Electronics and Communication Engineering (ECE) Department

B.TECH. PROGRAMME

CURRICULUM STRUCTURE

RELEASE DATE: July, 2018: Ver:1.0
May, 2019: Ver:1.1

1st Year 1st Semester Syllabus:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Basic Science course	**CHEM1001**	Chemistry I	3	1	0	4	4
2	Basic Science course	**MATH1101**	Mathematics I	3	1	0	4	4
3	Engg. Science course	**ELEC1001**	Basic Electrical Engg.	3	1	0	4	4
Total Theory				9	3	0	12	**12**

B. Practical								
1	Basic Science course	**CHEM1051**	Chemistry I Laboratory	0	0	3	3	1.5
2	Engg. Science Course	**ELEC1051**	Basic Electrical Engg. Laboratory	0	0	2	2	1
3	Engg. Science Course	**MECH1052**	Engg. Graphics & Design	1	0	4	5	3
Total Practical				0	0	9	**10**	**5.5**
Total of Semester				10	3	9	**22**	**17.5**

Honours Credit Courses (ECE)

Sl. No.	**Semester**	**Paper Code**	**Course Title**	**Contact Hours / Week**			**Credit Points**
				L	**T**	**P**	
1	**1st**	**HMTS1011**	Communication for Professionals	3	0	0	3
		HMTS1061	Professional Communication Laboratory	0	0	2	1

1st Year, 2nd Semester Syllabus:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Basic Science course	**PHYS1001**	Physics I	3	1	0	4	4
2	Basic Science course	**MATH1201**	Mathematics II	3	1	0	4	4
3	Engg.Science course	**CSEN1001**	Programming for Problem Solving	3	0	0	3	3
4	Humanities	**HMTS1202**	Business English	2	0	0	2	2
			TOTAL	11	2	0	13	13

B. Practical								
1	Basic Science Course	**PHYS1051**	Physics I Laboratory	0	0	3	3	1.5
2	Engg. Science Course	**CSEN1051**	Programming for Problem Solving Laboratory	0	0	4	4	2
3	Engg. Science Course	**MECH1051**	Workshop/ Manufacturing Practices	1	0	4	5	3
4	Humanities	**HMTS1252**	Language Laboratory	0	0	2	2	1
Total Practical				11	2	13	**14**	**7.5**
Total of Semester				12	2	13	**27**	**20.5**

Honours Credit Courses (ECE)

Sl. No.	**Semester**	**Paper Code**	**Course Title**	**Contact Hours / Week**			**Credit Points**
				L	**T**	**P**	
2	**2nd**	**ECEN1011**	Basic Electronics	3	0	0	3
		ECEN1061	Basic Electronics Laboratory	0	0	2	1

2nd Year, 1st Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Course	**ECEN2101**	Analog Circuits	3	0	0	3	3
2	Professional Core Course	**ECEN2102**	Circuit and Network Theory	3	0	0	3	3
3	Professional Core Course	**ECEN2103**	Signals and Systems	3	0	0	3	3
4	Basic Science course	**MATH2001**	Mathematical Methods	3	1	0	4	4
5	Engg. Science courses	**CSEN2004**	Data Structure and Basic Algorithms	3	0	0	3	3
6	Humanities	**HMTS2001**	Human Values and Professional Ethics	3	0	0	3	3
Total Theory				19	0	0	**19**	**19**

B. Practical								
1	Professional Core Course	**ECEN2151**	Analog Circuits Laboratory	0	0	2	2	1
2	Professional Core Course	**ECEN2152**	Circuit and Network Theory Laboratory	0	0	3	3	1.5
3	Professional Core Course	**ECEN2153**	Signals and Systems Laboratory	0	0	2	2	1
3	Engg. Science Courses	**CSEN2054**	Data Structure and Basic Algorithms Laboratory	0	0	3	3	1.5
Total Practical				0	0	10	**10**	**5**
Total of Semester							**29**	**24**

2nd Year, 2nd Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Course	**ECEN2201**	Analog Communication	3	0	0	3	3
2	Professional Core Course	**ECEN2002**	Digital Systems Design	3	0	0	3	3
3	Professional Core Course	**ECEN2203**	EM Theory and Transmission Lines	3	0	0	3	3
4	Professional Core Course	**ECEN2204**	Electronic Devices	3	0	0	3	3
5	Basic Science Course	**MATH2202**	Advanced Numerical Methods	3	0	0	3	3
Total Theory				15	0	0	**15**	**15**

B. Practical								
1	Professional Core Course	**ECEN2251**	Analog Communication Laboratory	0	0	2	2	1
2	Professional Core Course	**ECEN2052**	Digital Systems Design Laboratory	0	0	2	2	1
3	Professional Core Course	**ECEN2253**	EM Theory and Transmission Lines Laboratory	0	0	2	2	1
4	Basic Science courses	**MATH2252**	Advanced Numerical Methods Laboratory	0	0	2	2	1
Total Practical				0	0	8	**8**	**4**
Total of Semester							**23**	**19**

C. Mandatory Course(non-credit)								
1	Mandatory	**EVSC2016**	Environmental Sciences	2	0	0	2	0
Total of Semester				**17**	**0**	**8**	**25**	**19**

Honors Credit Courses (ECE)

Sl. No.	**Semester**	**Paper Code**	**Course Title**	**Contact Hours / Week**			**Credit Points**
				L	**T**	**P**	
3	**4th**	**ECEN2211**	Control Systems	3	0	0	3
		ECEN2261	Control Systems Laboratory	0	0	2	1

3rd Year, 1st Semester

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Course	**ECEN3101**	Digital Communication	3	0	0	3	3
2	Professional Core Course	**ECEN3102**	Digital Signal Processing	3	0	0	3	3
3	Professional Core Course	**ECEN3103**	Microwave Engineering	3	0	0	3	3
4	Professional Core Course	**ECEN3104**	Microprocessors and Microcontrollers	3	0	0	3	3
5	Professional Core Course	**ECEN3105**	Information Theory and Coding	3	0	0	3	3
6	Professional Elective-1	**ECEN3131**	Telecommunication Systems	3	0	0	3	3
		ECEN313	Computer Networks					
		ECEN3133	Speech and Audio Processing					
Total Theory				18	0	0	18	**18**

B. Practical								
1	Professional Core Courses	**ECEN3151**	Digital Communication Laboratory	0	0	2	2	1
2	Professional Core Courses	**ECEN3152**	Digital Signal Processing Laboratory	0	0	2	2	1
3	Professional Core Course	**ECEN3153**	Microwave Engineering Laboratory	0	0	2	2	1
4	Professional Core Course	**ECEN3154**	Microprocessors and Microcontrollers Laboratory	0	0	2	2	1
Total Practical				0	0	8	**8**	**4**
Total of Semester							**26**	**22**

3rd Year, 2nd Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Courses	**ECEN3201**	Digital VLSI Design	3	0	0	3	3
2	Engineering Science Course	**CSEN3208**	Object Oriented Programming Concept by using C++	3	0	0	3	3
3	HU	**HMTS3201**	Economics for Engineers	3	0	0	3	3
4	Professional Elective - 2	**ECEN3231**	Advanced Digital Communication	3	0	0	3	3
		ECEN3232	Bio-Medical Electronics					
		ECEN3233	Power Electronics					
5	Open Elective -1	**ECEN3221**	Artificial Intelligence in Radio Communication	3	0	0	3	3
		AEIE3221	Introduction to Sensors					
		CSEN3221	Fundamentals of RDBMS					
		MATH3221	Computational Mathematics					
		MATH3222	Advanced Probability and Information Theory					
		MATH3223	Scientific Computing					
Total Theory				15	0	0	**15**	**15**

B. Practical								
1	Professional Core Course	**ECEN3251**	Digital VLSI Design Laboratory	0	0	2	2	1
2	Engineering Science Course	**CSEN3258**	Object Oriented Programming Concept by using C++ Laboratory	0	0	3	3	1.5
Total Practical				0	0	5	**5**	**2.5**

C. Sessional								
1	Professional Core Courses	**ECEN3252**	Mini Project/Electronic Design workshop	0	0	3	3	1.5
2	Project Work, Seminar, Internship etc.	**ECEN3293**	Term paper with Seminar	0	0	4	4	2
Total Sessional				0	0	7	**7**	**3.5**
Total of Semester							**27**	**21**

D. Mandatory Course(non-credit)								
1	Mandatory	**INCO3016**	Indian Constitution and Civil Society	2	0	0	2	0
Total of Semester				**17**	**0**	**12**	**29**	**21**

Open Elective -1	**ECEN3221**	Analog and Digital Communication
	ECEN3222	Designing with Processors and Controllers

