Guru Jambheshwar University of Science and Technology
Curriculum for First Year
Undergraduate Degree Courses in Engineering & Technology
(w. e. f. session 2018-19)

General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:-

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical(Lab)/week	0.5 credits 1 credit

B. Range of credits –

A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program:-

For all semesters

S. No.	Category	Suggested Breakup of Credits(Total 160)
1	Humanities and Social Sciences including Management courses	12*
2	Basic Science courses	25*
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24*
4	Professional core courses	48*
5	Professional Elective courses relevant to chosen specialization/branch	18*
6	Open subjects – Electives from other technical and /or emerging subjects	18*
7	Project work, seminar and internship in industry or elsewhere	15*
8	Mandatory Courses [Induction training, Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160*

**Minor variation is allowed as per need of the respective disciplines.*

For First year

S. No.	Category	Credits
1	Humanities and Social Sciences courses	03
2	Basic Science courses	19
3	Engineering Science courses	16
4	Mandatory Courses	00
	Total	38

D. Credit distribution in the First year of Undergraduate Engineering Program:

	Lecture (L)	**Tutorial (T)**	**Laboratory/Practical (P)**	**Total credits (C)**
Physics	3	1	3	5.5
Chemistry	3	1	3	5.5
Maths-I	3	1	0	4
Maths -II	3	1	0	4
Programming for Problem solving	3	0	4	5
English	2	0	2	3
Engineering Graphics & Design	1	0	4	3
Workshop/Manufacturing Practices	1	0	4	3
Basic Electrical Engg.	3	1	2	5
Total				38

E. Course code and definition:-

Course code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
C	credits
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
MC	Mandatory courses

F. Category of Courses:-

BASIC SCIENCE COURSES

(FIRST YEAR)

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
2	BSC101	Physics	3	1	3	5.5
1	BSC102	Chemistry	3	1	3	5.5
3	BSC103/105	Maths –I	3	1	0	4
4	BSC104/106	Maths –II	3	1	0	4

ENGINEERING SCIENCE COURSES

(FIRST YEAR)

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	ESC101	Basic Electrical Engineering	3	1	2	5
2	ESC102	Engineering Graphics & Design	1	0	4	3
3	ESC103	Programming for Problem Solving	3	0	4	5
4	ESC104	Workshop/Manufacturing Practices	1	0	4	3

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

(FIRST YEAR)

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	HSMC101	English	2	0	2	3

MANDATORY COURSES

(FIRST YEAR)

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	MC 101	Induction Training	3 weeks			0.0
2	MC102	Environmental Sciences	3	0	0	0.0
3	MC103	Indian Constitution	3	0	0	0.0

G. Structure of curriculum

Mandatory Induction Training

(3 weeks duration)

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

Scheme (First year): Common to all branches of UG Engineering & Technology

Semester I

Sr. No.	Category	Course Code		Course Title	Hours per week			Course Credits		
		Theory	Practical		L	T	P	Theory	Practical	Total
1	Basic Science Courses	BSC101(I)-T BSC101(IV)-T	BSC101(I)-P BSC101(IV)-P	Physics: Introduction to Electromagnetic Theory (Group A: Mechanical Engineering, Agricultural Engineering, Aeronautical Engineering, Automobile Engineering) Physics: Oscillation, Waves and Optics (Group A : Electrical Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Printing Technology, Packaging Technology) OR	3	1	3	4.0	1.5	5.5
		BSC 102-T	BSC 102-P	Chemistry (Group B)	3	1	3	4.0	1.5	
2	Basic Science Courses	BSC103-T BSC105-T	---	Maths –I Maths –I (CSE/IT)	3	1	0	4.0	--	4.0
3	Engineering Science Courses	ESC101-T	ESC101-P	Basic Electrical Engineering (Group A) OR	3	1	2	4.0	1.0	5.0
		ESC103-T	ESC103-P	Programming for Problem Solving (Group B)	3	0	4	3.0	2.0	
4	Engineering Science Courses	ESC104-T	ESC104-P	Workshop/Manufacturing Practices (Group A) OR	1	0	4	1.0	2.0	3.0
		---	ESC102-P	Engineering Graphics & Design (Group B)	1	0	4	--	3.0	
5	Mandatory Courses	MC 101		Induction Training (Group A & B)	3 weeks			--	--	0.0
Total										17.5

