studies and Best practices

Exploring the Four Orders of Nature -Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

The Holistic Perception of Harmony in Existence

Suggested Readings:

1. A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Asthana, G.P. Bagaria, Excel Books Pvt. Ltd. New Delhi
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews

Course Title: Workshop/Manufacturing Practices					
Course Code : MEC1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	1	0	3	4	2.5

Course Outcomes:

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

MEC1051.1. Follow the various safety practices in workshop and personal protective elements.

MEC1051.2. Identify tools, work material and measuring instruments useful for fitting, carpentry and sheet metal practices.

MEC1051.3. Operate machine tools, components and processes to prepare jobs of specific shape and size.

MEC1051.4. Acquire knowledge of foundry process and casting of a product.

MEC1051.5. Perform welding, brazing and soldering processes.

MEC1051.6. Assemble a simple product.

Syllabus:

(i) Lectures: (13 hours)

Detailed contents

1. Introduction on Workshop and familiarization with safety norms (1 lecture)
2. Carpentry and Fitting (2 lectures)
3. Sheet metal (1 lecture)
4. Metal casting (1 lecture)
5. Welding (arc welding & gas welding), brazing and soldering (2 lectures)
6. Manufacturing Methods- machining (Lathe, Shaping and Milling) (4 lectures)
7. Additive manufacturing (1 lecture)

(ii) Workshop Practice :(39 hours)

1. Safety practices in workshop (3 hours)
2. Carpentry shop (3 hours)
3. Fitting shop (6 hours)
4. Foundry shop (3 hours)
5. Machine shop (9 hours)
6. Welding shop-Arc welding (3 hours)
7. Sheet metal shop and brazing (6 hours)
8. Soldering operation (3 hours)
9. Assembling of a product (3 hours)

SuggestedText/ReferenceBooks:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Title : Engineering Graphics and Design					
Course Code : MEC1052					
Contact hrs per week:	L	T	P	Total	Credit Points
	1	0	3	4	2.5

Course Outcomes:

After going through the course, the students will be able to

MEC1052.1. Visualize the basic concept of engineering drawing.

MEC1052.2. Use engineering drawing tools (conventional / modern tools).

MEC1052.3. Apply the various standards and symbols followed in engineering drawing.

MEC1052.4. Implement the concept of projections used in engineering graphics.

MEC1052.5. Relate the concept of sections to determine its true shape.

MEC1052.6. Execute the concept of isometric projections.

Lecture Plan (13 L)

1. Importance and principles of engineering drawing (1 L)
2. Lettering (1 L)
3. Concepts of Scale, dimensioning and Conic sections (3 L)
4. Introduction to concept of projection (Projections of points, lines and surfaces) (3 L)
5. Definitions of different solids and their projections (1 L)
6. Section of solids and sectional view (1 L)
7. Isometric projection (1 L)
8. Introduction to CAD (1 L)
9. Viva-voce (1L)

Detailed contents of Laboratory hours (39 hours)

Module 1: Introduction to Engineering Drawing (**3 hours**)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic sections like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

Module 2: Orthographic Projections (**9hours**)

Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes; Projection of lamina.

Module 3: Projections of Regular Solids (**6 hours**)

Those axes inclined to both the Planes- Auxiliary Views.

Module 4: Sections and Sectional Views of Right Angular Solids (**3 hours**)

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Sectional orthographic views of geometrical solids.

Module 5: Isometric Projections (**6 hours**)

Principles of Isometric projection -Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Module 6: Overview of Computer Graphics (**3 hours**)

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

Module 7: Customization& CAD Drawing (**3 hours**)

Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Module 8: Annotations, layering & other functions (**3 hours**)

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection

techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

Module 9: Demonstration of a simple team design project that illustrates (**3 hours**)

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

References:

1. Bhatt, N.D., Panchal V.M. & Ingle P.R., (2014) "Elementary Engineering Drawing"; CharotanPublishing House

2. Narayana, K.L. and Kannaaiah P "Engineering Graphics"; TMH

3. Lakshminarayanan, V. and Vaish Wanar, R.S "Engineering Graphics" Jain Brothers.

4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Edication.

5. Agarwal B. & Agarwal C. M. (2012), Engineering graphics, TMH Publications.

2nd YEAR 1stSEMESTER

Course Title : Analog Circuits					
Course Code :ECE2101					
Contact Hours per week	L	T	P	Total	Credit
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to

ECE2101.1. Apply the previous knowledge gathered from Basic Electrical and Basic Electronics papers.

ECE2101.2. Understand the concepts of BJT, MOSFET and biasing techniques of BJT and MOSFET based amplifier circuits.

ECE2101.3. Analyze frequency response of amplifier circuits.

ECE2101.4. Design different type sinusoidal oscillators and multivibrator circuits.

ECE2101.5. Construct algebraic equations based amplifier and analog computers using OP-AMP

ECE2101.6. Design stable high-gain amplifier circuits.

MODULE 1: Analog Signals and Devices [9L]

Basic concepts and device biasing [5L]:

Analog, discrete and digital signals. Diode: piecewise-linear model, clipping and clamping operation. Diode, Application of Zener diode as voltage regulator, BJT biasing circuits, Q-point and stability.

Small Signal analysis of Amplifiers [4L]:

Small signal (h-parameter and re model) analysis of BJT CE mode amplifier circuit (derive input impedance, output impedance, voltage gain, current gain for the amplifiers).

MODULE 2: Oscillators and Frequency Responses of Amplifiers [9L]

Frequency Responses of Amplifiers [2L]:

Frequency response of CE mode RC-coupled amplifier; effect of external and parasitic capacitors on cut-off frequencies.

Oscillator Circuits [7L]:

Classification of Oscillator, Oscillators circuits: Phase-shift, Wien-Bridge, Hartley, Colpitt and Crystal Oscillators.

MODULE 3: Operational Amplifiers (OPAMPs) [7L]

Fundamentals of OPAMP [4L]:

Basic building blocks of OPAMP: Differential Amplifiers, Current source and current mirror circuits. Types of differential amplifiers, AC and DC analysis of differential amplifiers; Characteristics of an ideal and practical OPAMP.

Applications of OPAMP [3L]:

Inverting and non-inverting OPAMP amplifiers, Adder, Subtractor,Log-antilog amplifiers, Multiplier, Integrator, Differentiator, Analog computer, Instrumentation amplifier, Precision rectifiers, basic comparator, Schmitt Trigger.

MODULE 4: Analog Circuit Applications [7L]

Power Amplifiers [4L]:

Concepts and operations of Class A, B and AB amplifiers; Calculation of DC power, AC power and efficiency of these amplifiers. Class C amplifier.

Applications Analog IC [3L]:

Description of 555 Timer IC, astable and mono-stable operations using 555. Study of 78XX and 79XX voltage regulator ICs.

Books:

1. Microelectronic Circuits by Adel S. Sedra, Kenneth C. Smith
2. Electronics Devices and Circuits by Robert L. Boylestad, Louis Nashelskey
3. Fundamentals of Microelectronics by Behzad Razavi
4. Integrated electronics by Jacob Millman, Christos C. Halkias

Course Title:Analog Circuits Laboratory					
CourseCode:ECE2151					
Contact Hoursperweek	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:
The students, after finishing the course, will be able to:

ECE2151.1. Study and compare frequency responses of amplifiers.

ECE2151.2. Design different timer circuits with 555 IC.

ECE2151.3. Design rectifiers and measure rectifier parameters.

ECE2151.4. Generate various waveforms using OP AMPs.

List of experiments:

Experiments using discrete components
1. Study of frequency response of RC coupled amplifier circuit.
2. Study of astable multi-vibrator using 555 timer IC.
3. Study of monostable multi-vibrator using 555 timer IC.
4. Study of full wave and half wave precision rectifier circuits.
5. Study of Wien-Bridge oscillator circuit.
6. Study of Phase Shift oscillator circuit.
7. Study of astable multi-vibrator using OPAMP.
8. Study of Triangular wave generator circuit using OPAMP.
9. Study of Schmitt trigger circuit.
10. Study of fixed voltage regulator circuits using 78XX and 79XX ICs.

Experiments using ASLKv2010 StarterKit
11. Negative feedback amplifiers and instrumentation amplifiers to measure parameters like time response, frequency response, DC transfer characteristics.
12. Study of analog filters like LPF, HPF, BPF and BSF.
13. Study of VCO and PLL
14. Automatic gain / volume control (AGC/AVC)
15. PC based Oscilloscope

Courseoutcomes:
The students after finishing this course will be able to

Course Title: DigitalSystemsDesign					
CourseCode:ECE2102					
Contact Hoursperweek	L	T	P	Total	Credit Points
	3	0	0	3	3

ECE2102.1. Students will learn about the Binary Number system and minimization of logic expression using different methods.

ECE2102.2. Students will design different Arithmetic Combinational circuits like Adder, Subtractor.

ECE2102.3. Students will be able to design Multiplexer, De-Multiplexer, Decoder, Encoder,etc and learn about applications

ECE2102.4. Students will be able to design Sequential Circuits such as flip flops and perform inter conversion of them.

ECE2102.5. Students will design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded,Ring,Johnson).

ECE2102.6. Students will learn basic gates using RTL, DTL, TTL, ECL, and CMOS logic families and analyzedifferentmemorysystemsincludingRAM,ROMEPROM, EEROM,etc.

Module-1[8L]

Data and number systems; Binary, Octal, and Hexadecimal representation and their conversions; BCD, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. Boolean algebra, De-Morgan's theorem, Various Logic gates-their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method;Karnaugh-mapmethod,Quine-Mc Cluskey method (3 & 4 variables).

Module-2:[11L]

Arithmetic Circuits: Adder circuit – Ripple Carry and BCD Adder; Subtractor circuit.

Combinational Circuit: Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and parity Generator; Shannon's Expansion Theorem.

Module-3:[10 L]

Sequential Circuits- Sequential circuits design methodology; Basic memory element S-R, J-K, D, and T Flip Flops, Inter conversions of Flip-Flop; Finite State Machine Design using Sequential circuit design methodology; various types of Registers (with Parallel load, shift Registers), and Counters (Asynchronous ripple counters, Synchronous counters: BCD, Ring, Johnson).

Module-4:[9 L]

Memory Systems: Concepts and basic designs of RAM, ROM, EPROM, EEROM, Programming logic devicesand gate arrays(PLAsandPLDs) Tri-state logic.

Logic families- RTL, DTL, TTL, ECL, and CMOS, their operation and specifications.

Textbooks:

1. S.Salivahanan, S.Arivazhagan-Digital Circuit & Design, Oxford

2. Anand kumar-Fundamental of Digital Circuits, PHI
3. Virendra Kumar-Digital technology, New Age Publication
4. R.P.Jain-Modern Digital Electronics, 2/e, Mc Graw Hill

References:

1. H.Taub&D.Shilling-Digital Integrated Electronics, Mc Graw Hill
2. Tocci, Widmer, Moss-Digital Systems, 9/e, Pearson
3. Leach &Malvino-Digital Principles &Application, 5/e, Mc Graw Hill
4. Floyed & Jain-Digital Fundamentals, Pearson

Course Title:Digital Systems Design Lab					
CourseCode:ECE2152					
Contact Hoursperweek	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

The students after finishing this course will be able to :
ECE2152.1. Design code converters.

ECE2152.2. Design arithmetic circuits.

ECE2152.3. Design combinational logic circuits.

ECE2152.4. Realize flip-flops and counters.

List of Experiments:

1. Realization of basic gates using Universal logic gates.
2. Realization of code conversion circuits - BCD to Excess-3 and vice-versa.
3. Construction of simple arithmetic circuits - Adder, Subtractor.
4. Design of Parity Bit Generator and Checker circuits.
5. Construction of Decoder circuit using logic gates.
6. Construction of Multiplexer circuit using logic gates and realization of different combinational logic circuits using Multiplexer.
7. Design of 2-Bit Comparator Circuit.
8. Realization of RS, D and JK flip-flops using universal logic gates.
9. Realization of Asynchronous Up or Down counter.
10. Realization of Synchronous Up or Down counter.
11. Realization of Ring and Johnson's counters.

Course Title: Signals and Systems					
CourseCode:ECE2103					
Contact Hoursperweek	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

The students after finishing this course will be able to

ECE2103.1. Apply the previous knowledge of mathematics on differential calculus
ECE2103.2. Categorize and identify the different types of signals and systems
ECE2103.3. Evaluate the responses of different systems with the applications of convolution and also be able to determine the stability of a system.
ECE2103.4. Analyze the frequency domain characteristics of signals using Fourier series, Fourier transforms, Laplace Transform and their application in communication system.
ECE2103.5. Implement and extend the concepts of transformation tools to study LTI systems and principles of Sampling.
ECE2103.6. Analyze random signals and their properties, understand their differences from deterministic signals, hence extending the concept towardsunderstanding noise in communication circuits.

Module No-1: Introduction to Signal and Systems: [6 L]

Classification of Signals: Discrete time- continuous time signal, Periodic- aperiodic, Even – odd, Energy - power signals, Deterministic- random signals, Causal – noncausal signal, complex exponential and sinusoidal signals, periodicity,unit impulse, unit step, unit ramp Transformation of independent variable of signals-Time scaling, Time shifting.
Properties of Systems: Classification of systems,Linearity, Causality, Time invariance and BIBO Stability. Distortion-less systems, Invertible systems, Continuous –discretesystem

Module No-2: Analysis of continuous time signals and LTIC System: [11 L]

Continuous time Fourier Series,Dirichlet's conditions. Fourier transformation of continuous time signals and their properties.
Impulse response of LTIC systems, Convolution in continuous time, Correlation of continuous –time signals, Stability analysis using impulse response, Laplace transformation and its Properties. Parseval's theorem. Computation of transfer function. Analysis of LTI systems using different transformations. Natural & Forced response.

Module No-3: Analysis of discrete time signals and LTID System: [11L]
Convolution in discrete time, Correlation of discrete time signals, Discrete time Fourier Series, Fouriertransformation of discrete time signals and their properties.
Time domain analysis of LTID system, Natural & Forced response of a LTID system.
Application of Fourier Transform (understanding spectrum of time domain signals) in communication system.

Module No-4: Application of Signals and Systems theory: [8 L]

Sampling: Sampling Theorem, Types of sampling, Aliasing, Pre-alias filter, Reconstruction of a signal from its samples.

Random process and noise: Random variable, random process, ensemble, time average, ensemble average, stationary and ergodic process, correlation between two random variables. Distribution& density function, mean values &moments, function of two random variables, spectral densities, Noise sources in circuits, noise in communication circuits andsystems, noise voltage.