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

Honours Credit Courses (ECE)

Sl. No.	Semester	Paper Code	Course Title	Contact Hours / Week			Credit Points
				L	T	P	
4	**6th**	**ECEN3211**	Wireless and Cellular Communication	3	0	0	3
		ECEN3261	Wireless and Cellular Communication Laboratory	0	0	2	1

4th Year, 1st Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Elective-3	**ECEN4131**	Adaptive Signal Processing	3	0	0	3	3
		ECEN4132	Fiber Optic Communication					
		ECEN4133	EMI/EMC					
2	Open Elective-2	**INFO4121**	Fundamentals of Cloud Computing	3	0	0	3	3
		ECEN4121	Machine Learning and Regression Analysis					
		AEIE4122	Linear Control Systems and Applications					
		CSEN4121	Fundamentals of Operating Systems					
		MATH4121	Methods in Optimization					
		MATH4122	Advanced Linear Algebra					
		HMTS4122	German for Beginners					
3	Open Elective- 3	**AEIE4126**	Process Instrumentation	3	0	0	3	3
		CSEN4126	Intelligent Web and Big Data					
		CIVL4125	Remote Sensing and GIS					
		CHEN4122	Industrial Pollution Control					
		BIOT4026	Biology for Engineers					
4	HU	**HMTS4101**	Principles of Management	3	0	0	3	3
Total Theory				12	0	0	**12**	**12**

B. Sessional								
5	Project Work, Seminar, Internship etc.	**ECEN4195**	Project Stage – I	0	0	8	8	4
6	Project Work, Seminar, Internship etc.	**ECEN4191**	Industrial Training/Internship	-	-	-	-	2
Total Sessional				0	0	8	**8**	**6**
Total of Semester							**20**	**18**

Open Elective -2	**ECEN4121**	Software Defined Radio
	ECEN4122	Error Control Coding

Table 2: Open Elective 2 (to be offered by ECE department)

Open Elective -3	**ECEN4126**	Ad Hoc Networks and Security Challenges
	ECEN4127	Introduction to VLSI Design

Table 3: Open Elective 3 (to be offered by ECE department)

Honors Credit Courses (ECE)

Sl. No.	Semester	Paper Code	Course Title	Contact Hours / Week			Credit Points
				L	T	P	
5	7th	**ECEN4111**	Microelectronics and Analog VLSI design	3	0	0	3
		ECEN4161	Microelectronics and Analog VLSI design Laboratory	0	0	2	1

4th Year, 2nd Semester:

A. Theory								
Sl. No.	**Category**	**Course Code**	**Course Title**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Elective - 4	**ECEN4241**	Introduction to MEMS	3	0	0	3	3
		ECEN4242	Satellite Communication					
		ECEN4243	Ad Hoc wireless networks					
		ECEN4244	Nano Technology					
2	Professional Elective-5	**ECEN4231**	Wireless Sensor Networks	3	0	0	3	3
		ECEN4232	CDMA – the Technology and Applications					
		ECEN4233	Machine Intelligence and Introduction to Python					
3	Open Elective -4	**INFO4221**	Fundamentals of Cryptography	3	0	0	3	3
		AEIE4221	Introduction to Embedded System					
		ELEC4221	Illumination Engineering					
		BIOT4222	Non-conventional Energy					
		HMTS4222	Elementary Spanish					
Total Theory				9	0	0	**9**	**9**

B. Sessional								
4	Project Work, Seminar, Internship etc.	**ECEN4295**	Project Work II and Dissertation	0	0	16	16	8
5	Project Work, Seminar, Internship etc.	**ECEN4297**	Comprehensive Viva Voce	-	-	-	-	1
Total Sessional				0	0	16	**16**	**9**
Total of Semester							**25**	**18**

Open Elective -4	**ECEN4221**	Cellular and Mobile communication
	ECEN4222	Optical Fiber and its use in Communication

Table 4: Open Elective 4 (to be offered by ECE Department)

Honors Credit Chart (ECE)

Sl. No.	Semester	Paper Code	Course Title	Contact Hours / Week			Credit Points
				L	T	P	
1	1st	HMTS1011	Communication for Professionals	3	0	0	3
		HMTS1061	Professional Communication Laboratory	0	0	2	1
2	2nd	ECEN1011	Basic Electronics	3	0	0	3
		ECEN1061	Basic Electronics Laboratory	0	0	2	1
3	4th	ECEN2211	Control Systems	3	0	0	3
		ECEN2261	Control Systems Laboratory	0	0	2	1
4	6th	ECEN3211	Wireless and Cellular Communication	3	0	0	3
		ECEN3261	Wireless and Cellular Communication Laboratory	0	0	2	1
5	7th	ECEN4111	Microelectronics and Analog VLSI design	3	0	0	3
		ECEN4161	Microelectronics and Analog VLSI design Laboratory	0	0	2	1
Grand Total							20

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 160 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 various Honours Courses offered by the respective departments.
- ✓ A part or all of the above additional credits may also 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.

Heritage Institute of Technology, Kolkata (HIT-K) – Credit Summary for B Tech Programmes with effect from 2018-2019

Sl. No.	Course Type	AICTE Suggested	AEIE	BIOT	CIVL	CHEN	CSEN	ECEN	ELEC	INFO	MECH
1.	Humanities and Social Sciences including Management Courses	12	12	12	12	12	12	12	12	12	12
2.	Basic Science Courses	25	23	26.5	21	22	23	26	23	23	27
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	24	27	27.5	26	27	30	26	28	28	23
4.	Professional Core Courses	48	54	49	57	55	51	52	53	53	51.5
5.	Professional Elective Courses relevant to chosen Specialization / Branch	18	15	16	15	15	15	15	15	15	17.5
6.	Open Subjects – Electives from other Technical and/or Emerging Subjects	18	12	12	12	12	12	12	12	12	12
7.	Project Work, Seminar and Internship in industry or elsewhere	15	17	17	17	17	17	17	17	17	17
8.	Mandatory Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian	0	0	0	0	0	0	0	0	0	0

Sl. No.	Course Type	AICTE Suggested	AEIE	BIOT	CIVL	CHEN	CSEN	ECEN	ELEC	INFO	MECH
	Traditional Knowledge]										
	Total	**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**	**160**
9	Honours Courses	20	20	20	20	20	20	20	20	20	20
	Grand Total	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**

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
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1ST YEAR 1ST SEMESTER SYLLABUS
(B.TECH.)

Course Title : Chemistry I					
Course Code : CHEM1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Course outcomes:

The subject code CHEM1001 corresponds to chemistry theory classes for the first year B. Tech students, which is offered as Engineering Chemistry and is common for all branches of engineering subjects. The course provides basic knowledge of theory based subjects like quantum mechanics, thermodynamics, reaction dynamics, electrochemistry, structure and reactivity of molecules. The course outcomes of the subject are

1. Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.

2. An ability to design and conduct experiments, as well as to organize, analyzes, and interprets data.

3. An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.for engineering applications.

4. Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.

5. Understanding of bulk properties and processes using thermodynamic considerations.

6. Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.

7. Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

MODULE 1

Atomic structure and Wave Mechanics:

Brief outline of the atomic structure, Duel character of electron, De Broglies's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ, concept of atomic orbital.

3**L**

THERMODYNAMICS:

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, Clausius Clapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation.

4**L**

SPECTROSCOPIC TECHNIQUES & APPLICATION

Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation. Principle and application of UV- visible and IR spectroscopy

Principles of NMR Spectroscopy and X-ray diffraction technique

3L

MODULE 2

Chemical Bonding

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi-molecular orbital of ethylene and butadiene.

5L

PERIODICITY

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect.

3L

Ionic Equilibria

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation .

2L

MODULE 3

Conductance

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Application of conductance Acid-base and precipitation titration.

3L

Electrochemical Cell

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion.

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

4L

Reaction dynamics

Rate Laws, Order & Molecularity; zero, first and second order kinetics. Pseudo-unimolecular reaction, Arrhenius equation.

Mechanism and theories of reaction rates (Transition state theory, Collison theory).

Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).

3L

MODULE 4

Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

4L

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity.

3L

Organic reactions and synthesis of drug molecule (4 lectures)

Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation- reduction reactions. Synthesis of commonly used drug molecules.