Semester II

Sr. No.	Category	Course Code		Course Title	Hours per week			Course Credits		
		Theory	Practical		L	T	P	Theory	Practical	Total
1	Basic Science Courses	BSC101(II)-T BSC101(V)-T	BSC101(II)-P BSC101(V)-P	Physics: Introduction to Mechanics (Group B: Civil Engineering, Food Technology) Physics: Semiconductor Physics (Group B: Computer Science and Engineering, Information Technology) OR	3	1	3	4.0	1.5	5.5
		BSC 102 -T	BSC 102 -P	Chemistry (Group A)	3	1	3	4.0	1.5	
2	Basic Science Courses	BSC104-T BSC106-T	---	Maths –II Maths –II (CSE/IT)	3	1	0	4.0	--	4.0
3	Engineering Science Courses	ESC101 -T	ESC101 -P	Basic Electrical Engineering (Group B) OR	3	1	2	4.0	1.0	5.0
		ESC103 -T	ESC103 -P	Programming for Problem Solving (Group A)	3	0	4	3.0	2.0	
4	Engineering Science Courses	ESC104-T	ESC104-P	Workshop/Manufacturing Practices (Group B) OR	1	0	4	1.0	2.0	3.0
		---	ESC102-P	Engineering Graphics & Design (Group A)	1	0	4	--	3.0	
5	Humanities & Social Sciences and Management Courses	HSMC101-T	HSMC101-P	English (Group A & B)	2	0	2	2.0	1.0	3.0
6	Mandatory Courses	MC102-T	---	Environmental Sciences (Group A) OR	3	0	0	0.0	--	0.0
		MC103-T	---	Indian Constitution (Group B)	3	0	0	0.0	--	
Total										20.5

Group	Disciplines
A	• Electronics and Communication Engineering • Electrical Engineering • Electrical and Electronics Engineering • Printing Technology • Packaging Technology • Printing and Packaging Technology • Mechanical Engineering • Agricultural Engineering • Aeronautical Engineering • Automobile Engineering
B	• Computer Science and Engineering • Information Technology • Biomedical Engineering • Food Technology • Civil Engineering

Note:

1. *The following disciplines have been shifted **from Group B to Group A** w.e.f. session 2018-19*
   - *Electrical Engineering*
   - *Electrical and Electronics Engineering*
2. *The following mandatory courses (non-credit) will be offered in semesters as shown below :*

Induction Training	*1st Semester (Group A & Group B)*
Environmental Sciences	*2nd Semester (Group A)* *3rd Semester (Group B)*
Indian Constitution	*2nd Semester (Group B)* *3rd Semester (Group A)*
Essence of Indian Traditional Knowledge	*4th Semester (Group A)* *5th Semester (Group B)*

Curriculum Contents (First year)

Course code		BSC102
Category		Basic Science Course
Course title		**Chemistry (Theory & Lab.)** **Contents** (i) Chemistry (Concepts in chemistry for engineering) (ii) Chemistry Laboratory
Scheme and Credits		**L: 3; T: 1; P: 3; Credits: 5.5**
Pre-requisites (if any)		-
Course Assessment Methods (Internal: 30; External: 70)	**Theory**	Internal Examination: • Two minor tests each of 20 marks • Class Performance measured through percentage of lectures attended (4 marks) • Assignments, quiz etc. (6 marks) End semester examination: • Nine questions are to be set by the examiner. • Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. • Rest of the eight questions is to be set with a fair weightage of all the units. • All questions will carry equal marks. • The Students will be required to attempt 05 questions in all.
Course Assessment Methods (Internal: 30; External: 70)	**Lab.**	• Internal practical evaluation is to be done by the course coordinator. • The end semester practical examination will be conducted jointly by external and internal examiners.