Text Books:

1. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals &Systems, Pearson
2. B.P.Lathi- Signal Processing & Linear Systems- Oxford
3. P.RameshBabu&R.Anandanatarajan- Signals and Systems 4/e- Scitech
4. Sanjay Sharma-Signals and Systems, Kataria Publication

References:

1. G. Proakis& D.G. Melonakos- Digital Signal Processing Principles, Algorithms and Applications,.
2. A.NagoorKani- Signals and Systems- McGraw Hill
3. S.Haykin&B.V.Veen, Signals and Systems- John Wiley
4. S.Haykin,Digital Communication-John Wiley
5. Digital signal Processing by S.K. Mitra-Tata McGraw Hill

Course Outcomes:

Course Title: Network Theory					
CourseCode:ECE2104					
Contact Hoursperweek	L	T	P	Total	Credit Points
	3	0	0	3	3

The students after finishing this course will be able to

ECE2104.1. Apply the previous knowledge gathered from Basic Electrical Engineering for understanding the basic concepts of this subject.

ECE2104.2. Apply Network Theorems to solve various complex electric circuits.

ECE2104.3. Analyze higher order circuits having reactive elements in Laplace domain.

ECE2104.4. Apply graph theory to solve various network related problems.

ECE2104.5. Analyze the input output behavior of two port networks using various types of parameters.

ECE2104.6. Design of various types of filter circuits and simulation using SPICE software.

Module-I [11 L]

Network equations: Concepts of independent and dependent types of voltage and current sources, Nodal and Mesh analysis of different circuits. Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer Theorem, Reciprocity and Compensation theorem applied to circuits containing different types of sources. [5L]

Resonant Circuits: Series and parallel resonance, Impedance and admittance characteristics, Quality factor, Half power points, Bandwidth, Phasor diagrams. [4L]

Coupled Circuits: Self-inductance and mutual inductance, Coefficient of coupling, Dot convention, Analysis of coupled circuits. [2L]

Module-II [8 L]

Laplace Transform Fundamentals: Concept of complex frequency. Properties of Laplace transform: linearity, differentiation, integration, periodicity, initial and final value theorems. Transform of standard periodic waveforms. [3L]

Circuit elements, sources and their transformed equivalents, treatment of mutual couplings in time and Laplace domain. Transient and steady state response of RL, RC, LC and RLC with and without stored energy. Concept of natural frequency and damping. [3L]

Analysis of different circuits containing reactive elements and switches in Laplace domain. [2L]

Module-III [10L]

Graph theory: Fundamentals of graph theory related to circuit analysis, formation of Incidence matrix, tie-set matrix and f-cut set matrix and their properties. Construction of graph of any given network, Loop currents and node-pair potentials, matrix formation of KVL & KCL equations using graph theory. [4L]

Two port networks: Introduction to two port circuit analysis, Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point impedance, transfer impedance & admittance. [5L]

Concept of characteristic impedance and its significance. [1L]

Module-IV [8L]

Filter Circuits: Concept and classification of filter circuits. Advantage of active filters over passive filters, Analysis and synthesis of Active Low pass, High pass, Band pass and Band reject filters of 1st and 2nd order using operational amplifier. Filter approximations: Butterworth, Chebyshev filters. [5L]

SPICE Simulation: Introduction to SPICE program, DC analysis, transient analysis and AC analysis of different circuits using SPICE, calculation of input and output Impedance using SPICE, Analysis of various circuits having dependent current and voltage sources using SPICE. [3L]

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers

2. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

3. Network Analysis, M.E. Valkenburg, Pearson Education .

4. Fundamental of Electric circuit theory, D. Chattopadhay& P.C. Rakshit, S. Chand.

Reference Books:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly& S.M. Durbin,The Mc Graw Hill Company.

2. Modern Network Analysis, F.M.Reza&S.Seely, McGraw Hill.

Course Title: Introduction to Complex and Fourier Analysis					
Course Code: MTH2101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcomes:

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

MTH2101.1: Remember and understand the limit, continuity, differentiability and analyticity of functions of complex variables.

MTH2101.2: Apply the concepts of complex integration in different engineering domains.

MTH2101.3: Use the concepts of singularities, poles and residues in engineering problems.

MTH2101.4: Generate the complex exponential Fourier series and understandthe use of Fourier series to represent periodical physical phenomena in engineering analysis.

MTH2101.5: Understand Fourier integral theorems, Fourier sine and cosine transforms by applying them to appropriate examples.

MTH2101.6: Interpret the nature of a physical phenomenon when the domain is shifted by Fourier transform e.g. continuous time signals and systems.

Module I: [10L] Functions of Complex Variables

Complex numbers and its geometrical representation. Stereographic projection. Functions of a complex variable – limits, continuity, and differentiability. Analytic Functions, Cauchy- Riemann equations, Necessary and sufficient conditions for analyticity of complex functions (Statement only), Harmonic functions. Milne-Thompson method. Conformal mapping.

Module II: [10L] Complex Integration

Line Integral on complex plane, Cauchy-Goursat theorem, Cauchy's Integral Formula. Taylor's and Laurent's series expansion. Zeros, Different types of Singularities. Definitions of poles and residues, Residue Theorem, Evaluation of real integrals using residue theorem, Integrals of the form $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} dx, \int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin x \, dx, \int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos x \, dx$ and $\int_{0}^{\infty} \frac{P(x)}{Q(x)} dx$ for a real variable x with $Q(x) \neq 0$.

Module III: [10L] Fourier Series

Definite Integral, Orthogonality of trigonometric functions. Power Series and its convergence. Periodic functions, even and odd functions, Dirichlet's conditions, Euler formulas for Fourier coefficients,Fourier series for functions of period $2l$. Fourier series representation of a function, e.g. Periodic square wave, Half wave rectifier, Unit step function. Half range Fourier sine series and cosine series, Parseval's identity.

Module IV: [10L] Fourier Transform

Fourier Integral theorem (statement only), Fourier transform, Fourier sine and cosine transform. Linearity, scaling, frequency shifting and time shifting properties.Parseval'sidentity for Fourier transforms. Inverse Fourier transform. Convolution Theorem. Discussion of some physical problems: e.g Forced oscillations.

Text Books

1. Advanced Engineering Mathematics – Erwin Kreyszig.
2. Higher Engineering Mathematics – B. V. Ramana.

Reference Books

1. Complex Variables and Applications – J. W. Brown, R. V. Churchill.
2. Schaum's Outline of Complex Variables – Murray R. Spigel, S. Lipschutz, J. J. Schiller, D. Spellman.
3. Schaum's Outline of Fourier Analysis with Applications to Boundary Value Problems– Murray R. Spigel.
4. Integral Transforms for Engineers and Applied Mathematicians – Larry C. Andrew, B. K.Shivamoggi.

Course Title :Data Structure and Basic Algorithm					
Course Code :CSE2004					
Contact hrs per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

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

CSE2004.1: Identifyandselectappropriatedatastructuresasappliedtospecifiedproblemdefinition.
CSE2004.2: Implementoperationslikesearching,insertion,deletion,traversaletc.onlineardatastructures likearray, stackandqueue.
CSE2004.3: Implement operations like searching, insertion, deletion, traversal etc. on nonlinear datastructures liketreeandgraph.
CSE2004.4: Applyappropriatesorting/searchingtechniqueforgivenproblem.
CSE2004.5: Analyzeandcomparethedifferentsortingalgorithms.
CSE2004.6: DesignadvanceddatastructureusingNonlineardatastructures.

MODULE 1: Linear Data Structure I: [8L]

Introduction (2L):
Concepts of data structures (Data, data structure, Abstract Data Type), Need of data structure, Basic idea of pseudo-code, algorithm analysis and Big O notation.

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

Linked List (4L):
Singly linked list, Circular linked list, Doubly linked list (Creation, insertion at different positions, deletion from different positions of the list), Linked list representation of polynomial and applications.

MODULE 2: [6L]

Stack and Queue (4L):
Stackanditsimplementations(usingarrayand linked list),applications.
Queue,circularqueue,deque (usingarrayand linked list).

Recursion (2L):
Principlesofrecursion–Designofrecursivealgorithms,differencesbetweenrecursionanditeration,merits anddemeritsof recursion,Tail recursion.

MODULE 3: [12L]

Trees (9L):
Basicterminologies,treerepresentation(usingarrayandlinkedlist).
Binary trees – binary tree traversal (pre-order, in-order, post-order), threaded binary tree (examples only).Binarysearchtreeand itsoperations(creation,insertion,deletion,searching).

HeightBalancedbinary tree– AVL treeandits operations (insertion, deletionwithexamplesonly).

Graphs (3L):
Basicterminologies,Graphrepresentations/storageimplementations(usingadjacencymatrixand adjacency list)
Graphtraversalalgorithms –Depth-firstsearch(DFS),Breadth-firstsearch(BFS).

MODULE 4: [10L]

Sorting Algorithms (6L):
Bubblesort,Insertionsort,Selectionsort,Mergesort,Quicksort,Heapsortandtheircomparisons.

Searching (1L):
Linearsearch,binarysearchandtheircomparisons.

Hashing (3L):
Basicterminologies,Differenthashingfunctions,Collisionresolutiontechniques(OpenaddressingandChaining).

TEXT BOOKS

1. "DataStructures andProgramDesignInC",2/E byRobertL.Kruse,BruceP.Leung.
2. "FundamentalsofDataStructuresofC" byEllisHorowitz,SartajSahni,SusanAnderson-freed.
3. "ClassicDataStructures"byD.Samanta.
4. "DataStructuresinC"byAaronM.Tanenbaum.
5. "DataStructures" byS.Lipschutz.

REFERENCE BOOKS

1. "DataStructuresinC"byAaronM.Tanenbaum.
2. "DataStructures" byS.Lipschutz.

Course Title: Data Structure and Basic Algorithm Laboratory					
Course Code: CSE2054					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcomes:

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

CSE2054.1: Identify the appropriate data structure for given problem.
CSE2054.2: Understand the concept of Dynamic memory management, data types, algorithms etc.
CSE2054.3: Understand and implement basic data structures such as arrays, linked lists, stacks andqueues.
CSE2054.4: Implement various applications involving array, stack, queue and linked lists.
CSE2054.5: Solve problem involving graphs and trees.
CSE2054.6: Apply algorithm for solving problems like sorting and searching.

List of experiments:

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements, Circular Queue: Adding & deleting elements.
3. Evaluation of expressions operations on stacks.
4. Implementation of linked lists: inserting, deleting, and inverting a linked list.
5. Implementation of stacks & queues using linked lists
6. Polynomial addition.
7. Addition of Sparse matrices.
8. Traversal of Trees.
9. DFS and BFS implementation.
10. Sorting and searching algorithms.

TEXT BOOKS

3. "DataStructures andProgramDesignInC",2/E byRobertL.Kruse,BruceP.Leung.
4. "FundamentalsofDataStructuresofC" byEllisHorowitz,SartajSahni,SusanAnderson-freed.
5. "ClassicDataStructures"byD.Samanta.

REFERENCE BOOKS

1. "DataStructuresinC"byAaronM.Tanenbaum.
2. "DataStructures" byS.Lipschutz.

Course Title: Signals And Networks Laboratory					
Course Code :ECE2156					
Contact Hours per week	L	T	P	Total	Credit points
	0	0	2	2	1

Course Outcomes:

The students after finishing this course will be able to

ECE2156.1. Generate different signals and perform time domain operations on the signals

ECE2156.2. Analyze the time domain and frequency domain analysis of a system

ECE2156.3. Apply different circuit analysis methods using SPICE software.

ECE2156.4. Design different types of filters for applications in electrical networks

List of Experiments:

1. Generation of continuous-time signals: Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signals.

2. Generation of Discrete-time signals: Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signals

3. To study the different operations on signals- Time shifting, Time scaling, Time reversal

4. To study convolution theorem and verification of its properties.

5. Verification of Fourier Transform, Inverse Fourier transform and its properties

6. Verification of Laplace Transform, Inverse Laplace transform and its properties.

7. Study of transient responses of R-L and R-C networks using SPICE software.

8. Study of transient responses of R-L-C series and parallel circuits using SPICE software.

9. Verification of Reciprocity and Compensation theorems using SPICE software.

10. Determination of Impedance (Z) and Admittance (Y) parameters of two port networks using SPICE software.

11. Design and simulation of active low pass and high pass filters using SPICE software.

12. Design of band pass and band reject filters using active low pass and high pass filters and simulation using SPICE software.

CourseTitle:Micro Project: Design Thinking & Idea Lab (ECE)					
Course Code :ECE2196					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

The students after finishing this course will be able to

ECE2196.1. Develop new ways of creative thinking and learn the innovation cycle of design thinking process for developing innovative products.

ECE2196.2. Propose real-time innovative engineering product designs and chooseappropriateframeworks, strategies, techniques during prototype development.

ECE2196.3. Learn all the skills associated with the tools and inventory associated with the IDEA Lab.

ECE2196.4. Learn necessary skills to build useful and standalone system/ project with enclosures.

Course contents:

(i) Lecture [L: 1; T: 0; P:0]

1. Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design ThinkingProcess (explain with examples).

2. Understanding Creative thinking process, Understanding Problem Solving,Testing Creative Problem Solving.

3. Process of Engineering Product Design, Design Thinking Approach,Stages of Product Design, Examples of best product designs and functions.

4. What is Prototype? Why Prototype? Rapid Prototype Development process,Testing, Sample Example.

5. Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation ofIndividual differences.

6. Practical Examples of Customer Challenges, Use of Design Thinking toEnhance Customer Experience.

7. Solving Practical Engineering Problem through Innovative Product Design& Creative Solution.

(ii) Laboratory: [L: 0; T: 0; P: 2]

1. Familiarization with the concepts of Design Thinking and different laboratory equipments (DSO, DMM, Signal and function generator).Introduction to the fundamentals of PCB&

elementary PCB design.

2. Introduction to the fundamentals Vero board. Hands on practice of Soldering usingsoldering iron, and Vero board. In the process design and implement a bridge rectifier on Vero board using necessary circuit components.

3. Design of a RC filter as per the given specification and implement the corresponding circuit on the Vero board.

4. Design and implementation of a regulated power supply with the help of previously designed bridge rectifier and RC filter using zener diode andnecessary circuit components. Study the load regulation of the designed regulated power supply.

5. Introduction to the Arduino architecture. Installation of the required files tointerfaceArduino with the PC. During the process, load a sample test program toArduino in-order to check the functionality of the microcontroller kit.

6. Write a program to interface LCD display with the Arduino kit. Displaying different patterns as per the given specification on the LCD display.

7. Build a circuit by interfacingdifferent sensors to theArduino kit. Shape a prototype of a smart sensing device that will display the sensed data on the LCD displayconnected with the Arduino kit.

Text/Reference Books:

1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

2. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13 : 978-1260019193.

3. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542

4. Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.

5. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.

2nd YEAR 2nd SEMESTER

Course Outcomes:

Course Title :Introduction to Analog & Digital Communication					
Course Code: ECE2201					
Contact hours per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

After completing this course, the students will be able to:

ECE2201.1. Explain the operation of building blocks of a communication system.

