Revised Course Structure (first and second semester) for the B.Tech. Program to be Adopted wef 2018-19

(Mechanical Engineering, Civil Engineering, and Electronics and Instrumentation Engineering)

Semester I					
Code No.	**Course Name**	**L**	**T**	**P**	**C**
PH 101	Physics	3	1	0	4
MA 101	Mathematics I	3	1	0	4
ME 101	Engineering Mechanics	3	1	0	4
EE 101	Basic Electrical Engineering	3	1	0	4
HS 101	Communicative English	3	0	0	3
PH 111	Physics Laboratory	0	0	3	2
CE 101	Engineering Graphics & Design	1	0	3	3
EE 111	Basic Electrical Engineering Laboratory	0	0	3	2
HS 111	Language Laboratory	0	0	3	2
	Extra Academic Activities (EAA)[1]	0	0	2	0
Credits					**28**

Semester II					
Code No.	**Course Name**	**L**	**T**	**P**	**C**
CH 101	Chemistry	3	1	0	4
MA 102	Mathematics II	3	1	0	4
CS 101	Introduction to Programming	3	1	0	4
EC 101	Basic Electronics	3	1	0	4
CE 102	Environmental Science & Engineering	3	0	0	3
CH 111	Chemistry Laboratory	0	0	3	2
CS 111	Programming Laboratory	0	0	3	2
EC 111	Basic Electronics Laboratory	0	0	3	2
ME 111	Workshop Practice	0	0	3	2
	Extra Academic Activities (EAA)[1]	0	0	2	0
Credit					**27**

(Computer Science & Engineering, Electronics & Communication Engineering, and Electrical Engineering)

Semester I					
Code No.	**Course Name**	**L**	**T**	**P**	**C**
CH 101	Chemistry	3	1	0	4
MA 101	Mathematics I	3	1	0	4
CS 101	Introduction to Programming	3	1	0	4
EC 101	Basic Electronics	3	1	0	4
CE 102	Environmental Science & Engineering	3	0	0	3
CH 111	Chemistry Laboratory	0	0	3	2
CS 111	Programming Laboratory	0	0	3	2
EC 111	Basic Electronics Laboratory	0	0	3	2
ME 111	Workshop Practice	0	0	3	2
	Extra Academic Activities (EAA)[1]	0	0	2	0
Credits					**27**

Semester II					
Code No.	**Course Name**	**L**	**T**	**P**	**C**
PH 101	Physics	3	1	0	4
MA 102	Mathematics II	3	1	0	4
ME 101	Engineering Mechanics	3	1	0	4
EE 101	Basic Electrical Engineering	3	1	0	4
HS 101	Communicative English	3	0	0	3
PH 111	Physics Laboratory	0	0	3	2
CE 101	Engineering Graphics & Design	1	0	3	3
EE 111	Basic Electrical Engineering Laboratory	0	0	3	2
HS 111	Language Laboratory	0	0	3	2
	Extra Academic Activities (EAA)[1]	0	0	2	0
Credit					**28**

1 EAA consists of YOGA/Physical Training/NCC/NSS/NSO, where YOGA is compulsory as a one semester course (first or second semesters), while any one from the rest is compulsory as a one semester course. Thus, if YOGA is registered in first semester then any one from the rest four is to be opted in second semester and vice-versa.

PH 101 **Physics** **L-T-P-C**
Semester/Year : First Year **Pre-requisite - None** **3-1-0-4**

Course objectives

- To solve dynamics of damped and forced oscillating system problems.
- To know the significance of Maxwell's equations in the Engineering applications of electromagnetic waves.
- Explain Quantum Mechanics to understand wave particle dualism. Necessity of quantum mechanics to explore the behavior of sub atomic particles. Evaluate the Eigen values and Eigen functions of a particle.
- To understand the basic electronics properties of materials. To demonstrate the success of quantum free electron theory over classical free electron theory. To examine the probability of occupancy of an electron in an energy state at different temperatures

No. of Classes	**Contents for Class**
Lecture 1	Introduction to Physics course syllabus, Introducing students to the evaluation/grading procedure, Mark distribution in each examination (Class test, mid-term, end-term)
Lecture 2	Introduction to vibration and oscillation, simple harmonic oscillator: equation of motion, general solution, Characteristic of SHM: amplitude, time period, phase velocity, acceleration, total energy
Lecture 3, 4	Damped harmonic motion: damping forces, practical examples of damped oscillation, equation of motion for damped oscillation, solution at different damping conditions: weak, large and critical damping
Lecture 5	Forced oscillation of a damped harmonic oscillator, general solution to equation of motion,
Lecture 6, 7	Steady state solution for forced oscillation, low frequency, high frequency and mid frequency conditions for forced oscillation, Resonance, power of forced oscillator
Lecture 8	Coupled oscillation: equation of motion for coupled oscillation, solutions
Lecture 9	Introduction of normal modes and normal coordinate
Lecture 10	Maxwell's equation: Electrodynamics before Maxwell
Lecture 11	Displacement current, Maxwell's equation in vacuum
Lecture 12	Maxwell's equation in matter. Boundary conditions
Lecture 13	Conservation laws: Continuity equation, Poynting's theorem
Lecture 14	Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization
Lecture 15, 16	EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in matter,
Lecture 17, 18	Reflection and transmission at normal incidence
Lecture 19, 20	Reflection and transmission at oblique incidence
Lecture 21	EM waves in conductors, Reflection at a conducting surface

Lecture 22	Origin and history of quantum mechanics, particle aspect of the wave and vice-versa, matrix and wave mechanics
Lecture 23	Particle aspect of wave – blackbody radiation, photo-electric effect, Wave aspect of particle - de Broglie's hypothesis, matter wave
Lecture 24	Electron diffraction: Davison-Germer experiment, Particle vs wave: classical scenario & quantum scenario – double slit experiment
Lecture 25	Wave particle duality, Heisenberg's uncertainty principle, wavefunction, its properties and probabilistic interpretation
Lecture 26	Wave packets, group velocity & phase velocity and relation between them in dispersive medium
Lecture 27	Development of the wave equation, Time dependent Schrödinger equation
Lecture 28	Introduction to wave function, Probabilistic interpretation of wave function, Probability density
Lecture 29	Quantum mechanical operators (position, momentum, energy), expectation value, correspondence principle, Eigen functions, Eigen value
Lecture 30	Stationary states, Time independent Schrödinger equation
Lecture 31	Infinite square well problem, allowed energies and wavefunctions, Normalization, expectation values
Lecture 32, 33	Potential barrier problem, tunneling phenomena, example of α-particle decay
Lecture 34	Classical theory of electrical conduction, Drude model; Success and failures of classical model;
Lecture 35	Band theory of solid (Qualitative description); Classification of materials on the basis of band theory of solids (qualitative description); Bloch's quantum theory of electrical conduction (Qualitative);
Lecture 36	Distribution of electrons between the energy states-the Fermi-Dirac distribution; temperature variation of Fermi-Dirac distribution function;
Lecture 37, 38	The density of energy states (using free electron model) of metal in 3-D; Estimation of Fermi energy for metals
Lecture 39	Fermi surface and Fermi Velocity; Intrinsic and Extrinsic semiconductors; Charge carriers in semiconductor; Concepts of hole; Free electron model applied to semiconductors
Lecture 40	The Hall effect, Magnetoresistance

Course Outcome:

CO1:- Learners will be able to relate different kind of oscillations to standard differential equations. They will be able to explain various natural vibration phenomena.

CO2:- To apply the concept of vector operators like gradient, curl and divergence. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.

CO3:- Examine the phenomena of wave propagation in different media and its interfaces.

CO4:- They will be able to solve model problems like particle in a box and tunneling through potential barrier. They can apply these models to physical situations like free electron theory, scanning tunneling microscope (STM).

CO5:- Apply the free electron theory to solids to describe electronic behavior. Understand the origin of energy bands, and how they influence electronic behavior. Learners will be enabled to differentiate semiconductors, conductors and insulators. They can be on a platform to appreciate device physics.

References

1. Quantum Physics, Resnick and Eisberg
2. Vibration and waves, A. P. French
3. Introduction to Electrodynamics, D. J. Griffiths
4. Quantum Mechanics, D. J. Griffiths
5. Solid State Physics, A J Dekker
6. The Physics of Solid, R Turton

PH 111	**Physics Laboratory**	**L-T-P-C**
Semester/Year : First Year	**Pre-Requisite - None**	**0-0-3-2**

Course objectives:

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. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

List of experiments

1. To calibrate an ammeter with the help of a potentiometer.
2. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
3. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the young's modulus of the material of the beam.
4. To determine the refractive index of the material of a given prism using a spectrometer.
5. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
6. To study the charging and discharging of a capacitor and hence to determine it's time constant
7. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
8. To determine the wavelength of sodium light using single slit diffraction.
9. Comparison of two low resistances by using meter bridge.

Books

1. University Practical Physics, D. C. Tayal
2. B.Sc. Practical Physics, Samir Kumar Ghosh

Course Outcomes (COs)

At the end of the course, the students will be able to

1. Apply the various procedures and techniques for the experiments.
2. Use the different measuring devices and meters to record the data with precision
3. Apply the mathematical concepts/equations to obtain quantitative results
4. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

CH 101 **CHEMISTRY** **L-T-P-C**

Semester/Year : First Year **3-1-0-4**

Pre-Requisite - None

Lect No	**Unit I: Water and its treatment**	CO
1	Sources and types of impurities in water; Hardness: Definition, Causes and its disadvantages, numerical problems of hardness of water	C1
2	Boiler scale: Definition, Causes and its prevention; Caustic Embrittlement: Definition, Causes and its prevention	C2
3	Boiler corrosion: Definition, Causes and its prevention, Treatment of water at domestic level: Zeolite process: Numerical problems on zeolite process	C3
4	Lime soda process: Principles, Process, Limitation and numerical problems	C4
5	Treatment of water at industrial level: Ion Exchange process: Principles, Process, and Limitation; Adsorption and Solvent extraction	C5
6	Chemical oxygen demand, Biological oxygen demand: Definition, experimental procedure for their determination, limitations, their significance and numerical problems	C6
	Unit II: Chemical Kinetics	
7	Zero order and pseodo unimolecular reactions; determination of the order of reaction, rate laws	C7
8-9	kinetics of complex reactions- parallel, consecutive and reversible reactions steady state concept;	C8
10	Arrhenius equation, energy of activation and its experimental determination	C9
11-12	simple collision theory-mechanism of bimolecular reaction, chain reaction, activated complex theory of reaction rate, ionic reactions	C10
	Unit III : Petroleum and Fuels	
13-15	Cracking of hydrocarbon, knocking, cetane number and octane number, Synthetic petrol, petrochemical and bio-fuels.	C11
16-17	Sources and Classification of Coal, Carbonization of coal, analysis of coal.	C12
18	Determination of Calorific value of coal by Bomb Calorimeter	C13
	Unit IV: Polymers and plastics	
19	Introduction to polymers and plastics, Functionality of polymers, Classification of polymers (on the basis of their method of synthesis, structure, on the basis of source, their behavior when heated to processing temperature)	C14
20	Amorphous and crystalline polymers, Determination of Molecular weights of polymers, Bio-polymers, Degradation of polymers	C15
21	Structural difference between thermoplastics and thermosetting polymers, Different methods for doing polymerization.	C16
22	Commercially important thermoplastics and thermosetting plastics (Polyethylene (LDPE & HDPE), Polyvinyl chloride).	C17
23	Commercially important thermoplastics and thermosetting plastics (Polystyrene, Polytetrafluoroethylene). Recycling of plastics.	C18
24	Conducting polymers (conjugated and doped conducting polymers) and their conducting mechanism, chemical resistance of polymers.	C19

	Unit V: Surface Chemistry	
25-27	Different forms of adsorptions; energetics of adsorptions; application of adsorptions; adsorption isotherms- Langmuir, Freundlich and BET isotherms	C20
28-29	colloids; surfactants; micelles; enzyme catalysis	C21
30	catalysis in industrial processes	C22
	Unit VI: Corrosion and its control	
31	Introduction to corrosion	C23
32-33	Types and mechanism of corrosion	C24
34-35	Factors affecting corrosion	C25
36	Methods to control corrosion	C26
	Unit VII: Chemistry of nanomaterials	
37-38	Introduction; different methods of synthesis of nanomaterials- top down and bottom up	C27
39	Role of surfactant or capping agent in morphology of nanoparticles	C28
40	Various dimensions of nanoparticles	C29
41-42	different analytical techniques for characterization of nanomaterials	C30

Books

1. Engineering Chemistry by Jain and Jain (Dhanpat Rai)
2. Engineering Chemistry by S Chawla (Dhanpat Rai)
3. Physical Chemistry by S Glasstone (McMillan India)
4. Environmental Chemistry by A K Dey (New Age international)
5. Chemistry of Nanomaterials by C N R Rao et al (Wiley-VCH)
6. Nanostructures and Nanomaterials -Synthesis , properties and applications by Guozhong Cao (Imperial College Press 57 Shelton Street Covent Garden London WC2H 9HE , 2004)

Course objectives

The objective of the course to impart fundamental knowledge about some selected aspects of chemistry. The topics include material chemistry, physical chemistry, organic chemistry and inorganic chemistry. Some industry relevant topics are also covered under which basic concepts are taught.

Course outcomes

After completion of the topic the students will be able to:

C1: Explain the aims of water and wastewater treatment

C2: Explain the importance of drinking water and discharge standards.

C3: Identify and explain the main physical, chemical and biological processes for water and wastewater treatment.

C4: Explain water quality characteristics of water sources. To describe the purpose and operational steps of key water treatment processes used to improve water quality.

C5: Working knowledge of drinking water regulations and standards required to protect public health and ensure compliance.

C6: Working knowledge of drinking water regulations and standards required to protect public health and ensure compliance.

C7: learn the significance of various orders of reaction in the study of kinetics of chemical reactions

C8: understand the different forms of complex chemical reactions and formulation of mechanism for them

C9: details of Arrhenius equation, energy of activation of chemical reaction and methods and ways for their experimental determination

C10: learn various theories that help to understand the complex reactions, chain reaction etc.

C11: Explain various type of fossil fuels available to the mankind

C12: Understand the importance of synthetic petrol, petrochemicals and bio-fuels

C13: Judge the quality of coal and petroleum for their proper utilization and conservation for future use.

C14: Understand the basic importance and synthetic procedure different typed of polymers/plastics

C15: Learn the concept of amorphous and crystallinity in polymer, the knowhow on determination of their molecular weight and their degradation.

C16: Learn structural difference between widely useful thermoplastics and thermosetting polymers, and method to produce them.

C17: Learn the different properties, synthesis and practical importance of plastics/polymers.

C18: Learn the different commercially important polymers and plastics and their recycling.

C19: Understand the behavior of polymers toward electricity, their conduction, methods of preparing conducting polymers and their resistance towards diverse chemicals and environment.

C20. Understand the different aspects surface phenomena and relate them different isotherms.

C21. Understand the phenomena of colloidal, surfactants and micellar formation and their applicability in chemical and physical processes, acquire substantial knowledge about the process of enzyme catalysis

C22. Learn the advantages and disadvantages of homogeneous and heterogeneous catalysis, relevance of heterogeneous catalysis in useful industrial processes.

C23: Understand the term corrosion, the reason for undergoing corrosion and the effects of corrosion. They will know the importance of discussing corrosion which is one of the greatest social enemy.

C24: Guess the kind of corrosion a particular metal is undergoing with clear understanding of the mechanism of corrosion

C25: Understand the various factor that affects the rates and extend of corrosion that is important in designing methods to prevent or control corrosion

C26: Select appropriate method for prevention of particular corrosion after understanding the principles of each methods.

C27: have detailed idea about various introductory concepts about nanomaterials and their different methods of preparations.

C28: understand the importance of different morphologies of nanoparticles and how various surfactants help to tune these morphologies

C29: gather knowledge about zero, one, two and three-dimensional nanoparticles with examples

C30: understand the working principles of various analytical tools routinely used for characterization of nanomaterials.

CH 111	CHEMISTRY LABORATORY	L-T-P-C
Semester/Year : First Year		0-0-3-2

Pre-Requisite - None

Experiment 1: To Determine the total hardness of pond water/ supplied water using Standard EDTA Solution

Experiment 2: Estimation of magnesium from supplied solution using standard EDTA

Experiment 3: Estimation of calcium from supplied solution using standard EDTA

Experiment 4: Determination of Dissolved oxygen (D.O) of lake water

Experiment 5: Determination of total alkalinity of supplied aqueous solution.

Experiment 6: To determine the strength of the $KMnO_4$ solution using standard oxalic acid solution

Experiment 7: To determine amount of Fe(II) present in the supplied solution using Standard KMnO4 solution

Experiment 8: To determine amount of Fe(III) present in the supplied solution using Standard K2Cr2O7

Experiment 9: Quantitative determination of Copper (II) using Standard HYPO ($Na_2S_2O_3$) Solution

Experiment 10: Estimation of calcium in milk powder using standard EDTA solution

Experiment 11. Detection of special elements in supplied organic compounds.

Experiment 12: Determination of functional groups in the supplied organic compounds

Experiment 13: Preparation of Copper (II) glycinato complex

Experiment 14: Determination of relative viscosity of the given organic compound by Ostwald Viscometer

Experiment 15: Determination of surface tension of the given organic compound by stalagmometer.

Course Objectives:

To teach good laboratory practice and skills to analyze and interpret the data from experiments with some insight into future career prospect in the fields related to Chemistry.

Course Outcomes of Chemistry Laboratory, CH-111

After studying this module, the students shall be able to

- know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, pisciculture etc. by performing experiments like determination of Total hardness, Total alkalinity, Ca^{2+}, Mg^{2+}, Fe, Cu ions and dissolved oxygen present in water.
- determine the physical properties of liquids by performing the experiments such as viscosity and surface tension of liquids. They will also be able to determine the viscous nature of the lubricating oil. The generated knowledge can be used for industrial product development like detergent formulation, paints, drugs etc.
- synthesize coordination complexes of biologically important transition metal ions.
- to perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.
- gain the knowledge of central role of chemistry and will understand the concepts of safe laboratory practices. They will develop and apply the appropriate lab skills and instrumentation to solve chemical problems and environmental issues facing our society in terms of energy, health and medicine.

MA 101	Mathematics-I	L-T-P-C
Semester/Year : First Semester		3-1-0-4

Pre-requisite: *Limit, Continuity, Differentiability, First order ODE, Rolle's theorem, Mean value theorem, Basic idea of integration.*

Infinite Series:

Definition of Sequence & Infinite series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).

Differential & Integral Calculus:

Successive Differentiation, Leibnitz's Theorem, Curvature: Radius & centre of curvature, Asymptotes and Curve tracing, Partial differentiation, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for a function of one variable, Euler's theorem, Taylor's theorem for a function of two variables, Jacobian. Improper Integrals: Beta function & Gamma function.

Ordinary Differential Equation:

Exact differential equation of first order, Integrating factors, Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters. Series Solutions of ODE near ordinary point.

Integral Transform:

Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method, Applications in IVP and BVP.

Text Books:

1. Jr. Joel Hass, C. Heil, M.D. Weir, Thomas' Calculus, 14th Edition, Pearson Education, 2018.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.