(i)Chemistry (Concepts in chemistry for engineering) [L : 3; T:1; P : 0 (4 credits)]

Detailed contents

(i) Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and

its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibrium (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

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

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan
(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
(iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The

course will enable the student to:

- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

(ii)Chemistry Laboratory [L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

Laboratory Outcomes

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

<table>
<tr><td colspan="2">Course code</td><td colspan="5">BSC101</td></tr>
<tr><td colspan="2">Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td colspan="2">Course title</td><td colspan="5">Physics (Theory & Lab.)</td></tr>
<tr><td colspan="2" rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td>3</td><td>1</td><td>3</td><td>5.5</td></tr>
<tr><td colspan="2"></td><td colspan="5"><u>Course contents in Physics</u>

BSC101(I)
Introduction to Electromagnetic Theory
(for Mechanical Engineering, Agricultural Engineering, Aeronautical Engineering, Automobile Engineering)

BSC101(II)
Introduction to Mechanics
(for Civil Engineering, Food Technology)

BSC101(III)
Introduction to Quantum Mechanics for Engineers

BSC101(IV)
Oscillation, Waves and Optics
(for Electrical Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Printing Technology, Packaging Technology)

BSC101(V)
Semiconductor Physics
(for Commuter Science and Engineering, Information Technology)</td></tr>
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• Two minor tests each of 20 marks
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• Nine questions are to be set by the examiner.
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BSC101(I) Introduction to Electromagnetic Theory[L : 3; T:1; P : 0 (4 credits)]

Pre-requisites (if any)	Mathematics course with vector calculus

Detailed contents:

Module 1: Electrostatics in vacuum (8 lectures)

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Farady's cage and coffee-ring effect; 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: Magnetostatics (6 lectures)

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Module 4: Magnetostatics in a linear magnetic medium (3 lectures)

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

Module 5: Faraday's law (4 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.

Module 6: Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations (5 lectures)

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 quasi-static approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.

Module 7: 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 and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Suggested Text Books

(i) David Griffiths, Introduction to Electrodynamics

Suggested Reference Books:

(i) Halliday and Resnick, Physics
(ii) W. Saslow, Electricity, magnetism and light

Course Outcomes

- Solve and formulate various problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media with simple geometries using separation of variables and the method of images.
- derive expressions for the energy both for the electrostatic and magnetostatic fields, and derive Poyntings theorem from Maxwells equations and interpret the terms in the theorem physically
- Describe and make calculations of plane electromagnetic waves in homogeneous media, including reflection of such waves in plane boundaries between homogeneous media.

❖ **Laboratory - Introduction to Electromagnetic Theory[L : 0; T:0 ; P : 3 (1.5 credits)]**

Choice of experiments

- LC circuit and LCR circuit;
- Resonance phenomena in LCR circuits
- Magnetic field from Helmholtz coil
- Measurement of Lorentz force in a vacuum tube
- To determine the Wavelength of a given laser by Diffraction Grating.
- To find the frequency of A.C. mains by using sonometer.
- To find the low resistance by carey - Foster's bridge.
- To study the characteristics of a solar cell.
- To find the value of e/m for electrons by Helical method.
- To find the value of co-efficient of self-inductance by using a Rayleigh bridge.
- To find the value of Hall Co-efficient of semi-conductor.
- To study the V-I characteristics of a p-n diode.
- To find the band gap of intrinsic semi-conductor using four probe method.
- To calculate the hysteresis loss by tracing a B-H curve.
- Electron Spin Resonance Spectrometer

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BSC101(II) Introduction to Mechanics[L : 3; T:1; P : 0 (4 credits)]

Pre-requisites (if any)	High-school education

Detailed contents:

Module 1: (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; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates

Module 2: (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; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite manoeuvres;

Module 3: (5 lectures)

Non-inertial frames of reference; Rotating coordinate system: Five-term acceleration formula. Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum;

Module 4: (6 lectures)

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

Module 5: (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; Examples.