ECE2201.2. Compare performances of analog modulation techniques and identify their applications

ECE2201.3. Analyze the functions of building blocks of a digital communication system

ECE2201.4. Identify the performance of various digital modulation & demodulation techniques

ECE2201.5. Explain basic working principle of practical communication systems.

ECE2201.6. Analyze the concept of information rate, channel capacity & channel coding.

Module -1: [8L]

Introduction to the concept of RF spectrum, building blocks of a communication system, necessity of modulation.

CW modulation: Amplitude modulation (DSB, SSB and VSB): Time & frequency domain representation, transmission BW & transmission efficiency.

Frequency Modulation (FM) and Phase Modulation (PM): Time and frequency domain representations, Transmission BW. Narrowband & Wideband FM.

Comparison between AM and FM. Practical uses of AM and FM. Double Super-heterodyne Receiver.

Module -2: [9L]

Digital Communication System: Building block, performance comparison of Analog and Digital communication technique.

Pulse Code Modulation: Sampling (natural sampler, flat top sampler & sample/hold circuit), Quantization, Quantization noise, Companding, Source encoding, differential pulse code modulation, Delta modulation, Adaptive delta modulation.

Line Coder: Desirable properties of line code, Polar/ Unipolar /Bipolar/ Manchester codes. Comparative study among these line codes,

Inter Symbol Interference (ISI), Eye pattern, Equalizer, Regenerative repeater.

Module 3: [9L]

Digital Modulation: Binary modulation: BASK, BFSK, BPSK and DPSK. Concept of M-ary Modulation, QPSK , OQPSK, QAM-8/16, Time and Frequency domain representations, Transmission bandwidth , Generation & Detection of digital modulation techniques. Signal space diagram of received signals. Detection of signals in presence of noise, Matched Filter Receiver, Integrate and Dump type filter, probability of error calculation, Optimum threshold detection, BER, Comparative study of bit error probability of digital modulation systems.

Module 4: [10L]

Various multiplexing techniques used in communication systems (TDMA, FDMA, CDMA, SDMA). Spread Spectrum Technique. Practical examples of digital communication – Cordless & Cellular systems, Bluetooth.

Measures of Information-Discrete memory less model, Mutual Information, Self-information, Entropy, Entropy of a block, conditional entropy, codification of source information using Shannon-Fano theorem, Introduction to Channel coding: Fundamentals of error correction, Hamming codes, CRC.

TEXT BOOKS:

1. B.P. Lathi, Modern Digital and Analog Communication System, Oxford University Press.
2. Haykin, Communication Systems- PHI
3. Principles of Communication Systems, H.Taub and D.L.Schilling, TMH Publishing Co.
4. Singh & Sapre—Communication Systems: 2/e, TMH
5. Digital Communications, J.G.Proakis, TMH Publishing Co.
6. Electronic Communications Systems, Wayne Tomasi, Pearson Education.
7. Carlson—Communication System,4/e , McGraw Hill

REFERENCE BOOKS:

1. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.
2. Digital Communication, A. Bhattacharya, TMH Publishing Co.
3. Wireless Communication and Networks: 3G and Beyond, I. Saha Misra, TMH Education.
4. L.W. Couch II, Modern Communication System, Prentice Hall India.
5. Roden, Analog & Digital Communication Systems, 5e, SPD
6. Communication Systems (Analog and Digital), Sanjay Sharma, Katson Books

Course Title : Introduction to Analog & Digital Communication Laboratory					
Course Code: ECE2251					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

After completing this course, the students will be able to:

ECE2251.1. Design, implement & analyze AM and FM signals in time & frequency domain

ECE2251.2. Design, implement & analyze FDM system & sampler circuits

ECE2251.3. Design, implement & analyze PN sequence generator, line codes and various digital modulation and demodulation schemes.

ECE2251.4. Analyze eye pattern & constellation diagram

List of Experiments:

(All circuits will be implemented using software (LTspice) and hardware components)

1. Design & implementation of Amplitude modulation & demodulation system and analyze in time & frequency domain.
2. Design & implementation of a voltage controlled oscillator (VCO). Implementation of FM modulator using VCO. Analyze the FM signal in time & frequency domain.
3. Implementation & study of Frequency Division Multiplexing & De-multiplexing system in time & frequency domain
4. Implementation & study of natural sampler, flat top sampler & sample/hold circuit
5. Implementation & study of 7-bit length and 15 bit length PN sequences using shift register
6. Implementation & study of Line Codes: Uni-Polar Non-Return to Zero, Polar Non-Return to Zero, Uni-Polar Return to Zero and Manchester Code.
7. Implementation and Study of BASK Modulator and demodulator.
8. Implementation and Study of BFSK Modulator and demodulator.
9. Study of Eye pattern for different bit rates
10. Study of Constellation Diagrams for QAM-8, QAM- 16 etc.

Course Title : Control Systems					
Course Code :ECE2202					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

After completing this course, the students will be able to:

ECE2202.1. Relate their pre-requisite knowledge from Mathematics and Signals & Systems.

ECE2202.2. Develop the ability to understand mathematical model of physical systems and study their nature, configuration and relevant mapping into equivalent models.

ECE2202.3. Apply the concept and classification of control systems to identify, analyze and solve stability related issues in time response, error analysis and stability analysis in an advanced way.

ECE2202.4. Evaluate, categorize and justify the margin of stability with respect to the system's nature using frequency domain analysis tools.

ECE2202.5. Conceptualize different methods of evaluating system behavior with the help of models compatible to simulation.

ECE2202.6. Design controllers according to desired performance specifications which can be applied for system design in higher semesters.

MODULE – I [9 L]

Introduction:

Concepts of Control Systems, Open Loop and Closed Loop Control Systems, Different Control Systems, Classification of Control Systems, Feedback Characteristics, Effects of feedback. [4L]

Transfer Function Representation of LTI Systems:

Block diagram representation of systems, Block diagram algebra, Representation by Signal Flow Graph, Transfer function using Mason's Gain Formula. [5L]

MODULE –II [10 L]

Time Domain Analysis:

Standard test signals, Time response of first order systems, Characteristic equation of feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants. [5L]

Stability Analysis:

The concept of stability, Difference between absolute and relative stability, Routh's stability criterion, Root Locus Technique. [5L]

MODULE – III [10 L]

Frequency Domain Analysis:

Frequency domain specifications, Bode Plot, Phase margin & Gain margin, Stability Analysis from Bode Plot. [6L]

Polar Plot, Nyquist Plot, Stability Analysis. [4L]

MODULE –IV [11 L]

Classical Control Design Techniques:

Compensation techniques, Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers, Introduction to non-linear control [6 L]

State Space Analysis of Continuous Time Systems:

Concepts of state, state variables and state model, Derivation of state models from block diagrams, Solving time invariant state equations, State Transition Matrix and its properties, Concepts of Controllability and Observability. [5 L]

TEXT BOOKS:

1. Automatic Control Systems– by B. C. Kuo, John Wiley and Sons.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Ltd.
3. Modern Control Engineering – by Katsuhiko Ogata , Prentice Hall of India Pvt. Ltd.
4. Modern Control Systems- by R.C. Dorf & R.H. Bishop- Addison- Wesley Longman.

REFERENCE BOOKS:

1. Control Systems Engg. by Norman S. Nise , John Wiley.
2. Control System Engineering by Ananda Natarajan , P. Ramesh Babu, Scitech Pub.
3. Automatic Control Systems- Basic analysis and design- by A. Wolovich- Oxford University Press.

Course Title : Control Systems Laboratory					
Course Code :ECE2252					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

After completing this course, the students will be able to:

ECE2252.1. Students will be able to understand the implementation of different system models using a system simulator.

ECE2252.2. Students will be able to analyze time domain behavior and system errors of 1st order and 2nd order systems.

ECE2252.3. Students will be able to evaluate the relative stability of systems using time and frequency domain analysis tools.

ECE2252.4. Students will be able to design controllers according to desired performance specifications of a system.

List of Experiments:

1. Familiarization with OCTAVE Control System Toolbox and SIMULINK.
2. Study of the effect of feedback on systems.
3. Study of first order systems having different time constants.
4. Study of second order systems having different damping ratios.
5. Verification and validation of time domain specifications of second order systems.
6. Study of steady state errors for different 'types' of systems.
7. Study of system stability using Root Locus Technique.
8. Study of system stability using Bode plot.
9. Study of system stability using Nyquist plot.
10. Study of system representation using State Model.
11. Study of P, PI, PD and PID controller action on system response.

Course Title: EM Theory And Transmission Lines					
Course Code: ECE2203					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

After completing this course, the students will be able to:

ECE2203.1. Apply their pre-requisite knowledge of Electrostatics and Magneto statics.

ECE2203.2. Comprehend Electromagnetic wave propagation in different mediums.

ECE2203.3. Understand different electromagnetic phenomena associated with Transmission Lines.

ECE2203.4. Design of Impedance Matching Networks for two wire Transmission Lines.

ECE2203.5. Develop the ability to analyze the radiation characteristics of antenna configurations and identify respective areas of application.

ECE2203.6. Understand pattern synthesis and analysis in linear antenna array.

Module I: [6]

Faraday's law & Lenz's law, Transformer and Motional Electromotive Forces, Displacement Current, J_C - J_D Relation, Maxwell's equations, Time Varying Potentials, Time-harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave.

Module II: [10]

Plane Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Good Conductor, Free space; Poynting Theorem, Power flow, Poynting vector, Skin Depth, Surface Resistance, Wave Polarization; Reflection and Transmission for normal and oblique incidence, Brief introduction to FDTD method in solving electromagnetic problems.

Module III: [12]

Transmission Lines; Concept of Lumped parameters and Distributed parameters. Line Parameters, Transmission line equations and solutions, Physical significance of the solutions, Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; Condition for minimum distortion and minimum attenuation, Transmission line losses, Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart -Applications;

Load Matching Techniques using stub / Quarter wave Matching, Bandwidth problem; Low loss RF transmission lines, line as circuit elements.

Module IV: [6]

Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wave dipole, Loop antenna, Yagi-Uda array, Basic Concepts of antenna array.

Text Books

1. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education.
3. Electromagnetic Waves Shevgaonkar, Tata-McGaw-Hillr –R K
4. Antenna Theory: Analysis and Design, 3rd edition, C.A. Balanis, Wiley India.

Reference Books

1. Engineering Electromagnetics, 2nd Edition - Nathan Ida, Springer India.
2. Time Harmonic Electromagnetic Fields, Roger F. Harrington, IEEE Press Series.
3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Engineering Electromagnetics, 7thEdition-W.H.Hayt&J.A.Buck, Tata-McGraw-Hill.
5. Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy-Scitech.

Course Title: EM Theory and Transmission Lines Laboratory					
Course Code: ECE2253					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**2**	**2**	**1**

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

ECE2253.1. The students will be able to plot SW pattern under different conditions.

ECE2253.2. They will learn generation and study of Smith Chart.

ECE2253.3. The students will be able to study radiation patterns of various types of antennae.

ECE2253.4. They will be able to undertake parametric study of antenna.

List of Experiments

1. Study of reflection of electromagnetic waves from plane boundary using FDTD method.
2. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short circuited and terminated by capacitive, inductive and resistive load at the load end.
3. Study of Smith chart on MATLAB/OCTAVE/PYTHON platform.
4. Radiation Pattern study of dipole antenna.
5. Radiation Pattern study of a folded-dipole antenna.
6. Radiation pattern study of Helical Antenna.
7. Parametric study (Gain, Directivity, HPBW and FNBW) of three, five and seven element Yagi Uda configurations.
8. Radiation pattern study of a Pyramidal Horn Antenna.
9. Design of half wave dipole antenna at 800 MHz using full wave electromagnetic simulator.

Course Title : Digital Signal Processing					
Course Code :ECE2204					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course outcomes:

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

ECE2204.1. Recall the concepts of trigonometry, complex algebra, Fourier transform to analyze different signals and systems.

ECE2204.2. Apply the concept of Z-transform, convolution to determine the transfer function of a system and evaluate the output of the system.

ECE2204.3. Extend the knowledge of discrete-time Fourier transform to interpret DFT, FFT and apply the concept as a frequency transformation tool.

ECE2204.4. Design transfer functions of IIR/FIR filters applying transformation techniques/windowing methods.

ECE2204.5. Construct and model digital filters from their transfer function, develop concept of multirate signal processing and architecture of digital signal processor.

ECE2204.6. Develop a thorough understanding of the central elements of digital signal processing theory and apply this theory to real-world signal processing applications.

MODULE I [7L]

Introduction to Digital signal processing

Prerequisites: Concept of sampling, construction of discrete-time signals and systems, aliasing effect, Reconstruction of signals, concept of convolution, graphical, analytical methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems, introduction to Z-transform, ROC, properties of Z-transform.

Introduction to Z-transform, ROC, properties of Z-transform, poles and zeros and stability of LTI discrete systems, mapping between s-plane and Z-plane, convolution, correlation and multiplication using Z-transform, initial value theorem, final-value theorem, Parseval's relation, inverse Z-transform, inverse Z-transform, solution of difference equation by Z-transform.

MODULE II [8L]

Discrete Fourier Transform

Prerequisites: Concept of DFT and IDFT, concept and properties for DFT/IDFT, Twiddle factors and their properties.

DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, concentric circle, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises, computational burden on direct DFT.

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, IDFT using DIT & DIF-FFT.

MODULE III [13 L]

Digital Filters

Filter Concepts: Introduction to the concept of Digital Filters, frequency response and filter characteristics, basic concepts of IIR and FIR filters.

IIR Filters:

Introduction to analog filter design: Butterworth and Chebyshev filters design, Transformation techniques: Impulse invariant method and bilinear transformation, warping effect and prewarping, design procedure for low pass digital Butterworth and Chebyshev filter design.

FIR Filters:

Linear phase filters: Condition for filter to have linear phase response and its frequency response (Type I, II, III, IV),

Design techniques:

Fourier series method, Gibb's phenomenon, Windowing method (Rectangular, Hamming and Hanning window), comparison study of windows,, advantages & disadvantages of FIR & IIR Filters.

MODULE IV [8L]

Realization of Digital Filters: Introduction Realization of discrete time systems: FIR and IIR system. Different methods of realizations: Direct form I, Direct form II, Cascade form structure, Parallel form structure, their advantages and disadvantages with examples**.**

Multi-rate Signal Processing: Understanding and necessity of multi-rate system, Decimation and interpolation- time domain and frequency domain behaviour of multi-rate systems, advantages and disadvantages (aliasing & anti-aliasing).

Introduction to Digital Signal Processor: TMS320C67XX families, architecture and applications.

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co
3. Digital Signal Processing, P. Ramesh Babu, Scitech Publications (India).
4. Digital Signal Processing, A. Nagoor Kani, TMH Education .
5. Theory and application of digital signal processing- L.R. Rabiner & B. Gold- PHI.
6. Analog & digital Signal Processing- A. Ambardar- Books/Cole Pub.