3L

TEXT BOOKS

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

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar
2. Physical Chemistry, P. C. Rakshit, (7^{th} Edition)
3. Organic Chemistry, Morrison & Boyd , (7^{th} Edition)
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4^{th} Edition)
5. Physical Chemistry , G. W. Castellan, (3^{rd} Edition)
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1^{st} Edition)

Course Title : Chemistry I Laboratory					
Course Code : CHEM1051					
Contact hrs per week :	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course outcomes:

The subject code CHEM1051 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 laboratory equipments. 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

1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.
2. Estimation of ions like Fe^{2+}, Cu^{2+} and Cl^{-} present in water sample to know the composition of industrial water.
3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.
4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.
5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.
6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

List of Experiments:

1. Estimation of iron using $KMnO_4$: 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. Potentiometric 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 ethyl acetate.
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: MATH1101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Course Outcomes

MATH1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.

MATH1101.2 Develop the concept of eigen values and eigen vectors.

MATH1101.3 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.

MATH1101.4 Analyze the nature of sequence and infinite series

MATH1101.5 Choose proper method for finding solution of a specific differential equation.

MATH1101.6 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 on these 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.
3. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
4. S. L. Ross, Differential Equations", Wiley India, 1984.
5. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
6. Vector Analysis(Schaum's outline series): M.R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
7. Engineering Mathematics: S. S. Sastry (PHI)
8. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP),Indian Edition.
9. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)

Course Title : Basic Electrical Engg.					
Course Code : ELEC1001					
Contact Hours	L	T	P	Total	Credit Points
per week	3	1	0	4	4

Course Outcomes

After attending the course, the students will be able to

- Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.
- Analyse DC Machines; Starters and speed control of DC motors.
- Analyse magnetic circuits.
- Analyse single and three phase AC circuits.
- Analyse the operation of single phase transformers.
- Analyse the operation of three phase induction motors.

Module-I:

DC Network Theorem: Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's 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

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

Three phase system: Generation of three-phase AC power, 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

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 : ELEC1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes: The students are expected to

- Get an exposure to common electrical apparatus and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the application of common electrical measuring instruments.
- 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 : Engineering Graphics and Design					
Course Code : MECH1052					
Contact hrs per week:	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcomes:

After going through the course, the students will be able

- To understand the meaning of engineering drawing.
- To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
- To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
- To read and understand projection drawings.
- To draw the section view and true shape of a surface when a regular object is cut by a section plane.
- To use engineering drawing software (CAD).

Lecture Plan (13 L)

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

Detailed contents of Lab hours (52 hrs)

Module 1: Introduction to Engineering Drawing covering**,**
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

(4 hrs + 4 hrs)

Module 2: Orthographic Projections covering**,**
Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina.

(4 hrs+4 hrs + 4 hrs)

Module 3: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views.

(4 hrs + 4 hrs)

Module 4: Sections and Sectional Views of Right Angular Solids covering**,**
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

(4 hrs)

Module 5: Isometric Projections covering**,**
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.

(4 hrs + 4 hrs)

Module 6: Overview of Computer Graphics covering,
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.

(4 hrs)

Module 7: Customisation & CAD Drawing
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 tolerancing; 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;

(2 hrs)

Annotations, layering & other functions covering
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.

(2 hrs)

Module 6: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

(4 hrs)

References:

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

Course Title : Communication for Professionals					
Course Code : HMTS1011					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcomes:

Students will be able to-

1. Write business letters and reports
2. Communicate in an official and formal environment.
3. Effectively use the various channels of communication at work place.
4. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.
5. Learn to articulate opinions and views with clarity.
6. Use various techniques of communication for multiple requirements of globalized workplaces.

Module- I (9hrs.)
Introduction to Linguistics

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation)
- Word- stress, stress in connected speech
- Intonation (Falling and Rising Tone)
- Voice Modulation
- Accent Training
- Vocabulary Building
- The concept of Word Formation
- Root words from foreign languages and their use in English
- Acquaintance with prefixes and suffixes from foreign languages in Englishto formderivatives
- Synonyms, Antonyms and standard abbreviations

Module- II (10hrs.)
Communication Skills

- Definition, nature & attributes of Communication
- Process of Communication
- Models or Theories of Communication
- Types of Communication
- Levels or Channels of Communication
- Barriers to Communication

Module- III (10hrs.)
Professional Writing Skills

- Letter Writing : Importance, Types , Process, Form and Structure, Style and Tone
- Proposal Writing: Purpose, Types of Proposals, Structure of Formal Proposals.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies.

Module- IV (10hrs.)
Communication skills at Work

- Communication and its role in the workplace
- Benefits of effective communication in the workplace

- 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

References:

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

Course Title: Professional Communication Laboratory					
Course Code: HMTS1061					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcomes-

Students will be skilled in the following areas:

1. Communicate in an official and formal environment.
2. Effectively communicate in a group and engage in relevant discussion.
3. Engage in research and prepare presentations on selected topics.
4. Understand the dynamics of multicultural circumstances at workplace and act accordingly.
5. Organize content in an attempt to prepare official documents.
6. Appreciate the use of language to create beautiful expressions

Module- I (4hrs)

Techniques for Effective Speaking

Voice Modulation: Developing correct tone

Using correct stress patterns: word stress, primary stress, secondary stress

Rhythm in connected speech

Module- II (6hrs.)

Effective Speaking and Social awareness

The Art of Speaking

- 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
- Cross-Cultural Communication : Multiple aspects/dimensions of culture
- Challenges of cross-cultural communication
- Improving cross-cultural communication skills at workplace.

Module- III (6hrs)

- Group Discussion: Nature and purpose
- 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- IV (10hrs.)

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, 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 SYLLABUS
(B.TECH.)

Course Title : Physics I					
Course Code : PHYS1001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcomes:

1. To develop basic understanding of the modern science to the technology related domain.
2. Analytical & logical skill development through solving problems.
3. To impart idea of concise notation for presenting equations arising from mathematical formulation of physical as well as geometrical problems percolating ability of forming mental pictures of them.
4. Imparting the essence and developing the knowledge of controlling distant object like satellite, data transfer through optical fiber, implication of laser technology, handling materials in terms of their electrical and magnetic properties etc.
5. To understand how the systems under force field work giving their trajectories which is the basic of classical Field theory
6. To impart basic knowledge of the electric and magnetic behavior of materials to increase the understanding of how and why electronic devices work

Module 1 : Mechanics (7+5)= 12L

Elementary concepts of grad, divergence and curl. Potential energy function; F=-grad V, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, Curl of a force field; Central forces ; conservation of angular momentum; Energy equation and energy diagrams; elliptical, parabolic and hyperbolic orbit; Kepler Problem; Application : Satellite manoeuvres .

Non-inertial frames of reference; rotating coordinate system; five term acceleration formula- centripetal and coriolis accelerations; applications: Weather system, Foucault pendulum.

Module 2 : Optics = (4 +3+ 5) = 12 L

Oscillatory Motion:

Damped harmonic motion – Over damped, critically damped and lightly damped oscillators; Forced oscillation and resonance. Electrical equivalent of mechanical oscillator, Wave equation, plane wave solution.

Optics:

Elementary features of polarization of light waves. Double refraction, Production and analysis of linearly, elliptic and Circularly polarized light, Polaroid and application of polarizations.: Polarimeter.

Laser & Fiber Optics:

Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Fiber optics - principle of operation, numerical aperture, acceptance angle, Single mode , graded indexed fiber.

Module 3: **Electrostatics (8+4) = 12 L**

Electrostatics in free space

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplace's and Poisson's equation for electrostatic potential. Boundary conditions of electric field and electrostatic potential. Method of images , energy of a charge distribution and its expression in terms of electric field.

Electrostatics in a linear dielectric medium

Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, Boundary conditions on displacement, Solving simple electrostatic problem in presence of dielectric – point charge at the centre of a dielectric sphere, charge in front of dielectric slab, Dielectric slab and dielectric sphere in uniform electric field.

Module 4: **(6+3+3) = 12L**

Magnetostatics :
Biot-Savart law, divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; equation for vector potential and it's solutions for given current densities.

Magneto statics in a linear magnetic medium:
Magnetization and associated bound currents; Auxiliary magnetic field $\vec{H}$; boundary conditions on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to simple magnet like a bar magnet; Magnetic susceptibility; ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Faraday's Law:
Differential form of Faraday's law expressing curl of electric field in terms of time derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi static approximation. Energy stored in a magnetic field.

Course Title: Physics I Laboratory					
Course Code: PHYS1051					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcomes:

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
5. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Minimum of six experiments taking at least one from each of the following four groups :

Group 1 : Experiments in General Properties of matter

1. Determination of **Young's modulus** by **Flexure Method**
2. Determination of **bending moment** and **shear force** of a rectangular beam of uniform cross- section.
3. Determination of **modulus of rigidity** of the material of a rod by **static method**
4. Determination of **rigidity modulus** of the material of a **wire by dynamic method.**
5. Determination of **coefficient of viscosity** by Poiseulle's capillary flow method.