Module 6: (7 lectures)

Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional 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 wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.

Suggested Reference Books

(i) Engineering Mechanics, 2nd ed. — MK Harbola
(ii) Introduction to Mechanics — MK Verma
(iii) An Introduction to Mechanics — D Kleppner & R Kolenkow
(iv) Principles of Mechanics — JL Synge & BA Griffiths
(v) Mechanics — JP Den Hartog
(vi) Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
(vii) Mechanical Vibrations — JP Den Hartog
(viii) Theory of Vibrations with Applications — WT Thomson

Course Outcomes

- Know about Forces in nature and constraints. Afterwards they would be able to solve simple mechanics problems related to laws of motion and co-ordination system.
- Derive expression for potential energy, central forces and harmonic oscillator (Damped and Un-damped) along with idea of planetary motion given by Kepler.
- Describe rigid body motion in one dimension to three dimensions with various examples of rigid body motion as well as numerical problem related to rigid body rotation.

❖ **Laboratory - Introduction to Mechanics [L : 0; T:0 ; P : 3 (1.5 credits)]**

Choice of experiments

- Experiments on an air-track;
- Experiment on moment of inertia measurement,
- Experiments with gyroscope;
- Resonance phenomena in mechanical oscillators.
- To find the wavelength of sodium light by Newton' ring
- To determine the specific rotation of a cane sugar solution with the help of Polarimeter.
- To determine the height of an Object/Line with the help of a sextant..
- To study the moment of inertia of fly wheel
- To find the frequency of A.C. mains by using sonometer.
- To study the characteristics of a solar cell
- To study the characteristics of (Cu-Fe, Cu-Constant) thermo couple.
- To study the V-I characteristics of a p-n diode.
- To calculate the hysteresis loss by tracing a B-H curve.
- Measurement of Susceptibility of Solids by Gouy's Method
- To Determine the Variation of Magnetic Field Along the Axis of a Circular Coil Carrying Current and Calculate the Radius of the coil.
- To Study The Gaussian Beam Pattern Spot Size and The Angle of Divergence of Laser Beam.

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BSC101(III) Introduction to Quantum Mechanics for Engineers [L : 3; T:1; P : 0 (4 credits)]

Pre-requisites (if any)	Mathematics course on differential equations and linear algebra

Detailed contents :

Module 1: Wave nature of particles and the Schrodinger equation (8 lectures)

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

Module 2: Mathematical Preliminaries for quantum mechanics (4 lectures)

Complex numbers, Linear vector spaces, inner product, operators, eigenvalue problems, Hermitian operators, Hermite polynomials, Legendre's equation, spherical harmonics.

Module 3: Applying the Schrodinger equation (15 lectures)

Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator.Numerical solution of stationary-state Schrodinger equation for one dimensional problems for different potentials Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope

Three-dimensional problems: particle in three dimensional box and related examples, Angular momentum operator, Rigid Rotor, Hydrogen atom ground-state, orbitals, interaction with magnetic field, spin Numerical solution stationary-state radial Schrodinger equation for spherically symmetric potentials.

Module 4: Introduction to molecular bonding (4 lectures)

Particle in double delta-function potential, Molecules (hydrogen molecule, valence bond and molecular orbitals picture), singlet/triplet states, chemical bonding, hybridization

Module 5: Introduction to solids (7 lectures)

Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands

Numerical solution for energy in one-dimensional periodic lattice by mixing plane waves.

Suggested Text Books

(ii) Eisberg and Resnick, Introduction to Quantum Physics

Suggested Reference Books

(i) D. J. Griffiths, Quantum mechanics
(ii) Richard Robinett, Quantum Mechanics
(iii) Daniel McQuarrie, Quantum Chemistry

Course Outcomes

- Develop an informed appreciation of the paradigm shift already in evidence in technologies behind modern services and products
- solve one-dimensional problems involving transmission, reflection and tunnelling of quantum probability amplitudes;
- demonstrate an understanding of the significance of operators and eigenvalue problems in quantum mechanics
- Pursue PG courses, research programs and industrial R & D programs in nanotechnologies
- Pursue simulation and modeling of systems encountered in nanotechnologies having basic knowledge of physics.