Reference Books:

1. S.G. Deo, V. Raghavendra, R. Kar, V. Lakshmikantham, Text Book of Ordinary Differential Equations, 3rd Edition, McGraw Hill Education, 2017.
2. B.C. Das, B.N. Mukherjee, Differential Calculus, U. N. Dhur & Sons Pvt. Ltd., 55th Edition, 1949.
3. B.C. Das, B.N. Mukherjee, Integral Calculus, U. N. Dhur & Sons Pvt. Ltd., 57th Edition, 1938.
4. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publisher, 2017.

Course Objectives

1. To make the students knowledgeable in the area of infinite series and their convergence so that he/she may be familiar with limitations of series approximations of functions arising in Mathematical Modelling.
2. To make the students familiar in the area of application of differentiation, curve tracing, expansion of functions, and improper integrals.
3. To enable the students understand the basic ideas of ordinary differential equations and their solutions and the application of integral transform in solving ODE.

Course Outcomes

1. At the end of this course, students will be able to apply the concept of series convergence in engineering problems.
2. The students will be capable to apply differentiation, integration and differential equations in engineering and daily life problems.
3. The students will be able to apply Laplace transform and its inverse in engineering problems.

MA 102	Mathematics-II	L-T-P-C
Semester/Year : Second Semester		3-1-0-4

Pre-requisite: *MA 101: Mathematics-I, Matrix and determinants, Vector operations.*

Linear Algebra:

Linear dependence and independence of vectors in R^n space; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Cayley-Hamilton's theorem & its applications, Diagonalization by Similarity Transformations.

Multiple Integrals:

Gradient, Divergence, Curl, Directional derivatives. Double and Triple integrals in Cartesian and Polar form with applications to Volume and Surface Area, Applications of Green's, Stokes' and Gauss Divergence theorems.

Complex Analysis:

Function of a Complex Variable, Analytic function, Harmonic function, Cauchy-Riemann equations, Complex line integral, Cauchy-Goursat theorem, Cauchy's Integral formula, Morera's theorem, Liouville's theorem, Singularities and Residues, Cauchy's Residue theorem and its application to evaluate real integrals.

Numerical Analysis:

Finite difference, Interpolation: Newton's forward and backward interpolation formulae, Lagrange's formula. Solution of algebraic and transcendental equations: Fixed point Iteration method, Newton-Raphson Method. Solution of system of linear equations by Iterative Methods: Gauss Jacobi's method & Gauss-Seidel method. Solution of ODE: Picard's method, Taylor series method and Runge-Kutta method (Fourth order).

Text Books:

1. Jr. Joel Hass, C. Heil, M.D. Weir, Thomas' Calculus, 14th Edition, Pearson Education, 2018.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.

Reference Books:

1. F. Ayres, Theory and Problems of Matrices, Schaum's Outline Series, 1st Edition, 1962.
2. M.R. Spiegel, Laplace Transforms, Schaum's Outline Series, 1st Edition, 1965.
3. L. V. Ahlfors, Complex Analysis, McGraw-Hill Education, 3rd Edition, 1979.
4. D. Sarason, Complex Function Theory, American Mathematical Society, 2007.
5. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publisher, 2017.

Course Objectives

1. To make the students knowledgeable in the area of system of linear equations together with solution techniques and applications in engineering problems.
2. To make the students familiar in calculating multiple integrals, and application of vector differential operators.
3. To enable the students understand the basic ideas of complex analysis and its application in evaluating real integrals.
4. To enable the students understand the limitations of direct methods and application of numerical methods in solving algebraic/ transcendental equations and ordinary differential equations.

Course Outcomes

1. The students will be able to apply the consistency concepts, eigenvalues and eigenvectors concepts in engineering problems.
2. The students will be capable to find the surface area and volume using multiple integrals in engineering and daily life problems.
3. The students will be able to apply basic idea of complex analysis in evaluating real integrals and engineering problems.
4. The students will be capable of solving numerically various types of equations/differential equations arising in engineering problems up to desired degree of accuracy.

HS 101	Communicative English	L-T-P-C
Semester/Year : First Year		3-0-0-3
	Pre-requisite - Nil	

Objectives of the Course

This course has been designed:

1) To impart advanced skills of technical communication in English through practice sessions to first semester UG students of Engineering and Technology.
2) To enable them to communicate confidently and competently in English language.

1. Writing

(i) Common Grammatical Error
(ii) Citation, Formatting, Stylesheet, Plagiarism etc.
(iii) Writing based on Visual Elements: Tables, Figures, Graphs etc.
(iv) Report writing & Poster Presentation

2. Speaking

(i) Simulation of interactive speaking environment&Group Activities: Group Discussions, Debates, Extempore

3. Reading

(i) Comprehension Skills
(ii) Critical reading Skills

4. Listening

(i) Proper Pronunciation and Transcription
(ii) Speech-Thought Coordination

Outcome

After completion of the course, the students are expected to have basic command over the English language in order to communicate with others in day to day affairs, understand and respond to lectures delivered in English, read and comprehend relevant materials written in English, and thus go forth into their professional lives beaming with confidence.

References

1. Knisely&Knisely, Engineering Communication, Cengage Learning; 2015
2. S. Upendran, Know Your English, Vols. 1 & 2, Univesities Press, 2014
3. Seema Miglani&Sikha Goyal, English for Professionals, vayu Education, 2010
4. Nilanjana Gupta, English for All, McMillan, 2000

HS 111	**Language Laboratory**	**L-T-P-C**
Semester/Year : First Year		**0-0-3-2**
	Pre-requisite - Nil	

Objectives of the Course

This course has been designed:

1) To develop and consolidate the spoken language skill of the participants by enhancing overall competency in the English Language
2) To allow students to develop proficiency so as to communicate more coherently and emphatically

1. Introduction to Phonetics - Speech Sound s- Vowels and Consonants
2. Articles, Prepositions, Word Formation-Prefixes & Suffixes, Synonyms & Antonyms
3. Tense & Number
4. Situational Dialogues- Role Play- Expressions in various situations- Self introduction and introducing others- Greetings- Apologies- Requests- Social and Professional Etiquette- Telephone Etiquette etc.
5. Minimal Pairs- Word Accent and Stress Shifts- Listening Comprehension.
6. Descriptions- Narrations- Giving directions and guidelines
7. Intonation and Common Errors in Pronunciation
8. Extempore- Public Speaking - Active and Passive Voice
8. Common Errors in English, Idioms and Phrases.
9. Neutralization of Mother Tongue Influence and Conversation Practice.
10. Information Transfer- Oral Presentation Skills Reading Comprehension

Outcome

After completion of the course, the students are expected to have good pronunciation, to be better in listening and comprehension, to become more effective communicators by organizing communication coherently, and to articulate ideas in a clear concise manner.

CE 101 **ENGINEERING GRAPHICS & DESIGN** **L-T-P-C**

Semester/Year : First Year **1-0-3-3**

Pre-requisite - Nil

Total hours	Lecture: 13 Hours, Tutorial: Nil, Practical: 42 Hours
Course Description	This course is designed to provide engineering undergraduates with basic understanding of the theory and practice of engineering drawings and computer aided drawing for engineering applications. Students will learn to read and construct blueprints and working drawings by means of lectures, discussion of drawing examples related to 2D and 3D objects, Auto-CAD practice. Topics will include basic fundamentals of graphics and drafting principles, Auto-Cad fundamentals, plan and elevation of simple and complex objects, conversion of given plan and elevation of an object into 3D views.
Course Objectives	1. To present fundamentals of graphics and drafting appropriate for developing functional skill in computer aided drafting. 2. To provide students with adequate knowledge and experience in preparing engineering drawings using AutoCAD and CATIA 3. To teach students to read, construct and understand basic engineering drawings. 4. To help students acquire the skills pertinent to the production of properly detailed, formatted and dimensioned Engineering drawings.
Course outcome	Upon completion of this course, students should be able to: 1. produce geometric construction, multiview, dimensioning and detail drawings of typical 3-D engineering objects. 2. apply the skill for preparing detail drawing of engineering objects. 3. understand and visualize the 3-D view of engineering objects. 4. understand and apply computer software to prepare engineering drawing.

Syllabus

Introduction

Introduction to Engg. Graphics. General instruction regarding instruments, dimensions and lettering. Division of lines, angles and curves. Construction of different polygons.

Scales and Conic sections

Construction of Scales – Plain, Diagonal and Vernier Scales, Construction of conic sections - parabola, ellipse, hyperbola, cycloid, trochoids, epicycloid and hypocycloid.

Orthographic projection

Projections of Regular Solid covering, those inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Conversion of pictorial views of objects into orthographic projections

Sections and Sectional Views

Sections and sectional views of Solids - Prism, Cylinder, Pyramid, Cone, Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Isometric projection

Isometric projection and isometric views of lines, planes and solids, isometric scale, conversion of orthographic projections into isometric views.

Computer Graphics

Overview, listing of computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD and CATIA 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];

Graphics tool Customisation

Drawing tool (CAD & CATIA) customization 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;

Annotations

Layering & other functions, 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, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar

projection theory, including sketching of perspective, isometric, multi-view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

Product design and development

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 and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Reference Books:

1. Engineering drawing	N.D.Bhatt & V.M.Panchal	Rupalee Publication, New Delhi
2. Engineering Drawing and Graphics+ AutoCAD	K. Venugopal	New Age International, New Delhi.
3. CATIA V5-6R2016 of Designers	Prof. Shyam Tickoo	BPB Publication, ISBN: 9789386551191, 9386551195 Edition: 14th, 2017
4. Text book on Engineering Drawing,	Narayana, K.L. & P Kannaiah),	Scitech Publishers
Theory and User Manuals for CAD and CATIA Software		

CE 102 **ENVIRONMENTAL SCIENCE & ENGINEERING** **L-T-P-C**

Semester/Year : First Year **3-0-0-3**

Pre-requisites: **None**

Course Objectives

CO1	To acquire a basic understanding and knowledge about the environment and its allied problems
CO2	Realize the importance of ecosystem and biodiversity for maintaining ecological balance
CO3	Develop the ability to evaluate measures for the improvement and protection of environment
CO4	To develop analytical skills, critical thinking, and demonstrate problem-solving skills using scientific techniques towards solutions of current problems and prevention of future problems.

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

CO1	Understand environmental problems arising due to developmental activities.
CO2	Identify the natural resources and suitable methods for conservation and sustainable development.
CO3	Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO4	Identify the environmental pollutants and abatement devices.

Detailed syllabus:

Introduction: Environment, Definition, scope and importance, multidisciplinary nature of environmental studies

Natural Resources: Forest Resources –use and over-exploitation of forests, deforestation, timber extraction, mining, dams and their effects on forests and tribal people Water Resources-Use and over – utilization of surface and groundwater, floods, droughts, conflicts over water, dams-benefits and problems. Mineral resources-use and exploitation, environmental effects of extracting and using mineral resources. Agriculture land and food resources-Land as resources land degradation, man induce landslides, soil erosion and desertification; World food problems, changes caused agricultural and overgrazing, effects of modern agriculture practices, fertilizers and pesticides problems, water logging, salinity, case studies Energy Resources- Growing energy needs, renewable and non-renewable energy resources, Sources of alternate energy sources, Case studies Energy conservation.

Ecosystem and Biodiversity: Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and

ecosystem diversity, value of biodiversity, Consumptive use, productive use, social, ethical aesthetic and optional values, biodiversity at global, national and local values, India as a mega-biodiversity nation, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity – in-situ and ex-situ conservation of biodiversity.

Environmental Pollution: causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes: Pollution case studies, disaster management- floods, earthquakes, cyclones and landslides.

Environment and society: Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, water conservation, rainwater harvesting, watershed management, wasteland reclamation, observance and popularization of Environmental Protection Act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act, Wildlife Protection Act, Forest Conservation Act, issue involved in enforcement of environmental legalizations, population growth, variation among nations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.

Reading

1. Henry J.G. and Heinke G.W. (2004). “Environmental Science and Engineering”. Second Edition, Prentice Hall of India. New Delhi.
2. Chandrasekhar M (2004), “Environmental Science”. Hi-Tech Publishers, Hyderabad.
3. Masters G.M. (2004), “Introduction to Environmental Engineering and Science”. Second Edition, Prentice Hall of India. New Delhi.
4. Garg S.K. and Garg R. (2006), Ecological and Environmental Studies, Khanna Publishers, Delhi
5. Bharucha, E. (2003), “Environmental Studies”, University Publishing Company, New Delhi.
6. De A.K. (2002), “Environmental Chemistry”, New Age India Publication Company, New Delhi.
7. Chauhan, A.S. (2006) Environmental Studies, Jain Brothers, New Delhi.
8. Deswal, S. and Deswal A. (2004), A Basic Course in Environmental Studies, Dhanpat

ME 101	ENGINEERING MECHANICS	L-T-P-C
Semester/Year : First Year		**3-1-0-4**

Pre-requisites: **None**

Objectives:

- To introduce the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems
- To understand the representation of forces and moments
- To describe static equilibrium of particles and rigid bodies
- To comprehend the effect of Friction on general plane motion
- To analyse the properties of surfaces & solids in relation to moment of inertia
- To illustrate the laws of motion, kinematics of motion and their interrelationship

PART – I: STATICS

Statics of rigid bodies: Classification of force systems- principle of transmissibility of a force Composition and resolution- Resultant of a coplanar force systems and conditions of equilibrium, free body diagrams. Moment of a force, couple, properties of couple- Varignon's theorem, Concurrent and parallel forces, conditions of equilibrium.

Beams: Types of loading, Support reactions of simply supported and overhanging beams under different types of loading.

Friction: Laws of dry friction - Angle of friction - Cone of friction - Ladder friction, Wedge friction, Belt friction, Simple Screw Jack.

Properties of surfaces: Centroid of simple and composite areas- Theorems of Pappus and Guldinus. Moment of inertia of areas, Parallel and perpendicular axes theorems- Radius of Gyration, moment of inertia of simple and composite areas.

Plane Truss: Statically determinate trusses; Analysis of a truss and frames - Method of joints, Method of section, Method of Members.

Virtual Work: Degree of freedom, Virtual displacement and virtual work; Principle of virtual work.

PART–II: DYNAMICS

Kinematics of Particles: Differential equations of kinematics; Cartesian coordinate system; Normal and tangent co-ordinate system, projectile motion.

Kinetics of Particles: Kinetics of rectilinear and curvilinear motion, D'Alemberts Principle, Principle of impulse and momentum, Work, energy and power, Direct and oblique collision

Rotation of Rigid Bodies: Moment of inertia of material bodies, Kinematics and Kinetics of rotation- equation of motion, Principle of work and energy; Principle of impulse and momentum.

Plane motion of Rigid Bodies: Translation of a rigid body in a plane; Kinematics of plane motion; Instantaneous center of rotation; Kinetics of plane motion – equation of motion, principle of work and energy; Principle of impulse and momentum.

Outcome:

On successful completion of this course, a student would be able to identify and analyze the problems by applying the fundamental principles of engineering mechanics and to proceed to design and development of the mechanical systems.

Texts/Reference:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati: Engineering Mechanics: McGraw Hill Education; 5th edition
2. J. L. Meriam & L.G. Kraige: Engineering Mechanics -Statics: John Wiley & Sons, Inc
3. J. L. Meriam & L.G. Kraige: Engineering Mechanics -Dynamics: John Wiley & Sons, Inc
4. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek: Vector Mechanics for Engineers- Statics & Dynamics: McGraw-Hill Higher Education; 9th edition
5. R.C. Hibbeler: Engineering Mechanics - Statics & Dynamics: Pearson Education; Fourteenth edition
6. A. Nelson: Engineering Mechanics Statics and Dynamics: McGraw Hill Education; 1st edition
7. K. L. Kumar, V. Kumar: Engineering Mechanics: McGraw Hill Education; 4th edition

ME 111	WORKSHOP PRACTICE	L-T-P-C
Semester/Year : First Year		0-0-3-2

Pre-requisites: **None**

Objectives:

- To develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude.
- To acquire skills in basic engineering practice
- To identify the hand tools and instruments
- To gain measuring skills
- To develop general machining skills in the students

General safety precautions in workshop and introduction.

Carpentry Shop: Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners etc.

Welding Shop: Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.

Fitting Shop: Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.

Machine Shop: Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling , grinding, slotting etc., General idea of cutting tools of the machines.

Texts/Reference:

1. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy: Workshop Technology Vol I & II; Media Promoters & Publishers Pvt. Ltd.
2. H S Bawa: Workshop Practice; McGraw Hill Education; 2nd edition

Course Outcomes

The student will be able to:

- know the importance of general safety precautions on different shop floors.
- identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
- fabrication of wooden joints and understand joining of metals.
- make metal joints and sheet metal work.
- understand the basics of removal of material from workpiece surface to attain specific shape.
- familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

EE 101 **BASIC ELECTRICAL ENGINEERING** **L-T-P-C 3-1-0-4**

Semester/Year : First Year

Prerequisite: None

Introduction: Definition of active, passive, linear, non-linear, unilateral, bilateral, symmetrical, unsymmetrical network with example. Basic concept of circuit elements and their uses. Sources: current sources and voltage sources, dependent source, independent source, circuit laws (KCL & KVL), commonly used symbol and notations in electrical circuits. (3 Hours)

A.C. Fundamentals and R, L, C Circuit: Equation of AC Voltage and currents, waveform, time period, frequency, amplitude, different forms of emf equations, phase, phase difference, average value, RMS value, form factor, peak factor. Series and parallel RL, RC, and RLC circuits and their phasor representation; steady state response; Operator j notation of complex quantity in rectangular and polar form. Concept of Impedance and admittance: definition, relation, impedance, and admittance triangle. Complex power: active, reactive and apparent power, power triangle. (10 Hours)

Network Theorems: Star delta conversions, Node & loop equations, Thevenin's Theorem (AC & DC), Norton's Theorem (AC & DC), Superposition Theorem (AC & DC), Maximum power transfer theorem (AC & DC), Reciprocity Theorem (AC & DC) (All theorems with independent sources only). (7 Hours)

Poly-phase Networks: Balanced Star-Delta connections, phase and line currents and voltages and their relations; (2 Hours)

Electromechanical Energy conversion: Electromechanical laws: relation between electricity and magnetism, production of emfs (ac & dc), Faraday's law of electromagnetic induction, direction of induced emf, Lenz law, dynamically and statically induced emfs, self-inductances, and mutual inductances. (3 Hours)

Electrical Machines: Types of Electrical Machines and their applications; Working principle of DC machines, single phase transformer, and 3-phase induction motor; EMF equation, (7 Hours)

Measurement: Measurement of voltage, current and Power in single and three phase (2 hours)

Electrical safety: Definition, precautions, concepts of grounding and earthing. (2 Hours)

Reference Books:

S. N.	Author	Name of Book	Publisher
1	Del Toro V.	Electrical Engineering Fundamentals	PHI
2.	Theraja B. L.	Electrical Technology	S Chand
3.	Hayt W. H., Kemmerly J. E.	Engineering Circuit Analysis	McGraw Hill
4.	H. Cotton	Electrical Technology	PHI
5.	J. B. Gupta	Basic Electrical Engineering	Katson

Course Objective:

- To provide knowledge on various components used in fundamental electric circuits.
- To study the fundamentals of alternating current fundamentals and its use and behaviour in R, L and C circuits.
- To solve simple electrical circuit parameters using circuit analysis theorems, voltage and current dividers and node and mess analysis methods.
- To understand the basics of single phase and 3 phase poer supple fundamentals.
- To provide concept of electro-mechanical conversion of energy using DC machines and basics of transformers and 3 phase induction machines.
- To use simple electrical measurement techniques for measurement of current, voltage and power in both 1 phase and 3 phase systems.
- To learn basics of electrical safety in work place and sue of grounding and earthing.