Group 2: Experiments in Optics

1. Determination of **dispersive power** of the material of a prism
2. Determination of wavelength of light by **Newton's ring** method.
3. Determination of wavelength of light by **Fresnel's biprism method.**
4. Determination of the **wavelength of a given laser** source by diffraction method

Group 3: Electricity & Magnetism experiments

1. Determination of **dielectric constant** of a given dielectric material.
2. Determination of resistance of **ballistic galvanometer by half deflection** method and study of variation of **logarithmic decrement** with series resistance.
3. Determination of the **thermo-electric power** at a certain temperature of the given thermocouple.
4. Determination of **specific charge (e/m)** of electron.

Group 4: Quantum Physics Experiments

1. Determination of **Planck's constant**.
2. Determination of **Stefan's radiation** constant.
3. Verification of **Bohr's atomic orbital** theory through **Frank-Hertz experiment**.
4. Determination of **Rydberg constant** by studying **Hydrogen/ Helium** spectrum.
5. Determination of **Hall co-efficient of semiconductors.**
6. Determination of **band gap** of semiconductors.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Books of reference :

1. Optics – **Eugene Hecht** Pearson Education India Private Limited
2. Introduction to Electrodynamics, **David J. Griffiths**, Pearson Education India Learning Private Limited
3. Waves and Oscillations by **N.K. Bajaj**
4. Principles of Physics, 10ed, **David Halliday, Robert Resnick Jearl Walker** , Wiley
5. Electricity, Magnetism, and Light, **Wayne M. Saslow**, Academic Press
6. Classical mechanics, **Narayan Rana, Pramod Joag**, McGraw Hill Education

7. Introduction to Classical Mechanics, **R Takwale, P Puranik**, McGraw Hill Education
8. Optics, **Ghatak**, McGraw Hill Education India Private Limited
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – **C.L.Arora**

Course Title: Mathematics II					
Course Code: MATH1201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcomes

MATH1201. 1. Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.

MATH1201. 2. Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.

MATH1201. 3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.

MATH1201. 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.

MATH1201. 5. Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.

MATH1201. 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 4^{th} 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: Programming for Problem Solving					
Course Code: CSEN1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course outcome:

CO 1: Understand and remember functions of the different parts of a computer.

CO 2: Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.

CO 3: Understand and remember syntax and semantics of a high-level language (C programming language, in this course).

CO 4: Understand how code can be optimized in high-level languages.

CO 5: Apply high-level language to automate the solution to a problem.

CO 6: Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

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.
Total load – 40 hours

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: CSEN1051					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	4	4	2

Course Outcomes:

After completion of this course the students should be able:

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
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: Business English					
Course Code: HMTS1202					
Contact hrs per week:	L	T	P	Total	Credit Points
	2	0	0	2	2

Course Outcomes:

The learner will
1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.
5. Write reports according to various specifications.
6. Acquire the skill to express with brevity and clarity.

Module- I (6hrs.)
Grammar (Identifying Common Errors in Writing)

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced Modifiers
- Articles
- Prepositions
- Redundancies

Module- II (6hrs.)
Basic Writing Strategies
Sentence Structures

- Use of phrases and clauses in sentences
- Creating coherence
- Organizing principles –accuracy, clarity, brevity
- Techniques for writing precisely
- Different styles of writing: descriptive, narrative, expository
- Importance of proper punctuation

Module- III (8hrs)

Business Communication- Scope & Importance

Writing Formal Business Letters: Form and Structure-Parts ofa Business letter, Business Letter Formats, Style and Tone, Writing strategies.

Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular

Organizing e-mail messages, E-mail etiquette

Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of well-written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination of Chronological and Functional Resume, Content of

the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References

Module- IV (6hrs)

Writing skills

- Comprehension: Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage - practice
- Paragraph Writing: Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/developing a paragraph.
- Précis: The Art of Condensation-some working principles and strategies. Practice sessions of writing précis of given passages.
- Essay Writing: Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays

References:

1. Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.
4. Kalia, S. & Agarwal, S. Business Communication, Wiley India Pvt. Ltd., New Delhi, 2015
5. Mukherjee, H.S., Business Communication- Connecting at work., , Oxford University Press.2nd Edition.2015
6. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

Course Title: Language Laboratory					
Course Code: HMTS1252					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcomes:

The learner will

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.
5. Engage in research and prepare authentic, formal, official documents.
6. Acquire reading skills for specific purpose.

Module- I (4hrs)
Listening Skills

- Principles of Listening: Characteristics, Stages.
- Types of Listening: Passive listening, Marginal or superficial listening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.
- Guidelines for Effective Listening
- Barriers to Effective Listening
- Listening Comprehension

Module- II (8hrs)

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

Module- III (6hrs)

- Public Speaking: The Speech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.
- Characteristics of a good speech : content and delivery, structure of a speech
- Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.
- Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
- Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module- IV (8hrs)
Presentation Skills

- Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
- Project Team/Group Presentations

References:

6. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
7. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
8. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
9. Sen, S., Mahendra, A. & Patnaik, P., Communication and Language Skills, Cambridge University Press, 2015
10. Locker, Kitty O. Business and Administrative Communication McGraw-Hill/ Irwin.
11. Chaney, L. and Martin, J., Intercultural Business Communication. Prentice Hall

Course Title : Workshop /Manufacturing Practices					
Course Code : MECH1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	1	0	4	5	3

Course Outcomes:

Upon completion of this course

1. The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

2. The students will be able to fabricate components with their own hands.

3. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

4. By assembling different components, they will be able to produce small devices of their interest.

5. The students will be able to describe different components and processes of machine tools.

6. The students will be able to apply the knowledge of welding technology and they can perform arc and gas welding to join the material.

(i) Lectures & videos: (13 hours)

Detailed contents

1. Introduction on Workshop and Safety Precautions. **(1 lecture)**
2. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
3. CNC machining, Additive manufacturing **(1 lecture)**
4. Fitting operations & power tools **(1 lecture)**
5. Electrical & Electronics **(1 lecture)**
6. Carpentry **(1 lecture)**
7. Plastic moulding, glass cutting **(1 lecture)**
8. Metal casting **(1 lecture)**
9. Welding (arc welding & gas welding), brazing **(2 lecture)**
10. Viva-voce **(1 lecture)**

(ii) Workshop Practice :(52 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop **(12 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(4 hours)**
4. Electrical & Electronics **(4 hours)**
5. Welding shop (**Arc welding 4 hrs + gas welding 4 hrs**) **(8 hours)**
6. Casting **(4 hours)**
7. Smithy **(4 hours)**
8. Plastic moulding& Glass Cutting **(4 hours)**
9. Sheet metal Shop **(4 hours)**

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Suggested Text/Reference Books:

(i) 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.
(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
(iii)Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
(iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Title : Basic Electronics					
Course Code : ECEN1011					
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

1) Categorize different semiconductor materials based on their energy bands and analyze the characteristics of those materials for different doping concentrations based on previous knowledge on semiconductors acquired.

2) Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.

3) Design different application specific circuits associated with diodes operating both in forward and reverse bias.

4) Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.

5) Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.

6) Design and implement various practical purpose electronic circuits and systems meant for both special purpose and general purpose and analyze their performance depending on the type of required output and subsequently the applied input.

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, drift and diffusion currents in semiconductor

Diodes and Diode Circuits:
Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application.
Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

Module II [8 L]

Bipolar Junction Transistors (BJT):
PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB & CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation, current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

Module III [9 L]

Field Effect Transistors (FET):
N-channel Junction Field Effect Transistor (JFET) structure & V-I characteristics.

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

MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.

Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI),
Classification of Integrated circuits (IC) and their applications.

Module IV [9 L]

Feedback in amplifiers :
Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier:
Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices:
Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

References:

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

Course Title : Basic Electronics Laboratory					
Course Code : ECEN1061					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcomes:

1. The students will correlate theory with diode behavior.
2. They will design and check rectifier operation with regulation etc.
3. Students will design different modes with BJT and FET and check the operations.
4. They will design and study adder, integrator etc. with OP-AMPs.

List of Experiments (from)

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs 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.

DETAILED SYLLABI

2nd. YEAR, 1st. SEMESTER

Course Name : Analog Circuits					
Course Code : ECEN2101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

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

1. Apply the previous knowledge gathered from Basic Electrical and Basic Electronics papers.
2. Understand the concepts of BJT, MOSFET and biasing techniques of BJT and MOSFET based amplifier circuits.
3. Analyze frequency response of amplifier circuits.
4. Design different types sinusoidal oscillators and multivibrator circuits.
5. Construct algebraic equations based amplifier and analog computers using OP-AMP
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. BJT biasing circuits, Q-point and stability.