❖ **Laboratory - Introduction to Quantum Mechanics for Engineers [L : 0; T:0 ; P : 3 (1.5 credits)]**

Choice of experiments

- To find the value of Plank's constant by using a photoelectric cell.
- To determine the Wavelength of a given laser by Diffraction Grating.
- To study the Photoelectric effect
- Study of Zener Diode characteristics
- Dispersive Power of Material of Prism
- Atomic Spectra of Two Electron Systems
- To study the characteristics of a solar cell
- To find the value of e/m for electrons by Helical method.
- To find the ionisation potential of Argon/Mercury using a thyratron tube.
- To find the value of Hall Co-efficient of semi-conductor.
- To study the V-I characteristics of a p-n diode.
- To study two probe method.
- Electron spin Resonance
- To find the band gap of intrinsic semi-conductor using four probe method.
- To find the ionisation potential of Argon/Mercury using a thyratron tube.
- Measurement of Lande 'g' factor by Electron Spin Resonance Spectrometer

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BSC101(IV) Oscillations, waves and optics[L : 3; T:1; P : 0 (4 credits)]

Pre-requisites (if any)	(i) Mathematics course on Differential equations (ii) Introduction to Electromagnetic theory

Detailed contents:

Module 1: Simple harmonic motion, damped and forced simple harmonic oscillator (7 lectures)

Mechanical and electrical simple harmonic oscillators, complex number notation and 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, power absorbed by oscillator.

Module 2: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion (7 lectures)

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 and Fourier method, wave groups and group velocity.

Module 3: The propagation of light and geometric optics (10 lectures)

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method

Module 4: Wave optics (6 lectures)

Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer.

Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power

Module 5: Lasers (8)

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers(ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

(i) Ian G. Main, Oscillations and waves in physics
(ii) H.J. Pain, The physics of vibrations and waves
(iii)E. Hecht, Optics
(iv)A. Ghatak, Optics
(v)O. Svelto, Principles of Lasers

Course Outcomes

- Analyse oscillations and waves mathematically.
- Solve simple problems of geometric optics.
- Predict diffraction and interference patterns.
- Operate small telescopes and record images.
- Different type of laser and lasing action with application of laser in various fields

❖ **Laboratory - Oscillations, waves and optics [L : 0; T:0 ; P : 3 (1.5 credits)]**

Choice of experiments

- To find the wavelength of sodium light by Newton' ring
- To find the resolving power of telescope.
- Find the velocity of ultrasonic waves in non-conducting medium by piezo-electric method.
- To study the moment of inertia of fly wheel
- Bending of beam by Koening method
- Maxwell Needle Apparatus
- Strokes law experiment
- Electron Spin Resonance Spectrometer.
- Finding frequency of A.C. mains by using sonometer
- To determine the specific rotation of a cane sugar solution with the help of Polarimeter
- To determine the wave length of He-Ne Laser with the help of a single slit.
- To determine the Wavelength of a given laser by Diffraction Grating.
- To Study The Gaussian Beam Pattern Spot Size and The Angle of Divergence of Laser Beam
- To Study Faraday Effect and Calculate the Verdict Constant of given sample.
- Measurement of Dependence of Hall Coefficient on Temperatures

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BSC101(V) Semiconductor Physics [L : 3; T:1; P : 0 (4 credits)]

Pre-requisites (if any)	Introduction to Quantum Mechanics

Module 1: Electronic materials **(8)**
Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

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

Module 3: Light-semiconductor interaction **(6)**
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, Exciton, Drude model.

Module 4: Measurements **(6)**
Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.