Course Outcome:

At the end of the course the students will be able to

- Learn how to develop and employ circuit models for elimentary slsctric components, e.g. resistor, sources, inductor, capacitors and power sources.
- Demonstrate the relationship of current and voltage phasors in 1 phase AC and their relationship in combinations of R, L and C
- Become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and node and mesh methods.
- Appreciate the consequences of linearity, in particular the principle of superposition, Thevenin-Norton equivalent circuits and Reciprocity theorem.
- Gain an intuitive understanding of the role of AC power flow in star and delta networks and relationship of line and phase values.
- Develop the capability to analyze the concept of electromechanical conversion of energy using DC machines and basics of transformer with 3 phase induction machine.
- Apply various modes and methods of measurement of voltage, current and power in both 1 phase and 3 phase circuits.
- Demonstrate the common safety practices of using electricity in workplace with knowledge of grounding and earthing.

EE 111 **BASIC ELECTRICAL ENGINEERING LABORATORY** **L-T-P-C 0-0-3-2**

Semester/Year : First Year

Prerequisite: None

The laboratory experiments are designed to cover the syllabus of EE 1101 and a list of such experiments are listed. This list is not exclusive.

List of Experiments

1. Study and verification of Kirchhoff's Laws applied to direct current circuit.
2. Study the behavior of AC series circuits.
3. Study the behavior of AC Parallel circuits.
4. Verification of Superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Norton's theorem.
7. Verification of Maximum power transfer theorem.
8. Verification of Reciprocity theorem.
9. Measurement of LC parameters by using 3- Ammeter method.
10. Calibration of milliammeter.
11. Resonance of series RLC circuit.
12. To study the balanced three phase circuit.
13. Speed control DC motor using flux control and armature resistance control methods
14. OC and SC test on Single-phase transformer.
15. Study of balanced three-phase circuit/ Measurement of three-phase power using two wattmeter method.
16. Reversal of direction of rotation of a three-phase Induction motor/ Load test of three-phase Induction motor.

Course Objective:

- To provide practical knowledge on various electrical circuits including series-parallel combinations with R, L and C.
- To understand the basic electrical laws like KCL, KVL, Ohms law
- To demonstrate the use of various electrical circuit solving theorems including Thevenin;s theorm, Norton's theorem, maximum power transfer theorem, Reciprocity theorem.
- To study resonance of RLC circuit n series and parallel combinations.
- To demonstrate calibration of various meters like millivoltmeter, milliammeter.
- To demonstrate the DC motor speed control.
- To study the OC and SC test of 1 phase transformer
- To demonstrate measurement of current, voltage and power in electrical circuit.

Course Outcome:

At the end of the course the students will be able to

- Demonstrate the different circuit laws in practical circuits.
- Apply various network theorems to solve circuit parameters.
- Gain an intuitive understanding of the role of common measurement methods used for current, voltage and power in 1 phase and 3 phase circuits.
- Become adept at using various methods calibration of measuring meters.
- Demonstrate the ability to control of speed of DC motors using flux control and armature resistance control
- Find out the resonance frequency of a given RLC circuit in series and parallel combinations.

EC 101	**Basic Electronics**	**L-T-P-C**
Semester/Year : First Year		**3-1-0-4**

Pre-requisite- None

Course objectives- This course introduces students to the basic components of electronics: diodes, transistors, and op amps. It covers the basic operation and some common applications and fundamental aspects of digital electronics

Introduction to Electronic devices: passive devices, diode, bipolar junction transistor (BJT), metal oxide semiconductor field-effect transistor (MOSFET);

Diode: basic structure and operating principle, current-voltage characteristic, large and small-signal models, iterative and graphical analysis; Diode Applications : rectifier circuits (half-wave and full-wave rectifiers, rectifiers with capacitor filter), voltage regulator (using Zener diode), clipper (limiter) circuits, clamper circuits;

Bipolar Junction Transistors and their Applications: structure and modes of operation; n-p-n and p-n-p transistor in active mode, DC analysis of both transistor circuits; BJT as an amplifier, small-signal equivalent circuits, single-stage BJT amplifier (common-emitter mode); BJT as a switch; concepts of feedback amplifier

Metal Oxide Semiconductor Field-Effect Transistors and their Applications: structure and physical operation of n-type and p-type MOSFET; DC analysis of MOSFET circuits; MOSFET as an amplifier, small-signal equivalent circuits, single-stage MOSFET amplifier (common-source mode); MOSFET as a switch;

Operational Amplifier (Op Amp) : ideal op amp; inverting amplifier, amplifier with a T-network, effect of finite gain, summing amplifier; non-inverting configuration, voltage follower; op amp applications like current-to-voltage converter, voltage-to-current converter, difference amplifier, instrumentation amplifier, integrator and differentiator;

Digital Electronics: Boolean algebra and rules of simplification; combinational circuits like adder, decoder, encoder, multiplexer and demultiplexer; sequential circuits like flip-flops, counters and shift registers.

Text/Reference books:

1.	Microelectronic Circuits, 7th Edition	Adel S Sedra and Kenneth C Smith	Oxford University Press
2.	Microelectronics, 2nd Edition	Jacob Millman and Arvin Grabel	Tata McGraw Hills
3.	Digital Design, 5th Edition	M. Morris Mano and Michael D Ciletti	Pearson
4.	Fundamentals of Digital Circuits, 4th Edition	A Anand Kumar	PHI
5.	Integrated Electronics, 2nd Edition	Jacob Millman and Christos Halkias	Tata McGraw Hills

1. Course Outcome (CO)

CO	Course Outcome Statement	Bloom's Taxonomy level
1	Students can understand the fundamentals of electronic devices.	Knowledge
2	Student will become familiar with the principle of operation, configuration and their characteristics.	Comprehension
3	Students will understand and analyze the different topologies of above devices.	Evaluation and Analysis
4	Students will understand the designing of particular electronic circuit for specific application.	Application

2. Program Outcome (PO)

PO	Program Outcome Statement
1	**Engineering Knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3. Program Specific Outcome (PSO)

PSO	Program Specific Outcome Statement
1	Ability to Identify, Formulate & Solve problems of basics of Electronics & Communication Engineering and to apply them to various areas like Analog & digital Circuits, Signal & systems, Communication, VLSI, Embedded System etc.
2	Ability to design the systems of Electronics & Communication Engineering using advanced hardware and software tools with analytical skills to achieve the social needs.

3	Knowledge of social & environmental awareness along with ethical responsibility to achieve a successful career addresses the real world applications using optimal resources as an entrepreneur.

4. COURSE PLAN:

Day	MODULE	TOPIC	CO/PO/PSO
1-2	**INTRODUCTION TO ELECTRONIC DEVICES**	passive devices, diode, bipolar junction transistor (BJT), metal oxide semiconductor field-effect transistor (MOSFET)	CO (1) /PO (1) /PSO (1)
3-5	**DIODE: INTRODUCTION AND ANAYLSIS**	basic structure and operating principle, current-voltage characteristic, large and small-signal models, iterative and graphical analysis	CO (2,3) /PO (2,3) /PSO (2)
6-9	**DIODE: APPLICATIONS**	rectifier circuits (half-wave and full-wave rectifiers, rectifiers with capacitor filter), voltage regulator (using Zener diode), clipper (limiter) circuits, clamper circuits	CO (4) /PO (4,5,8) /PSO (3)
10-12	**BIPOLAR JUNCTION TRANSISTORS: INTRODUCTION AND ANALYSIS**	structure and modes of operation; n-p-n and p-n-p transistor in active mode, DC analysis of both transistor circuits	CO (2,3) /PO (2,3) /PSO (2)
13-16	**BIPOLAR JUNCTION TRANSISTORS: APPLICATIONS**	BJT as an amplifier, small-signal equivalent circuits, single-stage BJT amplifier (common-emitter mode); BJT as a switch; concepts of feedback amplifier	CO (4) /PO (4,5,8) /PSO (3)
17-19	**METAL OXIDE SEMICONDUCTOR FIELD-EFFECT TRANSISTORS: INTRODUCTION AND ANAYSIS**	structure and physical operation of n-type and p-type MOSFET; DC analysis of MOSFET circuits	CO (2,3) /PO (2,3) /PSO (2)
20-22	**METAL OXIDE SEMICONDUCTOR FIELD-EFFECT TRANSISTORS: APPLICATIONS**	MOSFET as an amplifier, small-signal equivalent circuits, single-stage MOSFET amplifier (common-source mode); MOSFET as a switch	CO (4) /PO (4,5,8) /PSO (3)
23-26	**OPERATIONAL AMPLIFIER (OP-AMP): IDEAL OP-AMP; INTRODUCTION AND BASIC TOPOLOGIES**	ideal op amp; inverting amplifier, amplifier with a T-network, effect of finite gain, summing amplifier; non-inverting configuration, voltage follower	CO (2,3) /PO (2,3) /PSO (2)
27-30	**OPERATIONAL AMPLIFIER (OP-AMP): APPLICATIONS**	current-to-voltage converter, voltage-to-current converter, difference amplifier, instrumentation amplifier, integrator and differentiator	CO (4) /PO (4,5,8) /PSO (3)

31-33	**DIGITAL ELECTRONICS: FUNDAMENTALS AND IMPLEMENTATION OF LOGIC GATES**	Boolean algebra and rules of simplification	CO (2,3) /PO (2,3) /PSO (2)
34-37	**COMBINATIONAL LOGIC-CIRCUITS IN DIGITAL SYSTEMS**	adder, decoder, encoder, multiplexer and demultiplexer	CO (4) /PO (4,5) /PSO (3)
38-42	**SEQUENTIAL LOGIC-CIRCUITS IN DIGITAL SYSTEMS**	flip-flops, counters and shift registers	CO (4) /PO (4,5) /PSO (3)

EC 111	**Basic Electronics Laboratory**	**L-T-P-C**
Semester/Year : First Year		**0-0-3-2**

Pre-Requisite – None

SYLLABUS:-

1. Familiarization with electronic components and usage of multimeter
2. Familiarization with oscilloscope, signal generator and further usage of multimeters
3. Frequency-response and square-wave testing of R-C, C-R and R-L networks
4. Studies on Voltage Rectifiers
5. Studies on Common-Emitter amplifiers
6. Studies on analog circuits using OP-AMP
7. Studies on logic gates

CS 101 **Introduction to Programming** **L-T-P-C**
Semester/Year : First Year **3-1-0-4**

Prerequisites: None

What is a program; Digital computer fundamentals; What is a language; How program executes.

C programming: Data types; Operators; Expressions; Scope resolution and variable types; Control flow structures; Functions; Arrays and pointers; Structures and Unions; Stream data processing.

Introduction to Object Oriented Programming; Objects and classes; Object hierarchy

BOOKS:

1. Programming in C – Gottfried B.S. (TMH)
2. The C Programming Language - Kernighan B.W. and Ritchie D.M. (PHI)
3. Programming in ANSI C - Balagurusamy E. (TMH)
4. C: How to program - H. M. Deitel and P. J. Deitel (Pearson Ed.)
5. Programming for Engineers - A.R. Bradley (Springer)
6. How to Solve it by Computer - R. G. Dromey (PHI)
7. The C++ Programming Language – Stroustrup B. (Addison-Wesley)

CS 111 **Programming Laboratory** **L-T-P-C**
Semester/Year : First Year **0-0-3-2**

Prerequisites: None

Basic arithmetic operations, control statements, functions, arrays and pointers, structures and unions, file handling etc.

Course Objective:

1. To make students aware about building blocks of programming.
2. To provide exposure to procedural programming.
3. To enable students to synthesize a problem and structure it in programmatic way.

Course Outcome (CO):

1. Learn formulation of simple algorithms for arithmetic and logical problems.
2. Able to translate the algorithms into programs (in C language).
3. Able to use derived types, control structures, functions and pointers for problem solving.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		✓			✓		✓				
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓		✓	✓	✓

National Institute of Technology Silchar
Academic Section

Revised Course Structure for the B.Tech. (Third Semester) Program to be Adopted wef 2018-19 entry Batch

Civil Engineering					
Code	**Course Name**	**L**	**T**	**P**	**C**
CE 201	Mechanics of Materials	3	1	0	4
MA 201	Mathematics III	3	1	0	4
CE 202	Civil Engineering Material, Testing and Evaluation	3	0	0	3
CE 203	Introduction to Geo Sciences	3	0	0	3
CE 204	Surveying & Geomatics	3	1	0	4
CE 205	Fluid Mechanics	3	0	0	3
CE 211	Surveying & Geomatics Lab.	0	0	3	2
CE 212	Civil Engineering Materials, Testing and Evaluation Lab.	0	0	3	2
CE 213	Civil Engineering Drawing Lab.	0	0	3	2
Total Credits					**27**

Mechanical Engineering					
Code	**Course Name**	**L**	**T**	**P**	**C**
ME 201	Basic Thermodynamics	3	1	0	4
MA 201	Mathematics III	3	1	0	4
ME 202	Theory of Machines	3	1	0	4
ME 203	Fluid Mechanics - I	3	1	0	4
ME 204	Manufacturing Process	3	0	0	3
ME 205	Material Science	3	0	0	3
ME 211	Machine Drawing Lab	0	0	3	2
ME 212	Manufacturing Lab	0	0	3	2
ME 213	Thermo-Fluid Lab - I	0	0	3	2
Total Credits					**28**

Electrical Engineering					
Code	**Course Name**	**L**	**T**	**P**	**C**
EE 201	Signals and Systems	3	1	0	4
MA 201	Mathematics III	3	1	0	4
EE 202	Analog Electronics	3	1	0	4
EE 203	Energy Science and Technology	3	0	0	3
EE 204	Measuring Instruments and Measurement	3	1	0	4
EE 205	Electromagnetic Field Theory	3	1	0	4
EE 211	Programming and Simulation Lab	0	0	3	2
EE 212	Measurement Lab	0	0	3	2
EE 213	Analog Electronics Lab	0	0	3	2
Total Credits					**29**

Electronics & Communication Engineering					
Code	**Course Name**	**L**	**T**	**P**	**C**
EC 201	Electronic Devices	3	0	0	3
MA 201	Mathematics III	3	1	0	4
EC 202	Network Analysis & Synthesis	3	1	0	4
CS 201	Data Structure	3	1	0	4
EC 203	Analog Electronic Circuits	3	1	0	4
EC 204	Signals and Systems	3	1	0	4
EC 211	Circuit Theory Lab	0	0	3	2
EC 212	Analog Electronic Circuits Lab	0	0	3	2
CS 211	Data Structure Lab	0	0	3	2
Total Credits					**29**

Computer Science & Engineering					
Code	**Course Name**	**L**	**T**	**P**	**C**
CS 201	Data Structure	3	1	0	4
MA 201	Mathematics III	3	1	0	4
CS 202	Discrete Structures	3	1	0	4
EC 281	Electronic Circuits and Switching	3	1	0	4
CS 203	Microprocessor	3	1	0	4
CS 211	Data Structure Lab	0	0	3	2
CS 212	Microprocessor Lab	0	0	3	2
EC 286	Electronic Circuits and Switching Lab	0	0	3	2
Total Credits					**26**

Electronics & Instrumentation Engineering					
Code	**Course Name**	**L**	**T**	**P**	**C**
EI 201	Electrical & Electronic Measurements	3	1	0	4
MA 201	Mathematics III	3	1	0	4
EI 202	Analog Electronics	3	1	0	4
EI 203	Circuits & Networks	3	1	0	4
CS 201	Data Structure	3	1	0	4
EI 211	Measurement Lab	0	0	3	2
EI 212	Analog Electronics Lab	0	0	3	2
EI 213	Circuits & Networks Lab	0	0	3	2
CS 211	Data Structure Lab	0	0	3	2
Total Credits					**28**

L-T-P-C: 0-0-3-2

B.Tech Sem- III
Civil Engineering Drawing Lab
Code : CE 213

Pre-requisites: Engineering drawing

Course objectives:

- To provide basic concepts in civil engineering drawing
- To impart knowledge about standard principles of Building drawing
- To draw sectional views of civil engineering drawings

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

- Prepare working drawings to communicate the ideas and information
- Read, understand and interpret engineering drawings

Detailed Syllabus:

1) The drawing is to be drawn using AutoCAD
2) Plan, elevation, side view of residential/office buildings
3) Drawing of 2 bed room/3 bed room houses (Single and two storeyed), ground and first floor plans, elevation and section for load bearing and framed structures
4) Detailing of doors/windows
5) Drawing of several types of footing, bricks work, floor, staircase, masonry, arches and lintels
6) Types of steel roof trusses
7) Project on establishments like building/post office/Hostel/Library/Hospital/ Auditorium etc.

`L-T-P-C: 0-0-3-2

B.Tech Sem III
Civil Engineering Materials Testing and Evaluation Lab
Code : CE 212

Pre-requisites: Civil Engineering Materials Testing and Evaluation

Course Objective

The objective of the Materials testing Laboratory is to demonstrate the basic principles in the area of strength and mechanics of materials to the undergraduate students through a series of experiments.

- Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials
- Ability to function on multi-disciplinary teams in the area of materials testing.
- Ability to use the techniques, skills and modern engineering tools necessary for engineering.
- Understanding of professional and ethical responsibility in the areas of material testing.
- Ability to communicate effectively the mechanical properties of materials

Course Outcome

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

- Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
- Identify, formulate and solve engineering problems of structural elements subjected to flexure.
- Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to undesirable materials.

Detailed Syllabus:

1. Tests on steel
   (A) Tensile and Elongation
   (B) Proof Stress
   (C) Bend-rebend test
   (D) Nominal mass

2. Tests on Cement
   (A) Normal Consistency
   (B) Fineness
   (C) Initial and Final setting time
   (D) Specific Gravity
   (E) Soundness
   (F) Compressive Strength

3. Tests on bricks
   (A) Dimensional Tolerance
   (B) Compressive Strength
   (C) Water absorption
   (D) Efflorescence

4. Tests on fine aggregates
   (A) Fineness modulus and grain size distribution
   (B) Specific gravity
   (C) Water absorption
   (D) Bulking
   (E) Bulk density

5. Tests on Coarse aggregates
   (A) Specific gravity and water absorption of coarse aggregates
   (B) Sieve analysis of coarse aggregates
   (C) Aggregate Crushing Value
   (D) Aggregate Impact value
   (E) Specific Gravity

Reference Books

- Davis, Troxell and Hawk, "testing of Engineering Materials", International Student Edition- McGraw Hill Book Co. New Delhi.
- M L Gambhir and Neha jamwal, " Building and construction materials Testing and quality control". McGraw Hill.

L-T-P-C: 3-0-0-3

B.Tech 3rd Semester
Civil Engineering Materials, Testing and Evaluation
Code : CE 202

Detailed Syllabus:

Building stones: Classification of stones- Characteristics of good building stones, important types of building stones, their properties and uses.