REFERENCE BOOKS:

1. Digital Signal Processing, Tarun Kumar Rawat, Oxford Press
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co .
3. Digital Signal Processing; A Hands on Approach, C. Schuler &M.Chugani, TMH Publishing Co.
4. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education .
5. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press.
6. Texas Instruments DSP Processor user manuals and application notes.

Course Title : Digital Signal Processing & Applications Laboratory					
Course Code :ECE2254					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course outcomes:

The students will be able to:

ECE2254.1. Interpret the response of discrete time systems using the concept of convolution.

ECE2254.2. Apply different transformation tools-Z-transform, discrete Fourier transform, fast Fourier transform on signals and justify their properties as well.

ECE2254.3. Compare the frequency response of FIR and IIR filters (LPF, HPF, BPF and BSF) of digital filters and implement the systems using suitable realization techniques.

ECE2254.4. Develop DSP processors based real time system to analyze different real time signals like speech signal, image signal and some other biomedical signals.

Simulation Laboratory using standard Simulator:

1. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
2. Z-transform of various sequences – verification of the properties of Z-transform.
3. Twiddle factors – verification of the properties.
4. DFTs / IDFTs using matrix multiplication and also using commands.
5. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
6. Verifications of different algorithms associated with filtering of long data sequences and Overlap–add and Overlap-save methods.
7. Butterworth IIR filters design with different set of parameters.
8. Chebyshev IIR filters design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using DSP Processor:

1. Hardware implementation to verify Convolution, DFT and IDFT using TMS320C67xx processor.

2. Hardware implementation to verify the results of different digital filters using TMS320C67xx processor.

Course Title : Electronic Devices					
Course Code :ECE2205					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

ECE2205.1. Apply the knowledge of energy band diagram in analyzing different semiconducting materials

ECE2205.2. Understanding the concepts of carrier distribution and Fermi energy level in semiconductors under both equilibrium and non-equilibrium conditions.

ECE2205.3. Justify different operations of solid state devices using relative position of Fermi energy levels across homo and hetero *p-n* junctions.

ECE2205.4. Describe working principles of different devices using mathematical models and energy band diagrams.

ECE2205.5. Analyze different phenomena in bipolar junction transistor (BJT) using semiconductor physics and mathematical models.

ECE2205.6. Analyze the physics behind the working of different field effect transistors (FET) in both qualitative and quantitative ways.

Module -1 : Semiconductor Physics [10L]

Recapitulation of Quantum Mechanics. Kronig-Penny Model, Energy Band diagram, E-K diagram, Direct and Indirect Band-gap semiconductors, concept of effective mass, carrier distribution in solid, concept of density-of-states (only expression), Fermi-Dirac distribution function, Fermi level, Intrinsic and extrinsic semiconductors, idea of degeneracy and non-degeneracy, Fermi-level shift with the changes in doping and temperature. (5L)

Semiconductor under equilibrium: Carrier concentration in terms of effective Density of states, Mass-Action Law. (2L)

Semiconductor under Non-Equilibrium: Excess carrier generation and recombination with expression, concept of Quasi-Fermi level. Drift and Diffusion of carrier with expressions, continuity equation, Scattering effect, Hall effect, Piezoelectric effect. (3L)

Module -2 : Diodes [10L]

Homo-Junctions: *p-n* junction physics: derivations and plots of depletion charge, electric field, potential profiles; energy band diagram, depletion width, *p-n* junction resistances and capacitances, Varactor diode, *p-n* junction current, concept about linearly graded and abrupt junctions, small-signal diode switching model. (4L)

Basic operations of different diodes : Tunnel diode, Photodiode (*p-n, p-i-n, APD*), Solar Cell, *LED*, *OLED*. (3L)

Hetero-junctions: Physics of Metal-Semiconductor junctions & Semiconductor-Semiconductor hetero-junctions, Rectifying & Non-Rectifying nature of Hetero-junctions, basic concept of potential-well and *2D-Electron Gas (2DEG),* mobility and its variation with time & temperature*,* concept of *HEMT, QLED*. (3L)

Module -3 : Bipolar Junction Transistors (BJT) [8L]

BJT operating principle, minority carrier distributions, different modes of operations and respective energy band diagrams, input and output characteristics of BJT in different configurations, non-ideal effects in BJT, concepts about large and small-signal modeling of the device, Eber's Moll model, Hybrid-π model, Basic operation of Photo-transistor, High-Frequency Transistor: Heterojunction Bipolar Transistor (HBT).

Module -4 : Field Effect Transistors (FET) [8L]

MOSFET: Physics of 2-terminal MOS structures with proper band diagrams, formation of inversion layer, MOSFET classifications: Enhancement and depletion type MOSFETs, basic operations and I-V characteristics of both the devices; Concept of Threshold voltage and Flat-Band voltage, MOS capacitance-voltage (C-V) characteristics, Small-signal model of MOSFET, Introduction to CMOS technology and device fabrication.

Text Books:

1. Donald Neamen&Dhrubes Biswas – Semiconductor Physics and Devices, 4th Edition, McGraw Hill Education.
2. Ben G. Streetman & Sanjay Kumar Banerjee – Solid State Electronic Devices, 7th Edition, Pearson Education.
3. D. K. Bhattacharyya & Rajnish Sharma – Solid State Electronic Devices, 2nd Edition, Oxford University Press.
4. S. M. Sze & Kwok K. Ng -- Physics of Semiconductor Devices, 3rd Edition, Wiley.

Reference Books:

5. Vladimir V. Mitin, Viatcheslav Kochelap, and Michael A. Stroschio --- Quantum Heterostructures: Microelectronics and Optoelectronics, Cambridge University Press.

6. Paul Harrison – Quantum Wells, Wires, and Dots : Theoretical and Computational Physics of Semiconductor Nanostructures, 3rd Edition, Wiley.
7. David A. Bell – Electronics Devices & Circuits, 5th Edition, Oxford University Press.

Paper Name: **Advanced Numerical Methods (B. Tech. ECE)**					
Paper Code: **MTH2202**					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

MTH2202.1 Analyze certain algorithms, numerical techniques and iterative methods that are used for solving system of linear equations.

MTH2202.2 Implement appropriate numerical methods for solving advanced engineering problems dealing with interpolation, integration and differentiation.

MTH2202.3 Apply various methods for determining eigenvalues of a square matrix and estimating their location in case actual determination is not possible.

MTH2202.4 Develop an understanding to reduce a matrix to its constituent parts in order to make certain subsequent calculations simpler.

MTH2202.5 Apply various search techniques for solving non linear programming problems.

MTH2202.6 Compare the accuracy and efficiency of certain numerical methods.

Detailed Syllabus:

Module I: [10L]

System of Linear Equations: Gauss Elimination Method, pivoting and scaling. Gauss-Jordan, Gauss-Jacobi and Gauss-Seidel Methods and their computational complexity, Matrix Norm, Symmetric positive definite systems and indefinite systems: Cholesky factorization. Error Analysis: error prediction.

Module II: [10L]

Eigen Value problems: Eigenvalue location,QR decomposition and its application in finding eigenvalues and least square solutions, Power method and inversion iteration to find a dominant eigenvalue and eigenvector, Singular value decomposition.

Module III: [10L]

Interpolation, Integration & Differentiation: Purpose of interpolation, choice of interpolating function, Calculus of finite differences, Polynomial interpolation: Newton's forward and backward interpolation, Lagrange's method, Newton's divided difference interpolation, Computational

complexity of these methods, Piecewise polynomial interpolation: cubic spline interpolation, General form of quadrature rule: Newton-Cotes quadrature. Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule.

Module IV: [10L]

Prerequisites, Optimization: Unimodal functions, One-dimensional unconstrained optimization algorithms: Interval halving, Dichotomous search, Golden section search, Fibonacci search, Curve fitting and method of least squares.

Text Books:

1. Trefethen L. N. and Bau D. *Numerical Linear Algebra*, SIAM
2. Watkins D. S. *Fundamentals of Matrix Computation*, Wiley
3. B.S. Grewal,. *Numerical Methods in Engineering and Science*, Khanna Publishers.
4. Jain M. K. and Iyengar S.R.K. *Numerical methods for scientific and engineering computation,* Newage Internation Publishers
5. Conte S. D. and Boor C. D. *Elementary Numerical Analysis - An Algorithmic Approach*, McGraw Hill
6. S.S. Sastry. *Introductory Methods of Numerical Analysis, ,*PHI Learning Pvt. Ltd.
7. S. S. Rao, *Engineering Optimization,* New Age International Publishers

Reference Books:

1. Golub G. H. and Van Loan C.F. *Matrix Computation*, John Hopkins U. Press, Baltimore
2. Stewart G. W. *Introduction to Matrix Computations*, Academic Press
3. Demmel J.W. *Applied numerical linear algebra*, SIAM, Philadelphia
4. N. Datta, R.N. Jana, Introductory NUmerical Analysis, Shreedhar Prakashani
5. Babu Ram, *NUmerical Methods,* Pearson
6. Heath M. T., *Scientific Computing: An Introductory Survey*, McGraw Hill
7. Joe D. Hoffman, *Numerical Methods for Engineers and Scientists*, McGraw Hill

Paper Name: **Advanced Numerical Methods Laboratory**					
Paper Code**: MTH2252**					
Contact hours per week:	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

MTH2252.1 Write programs in C to solve problems based on numerical methods.

MTH2252.2 Apply the knowledge of C programming to find non-iterative exact solutions of a system of linear equations.

MTH2252.3 Use C programming to develop algorithms to find iterative approximate solutions of a system of linear equations.

MTH2252.4 Demonstrate their ability of C programming to solve problems involving interpolation.

MTH2252.5 Exhibit their ability of C programming to solve problems involving integration.

MTH2252.6 Develop a program in C to apply Power method for finding dominant eigenvalue and dominant eigenvector of a square matrix.

Detailed Syllabus:

Development of computer programs in C for the following problems:

1. Gauss elimination Method.
2. Gauss-Seidel Method.
3. Lagrange's interpolation.
4. Newton's forward interpolation.
5. Newton's backward interpolation.
6. Trapezoidal rule and Simpson's $1/3^{rd}$ rule.
7. Weddle's rule.
8. Power method.

Books/References:

1. B. S. Grewal, Numerical Methods in Engineering and Science with Programs in FORTRAN 77, C and C++, **Khanna Publishers.**
2. T. Veerarajan, T. Ramachandran, Numerical Methods with Programs in C, **McGraw Hill**.

3rd YEAR 1st SEM

CourseName: Mobile Communication and Networks					
CourseCode:ECE3101					
Contact Hours perweek	**L**	**T**	**P**	**Total**	**CreditPoints**
	3	0	0	3	3

CourseOutcomes:

Aftercompletingthecoursethestudentswillbeableto:

ECE3101.1. Explain operations of cellular communication systems - their architecture, functioning, and various standards.

ECE3101.2. Understand the evolutionofmobilecommunicationgenerations.

ECE3101.3. Explain the key features of mobile communication networks using up to 4G standards.

ECE3101.4. Analyze the emergingtechnologiesrequiredforfourthgenerationmobilesystems such as SDR, MIMO etc. with confidence.

ECE3101.5. UnderstandtheconceptsofLTE-advanced, 4Gfeaturesandchallenges.

ECE3101.6. Analyze and compare architecture, functioning, protocols, capabilities and application of various mobile communication networks.

ModuleI[9L]:

Cellular concepts: [9]

Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Evolutionofmobile cellular communication:Overview of 2G 3G, 4G and 5G cellular mobile standards.

ModuleII[9L]:

Signal propagation: [9]

RF Propagation mechanisms and their characteristics. Fading channels-Multipath and small-scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, fading and study of some curious properties like flat and frequency selective fading, slow and fast fading. Free space propagation model,a couple of models like Hata, Okumura, Ground reflection (Two-Ray) model, Log distance path loss model. Antennas: antennas for mobile terminal, monopole antennas, PIFA, base station antennas and arrays, antennas for drones.

ModuleIII[9L]:

GSM, GPRS& CDMA systems-Architecture and Protocols: [6]

Introduction, GSM Subsystem–an overview, GSM Frequency Bands and Allocation Strategies, GSM Call Set-up Procedure, GPRS (2.5G) Network Architecture, GPRS Attachment and Detachment Procedure. CDMA Evolution-An overview, FH-SS and DS-SS, CDMA IS-95 Systems, CDMA Channel Concept-Forward and Reverse, RAKE Receiver. Transmission Power Control- Near Far Problem and Multipath Phenomenon, Handoff Process.

ModuleIV[9 L]:

Third-Generation (3G) Wireless System: [4]

UMTS Core Network Architecture, Channel Structure in UMTS Terrestrial Radio Access Network, High-Speed Downlink Packet Access (HSDPA).Evolution of CDMA-One (IS-95) to CDMA-2000,Physical Channels of CDMA-2000, Differences between CDMA-2000 and WCDMA.

Fourth Generation Systems: [5]

4G Vision, 4G Features and Challenges, Applications of 4G, 4G Technologies: Multicarrier Modulation,OFDM, Beam forming and MIMO, 3GPP LTE System, Core Architecture, LTE Bandwidth, Volte.

TextBooks:

1. T.S.Rappaport, "Wireless Communications Principles and Practice", PHI, II Edition, 2006.
2. Erik Dahlman , 4G, LTE-Advanced Pro and The Road to 5G.
3. From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and MobileBroadband,MartinSauter,Wiley
4. WirelessCommunicationandNetworks:3GandBeyond,I.SahaMisra,TMHEducation.

ReferenceBook:

1. Vijay K. Garg, "Wireless Communication and Networking", Elsevier, Morgan Kaufmann, Reprinted 2012.
2. William Lee ,"Mobile Cellular Telecommunications: Analog and Digital Systems", McGraw Hill Education
3. Sassan Ahmadi, 5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards Hardcover – 1 June 2019

CourseName: Mobile Communication and Networks Laboratory					
CourseCode:ECE3151					
Contact Hours perweek	**L**	**T**	**P**	**Total**	**CreditPoints**
	0	0	2	2	1

Course Outcomes:

After completing this course, the students will be able to:

ECE3151.1. The students will be able to associate different theories of wireless communication with practical experiments.

ECE3151.2. They will learn to relate the relations between various RF parameters and resulting outputs.

ECE3151.3. The students will be able to observe and plot various readings related to GPS and GSM systems.

ECE3151.4. They will be able to perform measurements of some basic transceiver parameters through practical demonstration.

List of experiments:

1. Simulation of RF propagation models. Observations and monitoring of the distance with change in the transmit power level.
2. Checking the behaviors of fading models – Rayleigh and Rician.
3. Study of fading in rainy condition- with variation of speed.
4. Finding the Bit Error Ratio (BER) against Signal-to-Noise Ratio (SNR) in a radio channel with AWGN type of noise and plotting the graphs for comparison.
5. Setting up GPS system and observation of features like signal-to-noise ratio (SNR) of the signals corresponding to the visible satellites.
6. Study of measurement procedure for some important Receiver parameters like Audio Frequency (AF) output, distortion, AF Response of detected output (using RF signal generator and AF generator- no RF link is required).
7. Study of measurement of RF power using Bird meter.
8. Study of a few typical routing algorithms with QualNet simulator.

