SEMESTER I

COURSE CONTENTS

Course Code	**BSC 103**				
Category	**Basic Science Course**				
Course Title	**Mathematics - I** Calculus and Linear Algebra **(Option 1) for All Branch excluding CSE** Calculus and Linear Algebra **(Option 2) for CSE**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	**Pre-requisites:** High-school education				

MATHEMATICS 1

……………………………………………………………………………………………………

CALCULUS AND LINEAR ALGEBRA 40 Lectures

Option 1 (For all branches) excluding CSE

……………………………………………………………………………………………………

Module 1: Calculus-I 6 Lectures

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus-II 6 Lectures

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Sequences and series 10 Lectures

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Multivariable Calculus (Differentiation) 8 Lectures

Limit continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5: Matrices **10 Lectures**

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Textbooks/References:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
- D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

COURSE OUTCOMES

To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals.

To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.

To familiarize the student with functions of several variables that is essential in most branches of engineering.

To develop the essential tool of matrices and linear algebra in a comprehensive manner.

……

……

CALCULUS AND LINEAR ALGEBRA **Option 2 (for CSE)** **40Lectures**

……

Module 1: Calculus-I **6 Lectures**

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus-II **6 Lectures**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L' Hospital's rule; Maxima and minima.

Module 3: Matrices **8 Lectures**

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Module 4: Vector spaces-I **10 Lectures**

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank nullity Theorem, composition of linear maps, Matrix associated with a linear map.

Module 5: Vector spaces-II **10 Lectures**

Eigen values, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, Eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Textbooks/References:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

COURSE OUTCOMES

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

……………………………………………………………………………………………

Course Code	**BSC 101**				
Category	**Basic Science Course**				
Course Title	**Physics-I** (i) Introduction to Electromagnetic Theory – For ME (ii) Introduction to Mechanics – For Civil, MEMS (iii) Oscillation, Waves and Optics - For EEE (iv) Semiconductor Physics – For ECE, CSE (v) Basics of Electricity, Magnetism & Quantum Mechanics- For Chemical Engg.				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	Mathematics course with vector calculus, High-school education Mathematics course on differential equations and linear algebra				

PHYSICS- I

…………………………………………………………………………………………………

INTRODUCTION TO ELECTROMAGNETIC THEORY **For ME**

38 Lectures

…………………………………………………………………………………………………

Module 1: Electrostatics in vacuum **8 Lectures**

Electric field and electrostatic potential for a charge distribution; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution. Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

Module 2: Electrostatics in a linear dielectric medium **4 Lectures**

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Module 3: Magneto statics **6 Lectures**

Bio-Savart law, Static magnetic field; vector potential and calculating it for a given magnetic field; the equation for the vector potential and its solution for given current densities.

Module 4: Magneto statics in a linear magnetic medium **4 Lectures**

Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on **B** and **H**. Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Module 5: Faraday's law and Maxwell's equations **8 Lectures**

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time dependent electric field; calculating magnetic field due to changing electric fields in quasistatic approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting.

Module 6: Electromagnetic waves **8 Lectures**

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non conducting medium-vacuum interface for normal incidence.

Text Book:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn, 1998, Benjamin Cummings.

Reference books:

- Fundamentals of Physics Electricity and Magnetism, Halliday and Resnick, tenth edition (published 2013).
- W. Saslow, Electricity, magnetism and light, 1st edition
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.

COURSE OUTCOMES

To make student understand the basic of electrostatics in vacuum and in material medium.

To make student understand the basic of magneto statics in vacuum and in magnetic material medium.

Students to get familiarized with the Faraday's Law and Maxwell's equation leading to the application of EMW in vacuum and in media.

………………………………………………………………………………………………………

INTRODUCTION TO MECHANICS

for Civil, MEMS

38 Lectures

Module 1: Particle motion and Newton's law **8 Lectures**

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law;

Module 2: Central potential and Kepler's laws **7 Lectures**

Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Kepler problem;

Module 3: Rotating coordinate system **5 Lectures**

Non-inertial frames of reference; rotating coordinate system: Five-term acceleration formula- Centripetal and Coriolis accelerations; Foucault pendulum;

Module 4: Harmonic Oscillations **6 Lectures**

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance.