Brick & other clay products: Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, classification and testing of bricks, special types of bricks and their uses. Types of tiles and their use in buildings, terracotta, Stoneware.

Lime and Cement: IS classification of lime and uses, flow diagram of manufacturing process of cements, chemicals, composition of cement, IS specification and tests on Portland cement, different types of cement and their uses.

Paints, Varnishes & Distempers: Types of paints, varnishes and distempers, White washing.

Timber & wood based products: Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, plywood and its uses.

Steel & aluminium: Types of steel-mild steel, high carbon steel, high strength steel- properties and uses, commercial forms of steel and their uses.

Introduction to some new materials: Ferro cement, super plasticizers, FAL-G brick, fly ash, plastics, paints and geotextiles.

Testing & Evaluation: Stress-strain characteristics of Mild steel, Tor steel, Copper and Aluminium-Compressive strength of wood and punching shear strength of GI sheets- Brinnell's and Vicker's hardness test-Modulus of-rigidity of Soild shafts and Hollow shafts-Modulus of elasticity of the materials- Ductility test for steel- Shear test on Mild steel rods.

Advanced topics: Repair, rehabilitation & retrofitting materials such as micro concrete, FRP, Epoxy etc.

Suggested Readings :

1) Civil engineering Materials by S.C. Rangwala, Charotar Publishing House.
2) Civil engineering Materials and Construction Practices by R.K. GUPTA, Jain Brothers
3) Building Construction, B.C. Punmia, Ashok Kumar Jain and Arun K Jain, Lakshmi Publications
4) Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi.

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

CO1	Identify and characterize building materials.
CO2	Understand the manufacturing process of bricks, cement etc.
CO3	Identify the methods for preservation of timber and metals.
CO4	Understand the use of non-conventional Civil Engineering materials.
CO5	Understand the Characteristics of materials & able to evaluate the results.

L-T-P-C : 3- 0- 0- 3

B.Tech Sem- III
Fluid Mechanics
Code : CE 205

Basic Concepts: Continuum Approach, Important physical properties: Density, Specific weight, Viscosity, Surface tension, Capillarity, Compressibility, Vapour pressure, Classification of fluids – ideal and real fluid, non- Newtonian fluids.

Fluid Statics: Pressure at a point-Pascal's Law, pressure variation in a static fluid. Scales of pressure – absolute and gauge pressure, Measurement of pressure-manometers, Forces on submerged plane and curved surfaces, Buoyant Force-centre of buoyancy, metacenter, determination of metacentric height, equilibrium of floating and submerged bodies.

Kinematics of Fluids: Study of fluid motion – Lagrangian and Eulerian methods, Classification of flow-steady and unsteady flow, uniform and non-uniform flow, rotation and irrotational flow, laminar and turbulent flow, 1-,2- & 3D flow, Concepts of streamlines, pathlines and streakline, stream tube, Continuity equation, Circulation, vorticity, Stream function, Velocity potential, Flownet.

Dynamics of fluid flow: Euler's equation of motion, Bernoulli's equation and its application- venturimeter, orificemeter, Pitot tube, momentum equation and its application to simple problems.

Orifice, mouthpiece, Notches and Weirs: Classification, discharge through a free orifice, orifice coefficients- experimental determination, External and internal mouthpiece, mouthpiece running full and free. Classification, Velocity of Approach, Broad crested weir.

Laminar Flow : Navier Stokes equation, Laminar flow through pipes- Hagen Poiseuille law, Laminar flow between parallel plates, laminar flow around a sphere-Stokes law

Suggested Reading:

1. Fluid Mechanics, John F. Douglas, Janusz M. Gasiorek and John A. Swaffield, Pearson Education.
2. Fluid Mechanics, K.L. Kumar, S. Chand & Co.
3. Fluid Mechanics, Streeter & Wily, Mc Graw Hill.
4. Fluid Mechanics and hydraulic Mechanics, R.K. Bansal, Laxmi Publisher
5. Introduction to fluid mechanics and fluid machines By S. K. Som and G. Biswas, Tata Mcgraw Hill.

CO: After completion of this course, students should be able to:

- Apply fundamental knowledge of mechanics and analysis of fluid flow problems in civil engineering.
- To understand the basics concepts of pascal's law, design of pressure-pipe and open-channel hydraulics in civil engineering
- To understand the Euler's and Lagrangian approach. Bernoullis equation and application of Bernuallis theorem in various flow measuring devices.

L-T-P-C : 3-0-0-3

B.Tech Sem- III
Introduction to Geo Sciences
Code : CE 203

Pre-requisites: None

Detailed Syllabus:

General Geology: Branches and scope of geology, Importance of geology in Civil engineering. Earth-surface features and internal structure. Weathering of rock, erosion, transportation, deposition, geological agents.

Mineralogy: Definition of a crystal and mineral, physical properties in mineral identification, physical properties of common rock forming minerals and economic minerals.

Petrology: Formation and classification of rocks – Igneous, Sedimentary and metamorphic rocks, their texture and structures, properties of granite, pegmatite, dolerite, gabbro, charnockite, basalt, sandstone, conglomerate, breccia, limestone, shale, laterite, schist, gneiss, quartzite, marble, khondalite and slate.

Structural Geology: Geological map, outcrop, attitude of beds, types and classifications of folds, faults, joints, unconformities.

Engineering Properties of Rocks: Drilling, Core recovery, RQD, Sample preparation, tests on rock samples - compression, tensile, shear and slake durability tests.

Ground Water: Subsurface distribution of ground water, water table, aquifers, occurrence of ground water in different geological formations, springs, ground water exploration.

Earthquakes and Landslides: Causes and effects of earthquakes and landslides, Remedial measures to prevent damage for engineering structures.

Subsurface Investigations: Soil Profile, Geophysical methods – Electrical Resistivity and Seismic refraction methods. Site selection for engineering projects.

References:

1. A text Book of Geology, P.K.Mukhacharjee, World Press Pvt Ltd., Kolkata.

2. Engineering Geology, Kesavulu, Mc Millan India Ltd. Delhi.

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

CO1	Understand weathering process and identify geological formations
CO2	Determine quality of rock based on engineering properties
CO3	Address remedial measures required to counter effect of earthquakes and landslides
CO4	Analyse subsurface information for appropriate selection of site

L-T-P-C : 3-1-0-4

B.Tech Sem- III
Mechanics of Materials
Code : CE 201

Prerequisites: Engineering Mechanics, and Engineering Mathematics

Course Description: The course covers the following topics; stress and strain concepts, axial load, axially loaded members, torsion, angle of twist, bending, shear, combined loadings, and deflection of beams.

Simple stresses and Strains: Stress, strain, tensor, type of stresses, elastic limit, Hooke's law, stress-strain curve, factor of safety, elastic constants, initial stiffness, secant stiffness, elongation of bars of varying sections, elongation of bars of composite sections, elongation due to self-weight, bars of uniform strength, complementary shear stresses, Thermal stress.
Bending moments and Shear forces: Beam – elastic curve, type of loads, type of supports, SF and BM, sign convention, SF and BM diagrams for cantilever, simple supported and overhanging beams, relationship between rate of loading, SF and BM.
Deflection of beams: Relationship among curvature, slope and deflections, slope and deflection for cantilever and simply supported beams, Macaulay's method.
Stresses in beams: Theory of bending, neutral axis and moment of resistance, bending stresses in symmetrical sections, section modulus, composite beams, and shear stresses in beams.
Compound stresses: Stresses on inclined plane, stresses on inclined plane due to biaxial normal stresses and shear stresses, principal planes, principal stresses and strains, Mohr's circle of stresses.
Torsion: Analysis of torsional stresses in a plane circular shaft, power transmitted, combined bending and torsion, equivalent bending moment and torque.
Combined Bending and Direct Stresses: Resultant stresses for rectangular column and circular columns subjected to eccentric load, limit of eccentricity for no tension, middle third rule.
Thin Shells: Thin cylinders and spherical shells – Hoop stresses and strains and volumetric changes.
Column and Struts: Short and long columns, Failure of columns, slenderness ratio, Euler's theory, crippling load, Rankine's formula, Straight line and parabolic formula.
Mechanical Properties: Definitions of different properties and description of experiments for their determination.

Course Outcomes:

CO1. To be able to understand the basic concepts and principles of mechanics of materials.

CO2. To be able to calculate stresses and deformations of objects under external loadings.

CO3. To be able to apply the knowledge of mechanics of materials on engineering applications and design problems.

Reference Books:

1	Strength of Materials	G.H.Ryder	ELBS & Macmilan
2	Mechanics of Materials	Pytel & Singer	Harper Collins Publications India Pvt. Ltd., New Delhi
3	Strength of Materials	U.C. Jindal	Umesh Publications, New Delhi
4	Mechanics of Materials	Beer & Johnston	Tata McGraw-Hill, New Delhi

L-T-P-C : 0-0- 3- 2

B.Tech Sem- III
Surveying & Geomatics Lab
Code : CE 211

Pre-requisite: Surveying & Geomatics Theory

List of Experiments:

1. Chain survey by perpendiculars offsets.
2. Chain survey by oblique offsets.
3. Open and closed traverse survey with chain prismatic compass.
4. Plane table survey by methods of radiation, intersection, resection.
5. Profile leveling with dumpy level, cross sections, reciprocal leveling, contouring.
6. Surveying with Theodolite – vertical and horizontal angles.
7. Measuring distances and angles using total station.

Course Outcomes (Cos)

1. Identify different problems encountered in different types of surveying like problems in chaining, compass survey, levelling, total station etc. and will learn to solve these problems considering realistic constraints by performing these experiments.
2. To gain knowledge of taking accurate measurements, data filling in field booking, plotting of maps
3. Learn to identify different errors that may arise in different experiments and corrections to be applied to eliminate these errors.

L-T-P-C : 3-1-0-4

B.Tech Sem- III

Surveying & Geomatics

Code : CE 204

Pre-requisite: None

Detailed Syllabus

Introduction – Classification, Principles of Surveying, Types of Surveying.

Chain and compass survey – Distance measurement, Instruments, Adjustments, Angular measurements, Latitude and departure, Compass traversing.

Accuracy and errors – Errors and corrections in Chain and compass survey.

Triangulation – Triangulation systems, Intervisibility, Signals Satellite stations, computation & adjustments.

Levelling – Instruments, Adjustments, Levelling principles, Long sections, Cross sections, Reciprocal levelling, Trigonometrical levelling, Effects of curvature and refraction.

Theodolite Traversing – Details of instruments, Adjustments, Angular measurement, Horizontal and vertical traversing.

Contouring – Characteristic, Methods & uses.

Plane Table surveying – Equipments, Principles, Operation, Methods, Errors, Advantage and disadvantages.

Tacheometric survey – Principles, Stadia and Tangential methods, Error and Precision in Tacheometry.

Curves – Classification, Setting out of circular curve, Setting out of Transition curve.

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station – Parts of a Total Station – Accessories –Advantages and Applications Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements.

Photogrammetry Surveying - Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy.

Remote Sensing - Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Suggested Reading:

1. Surveying (Vol I & II), B.C. Punmia, Laxmi Publication, New Delhi.

2. Surveying (Vol-I & Vol-II), K. R. Arora, Standard Book House.

3. Surveying & Leveling (Vol-I & Vol-II), T. P. Karnatkar, Vidyarthi Prakashan.

4. Engineering Surveying, G.W. Scholfield, Butterworth, Heinemann, New Delhi.

5. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

6. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011

7. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.

Course Outcomes (Cos)

1. To introduce the students about different theories of surveying and application of the same.
2. To develop students with an understanding of the different aspects of surveying.
3. To prepare students for the effective use of these theories for measuring distances, levelling and bearings, setting out of curves, contours maps and use of total station.
4. Build self-confidence in different types of surveying, get motivated for further learning, and face competitive examinations.

B.TECH 3RD SEMESTER

CS-201 : Data Structure **L-T-P-C : 3-1-0-4**

Prerequisites: CS-101

Introduction: Introduction to data types, Data structures and Abstract Data Types (ADT), asymptotic notations; complexity analysis of algorithms.

Lists: Linked list, doubly linked list: header list, polynomial arithmetic, stack, recursion and their implementation; evaluation of postfix expression, conversion for infix to postfix expression and their algorithms; queue, circular queue; priority queues; Dequeue; multiple stacks and queues

Trees: Introduction, Binary tree, BST, AVL trees, B Trees, B+ Trees; Multiway Search trees: Implementation of dictionary and binary search tree; heap; hashing and hash table.

Graphs: Basic concepts; Representation schemes; graph traversals; spanning tree; shortest path algorithm.

Sorting & Searching: Different sorting techniques; Tree searching and graph searching techniques.

Memory management issues: Introduction, storage allocation, garbage collection, compaction.

BOOKS:

1. Data Structures using C/C++ – Tanenbaum A.S., Langsam Y., Augenstein M. J. (PHI)
2. Data Structure – Aho V., Ullman J.D. (Addision-Wesley)
3. The Art of Computer Programming (Vol. 1, 2, 3) – Knuth D.E. (Addision- Wesley).
4. Fundamentals of Data Structures – Horowitz E., Sahni S. (Galgotia Pub.)
5. Algorithms, Data Structures, Programs – Wirth N. (PHI)

Course Objective:

1. To make students familiar with requirement of special and user defined structures.
2. To make students understand uses of different data structures.
3. To develop expertise in designing of customized data structures.

Course Outcome (CO):

1. Student will be able to select appropriate data structure to be used for specified problem definition.
2. Students will be able to implement linear and non-linear data structures.
3. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
4. Students will be able to implement projects requiring the implementation of the learned data structures.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓	✓	✓		✓				✓		✓	✓
CO3	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

B.TECH 3RD SEMESTER

CS-202 : Discrete Structure **L-T-P-C : 3-1-0-4**

Prerequisites: None

Logic: Propositional logic and its applications; Propositional equivalences; Predicates and Quantifiers;

Rules of inference; Introduction to Proofs; Proof Methods; Proof by Mathematical Induction (Weak and Strong).

Set theory: Sets, operations on sets, cardinality, inductive definition of sets and proof by induction; Relations, representation of relations, properties of relations, equivalence relations and partitions; Partial orderings; Posets; Well-ordered sets.

Functions: Mappings; Injection and Surjection; Composition of functions; Inverse functions; Special functions; recursive function theory.

Algebraic Structures: Definition and elementary properties of groups; semigroups; monoids; rings; fields, vector spaces; lattices and Boolean Algebra.

Elementary combinatorics: Basic Counting Principles; Permutations and Combinations; Binomial Coefficients and Identities; Generalized Permutations and Combinations; Sterling's number of the second kind; Pigeon-hole Principle and its application; Inclusion-Exclusion Principle and its application; Recurrence Relations; Solving Linear Recurrence Relations; Generating Functions; Catalan Numbers; Fibonacci numbers.

Number Theory: Divisibility and Modular Arithmetic; Integer Representations and Algorithms; Prime numbers and related Theorems; Greatest Common Divisors; Euclid's Algorithm; Solving Congruence; Applications of Congruence, Fermat's Little Theorem, The Chinese Remainder Theorem; Applications in Cryptography.

BOOKS:

1. Discrete Mathematics and Applications – K. H. Rosen (TMH)
2. Elements of Discrete Mathematics – C. L. Liu, D. P. Mohapatra (McGraw-Hill)
3. Discrete Mathematics for Computer Scientists and Mathematicians –J. L. Mott, A. Kandel, T. P. Baker (PHI).
4. Discrete Mathematical Structures with Applications to Computer Science –J. P. Tremblay, R. Manohar (McGraw-Hill)

Course Objective:

1. To make the students learn the different discrete mathematical structures and concepts essential for the mastery of some of the higher-level computer science courses.
2. To develop in the students the art of mathematical and logical thinking which will help them to take a mathematical approach to solving complex engineering problems.
3. To emphasize the importance of proving the correctness of arguments and algorithms.
4. To learn how to formulate practical problems as discrete mathematical models and solve them mathematically.
5. To enhances one's ability to properly reason with and present a coherent and mathematically accurate argument.

Course Outcome (CO):

1. Understand the interpretations of propositional and predicate logic and express mathematical properties formally via the formal language of propositional and predicate logic.
2. Learn and manipulate basic mathematical objects such as sets, functions, and relations and verify simple mathematical properties that these objects possess.
3. Understand the elementary combinatorics and recurrence relations and apply combinatorial ideas to practical problems.
4. Learn the concepts of number-theory and modular arithmetic essential for the mastery of some of the higher-level computer science courses and solving engineering problems.

5. Use different methods of proofs to formulate and solve applied problems, to analyze and interpret algorithms and functions and logically verify them.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓	✓	✓		✓	✓				
CO2		✓	✓	✓	✓		✓			✓		
CO3	✓	✓			✓		✓					
CO4	✓	✓			✓		✓				✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	

B.TECH 3RD SEMESTER

CS-203 : Microprocessor **L-T-P-C : 3-1-0-4**

Prerequisites: CS-101

Introduction: Basic features of 8085 microprocessors and its addressing modes, 8085 microprocessor architecture.

Memory and I/O interfacing: Address decoding, Address aliasing, Memory read and write operations, Timing diagrams, Memory mapped I/O and I/O mapped I/O.

Programming of 8085: Instruction Set, Assembly Language Programming and Illustrative examples.

8085 Interrupt Structure.

Data Transfer Techniques: Synchronous and Asynchronous modes of data transfer, Interrupt driven I/O, DMA.

Introduction to advanced microprocessors: 8086 as an example, 8086 Architecture and Internal Register Set, Instruction Set, Min-Max mode, Concept of Co-processor and its interfacing, Memory and I/O Interfacing, Programming of 8086.

BOOKS:

1. Microprocessor Architecture, Programming and Applications with 8085 – R. Gaonkar (Penram)
2. Microprocessors: Theory and Applications – Rafiquzzaman (Pearson Ed)

Course Objective:

1. To make students familiar with use of microprocessor.
2. To develop skillset of students in assembly language.
3. To make students conversant with microprocessor based system design and their analysis.

Course Outcome (CO):

1. Use of assembly language for solving engineering problems.
2. Design microprocessor based system for solving engineering problems.
3. Able to analyze microprocessor based system.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓	✓	✓			✓				
CO2	✓	✓	✓		✓		✓	✓	✓	✓	✓	
CO3		✓	✓	✓		✓	✓	✓		✓	✓	

B.TECH 3RD SEMESTER

CS-211 : Data Structure Laboratory **L-T-P-C : 0-0-3-2**

Prerequisites: CS-111

Use of special data structures for solving real-life problems, Implementation of customized data structures and defining their access & retrieval mechanism, Analyzing merit & demerit of different data structures.

Course Objective:

1. To make students familiar with implementation of data structures.
2. To impart students with customized data structure design skill.

Course Outcome (CO):

1. Be able to design and analyze the time and space efficiency of the data structure.
2. Be capable to identity the appropriate data structure for a given problem.
3. Able to apply concepts for solving real-life problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO2	✓		✓									✓
CO3	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CS-212 : Microprocessor Laboratory **L-T-P-C : 0-0-3-2**

Prerequisites: CS-111

Design and implementation of assembly level programs for different microprocessor families, Design and implementation of programs for interfacing devices with microprocessor.

Course Objective:

1. To make students familiar with 8085/8086 instructions and interrupts & function calls.
2. Develop and test assembly language programs to use instructions of 8085/8086.
3. Familiarize with interfacing of various peripheral devices with 8085/8086.