Course Name: Microwave Engineering					
Course Code: ECE3102					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Course outcomes:

After completing this course, the students will be able to:

ECE3102.1. Apply previous E.M. theory concepts to understand microwave engineering.
ECE3102.2. Identify high frequency electromagnetic wave propagation characteristics through guided media.
ECE3102.3. Analyze microwave passive components and circuits.
ECE3102.4. Enhance their knowledge on semiconductor and vacuum tube devices operating at high frequency.
ECE3102.5. Design high frequency filters and amplifiers.
ECE3102.6. Implement the concepts in developing different prototype microwave systems.

Module I [12L]

Introduction: RF & Microwave Spectrum, Typical applications of RF and Microwave Engineering, Safety considerations [1L]

Waveguides and Resonators: Rectangular waveguides, TE & TM modes, TE 10 mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, Power transmission, attenuation, waveguide excitation, wall current. [5L]

Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor of a rectangular cavity resonator, excitation. Introduction of circular waveguide; Circular waveguides, TE_{11} mode analysis. [3L]

Planar Transmission Lines Strip Line, Micro-strip lines, Coplanar waveguide, Slot line- design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines.[3L]

Module II [10L]

Microwave Network Representation Impedance and Equivalent Voltage and Current, Impedance and Admittance Parameters, Scattering Matrix, Properties of Scattering Parameters for Reciprocal and Lossless Network, Generalized S parameters, S parameters of Two-port Networks with Mismatched Load [5L]

Microwave Passive Devices T-Junctions: E/H/Hybrid T-junctions, Wilkinsion Power Divider, Bethe hole coupler, Directional Couplers, Ratrace coupler, Isolator, Phase Shifters, Circulators, Attenuators, Methods for coupling of Microwave signal. [5L]

Module III [9L]

Microwave Tubes Principle of Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and TWT microwave active devices: Typical characteristics &applications (only physical explanation is required, no mathematical derivation required).[3L]

Semiconductor Microwave devices TED (Gunn diode), Modes of Gunn diode, Avalanche Transit Time (IMPATT) device, Tunnel diode, Schottky diode, PIN diode characteristics & applications; Microwave field effect transistor (MESFET), High Electron Mobility Transistor(HEMT)[6L]

Module IV [11L]

Microwave Filter Design procedure of filter design using insertion loss method (maximally flat and equi-ripple), low pass prototype design, conversion to other filter prototypes.[5L]

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. [6L]

Text books:

1. Microwave Engineering, 3rd edition, David M. Pozar, Wiley &Sons Inc.

2. Microwave Engineering, Monojit Mitra, Dhanpat Rai &Co.

3. Microwave Engineering, A Das & S Das, TMH.

4. Microwave Devices & Circuits, SY Liao , Pearson Education/PHI

5. Microwave Engineering Fundamentals, Design and Applications, Subal Kar, University Press.

References:

1. Microwave Engineering-Passive Circuits, PA Rizzi , Pearson Education.

2. Microwaves, K C Gupta, New Age Publishers.

3. Foundation of Microwave Engineering, 2nd edition, Robert E Collin, McGraw Hill, Inc.

4. Microwave Devices & Circuit Design, GP Srivastava & VL Gupta, PHI

5. Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design, M. Radmanesh, Artech house

Course Name: Microwave Engineering Laboratory					
Course Code: ECE3152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**2**	**2**	**1**

Course Outcome:

After completing the following experiments, students will be able to:

ECE3152.1. Understand electromagnetic wave propagation at high frequency.

ECE3152.2. Identify the difference between active and passive microwave devices

ECE3152.3. Analyze and Characterize Microwave Devices.

ECE3152.4. Design measurement setup to perform analysis of microwave devices.

LIST OF 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 Reflex Klystron oscillator using X-band waveguide test bench.

4. Study of Gunn Diode Characteristics using X-band waveguide test bench.

5. Characterization of waveguide tee (magic tee / E-plane tee / H-plane tee) using waveguide test bench at X-band.

6. Analysis of directional coupler using X-band waveguide test bench set up.

7. Analysis of waveguide type filter using X-band waveguide test bench set up.

8. Design of microwave filter (low pass/ high pass/ band pass) using full wave e.m. simulator (HFSS/CST/IE3D)

CourseName: Processor Fundamentals and Microcontrollers					
CourseCode: ECE3103					
Contact Hours perweek	**L**	**T**	**P**	**Total**	**CreditPoints**
	3	0	0	3	3

Course Outcomes:

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

ECE3103.1. Understand the architectures and functional diagrams of microprocessors and microcontrollers and their differences.

ECE3103.2. Develop programs for processors and controllers.

ECE3103.3. Analyze advanced processors/microcontrollers and their organizations.

ECE3103.4. Apply concepts of peripherals and interfacing protocols to processors/microcontroller.

ECE3103.5. Synthesis of microprocessor and microcontroller based complex systems.

ECE3103.6. Design innovative engineering solutions using suitable processors /controllers.

Total Lectures = 36 L

Module I:[10L] Intel 8085 Microprocessor Architecture, Timing and Control Signals, Instruction classification, Instruction set, Addressing Modes , ALP format – Programming 8085, Memory Interfacing, Timing diagram, stack subroutine, Interrupt structure of 8085 microprocessor.

Module II: [10L] 8086 Architecture, Advanced Coprocessor Architecture 8088 286, 486, RISC & CISC Processors- Basic concept and Design.

Module III: [7L] Architecture of 8051 Microcontroller, Signals &Memory, I/O ports, Counters and Timers, Serial (I2C, USB) & Parallel (ISA, ATA) Interface, Assembly/Embedded- C language programming concepts for various software routines.

Module IV: [9L] I/O Interfacing– PPI 8255, Programmable interrupt controller 8259 – Programmable DMA controller 8257 –Programmable interval timer 8253/4, ADC &DAC Interfacing. ARM Architecture, Memory Organization, Register Organization, Processor Modes, Instruction Set, Thumb instructions.

Text/Reference Books

1. R.S. Gaonkar. Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.

2. D. A. Patterson and J. H. Hennesey, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.

3. M.A. Mazidi, Janice GilliMazidi, and R.D.Kinley, "The 8051 Micro Controller and Embedded Systems", PHI Pearson Education, 5th Indian reprint, 2003.

4. Douglas Hall, Microprocessor Interfacing, Tata McGraw Hill, 1991.

5. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

6. Steve Furber, ARM System on chip architecture, Pearson education.

7. L. B. Das, Embedded Systems an Integrated Approach, Pearson education

CourseName: Processor Fundamentals and Microcontrollers Laboratory					
CourseCode:ECE3153					
Contact Hours perweek	**L**	**T**	**P**	**Total**	**CreditPoints**
	0	0	2	2	1

Course Outcomes:

The students will be able to:

ECE3153.1. Perform arithmetic and logical problems using 8085 ALP.

ECE3153.2. Develop interfacing between processors and peripheral chips.

ECE3153.3. Design systems to interface 8051 with various devices.

ECE3153.4. Generate suitable ALP for 8086 to solve problems.

The experiments (at least 10) will be selected from the list below.

1. Store two eight bit numbers in memory. Add/Subtract the two numbers, checking for carry/borrow and then store the result and carry/borrow in consecutive memory locations (8085 assembly) .
2. Exchange data between two separate N byte memories block (8085 assembly).
3. Arrange a set of N numbers in ascending and descending orders (8085 assembly).
4. Adding of a set of numbers until a zero is found (8085 assembly).
5. Generate a Fibonacci series for first N numbers, (8085 assembly).
6. Interface 8255 with 8085 using port A as input and displaying input value in port B configured as output.
7. Interface 8255 with 8085 using port A as input and then displaying it's compliment in port B configured as output
8. Use interfaced 8255 to have a multi digit display of the seven segments LED with multiplexing.
9. Interface with 8051 making LED blink with input from port 2 and output from port 1.
10. Use 8051 to mimic traffic light conditions.
11. Write 8086 program to add two 8/16 bit numbers with and without carry.
12. Write a 8086 program to move a block of numbers one memory location to another memory location.

Course Name : Microelectronic Devices and Analog VLSI Design					
Course Code :ECE3104					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcomes (COs):

After completing the course the students would be able to:

ECE3104.1. Understand the fundamentals of MOSFET Device Physics.

ECE3104.2. Correlate the fundamental understanding with the evolving VLSI Design Trends and Challenges.

ECE3104.3. Understand the IC Fabrication Process Flow and analog layout techniques for scaled MOSFETs.

ECE3104.5. Analyze and design MOS-based analog VLSI sub-circuits like current mirrors and bandgap references.

ECE3104.6. Design MOS circuits of practical importance e.g., common-source amplifiers, differential amplifiers, switched capacitor filters and level shifters.

ECE3104.7. Understand and apply the knowledge of analog VLSI sub-circuits to develop integrated subsystems for analog applications.

Module I: Introduction and the MOS Transistor [8L]

Unit1: Evolution of Microelectronics, Moore's Law, Process Node Definition, Evolution of Process Technology, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI), ITRS, VLSI Design Trend and Challenges.

Unit2: Structure and Principle of operation of enhancement-mode MOSFETs, MOS-Characteristics, MOS Capacitors, C-V characteristics of MOS gate capacitance, Scaling Theories: Constant Field Scaling, Constant Voltage Scaling and their effects on the device parameters, Short Channel MOSFETs, NMOS vs PMOS, SOI and FinFET structures.

Module II: Fabrication Flow [8L]

Unit1: IC Process Flow, clean room technology, Wafer Growth and Preparation, CVD Techniques, Epitaxy, Molecular Beam Epitaxy (MBE), Oxidation (Dry and Wet), LOCOS and STI, Photo

Lithography: Contact, Proximity, Projection, Photo Resist, Etching (Wet and Dry), Diffusion, Ion Implantation, Metallization and interconnects.

Unit2: CMOS Fabrication flow step by step using self-aligned techniques (N-well Process), CMOS Fabrication Process Overview and Structure for N-Well, P-Well, Twin Tub, Lambda and Micron rules, Stick Diagrams, Analog layout techniques of passive components, concept of fingering, interdigitated structure and common centroid technique.

Module III: Analog VLSI Sub-circuits [10L]

Unit1: Analog VLSI Design Steps, Basic Building Blocks of Analog VLSI Chips, large signal and small signal analysis and equivalent circuit model, small signal parameters for low frequency and high frequency model, MOS Switch

Unit2: MOS Diode, Active Load/Resistors, Voltage Dividers, Current Mirror, CMOS Current Mirror & Sink (Cascode), CMOS Bandgap Reference (Basic Circuit Only).

Module IV: Analog VLSI Circuits [10L]

Unit1: Common-Source single stage amplifier, Differential Amplifier: Common Mode, Differential Mode, Transfer Characteristic Curves, CMRR, and Differential Amplifier with Active Load.

Unit2: Switched Capacitor Circuit topologies, Filter, Integrator.

Unit 3: I/O Design: GPIO (General Purpose I/O) Transmitter and Receiver block diagram, Level Shifter Design.

Text Book:

1. VLSI Technology 2ND Edition, Author: Sze, S.M.; MCGRAW HILL COMPANIES .

2. CMOS Analog Circuit Design (second edition) Phillip E. Allen and Douglas R. Holberg (Oxford) .

3. Microelectronic Circuits- A.S. Sedra &K.C.Smith- Oxford International student edition.

References:

1. The MOS Transistor (second edition) Yannis Tsividis (Oxford) .

2. Design of Analog CMOS Integrated Circuit, B. Razavi, Mc, Graw Hill .

Course Name : Microelectronic Devices and Analog VLSI design Laboratory					
Course Code :ECE3154					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcomes:

After completing the course the students would be able to:

ECE3154.1. Understand the basics of analog VLSI design flow.

ECE3154.2. Understand the basic principle of operation of MOS devices.

ECE3154.3. Analyze VLSI sub-circuits.

ECE3154.4. Design and analyze amplifier circuits.

List of Experiments:

1. Familiarization with Industry Standard Cadence Software Tool for Submicron Technology (45 nm)
2. Study of Transfer and Output Characteristics of NMOS
3. Study of Transfer and Output Characteristics of PMOS
4. Study of MOS as a Capacitor
5. Study of MOS as a Diode
6. Study of Voltage Divider using MOS as Active Resistor
7. Study of Current Mirror Circuit using MOS
8. Study of Cascode Current Mirror Circuit using MOS
9. Layout Design & Post Layout Simulation of Current Mirror Circuit (Using Common Centroid Analog Layout Technique of Matched Pairs)
10. Circuit analysis of a Single Stage Amplifier
11. Circuit analysis of a Differential Amplifier

Professional Elective - 1

Course Name : Artificial Intelligence					
Course Code :ECE3131					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After completing the course the student will be able to:

ECE3131.1. Apply fundamental engineering knowledge for feature extraction and selection techniques processing data set.

ECE3131.2. Understand the notion of problem solving using AI searching techniques, analyze various search algorithms and evaluate and demonstrate their effectiveness.

ECE3131.3. Illustrate the concept of knowledge representation and reasoning, apply constraints and logic for intelligent systems

ECE3131.4. Explain probabilistic reasoning in an uncertain domain and understand planning.

ECE3131.5. Explain the fundamental concepts of different Machine learning models

ECE3131.6. Apply the concept of AI in solving real life problems.

Module I: [11L]

Introduction: Introduction to AI, Applications of AI techniques- Rational Intelligent Agents, Agents and Environments, Ethical and Legal Considerations in AI,Nature of Environments, Data processing, Feature selection, Principal Components Analysis (PCA). [5L]

Problem Solving by searching: State space search; Uninformed search: Depth First Search, Breadth First Search, Bidirectional Search; informed / heuristic search: Greedy Best-first Search, A* search[6L]

Module II: [9L]

Advanced intelligent search techniques: Stochastic Search**-** Hill Climbing, Simulated Annealing, and Evolutionary Search - Genetic Algorithm. [5L]

Knowledge Representation: Logic based representations, First Order Logic, Inference Rules, Rule based representations, forward and backward chaining. [4L]

Module III [11L]

Probabilistic reasoning and uncertainty: Uncertainty and methods to handle it, the semantics of Bayesian networks and reasoning with them,Dempster-Shafer (D-S) Theory, Brief discussion on Fuzzy sets and Fuzzy logic. [5L]

Planning: Planning with State Space Search, Planning graph. [3L]

Module IV [8L]

Machine Learning: Forms of learning, Test statistics, Linear regression, Classification-naive-Bayes, nearest neighbour, Decision trees, support vector machine, Clustering-K-means, Hierarchical Clustering, and Density-based Clustering, Neural Networks, Activation Functions :RELU, LRELU, Auto Encoders.[8L]

Text Books:

1) Stuart Russell, and Peter Norvig, "Artificial intelligence: a modern approach", Prentice Hall.
2) N. J. Nilsson. "Principles of Artificial Intelligence", Narosa Publishing House.
3) Kevin Night,, and Elaine Rich. "Artificial Intelligence (SIE)", McGraw Hill.
4) Ian Good fellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017

Reference Books:

1) Charles Severance. "Python for Everybody".
2) M. Bishop, "Pattern Recognition and Machine Learning", Springer.
3) R. Brachman, and H. Levesque. "Knowledge Representation and Reasoning", Morgan Kaufmann.
4) N.P. Padhy. Artificial Intelligence and Intelligent Systems, Oxford University Press.
5) Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

Course Name :Computer Networks
Course Code :ECE3132

Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course outcomes:

After completing the course the student will be able to:

ECE3132.1. Gain knowledge of the fundamental concepts of computer networking.