Small Signal analysis of Amplifiers [4L]:
Small signal (h-parameter and r_e 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.

Feedback & Oscillator Circuits [7L]:
Concept of feedback, Effects of negative feedback in amplifiers, 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 OPAMP.

Applications of OPAMP [3L]:
Inverting and non-inverting OPAMP amplifiers, Log-antilog amplifiers, 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.

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 Name : Analog Circuits Laboratory					
Course Code : ECEN2151					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

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

1. Study and compare frequency responses of amplifiers.
2. Design different timer circuits with 555 IC.
3. Design rectifiers and measure rectifier parameters.
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 ASLKv2010StarterKit

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

Course Name : Circuit and Network Theory					
Course Code : ECEN2102					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

COURSE OUTCOMES

1. Apply the previous knowledge gathered from Basic Electrical Engineering for understanding the basic concepts of this subject.
2. Solve problems in various electric circuits using Network Theorems.
3. Analyze complex circuits in Laplace domain.
4. Understand the application of Graph theory to solve various network behaviour.
5. Evaluate the output of various Two port network without going through the detailed configuration.
6. Design various types of filters using SPICE software.

Module-I

Network equations: Concepts of voltage source and current source, Formulation of Node & Mesh equations. Loop and node variable analysis of transformed circuits. Network Theorems: Thevenin's, Norton's, Superposition, Maximum Power Transfer Theorem, Reciprocity theorem applied to circuits containing dependent sources.
[5L]

Resonant Circuits: Series and Parallel resonance, Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth, Phasor diagrams.
[4L]

Coupled Circuits: Coefficient of coupling, Dot convention, Analysis of coupled circuits.
[2L]

Module-II

Laplace Transform: Concept of complex frequency. Properties of Laplace transform linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents, Independent and dependent sources and equivalence of sources, treatment of mutual couplings in t & s domain. Transient and steady state response of RL, RC, LC and RLC with or without stored energy. Concept of natural frequency and damping. Sketching transient response, determination of time domain specifications. Concept of Convolution theorem and its application.
[8L]

Module-III

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory.
[4L]

Two port networks: 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 & transfer impedance & admittance.
[5L]

Module-IV

Filter Circuits: Concept of filters, Classification of filters. Analysis and synthesis of Active Low pass, High pass, Band pass and Band reject filters using operational amplifier. Filter approximations: Butterworth, Chebyshev filters.
[5L]

SPICE: Structure of a SPICE program, active and passive device/element statements, different study like DC analysis, transient analysis and ac analysis statement in SPICE. Plotting and printing statement, input and output Impedance calculation using SPICE, voltage and current controlled components in SPICE.
[3L]

Total: 36L

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 Name : Circuit and Network Theory Laboratory					
Course Code : ECEN2152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

1. The students will be able to apply MATLAB/OCTAVE for circuit analysis.
2. They will derive transfer functions of electrical networks.
3. The students will analyze two port network
4. They will be able to design different filters.

List of Experiments:

1. Determination of Laplace transform and Inverse Laplace transform of different using MATLAB/OCTAVE.
2. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB/OCTAVE in both discrete and analog form;
3. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB/OCTAVE
4. Find out the transfer function of an electrical Network containing RL, RC & RLC and find out pole-zero
5. Transient response of R-L and R-C network using SPICE
6. Transient response of R-L and R-C network using hardware components
7. Transient response of R-L-C series and parallel circuit using SPICE and hardware Verification
8. Verification of Network theorems (Reciprocity, Compensation theorem) using SPICE software
9. Determination of Impedance (Z), Admittance (Y) and Transmission (T) parameter of a two port network using SPICE or circuit maker.
10. Determination of Impedance (Z), Admittance (Y) and Transmission (T) parameter of a two port network using hardware.
11. Design of Butterworth Low Pass and High Pass filters: Simulation / Hardware.
12. Design of Band Pass and Band Reject filters using Butterworth Low Pass and High Pass filters: Simulation /Hardware.

Course Name : Signals And Systems					
Course Code : ECEN2103					
Contact Hours per week	L	T	P	Total	Credit Point
	3	0	0	3	3

Course Outcomes:

1. Students should be able to apply the previous knowledge of mathematics on differential calculus.
2. Students should be able to categorize and indentify the different types of signals and systems.
3. Student should be able to analyze the frequency domain characteristics of signals using Fourier series, Fourier transforms, Laplace Transform, Z- Transform.
4. Students should be able to implement and extends the concepts of transformation tools to design of communication systems and filters.
5. Students should be able to analyze random signals and its properties, hence extending the concept towards in communications systems.
6. Students should be able to evaluate the response different systems with the applications of different mathematical tools.

Module No-1: Introduction to Signal and Systems: (**8 L**)

1.1. Classification of Signals: Discrete and continuous signal, Periodic aperiodic, even – odd, energy and power signals, deterministic and random signals, complex exponential and sinusoidal signals, periodicity, unit impulse, unit step, transformation of independent variable of signals, time scaling, time shifting.

1.2. Properties of Systems: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Distortion-less systems, Invertible systems, Frequency response of LTI system-continuous and discrete system.

Module No-2: Analysis of continuous time signals: (**8 L**)

2.1. Convolution in continuous time, Correlation of continuous –time signals,Continuous time Fourier Series, Fourier transformation of continuous time signals and their properties.

2.2. Laplace transformation: analysis and characterization of LTI systems with examples and properties. Computation of impulse response and transfer function using Laplace transform, Analysis of basic electrical circuits using Laplace Transform, Parseval's theorem.

Module No-3: Analysis of discrete time signals: (**10L**)

3.1. Convolution in discrete time, Correlation of discrete time signals, Discrete time Fourier Series, Fourier transformation of discrete time signals and their properties.

3.2. Z-transform for discrete time signals, Region of convergence, System functions, Poles and zeros of system, analysis and characterization of LTI systems with examples and properties using z-transform , Computation of impulse response and transfer function using z-transform.

Module No-4: Application of Signals and Systems theory:(10 L)

4.1 Sampling Theorem, Types of sampling, Aliasing, Pre-alias filter, Reconstruction of a signal from its samples, Modulation for communication, Sampling of Band-pass signals, Filtering

4.2. Random process and noise: Random variable, random process, ensemble, sample function, time average, ensemble average, stationary and ergodic process, correlation between two random variables. Definitions- distribution & density function, mean values &moments, function of two random variables, spectral densities, response of LTI system to random inputs, Noise sources in circuits, noise in communication circuits and systems, 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.Ramesh Babu & R.Anandanatarajan- Signals and Systems 4/e- Scitech
4. Sanjay Sharma-Signals and Systems, Kataria Publication

References:

1 J.G. Proakis & D.G. Manolakis- Digital Signal Processing Principles, Algorithms and Applications,.
2 A.Nagoor Kani- 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 Name : Signals And Systems Laboratory					
Course Code : ECEN2153					
Contact Hours	L	T	P	Total	Credit Points
per week	0	0	2	2	1

Course Outcomes:

1. The students after the course will learn to study signal synthesis using SA.

2. They will understand convolution of two signals.

3. The students will learn Fourier and Laplace transforms and applications.

4. They will be able to measure filter response.

Hardware Experiments-:

1. To Study Signal Synthesis via sum of harmonics using spectrum analyzer.

2. Study of sampling theorem.

Software Experiments-:

1. To study the generation of different type of continuous and discrete signals.

2. To study the different operation of signals.

3. To study convolution theorem in time and frequency domain.

4. To study the autocorrelation and crosscorrelation of signal.

5. To study the Fourier transform and Laplace transform.

6. Magnitude and phase response of the filters.

Course Name : Mathematical Methods					
Course Code : MATH2001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

COs:

MATH2001.1 Construct appropriate mathematical models of physical systems.

MATH2001.2 Recognize the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.

MATH2001.3 Generate the complex exponential Fourier series of a function and make out how the complex Fourier coefficients are related to the Fourier cosine and sine coefficients.

MATH2001.4 Interpret the nature of a physical phenomena when the domain is shifted by Fourier Transform e.g. continuous time signals and systems.

MATH2001.5 Develop computational understanding of second order differential equations with analytic coefficients along with Bessel and Legendre differential equations with their corresponding recurrence relations.

MATH2001.6 Master how partial differentials equations can serve as models for physical processes such as vibrations, heat transfer etc.

MODULE I : [12L]

Functions of Complex Variables:

Complex numbers and its geometrical representation.

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.

Line Integral on complex plane, Cauchy-Goursattheorem, 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.