Course Outcome (CO):

1. Develop skillset for assembly language programming, use of assembler directives, interrupts, branch and loop operations.
2. Able to interface a microprocessor to various peripheral devices for simple applications.
3. Able to effectively utilize microprocessor peripherals.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓	✓	✓				✓	✓		
CO2	✓	✓	✓	✓	✓	✓	✓		✓			
CO3	✓	✓	✓	✓						✓	✓	

3rd semester
Signals and Systems
Code : EE 201

L	T	P	C
3	1	0	4

Course requirement: To provide the foundation and basic prerequisite for the core and elective subjects such as Control Systems, Digital Signal Processing, Power systems, Analog and Digital Communication etc.

Prerequisite: Mathematics I, Mathematics II, Basic Electrical Engineering

1. **Introduction to signals and systems**: Introduction to standard continuous time (CT) and discrete time (DT) signals: impulse, step and ramp, sinusoid, exponential signals, their properties and importance, power signal, energy signals. Basic properties of systems: linearity, time-invariance, causality, stability, invertibility etc. with special emphasis on LTI system, mathematical model for systems, impulse response of a LTI system (CT and DT systems), Computation of convolution integral and convolution sum, block diagram representations of CT and DT systems.
2. **Fourier series and Fourier transform**: Response of LTI systems (CT and DT) to complex exponentials, concept of Eigen functions, condition for orthogonality, Fourier series representation of CT and DT periodic signals, Basic properties of CI' and FT Fourier series coefficient, Perseval's Theorem.CT and DT Fourier transform (FT) of an aperiodic signal, convergence of FT, properties of FT. Perseval's relation, Magnitude and phase response, introductory concepts of ideal and practical filters.
3. **Sampling:** Concept of sampling, impulse sampling, Nyquist sampling theorem, zero order hold, reconstruction of signals from its samples.
4. **Laplace transform and Z-transform:** Bilateral and unilateral Laplace transform (LT), Concept of poles and zeros, Region of Convergence (ROC), relation of system causality and stability with ROC, properties, inverse LT, applications.Bilateral and unilateral Z Transform (ZT), Concept of poles and zeros, relation of system causality and
5. **Statistical signal analysis**: Random signals, random process, auto-correlation and cross correlation functions and their properties. Spectral density, relation of spectral density to autocorrelation function and white noise, analysis of linear systems with white noise.

Text Books:

S. N.	Author	Name of Book	Publisher
1.	Oppenheim, Wilsky and Nawab	Signals and Systems	Pearson Education
2.	T. K. Rawat	Signals and Systems	Oxford University Press
3.	Cooper G.R and C. D. McGillem	Probabilistic Methods of Signals and System Analysis	Oxford University Press

Reference Books:

S. N.	Author	Name of Book	Publisher
1.	Hwei P. Hsu	Signals and Systems	Schaum's Outlines McGraw-Hill
2.	C.T.Chen	Systems and Signal Analysis	Oxford University Press
3.	R.E. Ziemer, W.H Tranter. and D.R.Fannin	Signals and Systems	Pearson Education

Course Outcomes (COs)

Students who successfully complete the course will be able to:

CO1: define and represent various signals and system and analyze the signals and systems and their applications.

CO2: apply Fourier series and transform to analyze the signals it in frequency domain.

CO3: understand the Concept of sampling and reconstruction of signals from its samples.

CO4: apply the knowledge of Laplace and Z-Transform to analyze the continuous and discrete time systems in frequency domain.

CO5: analyze the statistical phenomenon of random signals and it's spectra.

Course Contents and its relation to CO's

Topics (Modules/ Sub modules)	**CO**
Module-1: Introduction to signals and systems	1
Module-2: Fourier series and Fourier Transform	2
Module-3: Sampling	3
Module-4: Laplace Transform and Z-Transform	4
Module-5: Statistical signal analysis	5

Course Articulation Matrix (CO-POs Mapping)

Course	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
EE 1201.1	CO-1 (unit-1)	3	3	3	3	3							3	3	-	3
EE 1201.2	CO- 2 (unit-2)	3	3	3	3	3							3	3	3	3
EE 1201.3	CO-3 (unit -3)	3	3	3	3	3							3	3	3	3
EE 1201.4	CO-4 (unit-4)	3	3	3	3	3							3	3	3	3
EE 1201.5	CO-4 (unit-4)	3	3	3	3	3							3	3	3	3
Average		3	3	3	3	3							3	3	**3**	**3**

3rd semester
Analog Electronics
Code : EE 202

L	T	P	C
3	1	0	4

Prerequisite: Basic Electronics (EC 101), Basic Electrical Engineering (EE 101)

1. Diode: Review of p-n junction diode, Zenerdiode**,** half wave and full wave diode rectifiers, filtering, efficiency.

2. Bipolar Junction Transistors: Review on principle of operation of BJT, BJT Ebers Moll model, CE, CB and CC configurations. Hybrid-π model of transistor in CE mode, conductance, capacitance, short-circuit current gain, CE current gain with resistive loads, CE stage as an amplifier and frequency response.

3. MOSFET: Small signal operation and models for MOSFET. Single stage MOSFET amplifiers.

4. Multistage Transistor Amplifiers: Analysis of CE- CE, CE-CC and CE-CB stages, Darlington pair, Millers Theorem.

5. Operational Amplifiers: Basic building block, Differential stage, gain stage, CMRR, Op-Amps as inverting, non-inverting amplifiers, buffers. Applications of Op-Amps: as adder, subtractor, integrator, differentiator, and Logarithmic functions. Use of Op-Amp as comparators, zero-crossing detectors, Schmitt Trigger and Relaxation Oscillator. ADC and DAC design using Op-Amps. 555 timers- Its applications.

6. Active filters: Low pass, high pass, band pass, band reject filter design using Op-Amps and analysis of frequency response using Bode plot.

7. Feedback Amplifiers: Classification and basic concepts of feedback amplifiers. Loop gain. stability problem: Nyquist and Bode plots. Voltage Shunt Feedback using OPAMP. Basic principle of sinusoidal oscillators. RC oscillator. LC and crystal oscillator. Voltage Controlled Oscillator (VCO).

Reference Books:

S N	Author	Name of Book	Publisher
1.	Robert L. Boylestad	Electronic Devices and Circuit	Theory Pearson, 8th Edition
2.	A. S. Sedra and K. C. Smith	Microelectronic Circuits	Oxford University Press, 5th Edition
3.	Jacob Millman	Electronic Devices and Circuits	McGraw Hill Education; 4th edition
4.	Ramakant A. Gayakwad	Op-Amps and Linear Integrated Circuits	Pearson Education; Fourth edition

CO's of Analog Electronics (3rd Semester, Electrical Engineering), EE 1202

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

CO1: Design suitable diode rectifiers for given specifications and desired performance in terms of efficiency.

CO2: Design amplifiers using BJT and MOSFETs for desired specifications.

CO3: Implement Op-Amp based circuits to perform arithmetic and differential operations.

CO4: Design active filters based on specified requirements.

CO5: Design oscillator circuits for given specifications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		2		2						2	1
CO2	2		2		2						2	1
CO3	2		2		2						2	1
CO4	2		2		2						2	1
CO5	2		2		2						2	1

CO-PSO Mapping:

	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	2	2	1
CO3	2	2	1
CO4	2	2	1
CO5	2	2	1

3rd Semester
Energy Science and Technology
Code : EE 203

L	T	P	C
3	0	0	3

Course objectives:

The primary objectives of the course are:

1. To make the students aware about the necessity of energy globally and also at national level and the potentials availability of different types of sources both globally and nationally.
2. To make the students understand the fundamental concepts of energy science, energy engineering, and tools to be used in the design, planning and analysis of energy system.
3. To make the students understand about the different techniques of harnessing energy, optimal and smart usage of energy, and saving techniques of energy.
4. To make the students sensitize about the ways and techniques of meeting the necessity of energy in our life through environmental friendly design of most of our energy hungry systems including habits and life style.

Course Outcomes:

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

1. Demonstrate the understanding of the perspectives of energy, about global requirement of energy and also at national level and the potentials availability of different types of energy sources both globally and nationally.
2. Demonstrate the understanding of the fundamental concepts of energy science, energy engineering, and tools to be used in the design, planning and analysis of energy system.
3. Demonstrate the understanding of the different techniques of harnessing energy, optimal and smart usage of energy, and saving techniques of energy.
4. Demonstratean understanding of the ways and techniques of meeting the necessity of energy in our life through environmental friendly design of most of our energy hungry systems including habits and life style.

Course Contents:

Perspective (3 h)

Energy systems: Past, present, and future – Global energy and development, Energy and environment, Climate change, Energy transitions

Indian energy scenario – Challenges and opportunities; Energy Access, Energy security

Tools and techniques (15 hrs)

Foundation for Energy science, Foundation for Energy engineering, Environmental impacts of energy use, Sustainability and life cycle analyses, Energy economics, Energy planning and policy, Pinch analysis and process integration, Modelling, simulation, and optimization, Heat transfer and computational fluid dynamics, Analytical techniques for experimentation

Technologies and systems (22 h)

Clean coal and CCS, Unconventional oil and gas, Advanced nuclear energy systems, Micro-grids , Wind and hydro energy, Wave, tidal and ocean energy, Solar photovoltaic systems , Silicon cells, PV modules and systems, Solar thermal systems, Thermal energy storage, Advanced bioenergy systems, Waste to Energy, Fuel cells, Hydrogen Energy, Energy Management, Energy Auditing, Energy and Carbon Benchmarking, Zero energy and energy-positive buildings, Demand side management, Demand response and Smart grids

Texts/Reference:

1. Sri Sivakumar, Umesh Chandra Sharma and Ram Prasad: Energy Science and Technology, All Volumes; Studium Press LLC.
2. John Andrews and Nick Jelley: Energy Science – principles, technologies and impacts; Oxford Univ. Press.
3. Zhigan Fang: Energy Science and Applied Technology; CRC Press.
4. Hatim Machrafi: Green Energy and Technology; Bentham e-Books.

Mapping of COs and POs:

COs	**a**	**c**	**e**	**f**	**g**
1				√	√
2	√	√	√		
3			√	√	
4			√	√	

3rd Semester

Measuring Instruments and Measurements **L T P C**

Code : EE 204 **3 1 0 4**

Prerequisites: Basic Electrical Engineering (EE 101), Basic Electronics (EC 101), Physics (PH 101)

1. **Introduction**: Introduction to measurement and instruments, Static and dynamic characteristics of instruments. Different types of instruments. Operating forces required for working of indicating instruments. Different types of damping and control systems. Construction and working principles of PMMC, MI, Induction type, Electrodynamometer type, their applications advantages and disadvantages, Errors in measurements.
2. **Galvanometers and Dynamics:** Dynamic behaviour of Galvanometer - equation of motion for different damping conditions. Response of galvanometer, operational constants, CDRX, relative damping, logarithmic decrement, sensibility. Ballistic Galvanometer and Flux meter construction and theory of operation.
3. **Magnetic Measurements:** Magnetic measurements, types of tests, Ballistic tests, measurement of flux density, determination of B.H. curve
4. **Measurement of Resistance, Inductance and Capacitance using DC and AC Bridges:** Measurement of low resistance by Kelvin's Double Bridge Method, Insulation resistance measurement by loss of charge method. A.C. & D.C. bridges: Maxwell's commutated D.C. bridge, Anderson bridge, Schering Bridge, Hays Bridge, Wagner's Earthing device, Campbell's Mutual Inductance Bridge, Circuit diagram, phasor diagram, derivations of equations for unknown, Q-factor, dissipation factor. Advantages and disadvantages.
5. **Potentiometers**: Standardization, Principle of working and construction of Crompton, potentiometer (D.C.) Polar and Co-ordinate type of potentiometers.
6. **Measurement of Power, Power Factor and Energy**: Measurement of power and energy, use of Current transformer and potential transformer, Electrodynamometer type of Wattmeter, Induction type energy meter, Indicating type Frequency meter, Electrodynamometer type P.F. meter, Maximum demand indicator.
7. **Electronic Instruments:** Digital Voltmeters, CRO, DSO, Lissajous Patterns, Digital Multimeter.

Reference Books:

SN	Author	Name of Book	Publisher
1.	A.K. Sawhney	Electrical & Electronics Measurements and Instrumentation	Dhanpat Rai and Sons
2.	E.W. Golding and F.C. Widdis	Electrical Measurements and Measuring Instruments	A.H. Wheeler & Company
3.	H.S. Kalsi	Electronic Instrumentation	Tata McGraw-Hill Education
4.	S. Tumanski	Principles of Electrical Measurement	CRC Press, Taylor & Francis

Course Outcomes (COs):

CO-1: Able to define, classify and use various analog & digital measuring instruments in Electrical Engineering field.

CO-2: Able to describe and analyze the behavior of magnetic measurements using B-H curve.

CO-3: Able to identify and evaluate the performance of AC-DC bridges and other methods for measurement of resistance, inductance and capacitance.

CO-4: Able to apply, analyze and evaluate instruments for the measurements of power, power factor and energy.

CO-PO mapping:

PO / CO	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
1	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
3	3	-	3	-	3	-	-	-	-	-	-	-	3	2	-
4	3	-	-	-	-	-	3	-	-	-	-	-	3	2	-
EE1204	**3**	**3**	**3**	-	**3**	**-**	**3**	-	-	-	-	-	**3**	**2**	-

3rd semester
Electromagnetic Field Theory
Code : EE 205

L	T	P	C
3	1	0	4

1. **Vector Analysis:** Introduction, co-ordinate–system transformation, vector calculus, Divergence of vector and Divergence theorem, curl of a vector and Stokes theorem, Laplacian of a scalar, classification of vector fields.
2. **Electrostatics:** Coulomb's law, Electric field strength, field due to a line charge, sheet charge and volume charge. Electric flux-density, Gauss's law (Maxwell's first equation in electrostatics), applications of Gauss's law. Electric Potential and potential difference, Potential of a point charge and system of charges, Conservative property, potential gradient, dipole. Energy density in electrostatic field.
3. **Magnetostatics:**Biot-Savart's law- magnetic field due to filamentary current, distributed current surface and volume currents. Ampere's circuital law, Scalar and vector magnetic potentials. Maxwell's equations for steady magnetic fields, force on a current element in a magnetic field. Force between two current elements and torque in a current loop.
4. **Electromagnetic field:** Faraday's law, Lorentz-force equation, displacement current and modified Ampere's circuital law in integral form. Continuity equation. Power flow in electromagnetic field - the Poynting theorem, sinusoidally time-varying fields and its Maxwell's equation. The retarded potentials, polarization of vector fields.
5. **Materials and fields:** Current and current density. Conductors in fields- drift velocity, mobility, conductivity. Dielectrics in fields- polarization, flux-density, electric susceptibility, relative permittivity. Magnetic materials, magnetization, permeability and magnetic boundary conditions.
6. **Electromagnetic waves:**Helmontz equation, radiation of electromagnetic waves. Wave motion in free space, perfect dielectric, lossy dielectric, propagation in good conductors-skin effect. Reflection of plane waves.

S. N.	Author	Name of Book	Publisher
1.	Mathew N.O. Sadiku	Elements of Electromagnetics	Oxford Univ Press
2.	N.N. Rao	Basic electromagnetic and applications	Prentice Hall
3.	William H. Hayt, Jr., John A. Buck	Engineering Electromagnetics	McGraw Hill Education
4.	Bradshaw and Byatt.	Introductory Engineering Field Theory	Prentice Hall

Course outcomes:

CO1: Apply the knowledge of the coordinate system and vector calculus along with Stokes and Divergence theorems for calculation of electromagnetic fields.

CO2: Evaluation of electrostatics-field intensities due to different charge distributions, Gauss law and its advantage and applications and polarization of electric charge in the different medium.

CO3: Analyze of magnetic field intensities due to different current distributions, Amperes circuital law and its applications.

CO4: Examine of Maxwell's equations modified for time- varying electric and magnetic field (electro-magnetic field).

CO5: Deduce the EM wave motion in different dielectrics.

Course Articulation Matrix (CO-POs Mapping)

Course	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2	PSO 3
EE-1205.1	CO-1	√	√	√	--	--	--	--	--	--	--	--	√	√	-	√
EE-1205.2	CO-2	√	√	√	√	--	--	--	--	--	--	--	√	√	√	√
EE-1205.3	CO-3	√	√	√	√	--	√	--	--	--	--	--	√	√	√	√
EE-1205.4	CO-4	√	√	√	√	√	√	--	--	--	--	--	√	√	√	√
EE-1205.5	CO-5	√	√	√	√	√	√	--	--	--	--	--	√	√	√	√
Average		√	√	√	√	√	√						√	√	√	√

3rd semester

Programming and Simulation Laboratory

Code : EE 211

L	T	P	C
0	0	3	2

Prerequisite: Mathematics I, Mathematics II, Basic Electrical Engineering

Syllabus: **MATLAB/ C/ Python** - Basic computation, use of different functions, plotting a graph. Sorting of data. Use of matrices- multiplication of two matrices, sorting of elements etc. Solution of linear system algebraic equations. Drawing regular curves, curves from equations. Numerical differentiation and integration. Finding roots of non-linear equations using Newton-Raphson or other iterative method. Solution of first order differential equation applying forth order Runge-Kutta method. Curve fitting.

MATLAB Simulink-Simulation of different mathematical expression. Importing/ exporting data from/ to workspace. Basic design using MATLAB Graphical User Interface (GUI). Use of GUI to plot graphs.

MULTISIM, PSPICE - Verification of Network Theorems (Superposition, Thevenin's and Norton's theorem). Simulation of rectifier circuit using normal p-n junction diode.

Reference Books:

Sl No	Author	Name of the Book	Publisher
1	B. S. Grewal	Higher Engineering Mathematics	Khanna Pub.
2	Rudra Pratap	Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers	Oxford Pub.
3	AvijitChakrabarty	Circuit Theory: Analysis and Synthesis	Dhanpat Rai & Co.
4	Robert L. Boylestad and Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson
5	YashvantKanetkar	Let Us C	Bpb Pub

3rd Semester

Measurement Laboratory **L T P C**

Code : EE 212 **0 0 3 2**

1. To calibrate a three phase Energy Meter by comparing with a Sub–standard meter.
2. Measurement of Power and Power Factor of a three-phase circuit.
3. Measurement of Power in HV circuit using instrument transformers (CT & PT).
4. To calibrate Single–phase Energy meter by comparing with a Sub-standard meter and also by calculation.
5. To measure high resistance by loss of charge method.
6. To measure medium resistance with the help of Wheatstone bridge and Substitution method.
7. To measure:
    a. the low resistance by using Kelvin's Double Bridge method.
    b. the value of Earth resistance.
8. To measure self-inductance of a coil using A.C. Anderson's bridge and Hay's bridge.
9. To measure capacitance of a given capacitor by using A.C. bridge.
10. To determine the phase sequence of a three-phase supply using phase sequence indicator.
11. Measurement of electrical quantities by using Cathode Ray Oscilloscope (CRO).

Course Outcomes (COs):

After completion of the course the student will be

CO1: Acquire hands-on experience about various electrical measuring devices and their working principles.

CO2: Able to calibrate the measuring instrument and find the calibration curve.