ECE3132.2. Apply the basic taxonomy and terminology of the computer networking area.

ECE3132.3. Implement various flow control, and access control mechanisms and their functions within a network.

ECE3132.4. Understand internetworking devices &principles, addressing technique, routing principles and algorithms such as IP, IPv6, distance vector, and link state.

ECE3132.5. Design and analyze the performance of the transport layer and examine its associated protocols.

ECE3132.6. Familiarization with the DNS and essential protocols of computer networks, and their application in Application Layer.

Module I [6 L]:
Overview of Data Communication and Networking: Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Module II [12L]:
Design issues, error detection and correction, Framing(Character and bit stuffing), Flow control Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Medium Access sub layer, Point to Point Protocol, Token Ring, Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA; Traditional Ethernet, Fast Ethernet, IEEE 802 Standards, Local Area Networks.

Module III [12L]:

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Virtual Circuit and Datagram network, Addressing: IP addressing, Sub-netting; Routing techniques: static vs. dynamic routing; Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, IPV6.

Transport layer: Process to Process delivery; UDP; TCP; Quality of service: techniques to improve QoS, Leaky bucket algorithm, Token bucket algorithm.

Module IV [6L]:

Principal of network application, Introduction to Domain name system, The Web and Hyper Text Transfer Protocol, File Transfer, SMTP, SNMP, Telnet, Introduction to blue-tooth, Electronic Mail, Socket Addressing.

Books:

1. B. A. Forouzan – "Data Communications and Networking (6th Ed.) " – TMH

2. A. S. Tanenbaum – "Computer Networks (6th Ed.)" – Pearson Education/PHI

3. W. Stallings – "Data and Computer Communications (10th Ed.)" – PHI/ Pearson Education

4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

5. Black, Data & Computer Communication, PHI

Course Name: Introduction to Optical Communication					
Course Code: ECE3133					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

After completing the course the student will be able to:

ECE3133.1. Apply the basic idea of electronics, physics and solid state devices and explain the operation of different components in an optical communication system.

ECE3133.2. Understand the properties of optical fiber and categorize the transmission characteristics of a wave through the optical fiber.

ECE3133.3. Analyze the structure of various optical sources and can classify them according to the performance, efficiency and application.

ECE3133.4. Explain the operation of optical detectors and can analyze the performance parameters of a detector.

ECE3133.5. Recognize the current optical technologies used for long distance communication and their application in optical networks.

ECE3133.6. Solve the problems related to optical fiber communication and can justify the physical significance of the solutions.

Module I [8L]: Optical Fiber

- Introduction to communication systems:

Principles, Components; Different Forms of Communications, Advantages of Optical Fiber Communication and its Spectral Characteristics.

- Optical Fiber:

Cylindrical Fiber Structure, Fabrication and Related Parameters, Single and Multimode Operation; Attenuation & losses, Material and Wave Guide Dispersion.Dispersion Compensation and Management. Nonlinear effects in propagation of optical signal through fiber: Self phase modulation, Cross Phase Modulation, Four wave mixing, Fiber Splices, Fiber Optic Connectors.

Module II [10L]: Optical Sources

- Light Emitting Diode:

Principle of operation, Structures, Power And Efficiency, Surface Emitting LED And Edge Emitting LED, Super Luminescent Diode (SLD), Coupling of LEDs to Fibers. Modulation Response of an LED.

- Laser diodes:

Principle of operation, Coherence, Significance Of Modes, Double Heterostructure, Gain and Index Guiding, Distributed Lasers. Quantum Well Lasers and Narrow Line Width Lasers. Modulation; Bandwidth for Modulation, Optical Transmitters: Components.

Module III [11L]: Detectors & Other Network Components

- Photo Detectors:

Photo Diodes, Photo Conducting Detectors, Photo Transistors, Optical Detection Principles, PIN Photo Detector, Avalanche Photo Detector: Efficiency, Responsivity, Bandwidth.

- WDM System:

Preamplifiers; Noise Sources, Signal To Noise Ratio. WDM Link Analysis and BitError-Rate Calculation. Point-To-Point Link, Wavelength Division Multiplexing and Demultiplexing: Building Blocks; Multiplexing; Intensity Modulation/Direct Detection System; Principle Of Regeneration.

- Optical amplifiers & Filters:

EDFA, SOA, Raman Amplifier, Fabry-Perot Filters.

Module IV [7L]: Optical Network

- Network Topologies:

LAN, MAN, WAN; Topologies: Bus, Star, Ring; Ethernet; FDDI, PON (Passive Optical Network), FSO: The concept & Challenges

- Telecom Networking:

SDH/SONET, SONET/SDH Layers, SONET Frame Structure

Text Books:

1. Fiber Optics and Optoelectronics, R. P. Khare, Oxford University Press

2. Optical Fiber Communication: John M. Senior (Pearson)

3. Optical Networks – A Practical Perspective: Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)

4. Optical Communication Systems: John Gawar (PHI) Reference Book: 1. Optical Fiber Communication: Gerd Kaiser (TMH)

Reference Book:

1. Optical Fiber Communication: Gerd Kaiser (TMH)

Course Name: Computer Organization					
Course Code: ECE3134					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

After completing this course, the students will be able to:

ECE3134.1. Solve basic binary math operations using the computer.

ECE3134.2. Demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target computer.

ECE3134.3. Apply knowledge of the processor's internal registers and operations by use of a PC based microprocessor simulator

ECE3134.4. Develop the capacity to simulate combinational and sequential logic required to interface I/O structures with processors using VHDL or Verilog.

ECE3134.5. Conceptualize the instruction set design with its associated microinstructions for a system.

ECE3134.6. Understand the knowledge of pipeline and vector computing to design parallel computer system.

Lectures total 36

Module 1: [10L] Functional Units of a computer, Princeton & Harvard Architecture, Flynn's Taxonomy, Instruction Set Architecture (ISA) covering Instruction format (IF) Instruction set (IS) and Addressing modes (AM), Inter-Process Communication (IPC), Instruction Cycle, Control Unit design, Hardwired and micro-programmed control unit, Microinstruction formats, Symbolic Micro-programs, RISC and CISC.

Module 2: [8L] Amdahl's law, Building data path & control, Single cycle and multi cycle processor, Pipelining, Instruction pipelining, Instruction level parallelism (ILP), Data and Control Hazard and their mitigation, Array, Vector Processor, Superscalar, Super Pipelined Computers, Accelerator.

Module 3: [10L] SRAM, DRAM, Primary and Secondary memory, Caching multi level, Cache schemes as Direct, Associative, Set associative, Processor - cache interactions for read/write request, write-through/write-back cache, Average memory access time, Cache replacement policies (LRU, LFU), Memory interleaving.

Flash memory, I/O mapped & memory mapped I/O, data transfer techniques as Programmed I/O, Interrupt driven I/O, and DMA.

Module 4: [8L] Limits of ILP (Coarse and fine grained parallelism), Introduction to multi-core systems (chip multiprocessor) and cache coherence issues, multi-threaded processors, Simultaneous multi-threaded (SMT) processors, Using Microprocessor cores in System on Chip (SOC) design. Design the ISA (IF, IS & AM) of a 16 bit RISC based machine followed by its data path, MMU, ALU, CU, and I/O interface with required BUS system, using Verilog/VHDL.

Text books:

1. "Computer Organization and Design: The Hardware/Software Interface," David A. Patterson, and John L. Hennessy, 5th Edition Elsevier.

2. "Computer Organization & Architecture," Smruti Ranjan Sarangi, McGraw Hill

3. "Computer Organization and Embedded Systems," Carl Hamachar, 6th edition, McGraw Hill

4. "Computer Architecture and Organization," John P Hayes, 3rd Edition, WCB/McGraw Hill

5. "Computer Organization and Architecture: Designing for Performance," William Stallings, 10th Edition

6. "Computer System Design and Architecture," Vincent P. Heuring and Harry F. Jordan, 2nd Edition, Pearson Education

7. "Computer System Architecture," Morris M. Mano, 3rd Edition Pearson

Online Simulators

1. RIPES: https://freesoft.dev/program/108505982
2. GEM5: https://www.gem5.org/documentation/learning_gem5/introduction/
3. CACTI: https://github.com/HewlettPackard/cacti
4. PIN: https://www.intel.com/content/www/us/en/developer/articles/tool/pin-a-binary-instrumentation-tool-downloads.html
5. TEJAS: https://www.cse.iitd.ac.in/~srsarangi/archbooksoft.html
6. XILINX (VHDL/ Verilog tools): https://www.xilinx.com/support/university/students.html

Course Name : Introduction to Machine Learning using Python Laboratory					
Course Code :ECE3155					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	1	0	3	4	2.5

Course Outcomes:

After completing the course the student will be able to:

ECE3155.1. Explain fundamental concepts of Python programing related to Python libraries, data types, arithmetic and logic, flow control.

ECE3155.2. Apply Python programing knowledge to understand, visualize, analyze and preprocess the data from a source.

ECE3155.3. Illustrate supervised learning algorithms using Python programing.

ECE3155.4. Explain fundamental understanding of unsupervised learning algorithms using Python programing.

Lecture Content: [12L]

- **Fundamentals of Python:** Intro to Python Language, Setting up the development environment Variables, Functions, Conditionals, Recursion, Iteration, Nested loops. Basic Operations of NumPy , Pandas, Matplotlib.
- **Data Handling:** Data Normalization, Feature Reduction/Dimensionality reduction, Data Visualization, Filtering Data
- **Supervised Learning Techniques: Regression:** Ordinary Least Squares, Linear Regression, Gradient descent, Ridge Regression, Lasso Regression.
  Classification: Learning a Class from Examples, Confusion matrix, Evaluation matrices. Learning algorithms: Support vector machine, K-Nearest Nabours, Classification Trees.

  Discussion on performance of different algorithms.
- **Unsupervised Learning:** Introduction to clustering, A Categorization of Major Clustering Methods, K-means clustering.

List of Experiments:

1. Write programs to introducethe basics of Python, libraries in Python.
2. Write programs to demonstrate different data types of Python.
3. Write programs to demonstrate the use of Variables, Functions, Conditionals in Python
4. Write programs to demonstrate the use of Recursion, Iteration, Nested loops, Libraries in Python
5. For a given set of training data examples stored in a .CSV file, write a program to demonstrate the working of data preprocessing.
6. Write a program to demonstrate the working of standardization, data visualization, and data filtering techniques.
7. Write a program to implement training testing split and validation techniques by forming

confusion matrix for classification with KNN.

8. Write a program to demonstrate the supervised classification of data with linear and non-linear SVM.
9. Write a program to implement classification Tree algorithms for given data set.
10. Write a program to implement the non-parametric Regression algorithm in order to fit data
11. Write a program to demonstrate regression model: Lasso, Ridge regression.
12. Write a program to demonstrate unsupervised learning with K- Means Clustering

Text Books:

1) EthemAlpaydin, 'Introduction to Machine Learning" , MIT Press, Prentice Hall of India.

2) R.O. Duda, P.E. Hart, and D.G. Stork, "Pattern Classification", John Wiley.

3) M. Bishop, "Pattern Recognition and Machine Learning", Springer.

4) "The Elements of Statistical Learning" by Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie.

5) Y. Daniel Liang. "Introduction to Programming Using Python", Pearson,

References:

1) T. M. Mitchell, "Machine Learning", McGraw Hill Education.

2) Murphy, Kevin, "Machine learning: a probabilistic perspective", MIT press.

3) Stuart Russell, and Peter Norvig, "Artificial intelligence: a modern approach", Prentice Hall.

4) "Deep Learning" by Ian Goodfellow, YoshuaBengio, Aaron Courville.

5) Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press.

Course Title :Indian Constitution and Civil Society					
Course Code :INC3016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	0

Course Outcomes:

After the completion of the course, students will be able to

INC3016.1. Analyse the historical, political and philosophical context behind the Indian Constitution-making process

INC3016.2. Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions

INC3016.3. Understand the contemporaneity andapplication of the Indian Constitution in present times

INC3016.4. critique the contexts for constitutional amendments in consonance with changing times and society

INC3016.5. establish the relationship between the Indian Constitution and civil societyat the collective as well as the individual levels

INC3016.6. consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work

Module 1- 6L

Introduction to the Constitution of India-Historical Background

Making of Indian Constitution -the process of framing the constitution, the constituent assembly

Module II-6L

Salient Features of the Indian constitution

Comparison with the constitutions of other countries

Module III- 6L

Relevance of the Constitution of India

Constitution and Governance

Constitution and Judiciary

Constitution and Parliament-Constitutional amendments

Module IV-6L

Constitution and Society-democracy, secularism, justice

Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental Duties

Reference Books

1. C.M.Elliot, (ed.), Civil Society and Democracy, OUP, Oxford, 20012..
2. David Held et.al (ed),The Idea of the Modern State, Open Univ. Press, Bristol, 1993
3. NeeraChandoke, State and Civil Society, Sage, Delhi, 19953

OPEN ELECTIVE-1

(For ECEStudents)

Course Name :Digital Image Processing & Pattern recognition					
Course Code :ECE3121					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course outcomes:

After completing the course, the student will be able to:

ECE3121.1. Understand fundamentals of digital image processing and representation of images in spatial domain.

ECE3121.2. Image transformation, segmentation, compression and enhancement techniques and their applications for interpretation of images.

ECE3121.3. Understand and develop algorithms for feature extraction from images.

ECE3121.4. Gain knowledge about the fundamentals of Pattern Recognition, such as recognition, decision-making, and statistical learning problems.

ECE3121.5. Identify parametric and non-parametric techniques, as well as supervised, unsupervised, and semi-supervised learning of pattern recognition.

ECE3121.6. Design systems and algorithms for Image Processing and Pattern Recognition to solve real-world problems.

Digital Image Processing

Module 1 [12L]

Digital Image Fundamentals- Analog vs Digital Image Processing, Elements of visual perception, computer vision, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Image Enhancement and filtering:

Spatial domain Processing-Pixel point processing: linear and piecewise linear transformations, log and power law transformations, Image Histogram and histogram equalization. Pixel Group Processing**:** Convolution in spatial domain, low frequency and high-frequency filtering, mean and median filters,

Frequency Domain Processing-Introduction to the Fourier transform, filtering in the frequency domain, Image smoothing and sharpening.