Module 5: Engineered semiconductor materials **(6)**
Density of states in 2D, 1d and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Heterojunctions and associated band-diagrams

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

❖ **Laboratory - Semiconductor Physics [L : 0; T:0 ; P : 3 (1.5 credits)]**
Choice of experiments

- To find the value of Plank's constant by using a photoelectric cell.
- To determine the Wavelength of a given laser by Diffraction Grating.
- Two Probe Method for Measurement of Resistivity of Insulators at Different Temperatures.
- Measurement of Susceptibility of Solids by Gouy's Method
- To compare the capacitances of two capacitors by De'sauty bridge and hence to find the dielectric constant of a medium.
- To find the frequency of A.C. mains by using sonometer.
- To find the low resistance by carey - Foster's bridge.
- To study the characteristics of a solar cell.
- To find the value of Hall Co-efficient of a semi-conductor.
- To study the V-I characteristics of a p-n diode.
- To find the band gap of intrinsic semi-conductor using four probe method.
- To calculate the hysteresis loss by tracing a B-H curve.
- Measurement of Magnetoresistance of Semiconductors
- Study of Dielectric Constant and Curie Temperature of Ferroelectric Ceramic.
- To Determine the Variation of Magnetic Field Along the Axis of a Circular Coil Carrying Current and Calculate the Radius of the coil.
- To Study The Gaussian Beam Pattern Spot Size and The Angle of Divergence of Laser Beam
- To Study Faraday Effect and Calculate the Verdict Constant of given sample

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Course code	BSC103				
Category	Basic Science Course				
Course title	**Maths -I**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	
Pre-requisites (if any)	-				
Course Assessment Methods (Internal: 30; External: 70)	Internal examination: • Two minor tests each of 20 marks • Class Performance measured through percentage of lectures attended (4 marks) • Assignments, quiz etc. (6 marks) End semester examination: • Nine questions are to be set by the examiner. • Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. • Rest of the eight questions is to be set with a fair weightage of all the units. • All questions will carry equal marks. • The Students will be required to attempt 05 questions in all.				

(i)Calculus and Linear Algebra

Detailed contents:

Module 1: Calculus: (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: (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; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Suggested Text/Reference Books

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

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.

The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

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Course code	**BSC104**				
Category	**Basic Science Course**				
Course title	**Maths-II** **(Calculus, Ordinary Differential Equations and Complex Variable)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	
Pre-requisites (if any)	-				
Course Assessment Methods (Internal: 30; External: 70)	Internal examination: • Two minor tests each of 20 marks • Class Performance measured through percentage of lectures attended (4 marks) • Assignments, quiz etc. (6 marks) End semester examination: • Nine questions are to be set by the examiner. • Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. • Rest of the eight questions is to be set with a fair weightage of all the units. • All questions will carry equal marks. • The Students will be required to attempt 05 questions in all.				

Calculus, Ordinary Differential Equations and Complex Variable

Detailed contents

Module 1: Multivariable Calculus (Integration): (10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2: First order ordinary differential equations: (6 lectures)

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

Module 3: Ordinary differential equations of higher orders: (8 lectures)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding

harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(iii) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

(iv) S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

(v) E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

(vi) E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

(vii) J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

(viii) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(ix) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

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Course code	**BSC105**				
Category	**Basic Science Course**				
Course title	**Maths-I (for Computer Science & Engg. /Information Technology students)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	
Pre-requisites (if any)	-				
Course Assessment Methods (Internal: 30; External: 70)	Internal examination: • Two minor tests each of 20 marks • Class Performance measured through percentage of lectures attended (4 marks) • Assignments, quiz etc. (6 marks) End semester examination: • Nine questions are to be set by the examiner. • Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. • Rest of the eight questions is to be set with a fair weightage of all the units. • All questions will carry equal marks. • The Students will be required to attempt 05 questions in all.				

Paper-I Calculus and Linear Algebra

Detailed contents :

Module 1: Calculus: (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: (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 (in case vector spaces is to be taught) (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 (Prerequisite Module 3-Matrices) (10 hours)

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 (Prerequisite Module 3 –Matrices & Module-4 Vector spaces) (10 lectures)

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

(ii) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(iii) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

(iv) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

(v) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

(vi) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

(vii) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

(viii) 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 basic calculus 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.