CO3: Able to work with analog and digital instruments such as ammeter, voltmeter, wattmeter, AC & DC bridges, CT/PT, single-phase and three-phase energy meters, CRO and DSO.

CO-PO Mapping and Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1				1	1		
CO2	3	2	2	1	1				1	1		
CO3	3	2	2	1	1				1	1		
Average	3	2	2	1	1				1	1		

3rd semester
Analog Electronics Laboratory
Code: 213

L	T	P	C
0	0	3	2

Prerequisite: Basic Electronics (EC 101), Basic Electrical Engineering (EE 101)

1. To design and setup a voltage follower circuit with OPAMP IC 741 and observe the waveforms.
2. To design and setup a non-inverting amplifier circuit with OPAMP IC 741C for a fixed gain, plot the waveform, observe the phase reversal, measure the gain.
3. To design and setup an inverting amplifier circuit with OPAMP 741 for a fixed gain, plot the waveforms, observe the phase reversal, measure the gain.
4. To design and setup a summing amplifier circuit with OPAMP 741 for a fixed gain and verify the output.
5. To design and setup a Schmitt trigger, plot the input and output waveforms and measure V_{UT} and V_{LT}.
6. To design a differentiator and integrator using OPAMP IC 741.
7. To design a low pass and high pass filter with a given fixed cut-off frequency.
8. To design and setup symmetrical and asymmetrical astablemultivibrators using IC 555 and (i) Plot the output waveform (ii) Measure the frequency of oscillation.
9. To design and setup a RC phase shift oscillator using OPAMP IC 741 and (i) Plot the output waveform (ii) Measure the frequency of oscillation.

CO's (Course Outcome):

Students able to:

1. Set up testing strategies and select proper instruments to evaluate performance characteristics of electronic circuit.
2. Choose testing and experimental procedures on different types of electronic circuit to analyze their operation.
3. Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.
4. Practice different types of wiring and instruments connections keeping in mind technical, economical, safety issues.

Course Articulation Matrix (CO-POs Mapping)

PO's → / CO's ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
EE-1213.1	3											
EE-1213.2		3	2	1								
EE-1213.3				3	2							
EE-1213.4				1	3							
Avg →	3	3	2	1.6	2.5							

Course Articulation Matrix (CO-PSOs Mapping)

PSO's → / CO's ↓	PSO1	PSO2	PSO3
EE-1213.1	3		
EE-1213.2	2	3	
EE-1213.3		2	
EE-1213.4		2	2
Avg.	2.5	2.3	2

Semester III ECE

EC-201	Electronic Devices	L T P C : 3 0 0 3
Pre-requisite- EE -101, EC-101		

Review of semiconductor Physics: Solids, crystals, energy band, electrons, holes, effective mass, doping, Fermi level, Equilibrium carrier concentration, Direct and indirect semiconductors, Recombination and Generation of carriers, Carrier transport – Drift and Diffusion, mobility, Lifetime Equations of state – Continuity and Poisson equation.

p-n Junctions: Thermal equilibrium conditions, depletion regions, depletion capacitance, current - voltage characteristics, charge storage and transient behavior, junction breakdown

Metal-Semiconductor contacts: The Schottky barrier, the ohmic contact and rectifying contacts

Metal-Insulator-Semiconductor Capacitors: Introduction, Ideal MIS Capacitor, Silicon MOS capacitor, capacitance voltage characteristics of MOS structure

MOSFET: Introduction, MOSFET structure and basic characteristics, Device Scaling and Short -Channel Effects

Bipolar Junction Transistor: The transistor action, static characteristics of BJT, frequency response and switching of BJT, the heterojunction BJT.

Other devices: LEDs, Solar cells, Solid State Memories.

Text / Reference Books

1. Semiconduct or Physics and Devices, Donald A Neamen, McGraw-Hill Education
2. Solid St at e Electronics Devices, Streetman and Banerjee, PHI
3. Introduction to Semiconductor Materials and Devices, M. S. Tyagi, Wiley India Pvt Ltd
4. Physics of Semiconduct or Devices, S. M. Sze and K. K. Ng, John Wiley & Sons

EC-202	Network Analysis and Synthesis	L T P C : 3 1 0 4
Pre-requisite- EE -101		

Network Topology: Graph of a network; Concept of tree; Incidence matrix; Tie -set matrix; Cut-set matrix; Formulation and solution of network equilibrium equations on loop and node basis; Coupled Circuits: Substitution theorem; Tellegen‟s theorem; Millman‟s theorem; Coupled Circuits; Dot convention for representing coupled circuits; Coefficient of coupling.

Laplace Transform & Its Application: Introduction to laplace transform; Laplace transform of some basic function; Laplace transform of periodic functions; Inverse laplace transform; Application of laplace transform:Circuit analysis (Steady State and Transient)

Two Port Network Functions and Responses:z, y, ABCD, and h parameters; Reciprocity and Symmetry; Interrelation of two port parameters; Int errelation of two port networks; Network functions; Significance of poles and zeroes, Restriction on location of poles and zeroes, Time domain behaviour from Pole -Zero plots.

Fourier Series and Fourier Transform: Fourier Series, Fourier analysis and evaluation of coefficients; Steady state response of network to periodic signals; Fourier transform and convergence; Fourier transform of some functions; Brief idea about network filters (Low pass, High pass, Band pass, and Band elimination) and their frequency response.

Network Synthesis: On network synthesis, Synthesis of passive network, Concept of stability, Positive real function, and its property, Foster and Cauer form of Synthesis

Text Book(s)

1. Network Analysis and Synthesis: A Chakraborty
2. Network Analysis, M E Van Valkenburg, PHI, third edition
3. Fundamentals of Electric Circuits, Charles K Alexander & Mat hew N.O. Sadiku, T at a McGraw Hill, fifth edit ion.
4. Network theory, Smarajit Ghosh, first edit ion (2005).
5. Network Analysis and Synthesis, Franklin F. Kuo, Wiley Student Edit ion, second edit ion, 2006.

EC-203	Analog Electronic Circuits	L T P C : 3 1 0 4
Pre-requisite- EC-101, EE -101		

Diodes: Basics of diode, Clipper, Clamper, Voltage multiplier, Zener diode and voltage regulator, LED, Photodiode, solar cell.

BJT and MOSFET: Basics of BJT and MOSFET, Biasing schemes and Bias stability, Mid -frequency small signal analysis of various BJT and MOSFET amplifier configurations using hybrid π -model, Multistage BJT and MOSFET amplifiers, Differential amplifier, Low and High frequency response of BJT and MOSFET circuits.

Feedback and Stability: Introduction to feedback, Ideal Feedback Topologies, Analysis of MOSFET based feedback amplifiers for Series -Shunt, Series -Series, Shunt-Shunt and Shunt-Series configurations, Stability Analysis, Compensation Technique.

Op-Amp and Oscillators: Basics of Op-Amp, Log-antilog amplifier, Square-root amplifier, Amplifier with T-network, Instrumentation amplifier, Precision rectifier, Active filters, Schmitt trigger circuits, Wein bridge and Phase shift oscillator, Colpitts, Hartley and Crystal oscillator, The 555 timer Astable and Monostable multivibrator.

Large Signal and power amplifiers: Introduction to power amplifiers, Harmonic distortion and power output, Class A, Class B, and Class AB amplifiers and their analysis. Thermal design considerations.

Text / Reference Books

1. Microelectronics: Circuit Analysis and Design (4th edit ion), Donald A. Neamen, McGraw-Hill Education
2. Microelectronic Circuits (7th edit ion), Adel S. Sedra and Kennet h C. Smit h, Oxford University Press
3. Fundament als of Microelectronics, Behzad Razavi, Wiley India Pvt Ltd
4. Microelectronic Circuits: Analysis and Design, Muhammad H. Rashid, Cengage Learning (2nd edition)

EC-204	Signals and Systems	L T P C : 3 1 0 4
Pre-requisite- EE -101		

Classification of Signals And Systems: Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals – periodic and a periodic signals, random signals, Energy & Power signals - CT systems and DT systems, Classification of systems.

Analysis of Continuous Time Signals: Fourier series analysis - Spectrum of Continuous Time (CT) signals - Fourier and Laplace transforms in Signal Analysis.

Linear Time Invariant– Continuous Time Systems: Differential Equation-Block diagram representation -impulse response, convolution integrals, Fourier and Laplace transforms in Analysis.

Analysis of Discrete Time Signals: Baseband Sampling of CT signals - Aliasing, Reconstruction of CT signal from DT signal DTFT and properties, Z-transform & properties.

Linear Time Invariant –Discrete Time Systems: Difference Equations -Block diagram representation - Impulse response-Convolution sum-DTFT and Z Transform analysis of Recursive and Non-Recursive systems

TEXT BOOKS:

1. Allan V. Oppenheim, S. Wilsky and S.H. Nawab, —Signals and Syst ems‖, Pearson, Indian Reprint , 2007
2. B. P. Lat hi, Principles of Linear Syst ems and Signals‖, Oxford, Second Edit ion, 2009.

REFERENCES:

1. H P Hsu, Signals and Systems‖, Schaum„s Outlines, Tata McGraw Hill, 2006
2. S. Haykin and B. Van Veen, "Signals and Systems", Second Edition, Wiley, 2003.
3. P. Ramakrishna Rao, Signals and Systems, Tata McGraw Hill Publications, 2008.
4. Edward W. Kamen, Bonnie S. Heck, Fundamentals of Signals and Systems Using the Web and MAT LAB, Pearson, Indian Reprint, 2007
5. John Alan Stuller, An Introduction to Signals and Systems, Thomson, 2007
6. M.J. Roberts, Signals & Systems, Analysis using Transform methods & MAT LAB, Tata McGraw Hill (India), 2007

EC-281	Electronic Circuits & Switching	L T P C : 3 1 0 4
Pre-requisite- None		

Number System: Introduction to various number systems and their Conversion. Arithmetic Operation using 1‟s and 2`s Compliments, Signed Binary and Floating Point Number Representation Introduction to Binary codes and their applications.

Boolean Algebra and Logic Gates: Boolean algebra and identities, Complete Logic set, logic gates and truth tables. Universal logic gates, Algebraic Reduction and realization using logic gates (3 Hours) Combinational

Logic Design: Specifying the Problem, Canonical Logic Forms, Extracting Canonical Forms, EX -OR Equivalence Operations, Logic Array, K-Maps: Two, Three and Four variable K-maps, NAND and NOR Logic Implementations.

Logic Components: Concept of Digital Components, Binary Adders, Subtraction and Multiplication, An Equality Detector and comparator, Line Decoder, encoders, Multiplexers and De -multiplexers.

Synchronous Sequential logic Design: sequential circuits, storage elements: Latches (SR, JK, T, D), Storage elements: Flip-Flops inclusion of Master-Slave, characteristics equation and state diagram of each FFs and Conversion of Flip-Flops. Analysis and synthesis of Clocked Sequential circuits and Mealy and Moore Models of Finite State Machines

Binary Counters: Introduction, Registers and shift registers, universal shift register, Principle and design of synchronous and asynchronous counters, Design of MOD-N counters, Ring counters. Decade counters, State Diagram of binary counters

IC Logic Families: Properties DTL, RTL, TTL, I2L and CMOS and its gate level implementation.

Text/References:

1. Modern Digit al Electronics, R.P.Jain, McGraw-Hill
2. Fundament als of Digit al Circuits, Anand Kumar, PHI
3. Digit al Elect ronics, A.K.Maini, Wiley India
4. Digit al Design, M. Morris Mano, and Michael D Ciletti, Pearson

EC-211	Circuit Theory Laboratory	L T P C : 0 0 3 2
Pre-requisite- None		

List of Experiments

1. Verification of Network Theorems (Superposition, Thevenin‟s, Norton‟s, Maximum Power Transfer). 2. Study of DC and AC Transients.
2. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
3. Determination of circuit parameters: Hybrid and Transmission parameters.
4. Frequency response of Low pass and High Pass Filters.
5. Frequency response of Band pass and Band Elimination Filters.
6. Determination of self-inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.
7. Study of resonance in R-L -C series circuit.
8. Study of resonance in R-L -C parallel circuit.
9. Spectral analysis of a non -sinusoidal waveform

EC-212	Analog Electronic Circuits Laboratory	L T P C : 0 0 3 2
Pre-requisite- EC-111		

List of Experiments:

1. To study the multi-stage RC coupled amplifier circuit using CE configuration npn transistor.
2. To design a current-biased emitter follower circuit
3. To measure and understand the current -vs -voltage (I-V) operating curves of the MOSFET
4. To realize Different applications of Op -Amps – Adder, Subtractor, Differentiator, Integrator etc.
5. To study Schmitt‟s Trigger Circuit
6. To study Phase Shift Oscillator Circuits
7. To design Active filter circuit with IC 741 (Low pass and High pass)
8. To realize Astable Multivibrator circuit using BJT/Op -Amp
9. To realize Monostable Multivibrator circuit using BJT/Op -Amp
10. To design an Analog to Digital Converter (Any one method)
11. To design Digital to Analog Converter (Any one method)
12. One innovative experiment based on electronics circuit

EC-286	**Electronic Circuits & Switching Laboratory**	**L**	**T**	**P**	**C**
	Third Semester Computer Science & Engineering	0	0	3	2

Pre-requisite- *Nil*

List of experiments:

1. Code conversion circuits- BCD to Excess-3 and vice-versa.
2. Four-bit parity generator and comparator circuits.
3. Construction of simple Decoder and Multiplexer circuits using logic gates.
4. Realization of RS-JK and D flip-flops using Universal logic gates.
5. Realization of Universal register using (a) JK flip-flops and logic gates and (b) multiplexer and flip-flops.
6. Construction of Adder circuit using Shift Register and full Adder.
7. Realization of Asynchronous and Asynchronous Up/Down counter.
8. Design of Sequential Counter with irregular sequences.
9. Realization of Ring counter and Johnson's counter.
10. Study of pulse shaping circuits.

EI-201	Electrical & Electronic Measurements	L	T	P	C
		3	1	0	4

Pre-requisite – Basic Electrical Engineering

Course Objectives:

- To understand the significance of measurement and types of errors in measurement.
- To explain the working of different electrical and electronics measuring instruments.
- To study the construction of A.C and D.C Bridges.
- To examine the different methods of power and energy measurement.
- To analyze the concepts of sinusoidal, triangular and square waveforms.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Identify the measurement errors.
CO2. Choose the appropriate instruments to measure a given set of parameters.
CO3. Develop an ability to use AC and DC bridges for measurements.
CO4. Relate the usage various measurement standards.
CO5. Apply knowledge of Electrical & Electronics measurements for practical implementations in engineering applications.

UNIT I:

Measurement and error: Introduction, Definition, significance of measurement, Measurement characteristics, Calibration of instruments, Static & dynamic characteristics. SI UNITs, Types of errors, Systematic and Random Errors in Measurements, expression of uncertainty-accuracy and precision index, propagation of errors, Probability of errors, Statistical analysis and Limiting error with examples.

UNIT II:

Electrical Measuring instruments: Classification of instruments, Principle and working of PMMC, Moving iron, Dynamo Meter type instruments, Overview of Ammeter, Voltmeter & Multimeter, True rms meters, Voltage and current Scaling, Galvanometer, different types of galvanometer and their applications, DC Potentiometers, AC potentiometers. Extension of range of instruments- shunts & multipliers- Instrument Transformers, Current transformers- Potential Transformers.

UNIT III:

A. C And D. C Bridges: General equation for bridge balance, Bridges for measurement of R, L and C, D.C. bridges, Wheatstone bridge, Kelvin's double bridge, General form of an A.C. bridge, Maxwell's inductance –capacitance bridge, Hay's bridge, Anderson's bridge, Schering bridge, Wien's bridge, Sources of errors in bridge measurement, Shielding and Grounding, Wagner earthing device.

UNIT IV:

Measurement of power and energy: Definitions of power, types, Measurement of power, different methods, construction and working of Electrodynamometer type of Wattmeter. Errors in power measurements. Energy, Induction type energy meter, Indicating type Frequency meter, Electrodynamometer type P.F. meter- construction and working principle, advantages, disadvantages. Measurement of Voltage, Current and Power in three-phase and single phase circuits.

UNIT V:

Electronic measuring Instruments: Measurement of quality factor (Q), Q-meter, Digital Voltmeter (DVM)-Ramp type, Integrating type, ADC, Digital frequency meter, Timer/Counter, AC and DC current probes, CRO probes, Oscilloscopes-CRO, Construction, Time based circuit, Measurement of time, phase and frequency, with CRO, Basics of DSO and applications.

UNIT VI:

Signal generations and waveform analyzing instruments: Function generator-Square, triangular Sinusoidal waveform generator, Spectrum analyzer.

TEXT BOOKS:

1. Electrical and Electronic Measurements by A.K. Sawhney - Dhanpat Rai

REFERENCE BOOKS:

2. Electronic Measurement & Instrumentation by H. Cooper – PHI.
3. Electronic Instrumentation by H. S. Kalsi – McGraw HilI

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2	✓	✓	✓		✓		✓					✓
CO3	✓	✓	✓	✓	✓		✓					✓
CO4	✓	✓	✓	✓	✓	✓	✓					✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

EI-202	Analog Electronics	L	T	P	C
		3	1	0	4

Pre-requisite – Basic Electronics

Course Objectives:

- To understand the fundamental terminologies and concepts of amplifies filters and oscillators.
- To explain how to perform the analysis of any analog electronics circuit consisting BJT, FET and OP-AMP.
- To develop skills to design BJT / FET amplifiers, oscillators and Operational Amplifier.
- To study and analyse feedback topologies, active filters, BJT/FET/Operational Amplifiers
- To analyse the concepts of small signal and large signal analysis for BJT and MOSFET

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Explain fundamental terminologies and concepts of amplifiers, filters and oscillators.

CO2. Perform the analysis of any analog electronics circuit consisting BJT, FET and OP-AMP.

CO3. Design amplifier circuits using BJT, FET & OPAMP and observe the amplitude & frequency responses.

CO4. Analyse feedback topologies, active filters, BJT/FET/Operational Amplifiers

CO5. Apply the knowledge of analog electronics for practical implementations in engineering applications.

UNIT I:

Characteristics and applications of diode, Zener diode, Basics of operational amplifiers, Characteristics of an ideal operational amplifier and its block diagram, Definition of differential voltage gain, CMMR, PSRR, slew rate and input offset current, Frequency Response, Application of operational amplifiers- first and second order filters, Difference amplifier, Adder, Subtractor, Integrator, Differentiator, Comparator, Clipper, clamper, Schmitt Trigger, Instrumentation Amplifier, Logarithmic amplifiers rectifiers, Precision rectifier.