MODULE II : [12L]

FOURIER SERIES, INTEGRALS AND TRANSFORMS:

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 REPRESENTATION OF A FUNCTION, E.G. PERIODIC SQUARE WAVE, HALF WAVE RECTIFIER, UNIT STEP FUNCTION.
HALF RANGE SERIES, PARSEVAL'S IDENTITY.
FOURIER INTEGRAL THEOREM, FOURIER TRANSFORM, FOURIER SINE AND COSINE TRANSFORM, LINEARITY, SCALING, FREQUENCY SHIFTING AND TIME SHIFTING PROPERTIES, CONVOLUTION THEOREM.
DISCUSSION OF SOME PHYSICAL PROBLEMS: E.G FORCED OSCILLATIONS.

MODULE III: [12L]

Series Solutions to Ordinary Differential Equations and Special Functions:

Series solution of ODE: Ordinary point, Singular point and Regular Singular point, series Solution when $x = a$ is an ordinary point, Frobenius method.

Legendre's Equation , Legendre's polynomials and its graphical representation.

Bessel's equation , Bessel's function of first kind and its graphical representation.

Finite Difference Method and its application to Boundary Value Problem.

MODULE IV : [12L]

Partial Differential Equations:

Introduction to partial differential equations, Formation of partial differential equations, Linear and Nonlinear pde of first order, Lagrange's and Charpit's method of solution.

Second order partial differential equations with constant coefficients , Illustration of wave equation, one dimensional heat equation, Laplace's equation, Boundary value problems and their solution by the method of separation of variables.

Solution of Boundary value problems by Laplace and Fourier transforms.

Suggested Books:

1. Complex Variables and Applications
   Brown Churchill
   MC GrawHill

2. Complex Variable
   Murrey R. Spiegel Schaum's
   Outline Series

3. Theory of Functions of a Complex Variable
   Shanti Narayan, P. K. Mittal
   S. Chand

4. Integral Transforms for Engineers and Applied Mathematicians
   Larry C. Andrew, B. K. Shivamoggi
   Macmillan

5. Fourier Analysis with Boundary Value Problem
   Murrey R.Spiegel
   Schaum's Outline Series

6. Mathematical Methods
   Potter, Merle C., Goldberg, Jack.
   PHI Learning

7. Ordinary and Partial Differential Equations
   M. D. Raisinghania
   S. Chand

8. Elements of Partial Differential Equation Ian
   Naismith Sneddon
   Dover Publications

9. Advanced Engineering Mathematics
   Kreyszig
   Willey

10. Higher Engineering Mathematics
    B. V. Ramana
    Tata McGraw-Hill

Course Name: Data Structure and Basic Algorithms					
Paper Code: CSEN2004					
Contact hrs per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**-**	**-**	**3**	**3**

COURSE OUTCOMES

1. To understand the data structures, their advantages and drawbacks
2. To identify the efficiency aspects of the graph and sorting algorithms covered in this course.
3. To learn about the data structures/ methods/ algorithms mentioned in the course with a comparative perspective
4. To describe problem statements and to design the solutions using programming language
5. To analyze and apply most appropriate data structure/ method/algorithm in a program to enhance the efficiency
6. To develop an efficient program modifying an efficient one using the knowledge gathered from this course.

Module-1: Linear Data structures I [8L]
Introduction [2L]
i. Concepts of Data and data structure, Data Type and Abstract Data Type.
ii. Algorithms and programs, Different types of algorithms with example
iii. Algorithm efficiency and analysis, time and space analysis of algorithms–order notations.
Array [3L]
i. Different representations – row major, column major
ii. Sparse matrix - its implementation and usage
Linked List [3L]
i. Singly linked list, its operations – with and without tail pointer
ii. Circular linked list, its operations, Doubly linked list,

Module-2: Linear Data structures II [8L]
Stack [3L]
i. Concept, Operations
ii. Implementation (using array, using linked list)
iii. Applications – Evaluation of expressions
Queue [3L]
i. Concept, Operations
ii. Implementation (using array, using linked list)
iii. Circular queue, implementation (using array)
iv. Applications
Recursion [2L]
i. Principles of recursion
ii. Use of stack
iii. Differences between recursion and iteration
iv. Tail recursion

Module-3: Non-linear Data structures [8L]
Trees [5L]
i. Basic terminologies, tree representation (using array, using linked list)
ii. Binary trees-traversal (pre, in, post - order), reconstruction
iii. Binary search tree-operations (creation, insertion, deletion, searching)
iv. Height balanced binary tree –AVL tree (insertion, deletion with examples only)

Graphs [3L]:
i. Basic Terminologies and definitions
ii. Representations/storage implementations–adjacency matrix, adjacency list,
iii. Graph traversal and connectivity–Depth first search (DFS), Breadth first search (BFS)

Module-4: Searching, Sorting, Hashing [8L]
Sorting Algorithms [4L]
i. Bubble sort, Insertion sort, Selection sort
ii. Merge sort, Quick sort,
iii. Comparisons

Searching [2L]
Sequential search, binary search
Hashing [2L]:
Hashing functions, collision resolution techniques

Text Books:
1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein.

Course Name: Data Structure and Basic Algorithms Lab					
Paper Code: CSEN 2054					
Contact hrs per week	**L**	**T**	**P**	**Total**	**Credit Points**
	-	**-**	**3**	**3**	**1.5**

List of Experiments:

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements
3. Circular Queue: Adding & deleting elements
4. Evaluation of expressions operations using stacks.
5. Implementation of linked lists: inserting, deleting, inverting a linked list.
6. Implementation of stacks & queues using linked lists:
7. Sparse Matrices: Multiplication, addition
8. Recursive and Non-recursive traversal of Trees.
9. Binary tree traversal.
10. DFS and BFS.
11. Application of sorting and searching algorithms.

Course Outcomes:

1. To write well-structured programs
2. To analyze run-time execution of sorting methods, including selection, merge sort and Quick sort.
3. To implement any ADT using both array based and linked-list based data structures.
4. To design advance data structure using Non-Linear data structure.
5. To select appropriate data structures as applied to specified problem definition.
6. To determine and analyze the complexity of given Algorithms.

Course Name: **Human Values and Professional Ethics**					
Course Code : HMTS2001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

COURSE OUTCOMES:

The students will:

i) be aware of the value system and the importance of following such values at workplace
ii) learn to apply ethical theories in the decision making process
iii) follow the ethical code of conduct as formulated by institutions and organizations
iv) Implement the principles governing work ethics
v) Develop strategies to implement the principles of sustainable model of development
vi) Implement ecological ethics wherever relevant and also develop eco-friendly technology

Module I (10 L)

Human society and the Value System

Values: Definition, Importance and application.
Formation of Values: The process of Socialization
Self and the integrated personality
Morality, courage, integrity

Types of Values:

Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values &their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at----
Individual Level
Societal Level
Cultural Level
Value Crisis management --- Strategies and Case Studies

Module II (10L)

Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism, Utilitarianism, Kant's theory and other non-consequential perspectives
Ethics of care, justice and fairness, rights and duties

Ethics-- Standardization
Codification
Acceptance
Application

Types of Ethics- Ethics of rights and Duties
Ethics of Responsibility
Ethics and Moral judgment
Ethics of care
Ethics of justice and fairness
Work ethics and quality of life at work

Professional Ethics
Ethics in Engineering Profession;
Moral issues and dilemmas, moral autonomy (types of inquiry)
Kohlberg's theory, Gilligan's theory (consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEE Institute of Engineers, Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership
Conflict between business demands and professional ideals
Social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies
Ethics and Industrial Law
Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III (10L)

Science, Technology and Engineering
Science, Technology and Engineering as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization
Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and safety engineering
Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk
Technology Transfer: Definition and Types
The Indian Context

Module IV (6L)

Environment and Eco- friendly Technology
Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation
Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment

Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends

Appropriate technology movement by Schumacher and later development
Reports of Club of Rome.

Suggested Readings:

1)Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2)Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York,1996.
3)Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008.
4)Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008.
5)Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
6)Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall,Inc.,USA, 1970.
7) Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

2nd. Year, 2nd. Semester

Course Name : Analog Communication					
Course Code : ECEN2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

COs:
After completing this course, the students will be able to:
1) Understand & apply the concepts of various types of signals, techniques for signal transmission and signal modulation from the knowledge gathered earlier.
2) Identify various parameters associated with Amplitude Modulation, time and frequency domain representations, side band frequencies etc and apply these knowledge to solve numerical problems.
3) Understand principles of various generation and detection techniques of Amplitude Modulation.
4) Identify and apply detailed knowledge of Angle modulation and demodulation techniques.
5) Analyze various multiplexing techniques and radio receivers.
6) Understand system noise and apply this knowledge to compare the noise performance of Analog Communication systems.