Module 2 [8L]

Colour Image Processing: RGB and HSI colour models and interrelation.

Image Compression Standards: Lossy and lossless compressions, BMP, TIFF & JPG image formats.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation, dilation and erosion, etc.

Video Segmentation: Temporal segmentation – shot boundary detection, hard-cuts and soft-cuts; Spatial segmentation – motion-based; Video object detection and tracking.

Module 3 [10L]

Introduction to the Pattern Recognition System: Components of Pattern Recognition System, Learning and adaptation, Supervised Learning (Classification), Unsupervised Learning (Clustering)and Semi-Supervised Learning, Bayesian Decision Theory: classifiers, discriminant functions, decision surfaces, Discriminant functions for Normal density, Error bounds for Normal density, Maximum Likelihood, Random Forest and Bayesian Parameter Estimation, Fisher Linear Discriminant, Hidden Markov Models.

Module 4 [10L]

Non-parametric Techniques &Feature Extraction: Parzen window estimation, k-nearest neighbour classification, Logistic regression, Perceptron classifier, Support Vector Machines, Decision Tree based classifiers. Feature extraction – discrete cosine and sine transform, Principal Component analysis, Kernel Principal Component Analysis, clustering: K-means, Agglomerative, DBSCAN.

Textbooks:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Pearson.

2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley.

3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press.

4. C. M. Bishop, Pattern Recognition and Machine Learning, Springer.

References:

1. C. Solomon, T. Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples, Wiley

2. K. Fukunaga, Statistical Pattern Recognition, Academic Press.

Course Outcomes:

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

AEI3122.1: Memorize the knowledge on mechanical, electromechanical, thermal and acoustic, and optical sensors.

Course Name : Fundamentals of Sensors And Transducers					
Course Code : AEI3122					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

AEI3122.2: Identify and classify the sensors based on type of measureand such as strain, force, pressure, displacement, temperature, flow, etc.

AEI3122.3: Choose the application specific Sensors and Transducers

AEI3122.4: Relate the sensors in various industrial applications.

AEI3122.5: Design and set up the sensing systems.

AEI3122.6: Create the applications of smart sensors

Module I – [10L]

Fundamentals: Definition, principle of sensing and transduction, classification of transducers, static and dynamic characteristics of Transducers.

Resistive Transducers: Potentiometric transducer- Theory, type, symbol, materials, error calculations due to loading effects, sensitivity, and specifications.

Strain gauge- Theory, type, symbol, materials, gauge factor, temperature compensation and dummy gauge, Strain measurement circuit- quarter, half and full bridge configuration, and specifications.

Inductive Transducers: Principle, common types, Reluctance change type, Mutual inductance change type, transformer action type. LVDT- Construction, working principle, characteristics (modulated and demodulated).

Module II - [8L]

Capacitive sensors: Parallel plate type- Variable distance, variable area, variable dielectric constant type, calculation of sensitivity, response characteristics, specifications, and applications.

Piezoelectric transducers: Piezoelectric effect, type, charge and voltage co-efficient and relationships, crystal model, materials, charge amplifier; Ultrasonic sensors- Liquid velocity and level measurements.

Module III-[10L]

Contact type Thermal Sensors:

Resistance change type:

Resistance Temperature Detector (RTD) - materials, temperature range, R-T characteristics, configurations, specifications, and applications. Thermistors- materials, temperature range, R-T characteristics, applications and specification.

Thermo-emf sensor:

Thermocouple- Thermo electric laws, types, temperature ranges, series and parallel configurations, cold junction compensation, compensating cables.

Introduction to semiconductor type temperature sensors.

Non-Contact type Thermal Sensors:

Thermal Radiation sensors- types, constructions, working, temperature ranges and comparison.

Module IV- [8L]

Radiation Sensors:

LED, LDR, photodiodes, Photovoltaic cells, photo emissive cell types, materials, construction, response, applications. Geiger counters, Scintillation detectors.

Introduction to smart sensors.

References:

1. A. K. Ghosh, Introduction to transducers, PHI, 2015

2. E. A. Doebelin, Measurement Systems: Application and Design, Mc Graw Hill, New York

3. H. K. P. Neubert, Instrument Transducers, Oxford University Press, London and Calcutta.

4. S. Renganathan, Transducer engineering, Allied Publishers Limited, 2003.

5. D. V. S. Murty, Transducer and instrumentation, PHI, second edition, 2008.

6. Jacob Fraden, Handbook of Modern Sensors: Physics, Designs and applications, Third edition, Springer International, 2010.

7. D Patranabis, Sensors and Transducers, PHI, 2nd ed.

Course Name: Fundamentals of Operating Systems					
Course Code: CSE3121					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**

	3	0	0	3	3

Course Outcomes

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

CSE3121.1: Understand the underlying technologies and features of memory management and storage management.

CSE3121.2: Understand the various design issues in process management.

CSE3121.3: Apply knowledge of mathematics, science and engineering in the areas of process management, memory management and storage management.

CSE3121.4: Analyze operating system operations, structures.

CSE3121.5: Judge the primitive operations of operating systems.

CSE3121.6 : Assemble the concepts learned here which are used in their own field of work.

Detailed Syllabus

Module1 [7L]

Introduction of General Operating System: Introduction: What do OS do? Computer System Organization, Interrupt Driven System, Storage Structure, I/O Structure, Operating System Functions, OS Services, Dual Mode Operations, Kernel, System Calls, Types of System Calls

Types of Operating Systems: Computer System Architecture (Monolithic, Microkernel, Layered, Hybrid), Different types of O.S.(Batch, Multi-programmed, Time-sharing, Real-time, Distributed, Parallel, for Mobile Unit, Single Processor System, Multiprocessor Systems), Virtual Machines, System Boot.

Module2 [9L]

Process Concept: What is process, Operations on Process (Process States), Process Control Block, Process Scheduling, Scheduling Queues,

Cooperating Process: Co-operating Processes, Inter-process Communication. IPC, Examples in IPC, Communication in Client-Server Systems

Threads: Threads, Benefits of Threads, User and Kernel Threads.

CPU Scheduling: Scheduling Criteria, Pre-emptive & Non-pre-emptive Scheduling, Scheduling Algorithms (FCFS, SJF, RR, priority).

Module3 [10L]

Process Synchronization: Critical Section Problem, Critical Region, Synchronization Hardware. Petersons Solution, Classical Problems of Synchronization, Semaphores, Monitors, Synchronization examples, Atomic Transactions.

Deadlock: Deadlocks: System model, Deadlock characterization, Method of handling Deadlock, Deadlock Prevention, Avoidance, Detection, Recovery from deadlock.

Module4 [10L]

Memory Management Strategies: Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Demand Paging, Copy-on-Write, Swapping, Page Replacement, Allocation of Frames, Thrashing, Memory Mapped Files, Allocating Kernel Memory, Operating System examples.

File Management: File System: File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection.

Textbooks

1. Silberschatz, P B Galvin, G Gagne, Operating systems, 9th edition/10th edition, John Wiley and sons.

Reference Books:

1. William Stalling, "Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
2. Andrew S Tanenbaum, Herbert BOS, "Modern Operating Systems", Pearson Education, 4th Edition, 2016.

Course Name : Total Quality Management (TQM)					
Course Code: MEC3123					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**

	3	0	0	3	3

Course Outcomes:

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

MEC3123.1: Explain the concepts of Total Quality Management and Total Quality Education , Report Quality Cost measure, Customer Satisfaction Index

MEC3123.2: Identify the problems in Quality Improvement Process , Use various QC tools, appreciate the benefits of implementing 5-S Techniques

MEC3123.3: Apply various Quality Function Deployment (QFD) Techniques

MEC3123.4: Analyze Statistical Process Control(SPC) data to improve processes, Design experiments for arriving at optimal solutions

MEC3123.5: Appreciate the incorporation of ISO System standard and its benefits , Address isues relating to closure of NCR'S

MEC3123.6: Propose how business leaders might plan and execute quality management in an organization , struggles to gain and sustain competitive advantage in today's global business arena

Module I: [9L] Introduction

Definition of quality ; Quality control vs. Quality Assurance ; TQM- Components of TQM; TQM vs. TPM; Quality Gurus ; Quality Planning and Quality costs; Collection and reporting of quality cost information; Leadership role in TQM; Role of senior management in TQM; Implementation and Barriers to TQM ; Customer Satisfaction- Customer perception of quality-customer complaints-customer feedback- customer retention; Employee involvement.

Module II: [11L] QMS

(ISO 9000):

Evolution of QMS- ISO 9000 series of standards- Quality manual – ISO 9001

requirements ; Different clauses of ISO 9001 system and their applicability in

various business processes ; Registration of ISO 9001 : 2000 ; ISO 9001: 2000

Certification ; Steps involved in ISO 9001 : 2000 Certification ; benefits/

limitations of ISO 9001 :2000 ; Internal Audits and Implementation of ISO 9001:2000.

EMS (ISO 14000):

Concepts of ISO 14001 ; Requirements of ISO 14001 ; Benefits of ISO 14001

Module III: [9L] Continuous Improvement in Quality

PLAN-DO-CHECK-ACT (PDCA); 7 QC tools and their use for quality improvement; Quality Function Deployment; QFD team ; Benefits of QFD; QFD Process KAIZEN; 5 – S Principle; Concept of quality circles.

Module IV: [10L] Statistical Process Control

Basic statistical concepts ; control charts for variables; Group control charts ; Control charts for attributes; Acceptance Sampling - OC Curve ; Process capability; Sampling Plans ; Six Sigma and its applications; Design of experiments and Taguchi Methodology

Text Books

1. Total Quality Management – J.D. Juran , MHE.
2. Total Quality Management - Besterfield, Pearson Education.

Reference Books

1. Statistical Quality Control –M. Mahajan, Dhanpat Rai &Co.(Pvt.) Ltd.

Course Name: Statistics and Information Theory
Course Code:MTH3122

Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

After successfully completing this course the students will be able to:

MTH3122.1: Solve the problems involving multiple random variables.

MTH3122.2: Compare and contrast different interpretations of probability theory selecting the preferred one in a specific context.

MTH3122.3: Formulate predictive models to tackle situations where deterministic algorithms are intractable.

MTH3122.4: Quantifies the amount of uncertainty involved in the value of a random variable or the outcome of a random process.

MTH3122.5: Understand mathematical analysis of problems in Information Theory.

MTH3122.6: Summarize data visually and numerically.

MODULE-I: Single and Bivariate Probability Distributions:

- Review of basic probability
- Moment generating functions
- Markov's inequality, Chebyshev's inequality and law of large numbers
- Joint distribution using joint probability mass/density function
- Finding marginal pmf/pdf from joint distribution
- Multiplicative property of joint pmf/pdf in case of independent random variables

MODULE-II: Markov Chains and Statistical Methods:

- Markov Chains: Introduction
- Chapman-Kolmogorov equations
- Classification of states
- Some applications: Gambler's Ruin Problem
- Measures of Central tendency: Moments, skewness and Kurtosis
- Spearman's Rank Correlation coefficient

- Curve fitting: Straight line and parabolas

MODULE-III: Statistics-II:

- Population and Samples,
- The sampling distribution of mean (standard deviation known),
- The sampling distribution of mean (standard deviation unknown),
- Point and Interval estimation,
- Null Hypotheses and Tests of Hypotheses.

MODULE-IV: Classical Information Theory:

- Motivation with some relevant examples
- Entropy : Definition with examples
- Joint Entropy and Conditional Entropy
- Relative Entropy and Mutual Information
- Relationship Between Entropy and Mutual Information
- Chain Rules for Entropy, Relative Entropy and Mutual Information
- Jensen's Inequality and Its Consequences

Text Books

1. Elements of Information Theory, Thomas M. Cover and Joy A. Thomas, Wiley
2. Fundamentals of Mathematical Statistics, S.C.Gupta and V. K. Kapoor, Sultan Chand and Sons
3. Business Statistics, J. K. Sharma, Vikas Publishing House

Suggested Books

1. Introduction to Probability Models, *S.M.Ross*, Elsevier.
2. Information Theory and Reliable Communication, *Robert G. Gallager*, John Wiley and Sons
3. Business Statistics Problem and Solutions, J. K. Sharma, Pearson.

OPEN ELECTIVES

(Offered by ECEDepartment)

3rd Year 1st Sem

Course outcomes:

After completing the course, the student will be able to:

ECE3121.1. Understand fundamentals of digital image processing and representation of images in spatial domain.

Course Name :Digital Image Processing & Pattern recognition					
Course Code :ECE3121					
Contact hours per week :	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

ECE3121.2. Image transformation, segmentation, compression and enhancement techniques and their applications for interpretation of images.

ECE3121.3. Understand and develop algorithms for feature extraction from images.

ECE3121.4. Gain knowledge about the fundamentals of Pattern Recognition, such as recognition, decision-making, and statistical learning problems.

ECE3121.5. Identify parametric and non-parametric techniques, as well as supervised, unsupervised, and semi-supervised learning of pattern recognition.

ECE3121.6. Design systems and algorithms for Image Processing and Pattern Recognition to solve real-world problems.

Digital Image Processing

Module 1 [12L]

Digital Image Fundamentals- Analog vs Digital Image Processing, Elements of visual perception, computer vision, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Image Enhancement and filtering:

Spatial domain Processing-Pixel point processing: linear and piecewise linear transformations, log and power law transformations, Image Histogram and histogram equalization. Pixel Group Processing**:** Convolution in spatial domain, low frequency and high-frequency filtering, mean and median filters,

Frequency Domain Processing-Introduction to the Fourier transform, Filtering in the frequency domain, Image smoothing and sharpening.

Module 2 [8L]

Colour Image Processing: RGB and HSI colour models and interrelation.

Image Compression Standards: Lossy and lossless compressions, BMP, TIFF & JPG image formats.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation, dilation and erosion, etc.

Video Segmentation: Temporal segmentation – shot boundary detection, hard-cuts and soft-cuts; Spatial segmentation – motion-based; Video object detection and tracking.

Module 3 [10L]

Introduction to the Pattern Recognition System: Components of Pattern Recognition System, Learning and adaptation, Supervised Learning (Classification), Unsupervised Learning (Clustering)and Semi-Supervised Learning, Bayesian Decision Theory: classifiers, discriminant functions, decision surfaces, Discriminant functions for Normal density, Error bounds for Normal density, Maximum Likelihood, Random Forest and Bayesian Parameter Estimation, Fisher Linear Discriminant, Hidden Markov Models.

Module 4 [10L]

Non-parametric Techniques &Feature Extraction: Parzen window estimation, k-nearest neighbour classification, Logistic regression, Perceptron classifier, Support Vector Machines, Decision Tree based classifiers. Feature extraction – discrete cosine and sine transform, Principal Component analysis, Kernel Principal Component Analysis, clustering: K-means, Agglomerative, DBSCAN.