The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.
- The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

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Course code	**BSC106**				
Category	**Basic Science Course**				
Course title	**Maths-II (for Computer Science & Engg./Information Technology Students)** **Probability and Statistics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	
Pre-requisites (if any)	-				
Course Assessment Methods (Internal: 30; External: 70)	Internal examination: • Two minor tests each of 20 marks • Class Performance measured through percentage of lectures attended (4 marks) • Assignments, quiz etc. (6 marks) End semester examination: • Nine questions are to be set by the examiner. • Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. • Rest of the eight questions is to be set with a fair weightage of all the units. • All questions will carry equal marks. • The Students will be required to attempt 05 questions in all.				

Paper -II: Probability and Statistics

Detailed contents

Module 1: Basic Probability: *(12 lectures)*
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions: *(4 lectures)*
Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module 3: Bivariate Distributions: *(4 lectures)*
Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4: Basic Statistics: (8 lectures)
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Module 5: Applied Statistics: (8 lectures)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Module 6: Small samples: (4 lectures)

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).

(iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

(vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Course Outcomes

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

The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The basic ideas of statistics including measures of central tendency, correlation and regression.
- The statistical methods of studying data samples.

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<table>
<tr><td colspan="2">Course code</td><td colspan="5">ESC103</td></tr>
<tr><td colspan="2">Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td colspan="2">Course title</td><td colspan="5">Programming for Problem Solving (Theory & Lab.)</td></tr>
<tr><td colspan="2" rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">The lab component should have one hour of tutorial followed or preceded by laboratory assignments.</td></tr>
<tr><td>3</td><td>0</td><td>4</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisites (if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Assessment Methods (Internal: 30; External: 70)</td><td>Theory</td><td colspan="5">Internal Examination:
Two minor tests each of 20 marks
Class Performance measured through percentage of lectures attended (4 marks)
Assignments, quiz etc. (6 marks)
End semester examination:
Nine questions are to be set by the examiner.
Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions.
Rest of the eight questions is to be set with a fair weightage of all the units.
All questions will carry equal marks.
The Students will be required to attempt 05 questions in all.</td></tr>
<tr><td>Course Assessment Methods (Internal: 30; External: 70)</td><td>Lab.</td><td colspan="5">Internal practical evaluation is to be done by the course coordinator.
The end semester practical examination will be conducted jointly by external and internal examiners.</td></tr>
</table>

(i)Programming for Problem Solving **([L : 3; T:0; P : 0 (3 credits)] [contact hrs : 40]**

Detailed contents

Unit 1

Introduction to Programming **(4 lectures)**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2

Arithmetic expressions and precedence **(2 lectures)**

Conditional Branching and Loops **(6 lectures)**

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 3
Arrays **(6 lectures)**
Arrays (1-D, 2-D), Character arrays and Strings

Unit 4
Basic Algorithms **(6 lectures)**
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5
Function **(5 lectures)**
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6
Recursion **(4 -5 lectures)**
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7
Structure **(4 lectures)**
Structures, Defining structures and Array of Structures

Unit 8
Pointers **(2 lectures)**
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9
File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.

- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

(ii) Laboratory - Programming for Problem Solving [L : 0; T:0 ; P : 4 (2credits)]

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self referential structures.
- To be able to create, read and write to and from simple text files.