Module-1:[9L]
Introduction to Analog Communication: Introduction to basic elements of communication systems, Concept of modulation and its needs.
Continuous Wave Linear Modulation:
a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index, frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; Calculation of Transmitted power & sideband power & Efficiency ; concept of under, over and critical modulation of AM-DSB-TC.
b) Other Amplitude Modulations: Single side band modulation (SSB) both TC & SC ,Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. The basic concepts of VSB, Spectra and band-width.

Module -2 :[9L]
Generation & Detection of Amplitude Modulated signals:
a) Generation: Multiplier modulator, Balanced Modulator, Switching modulator, Square law Modulator, Generation of SSB: Frequency Discrimination method, Phase Discrimination method
b) Detection: Rectifier Detector, Square Law detector, Envelope detector, Synchronous detection for AM- SC signals, Effects of Frequency & Phase error in Synchronous detection.

Module-3:[9L]
Angle Modulation:
a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Phasor diagram.
b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator
c) Demodulation of FM: Concept of frequency discriminators and phase discriminators, Phase Locked Loop. Comparison between AM and FM.

Module - 4 :[9L]
a) Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing,
b) Radio Receivers –Performance Characteristics of Radio Receivers, Basic block diagram of TRF and Superhetrodyne Receiver. Comparison between TRF and Superhetrodyne Receiver.
c) Noise in Communication System: Noise performance in Analog Communication systems: SNR calculation for DSB/TC, DSB-SC, SSB-TC, and SSBSC & FM.
Text Books:

1. B.P.Lathi -Communication Systems- BS Publications
2. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
3. Singh & Sapre—Communication Systems: 2/e, TMH
4. Haykin, Communication Systems- PHI

References:

1. Carlson—Communication System,4/e , Mc-Graw Hill
2. Proakis & Salehi Fundamentals of Communication Systems- Pearson
3. V Chandra Sekar – Analog Communication- Oxford University Press
4. P K Ghosh- Principles of Electrical Communications- University Press
5. L.W. Couch Ii, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
6. Blake, Electronic Communication Systems- Cengage Learning

Course Name : Analog Communication Laboratory					
Course Code : ECEN2251					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

1. The students will learn to analyze AM and FM signals using spectrum analyzer.
2. They will be able to design AM demodulator.
3. The students will be in a position to design FM demodulator.
4. They will know the procedure to measure Radio receiver parameters.

List of Experiments:

1. Measurement of modulation index varying modulating signal amplitude of an AM signal.
2. Design an AM demodulator (Envelope detector).
3. Spectral analysis of AM Signal.
4. Design of a voltage controlled oscillator (VCO).
5. Measurement of modulation index varying modulating signal amplitude of a FM signal.
6. Design a FM demodulator using PLL.
7. Spectral analysis of FM signal.
8. Study of Pre-Emphasis and De-Emphasis.
9. Measurement of selectivity, sensitivity and fidelity of a super-heterodyne receiver.
10. Experiment Beyond curriculum.

Course Name : Digital Systems Design					
Course Code : ECEN2002					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course outcomes:

1. Make use of the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method, and Tabular method.
2. Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.
3. Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).
4. Outline the concept of different types of A/D and D/A conversion techniques.
5. Realize basic gates using RTL, DTL, TTL, ECL, and CMOS logic families.
6. Relate the concept of Flip flops to analyze different memory systems including RAM, ROM, EPROM, EEROM, etc.

Module-1

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, K- map method, Tabular method.
[8]

Module-2:

a) Combinational circuits- Adder and Subtractor, BCD adder, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.
[7]

b) Memory Systems: Concepts and basic designs of RAM, ROM, EPROM, EEROM, Programming logic devices and gate arrays. (PLAs and PLDs)
[5]

Module-3:

Sequential Circuits- Basic memory element S-R, J-K, D, and T Flip Flops, Interconversions of Flip-Flop, State table and state transition diagram, sequential circuits design methodology, various types of Registers and Counters (Synchronous, asynchronous, Irregular, ring, johnson) and their design, Lockout and its remedy.
[8]

Module-4:

a) Different types of A/D (Flash, SAR, Counter type, Dual slope) and D/A(R-2R, weighted resistor) conversion techniques.
[4]

b) Logic families- RTL, DTL, TTL, ECL, and CMOS, their operation and specifications.
[4]

Total: 36 hours

Textbooks:

1. Morris Mano-Digital Logic Design, PHI
2. R.P.Jain-Modern Digital Electronics, 2/e, Mc Graw Hill
3. Virendra Kumar-Digital technology, New Age Publication
4. S.Salivahanan, S.Arivazhagan-Digital Circuit & Design, Bikas Publishing
5. A. Anand kumar-Fundamental of Digital Circuits, PHI

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 Name : Digital Systems Design Lab					
Course Code : ECEN2052					
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:

1. Design code converters.
2. Design adder and subtractor circuits.
3. Design decoders and multipexer circuits.
4. Realize counters.

List of Experiments:

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 and vice-versa.
3. Design of Four-bit parity generator and comparator circuits.
4. Construction of simple arithmetic circuits-Adder, Subtractor.
5. Construction of simple Decoder & Multiplexer circuits using logic gates.
6. Realization of different combinational circuits using Multiplexers.
7. Realization of RS, JK, and D flip-flops using Universal logic gates.
8. Realization of Asynchronous Up/Down counters.
9. Realization of Synchronous Up/Down counters.
10. Design of Sequential Counter with irregular sequences.
11. Realization of Ring and Johnson's counters.

Course Name : EM Theory And Transmission Lines					
Course Code : ECEN2203					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

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

1. Apply their pre-requisite knowledge of Electrostatics and Magnetostatics.
2. Comprehend Electromagnetic wave propagation in different mediums.
3. Understand different electromagnetic phenomena associated with Transmission Lines.
4. Design of Impedance Matching Networks for two wire Transmission Lines.
5. Develop the ability to analyze the radiation characteristics of antenna configurations and identify respective areas of application.
6. Understand pattern synthesis and analysis in linear antenna array.

Module I:

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.

[6]

Module II:

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**.**

[10]

Module III:

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

[12]

Module IV:

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.

[6]

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, 2ed 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 Name : EM Theory and Transmission Lines Laboratory					
Course Code : ECEN2253					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

1. The students will be able to plot SW pattern under different conditions.
2. They will learn generation and study of Smith Chart.
3. The students will be able to study radiation patterns of various types of antennae.
4. They will be able to undertake parametric study of antenna.

[At least THREE experiments from Module I and FOUR experiments from Module II]

Module I:

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
2. Measurement of Input Impedance of a terminated coaxial line using shift in minima technique.

3. Study of Smith chart on MATLAB/OCTAVE platform.

4. Simulation study of Smith chart - Single and double stub matching.

Module II:

5. Radiation Pattern study of dipole antenna.

6. Radiation Pattern study of a folded-dipole antenna.

7. Radiation pattern study of Helical Antenna.

8. Parametric study (Gain, Directivity, HPBW and FNBW) of three, five and seven element Yagi Uda configurations.

9. Radiation pattern study of a Pyramidal Horn Antenna.

10. Spectrum analysis of different analog signals (sine, triangular, square) using spectrum analyzer.

Course Name : Electronic Devices					
Course Code : ECEN2204					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

The students, after going through this course, will be able to:

1. Apply the previous knowledge of basic electronics engineering to appreciate the contents of this paper.
2. Understand both the particle and wave natures of electrons in Solid State Devices.
3. Identify unknown extrinsic semiconductor type using Hall Effect.
4. Describe working principles of different devices using mathematical models and energy band diagrams.
5. Justify different operations of solid state devices using relative position of Fermi energy levels across p-n junctions in devices.
6. Evaluate performance of different hetero junctions in semiconductor devices.

Module - 1: Semiconductor Physics (11L)
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 state (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. (6L)
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, Scattering Effect, Hall Effect, Piezo-electric effect (3L)

Module - 2: Diodes: **(11L)**
Homo-junctions: p-n junction physics: derivations and plots of depletion charge, electric field, potential profiles; energy band diagram, depletion width, p-n junction capacitances, Varactor diode, Derivation of p-n junction current equations, junction resistances; concepts about linearly graded and abrupt junctions. (5L)
Basic operations of different diodes: Breakdown diodes, Tunnel diode, Photo diodes (P-N, P-I-N, APD), Photoconductor, Solar cell; Basic concept about Spontaneous and Stimulated emissions, LED. (3L)
Hetero-junctions: Physics of Metal-Semiconductor & Semiconductor-Semiconductor hetero-junctions, Rectifying & Non-rectifying natures of Hetero-junctions, basic concept of potential-well & 2D electron gas. (3L)
Module - 3: Bipolar Junction Transistors (BJT): (7L)
BJT operating principle, minority carrier distributions, Different modes of operations and respective energy band diagrams, input output characteristics of BJT in CB & CE modes, base width modulation, Early effect, punch through, thermal runaway; concepts about large and small signal modeling of the device, Eber's Moll model, Hybrid-π model. Basic operation of Photo-transistor.