Module 5: Planar rigid body mechanics **5 Lectures**

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion;

Module 6: Three-dimensional rigid body motion **7 Lectures**

Introduction to three-dimensional rigid body motion - in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body: Rod executing conical motion with center of mass fixed - show that this motion looks two-dimensional but is three-dimensional.

Reference books:

- Engineering Mechanics, 2nd ed. Publisher: Cengage Learning; 2 edition (January 22, 2013) - MK Harbola
- Introduction to Mechanics, CRC Press - MK Verma

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill
- Principles of Mechanics. by Synge, John. L; Griffith, Byron. A. Publication date Publisher McGraw-Hill
- Mechanics - JP Den Hartog
- Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
- Mechanical Vibrations - JP Den Hartog
- Theory of Vibrations with Applications - WT Thomson

COURSE OUTCOMES

Students to learn basics of particle dynamics including the rotational motion in central potential field following Kepler's laws.

To learn the rotating co-ordinate system and harmonic motion with the effect of damping and forced oscillation.

…………………………………………………………………………………………………

OSCILLATIONS, WAVES AND OPTICS **For EEE**

38 Lectures

…………………………………………………………………………………………………

Module 1: Harmonic Oscillation **07 Lectures**

Simple harmonic motion, damped and forced simple harmonic oscillator Mechanical and electrical simple harmonic oscillators, phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator.

Module 2: Waves **07 Lectures**

Transverse and longitudinal waves in one dimension. Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves, wave groups and group velocity.

Module 3: Geometric Optics **10 Lectures**

Fermat's principle of stationary time and its applications. Laws of reflection and refraction, Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them.

Module 4: Wave Optics **06 Lectures**

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer,. Farunhoffer diffraction from a single slit, the Rayleigh criterion for limit of resolution; Diffraction gratings and their resolving power

Module 5: Lasers **08 Lectures**

Einstein's theory of matter radiation interaction, A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne), solid-state lasers (ruby); Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers.

Reference books:

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, A. Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

COURSE OUTCOME

Students to learn harmonic oscillations, physical and wave optics.
Students to get familiarize with the knowledge of waves and Lasers.

……………………………………………………………………………………………………

SEMICONDUCTOR PHYSICS **For ECE, CSE**
38 Lectures

Module 1: Electronic materials **8 Lectures**
Free electron theory, Density of states and energy band diagrams, Kronig-Penny model, Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Fermi level, Effective mass.

Module 2: Semiconductors **10 Lectures**
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky).

Module 3: Light-semiconductor interaction **7 Lectures**
Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect.

Module 4: Measurements **7 Lectures**
Four-point probe and vander Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics.

Module 5: Engineered semiconductor materials **6 Lectures**
Density of states in 2D, 1D and 0D (qualitatively). quantum wells, wires, and dots: design, fabrication, and characterization techniques. Hetero junctions and associated band-diagrams

References:

- J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
- B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
- S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
- Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
- P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
- Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
- Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

COURSE OUTCOMES

Students will be exposed to the understanding of semiconductor materials and their importance in Computer, Electronics and Communication Engineering.
To learn the interaction of light and semiconductor.
To get familiarized with the measurement techniques on semiconductor devices and circuits.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

BASICS OF ELECTRICITY, MAGNETISM AND QUANTUM PHYSICS
For Chemical Engg. 38 Lectures

……………………………………………………………………………………………………

Module 1: Electromagnetism 8 Lectures
Laws of electrostatics: Coulomb's and Gauss's Law, electric current and the continuity equation, laws of magnetism. Ampere's Law, Faraday's laws of electromagnetic induction: Self and mutual induction, motional and changing field emf, Displacement current, Maxwell's equations.

Module 2: Dielectrics 6 Lectures
Dielectric, Polar and non-polar dielectrics, Electric Polarisation, Polarizability, Types of polarization, Permittivity and dielectric constant, internal fields in a solid, Clausius-Mossotti equation.

Module 3: Magnetic Substances 7 Lectures
Magnetic moment and Magnetisation, permeability and susceptibility, classification of magnetic materials, diamagnetic, paramagnetic and ferromagnetic, magnetic domains and hysteresis, hysteresis loss, applications.

Module 4: Basic Quantum Mechanics 7 Lectures
Inadequacy of Classical Mechanics, Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect: Stopping Potential, Work Function, Compton Effect: Compton Shift.