UNIT II:

Transistor Amplifiers: Small Signal BJT amplifiers, AC equivalent circuit, hybrid model and their use in amplifier design. Analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations. Differential and multistage amplifiers

UNIT III:

JFET operation and characteristics, Biasing and small signal model of JFET, MOSFET symbols and characteristics (Enhancement and depletion mode), Small signal operation and models of MOSFET, Nonlinear one-port and two-port circuits, large signal and small signal analysis of MOSFET, nMOS and pMOS transistor. Internal capacitance of MOSFET: Gate capacitive effect and junction capacitance, Single stage MOS amplifiers, Comparison of Transistors

UNIT IV:

Introduction to Active Filters, First and second order Low-Pass Butterworth filter; filter Design, Frequency Scaling, First and Second-Order High-Pass Butterworth filters, Band-Pass and Band-Stop Filters; Wide Band-Pass, Band-reject and Narrow Band-Pass, Band Reject filters, All-Pass Filters

UNIT V:

Feedback topologies and analysis for discrete transistor amplifiers; stability of feedback circuits using Barkhausen criteria, Oscillators; Oscillator Principles, Oscillator Types, Frequency Stability, Phase shift oscillator, Wien Bridge Oscillator, Quadrature Oscillator, Square-Wave generator, Triangular-wave Generator, Saw tooth-wave generator, Voltage controlled Oscillator, timer 555, Multivibrators and Phase locked loop.

TEXT BOOKS:

1. Electronic Devices and Circuits theory, 9th/10th Edition, R.L. BoylestadandL.Nashelsky, Pearson Education, New Delhi.
2. Microelectronics Circuits, 5th Edition, International Student Edition Sedra and Smith, Oxford University Press, New Delhi.
3. Electronic Devices and Circuits, 3rd Edition, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. Electronics Circuits Analysis and Design, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Milliman's Electronics Devices and Circuits, 2nd Edition, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓			✓					✓
CO2	✓	✓	✓	✓	✓		✓					
CO3	✓	✓	✓	✓	✓		✓					✓
CO4	✓	✓	✓		✓	✓	✓					✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

EI-203	Circuits & Networks	L	T	P	C
		3	1	0	4

Pre-requisite – Basic Electrical Engineering

Course Objectives:

- To learn about various techniques available to solve various types of circuits and networks.
- To explain the concepts of sinusoidal transient response analysis.
- To develop skills to solve the given circuit with various theorems & methods.
- To study and analyze the Frequency response of electrical circuits.
- To relate various two port parameters and transform them & to design various types of filters.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Solve any DC and AC circuits.
CO2. Analyze two-port networks and apply Laplace Transform to find transient responses of circuits.
CO3. Analyze frequency response of circuits, filter circuits analysis.
CO4. Apply graph theory in solving networks
CO5. Synthesize networks.

UNIT I

BASIC CIRCUIT CONCEPTS: Lumped circuits, circuits elements, Voltage and current sources: independent, dependent, ideal and practical. V-I relationships of R, L and C, mutual inductor, simple resistive circuits, Kirchhoff's Laws, analysis of series and parallel circuits, network reduction, voltage division, current division, source transformation, star-delta transformation.

UNIT II

SINUSOIDAL STEADY STATE ANALYSIS: Concepts of phasor and complex impedance and admittance, analysis of simple series and parallel circuits, Peak, average and rms values of ac quantities: apparent power, active power, reactive power and power factor, series resonance and parallel resonance, bandwidth and Q factor, solution of three phase balanced circuits, power measurements by two wattmeter methods, solution of three phase unbalanced circuits.

UNIT III

CIRCUITS AND THEOREMS: Analysis of complex circuits using mesh and nodal methods, superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, compensation theorem, substitution theorem, maximum power transfer theorem, Millman's theorem with applications.

UNIT IV

RESPONSE OF ELECTRIC CIRCUITS: Concept of complex frequency, pole-zero plots, frequency response of RL, RC and RLC circuits, transient response of RL, RC and RLC series and parallel circuits with dc excitation, free response, step and sinusoidal responses, natural frequency, damped frequency, damping factor and logarithmic decrement, response of circuits for non-sinusoidal periodic inputs, locus diagrams.

UNIT V

ONE AND TWO-PORT NETWORK AND FILTERS: Driving point and transfer impedances, admittances, voltage and current ratios of one and two-port networks, admittance, impedance, hybrid – transmission and image parameters for one and two-port networks, impedance matching, equivalent Π and T networks, passive filters as a one and two-port network, realization of basic filters with R, L and C elements, characteristics of ideal filter, low pass and high pass filters, open- and short- circuit parameters.

TEXT BOOKS:

1. Network Analysis : M.E Van Valkenbrg
2. Network Analysis & Synthesis : Franklin F. Kua Second Edition

REFERENCE BOOKS:

1. A Course in Electrical Circuits and Analysis : M. L. Soni, J. C. Gupta
2. Network Synthesis : M. E. Van Valkenberg
3. Electrical Networks : Alexander & Sadiku

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓		✓				✓	✓
CO2	✓	✓	✓		✓		✓				✓	✓
CO3	✓	✓	✓				✓				✓	✓
CO4	✓	✓			✓		✓				✓	✓
CO5	✓	✓			✓	✓	✓	✓		✓	✓	✓

EI-211	Measurement Lab	L	T	P	C
		0	0	3	2

Pre-requisite – Electrical & Electronic Measurements

Course Objectives:

- To perform experiments for measurement of R, L and C using various methods.
- To perform experiments using Ammeter, Voltmeter, Wattmeter, Ballistic Galvanometer, Q-meter, CRO, CT, PT, Energy meters and multimeters to understand the working principles.
- To perform experiments for measurement of frequency, phase, mutual inductance, coupling coefficient of transformer, power and AC/DC parameters for implementation in various circuits
- To analyze and perform experiments for extension of range of ammeter, voltmeter and wattmeter.
- To perform experiments for calibration of single phase energy meter and three phase wattmeter.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Understand the working of Ammeter, Voltmeter, Wattmeter, Ballistic Galvanometer, Q-meter, CRO, CT, PT, Energy meters and multimeters.

CO2. Analyze and to measure R, L and C using various bridges.

CO3. Analyze and measure the frequency, phase, mutual inductance, coupling coefficient of transformer, power and AC/DC parameters for various circuits.

CO4. Understand the methodology for range extension of ammeter, voltmeter and wattmeter.

CO5. Apply concepts of electrical measurement for practical implementations in engineering applications.

List of Experiments (Any Fourteen experiments as instructed by course coordinators)

1. Measurement of an unknown medium resistance using Wheatstone bridge.
2. Measurement of an unknown low resistance using Kelvin's double bridge.
3. Measurement of an unknown self-inductance using Maxwell's inductance capacitance bridge.
4. Determination of critical damping resistance of a D'Arsonval galvanometer
5. Calibration of Ammeter, Voltmeter and Wattmeter using Potentiometer.
6. a) Design, construction and calibration of series and shunt type Ohmmeters;
   b) Measurement of insulation resistance of cable by Megger or Insulation tester
7. Calibration of wattmeter at different Power Factors.
8. Testing of CT & PT; Measurement of power of HV circuit using CT & PT.
9. Measurement of unknown Parameter using LCR meter (Q-meter).
10. Measurement of unknown Frequency using Frequency Counter Trainer.
11. Measurement of three-phase power by two wattmeter method.
12. Measurement of Phase & Frequency with CRO.
13. Magnetic measurement using Ballistic Galvanometer.
14. Measurement of R, L and C by using RLC bridge instrument.
15. Measurement of resistance by using: (i) Wheatstone bridge, (ii) Kelvin's double bridge.
16. Study of various types of multimeters and measurement of different AC, DC parameters.
17. Demonstration of MC, MI, Induction type and dynamometer type instruments.
18. Measurement of self-inductance, mutual inductance and coupling coefficient of transformer windings & Air cored Coils
19. Extension of range of Ammeter, Voltmeter and Wattmeter using Shunt Series resistance and instrumentation Transformers.
20. Calibration of Single Phase energy meter by: (i) Direct Loading; (ii) Phantom Loading at various points
21. Calibration of 3 Phase energy meter using standard watt meter.
22. a)Measurement of Capacitance using Schering Bridge; b) Measurement of Frequency using Wien's bridge

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓			✓					✓
CO2	✓	✓		✓	✓		✓					✓
CO3	✓	✓	✓	✓	✓		✓					✓
CO4	✓	✓	✓	✓	✓	✓	✓					✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

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EI-212	Analog Electronics Lab	L	T	P	C
		0	0	3	2

Pre-requisite – Analog Electronics Lab

Course Objectives:

- To construct the concepts of amplifiers in the design of public addressing system.
- Implement stable system using feedback concepts.
- Model multivibrators using transistor.
- Differentiate the working of multivibrators using special application IC 555 and general purpose op-amp.
- Availability to access and interfaces different VI using NI basic electronics modules.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.

CO2. Develop the ability to analyze and design analog electronic circuits using discrete components.

CO3. Observe the amplitude & frequency responses of common amplification circuits.

CO4. Design, construct & take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

CO5. Analyze & interface different VI using NI basic electronics modules.

List of Experiments:

1. Study of Instrumentation amplifier.
2. To implement the Operational Amplifier as a) Comparator, b) Summer and c) Subtractor.
3. To implement the Operational Amplifier as a Schmitt Trigger.
4. To study the Monostable multivibrator using IC 555 timer.
5. To study the astable multivibrator using IC 555 timer.
6. To implement a voltage regulatory circuit using Zener Diode.
7. To study the Biasing Techniques.
8. Design of bistable multivibrators, design of Schmitt trigger.
9. Design of Wein bridge oscillator using BJT.
10. Design of RC phase shift oscillators using BJT/ FET.
11. Design of Collpitt"s oscillators using BJT, Design of Hartly oscillators using BJT.
12. Study of Frequency response of Common Source (CS) amplifier.
13. To study different VI using NI Basic Electronics modules.
14. Active Filter Applications – LPF, HPF (first order).
15. IC 565 – PLL Applications, IC 566 – VCO Applications.
16. 4 bit DAC using OP AMP.
17. To study different VI using NI Basic Electronics modules.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓		✓				✓	
CO2	✓	✓	✓	✓	✓	✓	✓				✓	✓
CO3	✓	✓	✓				✓				✓	
CO4	✓	✓	✓	✓	✓	✓	✓				✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓				✓	✓

EI-213	Circuits & Networks Lab	L	T	P	C
		0	0	3	2

Pre-requisite – Basic Electrical Engineering, Circuits & Networks

Course Objectives:

- To understand the concept of R-L-C network, two-port network, filters and amplifier.
- To learn about the Laplace and inverse Laplace transform.
- To learn about the transient responses of the network.
- To learn about the frequency responses of filters.
- To learn about clipper and clamper circuits.

Course Outcomes (COs)

At the end of this course, the learner will be able to:

CO1. Infer and evaluate the transient response of R-L-C networks.
CO2. Evaluate and analyze the two-port network parameters.
CO3. Compare the frequency responses of different filters.
CO4. Apply Laplace and inverse Laplace transforms.
CO5. Apply the knowledge of Circuits & network for practical implementations in engineering applications.

List of experiments:

1. Milmann's Theorem
2. Reciprocity Theorem
3. Steady state response analysis of RL Network
4. Steady state response analysis of RC Network
5. Transient response in R-L and R-C Network: Simulation/hardware
6. Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
7. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
8. Frequency response of LP and HP filters
9. Frequency response of BP and BR filters
10. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
11. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals and simulation of difference equations using MATLAB
12. Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB
13. Determination of Laplace transform and inverse Laplace transformation using MATLAB
14. a) Study of RC low pass filter as an integrator
    b) Study of frequency response of low pass filter
15. a) Study of RC high pass filter as an differentiator
    b) Study of frequency response of high pass filter
16. Design of different clipper circuits
17. Study of different clamper circuits: positive, negative & bias
18. Design & study of Frequency response of two stage RC coupled amplifiers
19. Study of power amplifiers

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓			✓					✓
CO2	✓	✓	✓	✓	✓							
CO3	✓	✓		✓	✓		✓					✓
CO4	✓	✓	✓	✓		✓	✓					
CO5	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓

L-T-P-C : 3-1-0-4

Semester: III
Basic Thermodynamics
Code: ME 201

Pre-requisite: Mathematics-I (MA 101), Mathematics – II (MA 102)

Course Objectives/ Learning Objectives:

1. To cover the basic principles of Thermodynamics
2. To develop an intuitive understanding of thermodynamics by emphasizing the physics and physical arguments

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Lecture / Week (L T P C: 3 1 0 4)

Course Assessment Method (both continuous and semester-end assessment**)**
Class Tests / Quizzes, minor tests followed by Mid Semester and End Semester Examinations.

Topics Covered:
Concepts of Thermodynamics: Macroscopic and Microscopic concepts, System and its classification. Thermodynamic state, properties, process and cycles, Thermodynamic equilibrium, Energy interactions (Work transfer and its different modes, Heat transfer).
First Law of Thermodynamics: First law applied to non-flow as well as flow processes, Concepts of internal energy, Enthalpy, Specific heats, PMMI, Energy equations for flow systems, Application of energy equations to different engineering components.
Second Law of Thermodynamics: Need of the Second Law, Preliminary definitions, Different statements of the Second law of Thermodynamics and their equivalence, Reversibility and irreversibility, Causes of irreversibility, Reversible cycles, Carnot theorem, Absolute thermodynamic temperature scale, Third law of Thermodynamics.
Entropy: Clausius theorem and iInequality, Entropy principle, Entropy and disorder, Evaluation of entropy change during various processes, T-s and H-s diagrams, Concept of Third law of Thermodynamics.
Properties of Substances: Gases-Equation of state of an ideal gas, Specific heats, Internal energy, Enthalpy and Entropy change of ideal gas, Equation of state of Real Gases, Principle of corresponding state, Compressibility Factor.
Steam – Definition of sensible heat, Latent heat, Saturation temperature, Quality, Evaluation of properties from Steam table and Mollier diagram.
Concept of Exergy Analysis: Concept of exergy, Irreversibility, exergy balance, exergy transfer accompanying heat, exergy transfer accompanying work, flow exergy, exergy balance for control volume. Exergetic efficiency, exergetic efficiencies of common components: turbines, pumps, nozzles etc.

Text Books/Reference Books:

1. Cengel and Boles : Thermodynamics: An Engineering Approach, 7/e: Tata McGraw Hill
2. Moran, Shappiro, Boettner and Bailey: Principles of Engineering Thermodynamics, 8e: Wiley
3. P.K. Nag: Engineering Thermodynamics, 5/e: McGraw Hill
4. Boegnakke and Sonntag: Fundamentals of Thermodynamics: 7e: Wiley
5. Rogers and Mayhew: Engineering Thermodynamics, 4e: Pearson Education

Course Outcome:
On successful completion of this course, a student would be able to

1. develop the basic concepts of thermodynamic systems, equilibrium and fundamental laws of engineering thermodynamics.
2. apply first law of thermodynamics to various closed and open systems.
3. apply second law of thermodynamics to closed and open systems to calculate specified parameters such as work, heat transfer, or entropy.
4. apply the basic principles of classical thermodynamics to the analysis of processes and cycles involving pure simple substances.
5. calculate exergy destruction for various processes carried out on various thermal devices
6. identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical/physical models.

L-T-P-C : 3-1-0-4

Semester: III
Fluid Mechanics – I
Code: ME 203

Pre-requisite: Engineering Mechanics (ME-101), Physics-I (PH-101), Mathematics-I (MA-101), Mathematics-II (MA-102)

Course Objectives/ Learning Objectives:

1. To cover the basic principles and equations of fluid mechanics
2. To present numerous and diverse real-world engineering examples to give students a feel for how fluid mechanics is applied in engineering practice
3. To develop an intuitive understanding of fluid mechanics by emphasising the physics, and by supplying attractive figures and visual aids to reinforce the physics

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Lecture/Week and 1 Hr Laboratory Experiments /Week (L T P C: 3 1 0 4).

Course Assessment Method (both continuous and semester-end assessment)
Class Tests / Quizzes, minor tests followed by Mid Semester and End Semester Examinations.

Topics Covered:
Introduction: Definition of fluid, continuum hypothesis, different properties of fluid, classification (like Newtonian/non-Newtonian, ideal/real etc.).
Fluid Statics: pressure at a point, Pascal's law, variation of pressure within a static fluid – equation of hydrostatic pressure distribution, variation of properties in static atmosphere; measurement of pressure; hydrostatic thrust on plane and curved surfaces; buoyancy, stability of submerged and floating bodies.
Fluid Kinematics: preliminaries of Eulerian and Lagrangian description of fluid flow; velocity and acceleration of fluid particles in rectilinear and curvilinear co-ordinates; different types of flow – steady and unsteady flow, uniform and non-uniform flow, one- two and three dimensional flow, rotational and irrotational flow, laminar and turbulent flow; stream line, streak line and path line; stream filament and stream tube; principle of conservation of mass – equation of continuity for a stream tube and for unsteady three dimensional flow; deformation of a fluid particle – linear and angular deformation and rotation; vortex motion; relative equilibrium of fluids.
Fluid Dynamics: principle of conservation of linear momentum, Euler's equation of motion along a stream line and for unsteady three dimensional flow; derivation of Bernoulli's equation and physical significance of different terms; applications of Bernoulli's equation in flow measurement devices: stagnation tube, pitot tube, venturi meter, orifice meter, triangular and rectangular weir.
Application of Linear and Angular Momentum equation: linear momentum equation; analysis of force exerted by a fluid stream on a solid boundary – jet impingement, thrust on pipe bends etc. Principle of Conservation of Angular Momentum and its application. Steady Flow Energy Equation and its application.
Characteristics of Laminar and Turbulent Flow: Reynolds experiment, critical Reynolds number; laminar flow through pipe – Hagen Poiseuille equation.
Flow Through Closed Conduits: Darcy Weisbach equation, friction factor of closed conduits, flow through noncircular ducts, Moody's diagram and its use; minor losses – at sudden expansion, at sudden contraction, at bends, at valves and fittings etc; analysis of simple pipe network problems.

Free Surface Flow: Flow in open channel, Chezy's equation, Manning's equation, economical cross section, specific energy, hydraulic jump.

Text Book/Reference Books:

6. Introduction to Fluid Mechanics and Fluid; S.K. Som, G. Biswas and S. Chakraborty: Machines: Tata McGraw Hill.
7. Fluid Mechanics: Cengel and Cimbala: Tata McGraw Hill.
8. Introduction to Fluid Mechanics ; R.W. Fox, P.J. Pritchard and A. T. McDonald:: Wiley
9. Fluid Mechanics; Frank M. White;; McGraw Hill.
10. Fluid mechanics by A. K. Jain, Khanna Publishers.

Course Outcomes:

1. Students will be able to describe the basic concepts of fluid mechanics and recognize the various types of fluid flow problems encountered in practice.
2. Students will be able to determine the variation of pressure in a fluid at rest and also calculate the forces exerted by a fluid at rest on plane or curved submerged surfaces.
3. Students will be able to apply the role of material derivative in transforming between Lagrangian and Eulerian descriptions, and explain the four fundamental kinematic properties of fluid motion and deformation.
4. Students will be able to derive and apply various conservative equations related to fluid flow problems.
5. Students will be able to develop fundamental understanding about the techniques of numerical solution of fluid flow problems.

L-T-P-C : 0-0-3-2

Semester: III
Machine Drawing Lab
Code: ME 211
Pre-requisite: Engineering Graphics & Design (CE 101)

Course Objectives/ Learning Objectives:

1. To enable the student in learning the fundamentals of machine drawing with developing functional skill by hand on drafting as well as computer aided designing.
2. To develop the skill in acquiring adequate knowledge and experience in preparing and understanding the machine component's or equipment's drawing
3. To enable the student to read, construct and understand any machine component and assembly drawings.
4. To enable the student in acquiring the skills pertinent to the production of properly detailed, formatted and dimensioned machine component and assembly drawings

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Laboratory Experiments /Week (L T P C: 0 0 3 2)

Course Assessment Method (both continuous and semester-end assessment**)**
Drawing sheet assignments (prepared by the students in classes and also in hostels) followed by Mid Semester and End Semester Examinations.