Module - 4: Metal Oxide Semiconductor Field Effect Transistors (MOSFET): (7L)
Physics of 2-terminal MOS structures with proper band diagrams, formation of inversion layer; MOSFET classifications: Enhancement and Depletion type MOSFETs, basic operations and V-I characteristics of both the devices; concepts of Threshold voltage and Flat-band voltage, small signal model of MOSFET, Introduction to CMOS technology. Study of MOS capacitance.

Text Books :

1. Neamen- Semiconductor Physics and Devices- TMH
2. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
3. Streetman & Banerjee- Solid State Electronic Devices- PHI

Reference Books :

1. Milman, Halkias & Jit- Electronics Devices and Circuits- TMH
2. Bell-Electronics Devices and Circuits-Oxford
3. Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson
4. Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson

Course Name : Advanced Numerical Methods					
Course Code : MATH2202					
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:

MATH2202.1 Analyze certain algorithms, numerical techniques and iterative methods that are used for solving system of linear equations.

MATH2202.2 Implement appropriate numerical methods for solving advanced engineering problems dealing with interpolation, integration and differentiation.

MATH2202.3 Apply the knowledge of matrices for calculating eigenvalues and eigenvectors and their stability for reducing problems involving Science and Engineering

MATH2202.4 Develop an understanding to reduce a matrix to its constituent parts in order to make certain subsequent calculations simpler.

MATH2202.5 Apply various optimization methods for solving realistic engineering problems.

MATH2202.6 Compare the accuracy and efficiency of the above mentioned methods.

Module I **(9L)**

System of Linear Equations :

- Gauss Elimination: pivoting and scaling.
- Gauss-Jordan, Gauss-Jacobi, Gauss-Seidel.
- Computational complexity of the above methods.
- Symmetric positive definite systems and indefinite systems: Cholesky factorization.
- Error Analysis: error prediction and acceleration.

Module II **(9L)**

Eigen Value problems:

- Eigenvalue location, error and stability of eigenvalues.
- QR algorithm.
- Power method, inversion iteration in finding dominant eigenvalues and eigenvectors of sparse matrices.
- Singular value decomposition, application of SVD.

Module III **(9L)**

Interpolation, Integration & Differentiation:

- Purpose of interpolation, choice of interpolating function: Newton's forward and backward interpolation.
- Polynomial interpolation: Lagrange's method.
- Newton's divided difference interpolation.
- Computational complexity of the above methods.
- Piecewise polynomial interpolation: cubic spline interpolation.
- General form of quadrature rule: Newton-Cotes quadrature.
- Trapezoidal rule, Simpson's 1/3rd rule, Weddle's rule.
- Gaussian quadrature rule.

Module IV **(9L)**

Optimization:

- Unimodal functions.
- One-dimensional unconstrained optimization algorithms: interval halving, Dichotomous search, Golden section search, Fibonacci search.
- Cubic spline interpolation.
- Nonlinear Least Squares.

Books:

Text Book

1. Trefethen L. N. and Bau D. *Numerical Linear Algebra*, SIAM
2. Watkins D. S. *Fundamentals of Matrix Computation*, Wiley
3. Smith G. D. *Numerical Solutions to Partial Differential Equations*, Oxford University Press
4. Jain M. K. and Iyengar S.R.K. *Numerical methods for scientific and engineering computation*
5. Conte S. D. and Boor C. D. *Elementary Numerical Analysis - An Algorithmic Approach*, McGraw Hill
6. Atkinson K. E. *Introduction to Numerical Analysis,*John Wiley
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. Jain M.K. *Numerical Solutions of Differential Equations*
5. Smith, *Numerical solutions of partial Differential Equations (Finite difference methods)*
6. Heath M. T., *Scientific Computing: An Introductory Survey*, McGraw Hill
7. Joe D. Hoffman, *Numerical Methods for Engineers and Scientists*, McGraw Hill

Course Name : Advanced Numerical Methods Laboratory					
Course Code : MATH2252					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course outcomes: After completing the course the student will be able to:

MATH2252.1 Write programs in C to solve problems based on numerical methods.

MATH2252.2 Apply their knowledge of C programming to find non-iterative exact solutions of a system of equations.

MATH2252.3 Use C programming to develop algorithms to find iterative approximate solutions of a system of equations.

MATH2252.4 Demonstrate their ability of C programming to solve problems involving interpolation.

MATH2252.5 Use MATLAB/OCTAVE to implement algorithms in optimization problems.

MATH2252.6 Study the role of recurrence relations in optimization algorithms using MATLAB/OCTAVE.

Development of computer programs in C and/or MATLAB/OCTAVE for the following problems:

1. Gauss-elimination Method with complete and total pivoting.
2. Gauss-Seidel Method with diagonal dominance.
3. Newton's Forward Interpolation (polynomial to be printed).
4. Lagrange's interpolation (polynomial to be printed).
5. Implementation of one-dimensional unconstrained optimization algorithms (for example: Dichotomous search, Golden section search, Fibonacci search etc by MATLAB/OCTAVE).

Course Name : Environmental Sciences					
Course Code : EVSC2016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	**0**	**0**	**2**	**0**

Course outcomes

The subject code EVS2016 corresponds to basic environmental chemistry for the 2nd year B.Tech students, which is offered as Environmental Sciences and is mandatory for all branches of engineering. The course provides basic knowledge of various environmental pollutions as well as its impact and ways to curb it. The course outcomes of the subject are

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
5. Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
6. Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Module 1

Socio Environmental Impact **6L**

Basic ideas of environment and its component, Population growth: exponential and logistic; resources; sustainable development 3L

Concept of green chemistry, green catalyst, green solvents

Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India. 3L

Module 2 **6L**

Air Pollution

Structures of the atmosphere, global temperature models

Green house effect, global warming; acid rain: causes, effects and control. 3L

Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution. 3L

Module 3 **6L**

Water Pollution

Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.

Biochemical effects of heavy metals; eutrophication: source, effect and control. 2L

Water quality parameters: DO, BOD, COD.

Water treatment: surface water and waste water. 4L

Module 4 **6L**

Land Pollution

Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal. 3L

Noise Pollution

Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control. 3L

Text/Books

1. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.
2. A. K. De, "Environmental Chemistry", New Age International.
3. A. K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd

References/Books

1. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
2. D. De, D. De, Fundamentals of Environment & Ecology, S. Chand & Company Ltd.

Course Name : Control Systems					
Course Code : ECEN2211					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

COURSE OUTCOMES:

1. Students will be able to relate their pre-requisite knowledge from Mathematics and Signals & Systems.
2. They will develop the ability to understand mathematical model of physical systems and study their nature, configuration and relevant mapping into equivalent models.
3. The concept and classification of control systems, will be applied to identify, analyze and solve stability related issues in time response, error analysis and stability analysis in an advanced way.
4. Students will be able to evaluate, categorize and justify the margin of stability with respect to the system's nature using frequency domain analysis tools.
5. Students will be able to conceptualize different methods of evaluating system behavior with the help of models compatible to simulation.
6. Students will be able to design controllers according to desired performance specifications which can be applied for system design in higher semesters.

MODULE – I

INTRODUCTION:

Concepts of Control Systems- Open Loop and Closed Loop Control Systems, Different Control Systems - Classification of Control Systems, Feed-Back 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

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

FREQUENCY DOMAIN ANALYSIS:

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

Polar Plots- Nyquist Plots-Stability Analysis. [4L]

MODULE –IV

CLASSICAL CONTROL DESIGN TECHNIQUES:

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5L]

STATE SPACE ANALYSIS OF CONTINUOUS TIME SYSTEMS:

Concepts of state, state variables and state model, derivation of state models from block diagrams, Solving the Time invariant state Equations- State Transition Matrix and its properties – Concepts of Controllability and Observability . [6L]

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 Name : Control Systems Laboratory					
Course Code : ECEN2261					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

1. The students will learn the study of feedback on systems.

2. They will be able to study systems of first and second order.

3. The students will be in a position to analyze steady state errors for systems.

4. They will be able to study the stability of a system using Bode plot etc.

List of Experiments:

1. Familiarization with MATLAB/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 Nyquist plot.

9. Study of system stability using Bode plot.

10. Study of system relative stability using Nyquist Plot and Bode Plot.

11. Study of system representation using State Model.

12. Determination of PI, PD and PID controller action on first order simulated process