Module 5: Wave particle duality and bound states **10 Lectures**

de Broglie hypothesis, Bragg's Law, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation: time dependent and independent form, eigen value and eigen function, normalization of wave function, particle in a box, quantum harmonic oscillator, hydrogen atom.

Text Book:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.

Reference books:

- Introduction to Quantum mechanics, Nikhil Ranjan Roy, 2016, Vikash Publishing House Pvt. Ltd.
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
- Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.

COURSE OUTCOMES

Students to get basic knowledge of Electromagnetism, dielectrics, magnetic materials etc.

Familiarization with the basics of Quantum Mechanics and its application to few bound states.

……………………………………………………………………………………………………….

PHYSICS LABORATORY **Code: BSC101P**

Choice of 08-10 experiments from the following:

- Experiments on electromagnetic induction and electromagnetic breaking;
- LC circuit and LCR circuit
- Resonance phenomena in LCR circuits
- Magnetic field from Helmholtz coil
- Measurement of Lorentz force in a vacuum tube
- Coupled oscillators
- Experiments on an air-track
- Experiment on moment of inertia measurement
- Experiments with gyroscope
- Resonance phenomena in mechanical oscillators
- Frank-Hertz experiment
- Photoelectric effect experiment
- Recording hydrogen atom Spectrum
- Diffraction and interference experiments (from ordinary light or laser pointers)
- measurement of speed of light on a table top using modulation
- minimum deviation from a prism

LABROTARY OUTCOMES

Students to have hands on experiences with experiments on the basics laws and principles of Physics in the field of Mechanics, Optics, Electricity, Magnetism, Modern Physics, etc.

Course Code	**ESC 101**				
Category	**Engineering Science Course**				
Course Title	**Basic Electrical Engineering**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	**Intermediate level Electricity**				

…………………………………………………………………………………………………

BASIC ELECTRICAL ENGINEERING 40 Lectures

…………………………………………………………………………………………………

Module 1 : DC Circuits 7 Lectures

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits 7 Lectures

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers 6 Lectures

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines 8 Lectures

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters 6 Lectures

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations **6 Lectures**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

- D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
- L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

……………………………………………………………………………………………………

BASIC ELECTRICAL ENGINEERING LABORATORY Code: ESC101P

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

LABORATORY OUTCOMES

Get an exposure to common electrical components and their ratings.
Make electrical connections by wires of appropriate ratings.
Understand the usage of common electrical measuring instruments.
Understand the basic characteristics of transformers and electrical machines.
Get an exposure to the working of power electronic converters.

Course Code	ESC 102				
Category	Engineering Science Course				
Course Title	Engineering Graphics & Design (Theory & Lab)				
Scheme & Credits	L	T	P	Credit	Semester I
	1	0	4	3	
Pre-requisites	Basic knowledge of Computer and Solid Geometry				

……………………………………………………………………………………………………

ENGINEERING GRAPHICS & DESIGN

Lecture - 10 hours & Lab - 60 hours

……………………………………………………………………………………………………

Traditional Engineering and Computer Graphics: **10 Lectures**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Lab modules also include concurrent teaching)

Lab Module 1: Introduction to Engineering Drawing **5 Lectures**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Lab Module 2: Orthographic Projections **5 Lectures**

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

Lab Module 3: Projections of Regular Solids **5 Lectures**

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.

Lab Module 4: and Sectional Views of Right Angular Solids **5 Lectures**

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Lab Module 5: Isometric Projections **6 Lectures**

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

Lab Module 6: Overview of Computer Graphics **8 Lectures**

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

Lab Module 7: Customization & CAD Drawing **8 Lectures**

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;

Lab Module 8: Annotations, layering & other functions **9 Lectures**

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 ommand; 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, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Lab Module 9: Demonstration of a simple team design project **9 Lectures**

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).

Suggested Text/Reference Books:

- Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engg Drawing, Charotar Pub House
- Shah, M.B. & Rana B.C. (2008), Engg Drawing & Comp. Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engg Drawing, Scitech Publishers
- Corresponding set of CAD Software Theory and User Manuals

COURSE OUTCOMES

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare you to communicate effectively
- To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice The student will learn :
- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

………