Topics Covered:
ISI conventions in drawing Surface finish, Limits, Fits and tolerance (to be indicated on working drawings), Orthographic projection of different types of composite bodies.
Bolts and nuts, Keys, Pins, Setscrews, Riveted joints, Welded joints, Pipe joints, Flanged coupling, Flat and V-belt pulleys, Threads (internal and external), Studs, Washers, Springs, Plain journal bearing, Ball and roller bearings.
Assembly and part drawings for parts such as: Stuffing box, Foot step bearing, Plummer block, Universal joints, Gear pump, Screw jack, Cross head of steam engine, Connecting rod, Piston assembly, Stuffing box, Eccentric sheave, Tail stock.

Text Book/Reference Books:

1. N. D. Bhatt: Machine Drawing: Charotor Publishing House, Anand
2. Ajeet Singh: Machine Drawing, 2/e: Tata Mc Graw Hill Publishing
3. K.L. Narayana, P. Kannaiah & K. Venkata Reddy: Production Drawing: New Age International Publisher
4. R.K. Dhawan: A Text Book of Machine Drawing: S. Chand & Company Publishing House
5. B. Bhattacharyya, Machine Drawing, Oxford Higher Education
6. K. C. John, Text Book of Machine Drawing, Prentice Hall India (PHI)

Course Outcome:
The students will be able to:
1. Have basic thoughts and ideas on practical working drawing of machinery components
2. Gain knowledge on assembly drawing of machine parts.
3. Understand how to prepare bill of materials (part-list) in working drawing.
4. Understand and comprehend the sectional view of assembly of machine components.
5. Understand the type of fit and tolerances used in assembly of components.

L-T-P-C : 0-0-3-2

Semester: III
Manufacturing Lab
Code: ME 212

Pre-requisite: Material Science (ME 205), Manufacturing Process (ME 205)

Course Objectives/ Learning Objectives:

1. To provide hands-on laboratory experience in the area of production.
2. To provide basic knowledge about casting and tools used in casting.
3. To get familiarized with welding equipment and various welding processes.
4. To acquire practical knowledge in forging, heat treatment and metallographic studies.

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Laboratory Experiments /Week (L T P C: 0 0 3 2)

Topics Covered:
Introduction to moulding practice - preparation of moulding sand (green & dry) and use of moulder's tools; making of moulds by using selected pattern's; gating system design, melting and pouring practice; sand preparation, sand testing: specimen preparation, permeability, clay content, grain fineness number, green compression strength, green shear strength, dry strength, hardness etc. Practice of different welding processes - SAW, TIG, MIG, resistance welding, friction welding etc.; introduction to soldering, brazing etc.; making welded joints using different welding processes.
Introduction to forging tools, furnaces and forging machines; to practice basic forging operations drawing out, upsetting, necking etc.; introduction to forge welding.
Surface preparation and etching techniques, heat treatment and metallographic studies.

Course Outcomes:
After learning this course the students will be capable to

1. design patterns, Gating, runner and riser systems.
2. design and develop a product using various metal casting methods.
3. perform various arc and solid state welding processes and select a suitable process based on the Application and requirements .
4. fabricate machine components with suitable welding technique.
5. choose a suitable mechanical press working process to obtain the required shape of metal.
6. perform the various types of dies like Blanking & Piercing operations and study of simple, compound and progressive dies.
7. to study the structural characteristics or constitution of a metal or an alloy in relation to its physical and mechanical properties

L-T-P-C : 3-0-0-3

Semester: III
Manufacturing Process
Code: ME 204

Pre-requisite: Physics (PH 101), Chemistry (CH 101), Engineering Mechanics (ME 101), Workshop practice (ME 111)

Course Objectives/ Learning Objectives:

1. Give exposer of different manufacturing process and their application.
2. Provide broad knowledge about casting process and detail design of pattern, moulding material, riser and gating system.
3. Deliver basic knowledge regarding metal forming process and load calculation for deformation process (forging, extrusion and bending)
4. Impart knowledge about welding principles, classification, heat flow and welding defects.
5. Inculcate the basic of powder metallurgy and its application.

Contact hour and types of course (lecture, tutorial, seminar, project etc.)
3 Hrs Lecture / Week (L T P C: 3 0 0 3)

Course Assessment Methods:
Class Tests / Quizzes, minor tests followed by Mid Semester and End Semester Examinations.

Topics Covered:
Introduction to manufacturing process: Classification: casting, forming, fabrication and material removal processes.
Metal casting process: Introduction: History, advantages and limitation, application, casting terms, sand mould making; Patter: Pattern allowances, Pattern material; Moulding materials: Moulding sand composition, Moulding sand properties, Testing of sand properties, sand preparation, moulding machines, Moulding process; Cores: core material, core prints, core moulding process and chaplets; Forces acting on the Moulding flasks; Gating system for casting: Introduction, Gating system design and pouring time calculation; Riser Design: methods, chills; Introduction to melting practices: furnaces, inoculation, degasing, ladles; sand casting; Casting defects: Gas defects, Mould material defects, pouring metal defects, metallurgical defects; Introduction to nondestructive testing. Special Casting processes: Pressure die casting, centrifugal casting, and continuous casting, Blow moulding, Injection moulding.
Metal forming Processes: Concept of plastic deformation: hot working, cold working; Various metal forming techniques and their analysis: forging: types, analysis, forging defects; Rolling: Principle, rolling load, rolling defects; Extrusion: principles, classification, hot extrusion, cold extrusion, load estimation for extrusion, extruding tubes; Wire drawing, Rod and Tube drawing.
Sheet Metal operation: Basic principle, press tool operation, shearing operation: Parting, notching, blanking and piercing; Dra+
wing: Cupping (drawing), Deep drawing. Design of blanks for any shearing and cupping operation. Bending: load estimation for bending; spinning, stretch forming, coining and embossing; Sheet metal die design: Types of dies, Die and punch design.

Welding process: Introduction: fabrication methods, classification: Classification based on application of filler material & without filler material, source of energy, fusion and pressure welding

processes, Gas welding: Types of flames, Gas cutting. Electric Arc welding: principle of arc, arc welding equipment, AC and DC welding equipment, DC straight polarity (DCEN) and DC reverse polarity (DCEP) welding; Electrodes; Manual metal arc welding; arc blow; Tungsten Inert Gas (TIG) welding, Metal Inert Gas (MIG) welding, Gas Metal Arc Welding (GMAW), Submersed Arc Welding (SAW); Resistance welding: Principle, Resistance spot welding, Resistance seam welding, projection welding, upset welding. Welding Design: Heat input, Heat flow and welding defects. Other fabrication process like Electro-Slag welding, Forge welding, Brazing, Braze welding, soldering, adhesive bonding etc. A brief introduction to Powder metallurgy and its application

Text/Reference book.

1. P N Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill.
2. A Ghosh and A K Mallik, Manufacturing Science, Pearson India.
3. S Kalpakjian and S R Schmid, Manufacturing Processes for Engineering Materials, Pearson education, 2009.
4. Richard Heine, Carl Loper, Philip Rosenthal, Principles of Metal Casting, McGraw Hill Education
5. B.S. Nagendra Parashar and R.K. Mittal, Elements of Manufacturing Processes, PHI
6. S K Hajra Choudhury, S K Bose, A K Hajra Choudhury, Nirjhar Roy: Workshop Technology Vol I; Media Promoters & Publishers Pvt. Ltd.
7. J. T. Black and Ronald A. Kohser, DeGarmo's Materials and Processes in Manufacturing, Wiley India Edition

Course Outcomes:

Students will be able to

1. Identify and apply different manufacturing process for various product.
2. Select appropriate moulding material for making a sound mould.
3. Design pattern, cores, and mould for the metal casting process.
4. Identify the casting defect with cause.
5. Select appropriate metal forming processes for manufacturing of product.
6. Calculate load requirement for metal forming process (forging, rolling, and extrusion).
7. Select appropriate sheet metal operation for manufacturing product.
8. analyse shearing, drawing and bending operation
9. Select appropriate welding process as per engineering application
10. Select welding parameters for sound welding
11. Apply the knowledge for producing defect free welding.
12. Select suitable manufacturing process for powder metallurgy components.

L-T-P-C : 3-0-0-3

Semester: III
Material Science
Code: ME 205

Pre-requisite: Physics (PH101), Engineering Mechanics (ME101), Chemistry (CH 101)

Course Objectives/ Learning Objectives:

1. To give exposure in a materials science
2. To study atomic structure, Imperfections in solids, Diffusion and Dislocations theory.
3. To learn various kinds of dislocations and Strengthening Mechanisms, Mechanical properties of Metals, Failure.
4. Students will be able to understand Applications and Processing of Metals, Alloys and Ceramics, Applications and Processing of Polymers, Economic, Environmental and social issues of material usage

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Lecture / Week (L T P C: 3 0 0 3)

Course Assessment Methods:
Class Tests / Quizzes, minor tests followed by Mid Semester and End Semester Examinations.

Topics Covered
Introduction to Materials Science and engineering: Historical perspective and materials science, why study materials science and engineering? Classification of materials, functional classification of materials, environmental and other effects on materials, materials design and selection.
Atomic structure: Atomic structure and atomic bonding in solids, crystal structures, crystalline and non-crystalline materials, miller indices,
Imperfections in solids: Theoretical yield strength, point defects, line defects and dislocations, interfacial defects, bulk or volume defects and atomic vibrations.
Kinetics of phase transformation, crystallization, nucleation, homogenous nucleation, heterogenous nucleation, crystal growth, dendritic growth.
Dislocations and Strengthening Mechanisms: Dislocations & plastic deformation and mechanisms of plastic deformation in metals, strengthening mechanisms in metals, recovery, recrystallization and grain growth.
Phase transformations and phase equilibrium: Useful terminology, equilibrium phase diagrams, particle strengthening by precipitation and precipitation reactions, kinetics of nucleation and growth, the iron–carbon system, phase transformations, Normalising, Annealing, Spheroidising, transformation rate effects and TTT diagrams, Continuous cooling curve, microstructure and property changes in Fe-C alloys.
Mechanical properties of Metals: Interpretation of tensile stress-strain curves, normal stress strain curve, true stress strain curve, toughness and resilience, elastic deformation and plastic deformation, yielding under multi-axial stress, yield criteria, macroscopic aspects of plastic deformation and property variability & design considerations.

Failure: Fracture, Ductile and brittle fracture, fracture mechanics, impact fracture testing, ductile-to-brittle transition, fatigue, crack initiation and propagation, crack propagation rate, creep, generalized creep behavior, stress and temperature effects.

Applications and Processing of Polymers: Polymer types and Polymer synthesis & processing, crystallization, melting and glass transition, mechanical behavior of polymers, mechanisms of deformation and strengthening of polymers, characteristics and typical applications of few plastic materials, particle-reinforced composites, fiber-reinforced composites, structural composites.
Economic, Environmental and social issues of material usage: economic considerations, environmental and social considerations, recycling issues, life cycle analysis (LCA) and its use in design.

Text Books/Reference Books:

1. Avner: Introduction to physical metallurgy: Mc Graw hill
2. Smith: Material Science & Engineering, 4/e: McGraw-hill
3. Dieter: Mechanical Metallurgy, 3/e: McGraw-Hill
4. Callister: Material science and Engineering: John Wiley & Sons. Inc.
5. Askeland & Fulay: The science and engineering of Materials: Nelson Engineering

Course Outcomes:

1. Students will be able to apply core concepts in materials Science to solve engineering problems.
2. Students will be able to understand the professional and ethical responsibilities of a materials scientist and materials engineer.
3. Students will be able to describe its physical origin, as well as strength for a particular bond associated with the atomic structure.
4. Students will be able to determine the theoretical yield strength for a given metal or alloy based on imperfections.
5. Students will be able to do simple diffusion problems.
6. Students will be able to differentiate various metal treatment processes.
7. Students will be able to identify the mechanical properties of materials.
8. Student will be able to undergo failure analysis of metals.
9. Student will be able to describe a polymer's elastic behavior above and below the glass transition.
10. Students will be to describe properties of structural composites.
11. Students will be able to solve problems related to materials.
12. Students will be able to identify structure property correlation for material design for different applications.

L-T-P-C : 3-1-0-4

Semester: III
Theory of Machines
Code: ME 202

Pre-requisite: Engineering Mechanics (ME 101), Workshop Practice (ME 111), Engineering Graphics & Design (CE 101), Mathematics – I (MA 101), Mathematics – II (MA 102)

Course Objectives/ Learning Objectives:

1. To enable the students in gaining knowledge on fundamental theories of machines and mechanisms.
2. To enable the student in comprehending the analysis of kinematics and kinetics of machines and components.
3. To enable the student in deriving and analyzing the relative movements of mechanical components like gears, gear trains, cams, and linkages.
4. To develop the skills in designing, formulating and analyzing the motions of the machine components

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Lecture / Week and 1 hour Tutorial / Week (L T P C: 3 1 0 4)

Course Assessment Method:
Class Tests / Quizzes, minor tests followed by Mid Semester and End Semester Examinations.

Topics Covered:
Introduction and Kinematic Analysis of Mechanisms: Introduction, kinematics and dynamics of machines, machine, mechanism, and structure, mobility of mechanisms, kinematic inversion, Grashof's law, synthesis of mechanism, straight line generating mechanisms, intermittent motion mechanism, transmission angle-determination of minimum value, position analysis analytic and graphical approach, kinematic analysis of the slider-crank mechanism and four-bar mechanism, solutions of loop-closure equations.
Velocity and Acceleration Analysis of Mechanisms: Velocity analysis analytic and graphical approach, equations for velocities, applications to simple and compound mechanisms, acceleration analysis, Analytical and Graphical approach, equations for accelerations, applications to simple mechanisms, free-body diagram for a link, application to simple and compound mechanisms.
Cam and Follower: Classification of followers and cams, motion of the follower, displacement, velocity and acceleration diagrams, construction of cam profiles.
Governors: Types and application, Functions of a Governor, Characteristic of centrifugal governors, Quality of Governor: Definitions of controlling forces, stability, sensitiveness, isochronisms, capacity and coefficient of insensitiveness, Spring controlled governors of Hartnell and Hartung types, Effect of friction, Effort and power, Effect of Friction: Insensitiveness.
Balancing: Static and dynamic force diagram, Inertia forces and their balancing for rotating and reciprocating machines, Identification of inertia forces for reciprocating masses in engine mechanisms, Partial primary balance of single cylinder engines and uncontrolled locomotives, Balancing of multi cylinder in line engines, V- twin engines, Radial engines – direct and reverse crank methods.
Gears: Friction wheels, gear drives and classifications, gear terminology, law of gearing, velocity of sliding of teeth, forms of teeth: cycloidal and involute, centre distance, length of path of contact, length of arc of contact, contact ratio, interference in involute gears, minimum number of teeth on

the pinion, minimum number of teeth on the wheel, minimum number of teeth on a pinion for involute rack in order to avoid interference, spur gears, helical gears, spiral gears.
Gear Trains: Introduction, types of gear trains, simple gear train, compound gear train, design of spur gears, reverted gear train, epicyclic gear train, velocity ratio of epicyclic gear train, compound epicyclic gear train (sun and planet wheel), epicyclic gear train with bevel gears, torques in epicyclic gear trains, analytical and tabular method for solving the problems on gear trains.

Text Books/Reference Books:

1. S.S. Rattan: Theory of Machines: Tata McGraw Hill Publication
2. Vinogradov, Oleg (Oleg G.): Fundamentals of kinematics and dynamic of machines and mechanisms: CRC Press
3. John J. Uicker, Gordon R. Pennock, Joseph E. Shigley: Theory of Machines and Mechanisms: Oxford University Press.
4. Norton: Design of Machinery: McGraw Hill Publishers.
5. David H. Myszka: MACHINES AND MECHANISMS: Pearson Education, Inc., publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey.

Course Outcomes:

Students will be able:

1. To learn and comprehend the basics of mechanisms, joints, components and degrees of freedom
2. To learn the fundamentals of the theories and engineering applications of dynamics of machines.
3. To design and analyze the basics of synthesis and simple mechanisms.
4. To design and analyze the cam-follower, gears and gear train.
5. To analyze the operation of governor and balancing of masses

L-T-P-C : 0-0-3-2

Semester: III
Thermo-Fluid Lab-I
Code: ME 213

Pre-requisite: Basic Thermodynamics (ME 201), Fluid Mechanics - I (ME 203)

Course Objectives/ Learning Objectives:

1. To provide hands-on laboratory experience in the area of Thermo-fluid science.
2. To provide basic knowledge about the laws of fluid mechanics.
3. To provide basic knowledge about the laws of Thermodynamics
4. To get familiarized with the machines to investigate the laws of Thermo-fluid Sciences.

Contact hours and type of course (lecture, tutorial, seminar, project etc.)
3 Hrs Laboratory Experiments /Week (L T P C: 0 0 3 2)

Topics Covered:
Verification of the Bernoulli's theorem, Verification of the law of equilibrium of a floating body, Determination of the coefficient of discharge using flow measuring devices, Determination of the drag and lift forces on an aerodynamic body, Determination of coefficient of discharge using notches and weirs, Determination of major and minor losses in flow conduits, Determination of velocity of air using pitot tube, Calibration of a thermocouple, Determination of dryness fraction of steam using throttling calorimeter, Determination of viscosity of oil.

Course Outcomes:
After learning this course the students will be capable to

1. correlate and verify Bernoulli's theorem
2. use flow measuring devices to measure the coefficient of discharge.
3. correlate the phenomenon of equilibrium of any floating body and hence calculate metacentric height of a floating body.
4. visualize flow in an open channel with varying flow discharges and be able to calculate the coefficient of discharge.
5. draw the performance plots and analyse performance of the devices from the plots.
6. calculate the major and minor losses in flow conduits
7. measure air velocity using pitot tube.
8. calibrate a thermocouple
9. calculate dryness fraction of steam.

B.TECH. 3RD SEM

Mathematics-III
Code : MA 201

L	T	P	C
3	1	0	4

***Partial Differential Equation*:**

Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation, Non-linear PDE of first order, Charpit's Method, Homogeneous and Non-homogeneous linear equations with constant coefficients, Boundary and initial value problems (Dirichlet and Neumann type): Heat, Wave & Laplace's equations (Two dimensional Polar & Cartesian Co-ordinates), Solution by the method of separation of variables

***Fourier Transforms*:**

Introduction to Fourier series, Fourier sine and cosine transforms, Solution of PDE by Fourier transform.

***Probability & Statistics*:**

Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions.

Curve fitting: Fitting of straight lines & parabolas by the method of least squares.

Correlation & Regression analysis: Coefficient of correlation, Coefficient of regression, Lines of regression.

Text :/Reference Books:

1. L. Seymour& J. Schiller, Introduction to Probability & Statistics, Schaum's Outline Series.
2. E . Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd., 10th ed.
3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publisher.
4. I.N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, 1988.
5. J. Ravichandran, Probability and Statistics for Engineers, Wiley India Pvt. Ltd, 2010.