Textbooks:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Pearson.

2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley.

3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press.

4. C. M. Bishop, Pattern Recognition and Machine Learning, Springer.

References:

1. C. Solomon, T. Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples, Wiley

2. K. Fukunaga, Statistical Pattern Recognition, Academic Press.

CourseName:IntroductiontoMachineLearning					
CourseCode:ECE3122					
Contact Hours per week		T	P	Total	CreditPoints
	3	0	0	0	3

Courseoutcomes:

Aftercompletingthecoursethestudents willbeableto:

ECE3122.1. Apply fundamental engineering knowledge for analyzing data in a given feature space.

ECE3122.2. Explain the fundamental concepts of different Machine learning models and can evaluate a machine learning problem.

ECE3122.3. Apply machine learning techniques for classification and regression approaches in real-world applications.

ECE3122.4. Distinguish between supervised and unsupervised learning and able to apply machine learning tools for clustering approaches.

ECE3122.5. Analyze a machine learning problem with ensemble and reinforcement learning techniques.

ECE3122.6. Understand different techniques to create application using deep learning algorithms.

IntroductiontoMachineLearning

Module1 **[9L]**

Introduction: Foundations for ML: What is Machine Learning, Examples of Various Learning Paradigms, Perspectives and Issues, Version Spaces and Candidate Elimination Algorithm, Data Normalization, Feature Reduction/Dimensionality reduction, Validation Techniques (Cross-Validations), Bias-Variance Trade-off.
FeatureSelectionandDimensionalityReduction: Principal Components Analysis (PCA), Independent Component Analysis (ICA), and Linear Discriminate Analysis (LDA).

Module2 **[11L]**

SupervisedLearning:

Classification: Learning from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Regression and Classification Trees, Decision tree, Naïve Bayes, k-Nearest Neighbor. Support vector machines:LinearandNon-Linear,KernelFunctions. Artificial neural networks: Introduction, Introduction, Perceptron, Multilayer Perceptron, Backpropagation algorithm
Regression: Ordinary Least Squares, Linear Regression, Multiple Linear Regression: RidgeRegression,LassoRegression,Non-LinearRegression:LogisticRegression.

Module3 **[7L]**

UnsupervisedLearning:

Introduction to clustering, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models.

Module4 **[8L]**

EnsembleLearning: EnsembleLearningModelCombinationSchemes,Voting,Error-CorrectingOutputCodes,Bagging:RandomForestTrees,Boosting:Adaboost.
ReinforcementLearning:

Introductiontoreinforcementlearning, LearningFrameworkandMarkovDecisionProcesswith some examples.
DeepLearning: Autoencoder, Convolutional Neural Networks, Recurrent Neural Networks- with some real life examples.

TextBooks:

1) Ethem Alpaydin,'IntroductiontoMachineLearning",MITPress,PrenticeHallofIndia.
2) R.O.Duda,P.E.Hart,andD.G.Stork,"PatternClassification",JohnWiley.
3) M.Bishop,"PatternRecognitionandMachineLearning", Springer.
4) "TheElementsofStatisticalLearning" byJeromeH.Friedman,RobertTibshirani,andTrevorHastie.
5) Andreas C. Mueller ,Sarah Guido , "Introduction to Machine Learning with Python: A Guide for Data Scientists" ,O'Reilly.
6) Sebastian Raschka, "Python Machine Learning".

References:

1) T.M.Mitchell,"MachineLearning",McGrawHillEducation.
2) Murphy,Kevin,"Machinelearning:aprobabilisticperspective",MITpress.
3) StuartRussell,andPeterNorvig,"Artificialintelligence:amodernapproach",PrenticeHall.
4) "DeepLearning"byIanGoodfellow,YoshuaBengio,AaronCourville.
5) RichardS.SuttonandAndrewG.Barto,"Reinforcementlearning:Anintroduction",SecondEditi on,MITPress.

Course name: Error Control Coding for Secure Data Transmission					
Course Code: ECEN3123					
Contact hours	**L**	**T**	**P**	**Total**	**Credit points**

per week	**3**	**0**	**0**	**3**	**3**

Course Outcome:

After completing the course the students will be able to:

ECEN3123.1. Distinguish between different types of source codes.

ECEN3123.2. Figure out equations for entropy, mutual information and channel capacity for all types ofchannels, utilizing their knowledge on the elements.

ECEN3123.3. Explain and estimate the merit of various methods for generating and detecting differenttypes of error correcting codes.

ECEN3123.4. Formulate the basic equations of linear block codes, cyclic codes.

ECEN3123.5. Outline the basics of convolution code, linear algebra and BCH code.

ECEN3123.6. Develop overall understanding about different types of codes applied to both source andchannel end during data transmission

Module-1: Information theory, Source coding and channels [10L]

Information theory: Uncertainty and information, measure of information, Self and conditional

Information, mutual information and entropy, Fixed length code, Variable length code, Prefix code, Instantaneous code, Kraft Inequality,

Source Code: Source coding theorem, Huffman codes, Shanon- Fano coding, Arithmetic code

Channels: Discrete memory less channel, Channel matrix for different channel models- Losslesschannel, Deterministic channel, Noise-less channel, Deterministic channel capacity, channel coding, Information capacity theorem, The Shannon limit.

Module-2: Error Control code: Linear Block Code [7L]

Block code: Hamming codes Minimum distance, Error detecting and Error-correcting capabilities of block code.

Linear Block Code: Definition & properties of linear block codes, Matrix description of linear blockcodes, Encoding of linear block code, parity check matrix, decoding of a linear block code, Syndromeand Error detection.

Module-3: Cyclic and BCH code [10L]

Cyclic Code: Definition & properties of cyclic codes, Code Polynomials, Generator Polynomials, Division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Decoding of cyclic codes.

Galois Field: Introduction to Linear Algebra, Introduction to Galois Field, Primitive elements,generator polynomials in terms of minimal polynomials, Calculation of minimal polynomial.

BCH Code: Elementary concept of BCH Codes, Encoding and Decoding, Elementary concept ofReed Solomon Code.

Module-4: Convolution Codes: [9 L]

Encoding convolution code: Polynomial description of convolution codes, Distance notions forconvolution codes and the generating function.

Decoding of convolution codes: Viterbi decoder, distance and performance bounds forconvolution codes.

Example of convolution code - Turbo codes, Turbo decoding.

Graphical representation of convolution code: State diagram, Tree, Trellis diagram

Text Books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.

2. Introduction to Error Control Codes – S Gravano; Oxford Press

3. Information and Coding - N Abramson; McGraw Hill.

Reference Books:

1. Introduction to Information Theory - M Mansurpur; McGraw Hill.

2. Information Theory - R B Ash; Prentice Hall. 8. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall

Course Title: Introduction To VLSI Design					
Course Code : ECE3124					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

After completing the course the student will be able to:

ECE3124.1. Learn about VLSI Technology Growth as driven by Moore's law

ECE3124.2. Understand Various VLSI Design Methodologies

ECE3124.3. Design Digital Combinational logic, Circuits and Layout using CMOS Technology

ECE3124.4. Design Digital Sequential logic and Circuits using CMOS Technology.

ECE3124.5. Learn RTL Design using Verilog Hardware Description Language

ECE3124.6. Learn Basic Building Blocks of Analog Circuit using CMOS Technology

Module I- [4L] VLSI Design Methodology: Moore's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI), Technology growth and process Node, VLSI Design Trend and Challenges. VLSI Design Cycle, Y-Chart, Full Custom Design, Std Cell based Semi Custom Design, Gate Array Design, PLD: PLA, PAL, FPGA

Module II- [14L] Digital VLSI Circuits: **Unit1**: MOS Transistor Characteristics, MOS as Digital Switch, NMOS Logic Family, CMOS Logic Family, CMOS Inverter Characteristics (VTC), Inverter Delay & Noise, NAND and NOR gates, Complex Logic Circuits, Concept of Logical effort, Pass Transistor Logic & Transmission Gate, CMOS Sequential Circuits (Latch and Flip flop), Read and write operations of 1T DRAM and 6T SRAM cell.

Unit2: CMOS Cross Section, Inverter Layout, Lambda Rule vs Micron Rule, Stick Diagram, Euler Path Algorithm

Module III-[6L] Hardware Description Language: Introduction to Verilog Modeling: Behavioral, Data-Flow, Structural and Mixed Mode. Frontend Design Flow using Verilog (Behavioral, RTL and Gate Level), Combinational and sequential circuits with various examples, FSM Example: Mealy Machine and Moore Machine.

Module IV- [10L] Analog VLSI Circuits: MOS large signal model, Transconductance gain, MOS small signal model, MOS switch, MOS Diode, MOS Resistor, CMOS Current Source/Sink, Active Load, Voltage Dividers, CMOS Current Mirror.

Text Book:

1. CMOS VLSI Design, A Circuits and Systems Perspective (4th Edition) Author: Neil Weste, David Harris. Addison-Wesley, Pearson

2. Design of Analog CMOS Integrated Circuit, B. Razavi, Mc. GrawHill

3. Fundamentals of Digital Logic with Verilog Design, 3rd Edition, Brown and Vranesic, Mc. GrawHill

Reference Book:

4. Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, 2nd Ed., Oxford.

5. Digital Integrated Circuit, Design Perspective, Author: .M. Rabaey, Prentice-Hall

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Sl. No.	Name of the Activity	Points	Maximum Points allowed
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2	Tech Fest / Teachers Day / Freshers Welcome		
	(i) Organizer	05	10
	(ii) Participants	03	06
3	Rural Reporting	05	10
4	Tree Plantation (per tree)	01	10
5	Participation in Relief Camps	20	40
6	Participation in Debate/Group Discussion/ Tech quiz	10	20
7	Publication of Wall magazine at Institutional level (magazine/article/internet)	10	20
8	Publication in News paper, Magazine & Blogs	10	20
9	Research Publication (per publication)	15	30
10	Innovative Projects (other than course curriculum)	30	60
11	Blood donation camp		
	(i) Donor	08	16
	(ii) Camp Organizer	10	20
12	Participation in Sports/Games		
	(i) College Level	05	10
	(ii) University Level	10	20
	(iii) District Level	12	24
	(iv) State Level	15	30
	(v) National / International Level	20	40
13	Cultural programme (Dance, Drama, Elocution, Music etc.)	10	20
14	Member of Professional Society	10	20
15	Student Chapter Activities / Seminars		
	(i) Participant	05	20
	(ii) Presentation	10	20
	(iii) Organizer	10	20
16	Relevant industry visit & report	10	20
17	Activities in different clubs at HIT (Photography Club, Cine Club etc.)	05	10
18	Participation in Yoga Camp	05	10
19	Self-Entrepreneurship programme	20	20
20	Adventure sports	10	20
21	Training to under privileged / Physically challenged	15	30
22	Community Service & Allied Activities	10	20
23	Hackathon (State / National Level)		
	(i) Participation in Hackathon	10	20
	(ii) Qualifier for final round (not prize winner) in Hackathon	20	40
	(iii) Prize Winners of Hackathon	30	60

Format for Report Submission

Name :

Department :

Year/Semester :

Title of the Activity :

Date :

Name of the organization :

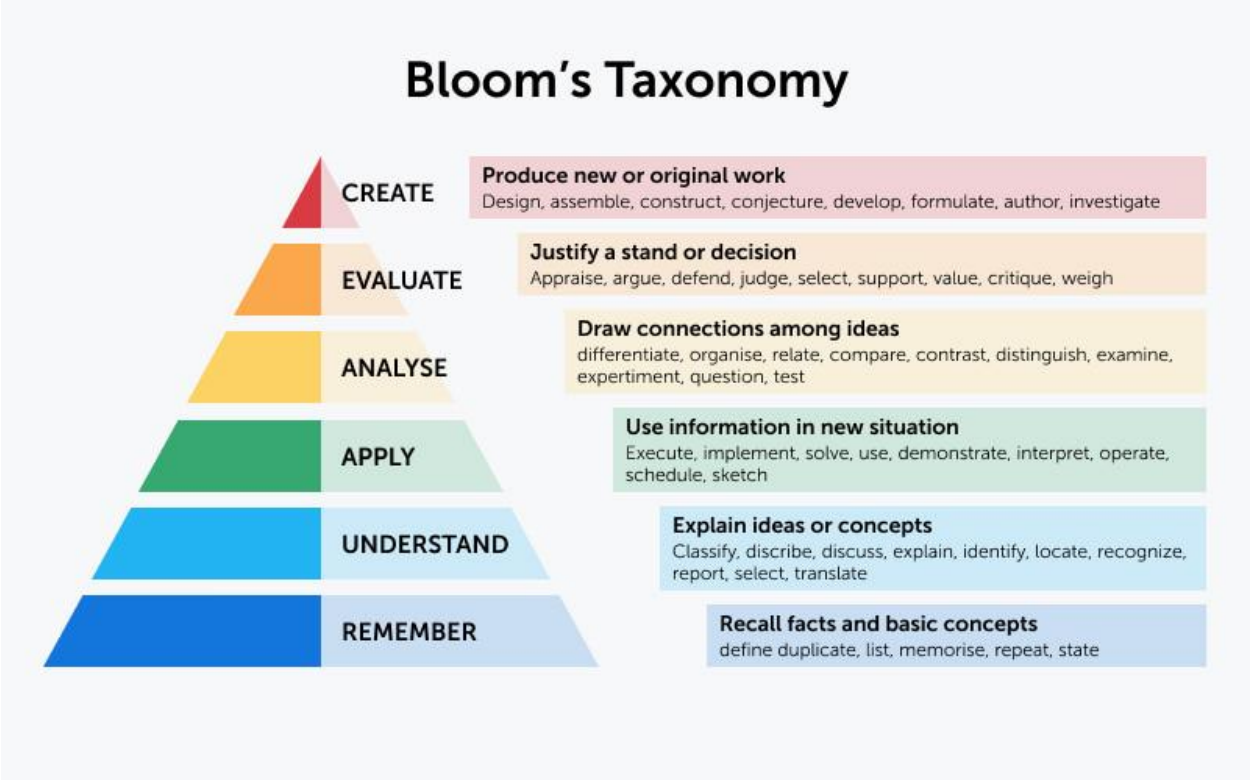
Report :

Signature
(Coordinator / Competent Authority)

Points earned:

Signature of the Mentor

APPENDIX – B


Bloom's Taxonomy
CREATE
Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate
EVALUATE
Justify a stand or decision
Appraise, argue, defend, judge, select, support, value, critique, weigh
ANALYSE
Draw connections among ideas
differentiate, organise, relate, compare, contrast, distinguish, examine, expertiment, question, test
APPLY
Use information in new situation
Execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
UNDERSTAND
Explain ideas or concepts
Classify, discribe, discuss, explain, identify, locate, recognize, report, select, translate
REMEMBER
Recall facts and basic concepts
define duplicate, list, memorise, repeat, state