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Course code	**HSMC 101**				
Category	**Humanities and Social Sciences including Management courses**				
Course title	**English**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	2	**0**	**2**	**3**	
Pre-requisites (if any)	**-**				
Course Assessment Methods (Internal: 30; External: 70)	**Internal examination:** • **Two minor tests each of 20 marks** • **Class Performance measured through percentage of lectures attended (4 marks)** • **Assignments, quiz etc. (6 marks)** **End semester examination:** • **Nine questions are to be set by the examiner.** • **Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions.** • **Rest of the eight questions is to be set with a fair weightage of all the units.** • **All questions will carry equal marks.** • **The Students will be required to attempt 05 questions in all.**				

English **([L : 2; T:0; P : 2 (3 credits)]**

Detailed contents

1. Vocabulary Building

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence
Organizing principles of paragraphs in documents
Techniques for writing precisely

3. Identifying Common Errors in Writing

Subject-verb agreement
Noun-pronoun agreement
Misplaced modifiers
Articles
Prepositions

Redundancies
Clichés

4. Nature and Style of sensible Writing

Describing
Defining
Classifying
Providing examples or evidence
Writing introduction and conclusion

5. Writing Practices

Comprehension
Précis Writing
Essay Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007
(iii)*On Writing Well.* William Zinsser. Harper Resource Book. 2001
(iv)*Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
(vi)*Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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Course code		**ESC 102**				
Category		**Engineering Science Courses**				
Course title		**Engineering Graphics & Design (Lab.)**				
Scheme and Credits		**L**	**T**	**P**	**Credits**	***Only end semester practical examination will be conducted for this course.***
		1	**0**	**4**	**3**	
Pre-requisites (if any)		**-**				
Course Assessment Methods (Internal: 30; External: 70)	**Lab.**	• **Internal practical evaluation is to be done by the course coordinator.** • **The end semester practical examination will be conducted jointly by external and internal examiners by taking viva-voce and written Examination on drawing sheet. Question paper for written examination will be based on the entire syllabus and to be set by external and internal examiners both.**				

Engineering Graphics & Design [A total of 10 lecture hours & 60 hours of lab.]

[[L : 1; T:0; P : 4 (3 credits)]

Detailed contents

Traditional Engineering Graphics:

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.

Computer Graphics:

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

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering,

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;

Module 2: Orthographic Projections covering,

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

Module 3: Projections of Regular Solids 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.

Module 4:Sections and Sectional Views of Right Angular Solids covering,
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections **covering,**
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering,
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customization & CAD Drawing
Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, 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;

Module 9: 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).

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

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

(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

(v) (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 modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

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<table>
<tr><td colspan="2">Course code</td><td colspan="5">ESC 104</td></tr>
<tr><td colspan="2">Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td colspan="2">Course title</td><td colspan="5">Workshop/Manufacturing Practices (Theory & Lab.)</td></tr>
<tr><td colspan="2" rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td>1</td><td>0</td><td>4</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisites (if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Assessment Methods (Internal: 30; External: 70)</td><td>Theory</td><td colspan="5">Internal Examination:
Two minor tests each of 20 marks
Class Performance measured through percentage of lectures attended (4 marks)
Assignments, quiz etc. (6 marks)
End semester examination:
Nine questions are to be set by the examiner.
Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions.
Rest of the eight questions is to be set with a fair weightage of all the units.
All questions will carry equal marks.
The Students will be required to attempt 05 questions in all.</td></tr>
<tr><td>Course Assessment Methods (Internal: 30; External: 70)</td><td>Lab.</td><td colspan="5">Internal practical evaluation is to be done by the course coordinator.
The end semester practical examination will be conducted jointly by external and internal examiners.
01 hour of the lab will be for delivering course contents through lectures & videos</td></tr>
</table>

Workshop/Manufacturing Practices **[L : 1; T:0; P : 0 (1 credit)]**

Detailed contents

1. Manufacturing Methods:

Manufacturing Processes: Primary Shaping processes, Machining processes, Joining Processes, Surface finishing Processes, Processes effecting change in properties.

Casting: Introduction, Basic steps in moulding and casting, Pattern and its types, Pattern allowances, runner, riser, gates, function of core, moulding sand and its constituents.

Forming: Punching, blanking, piercing, forging, hot rolling and cold rolling, extrusion.

Machining: Principle of machining,Lathe, Parts of a lathe machine and operations of Lathe machine, Shaper machine, Drilling machine, Milling machine.

Joining:Introduction, welding, soldering, brazing, sintering, adhesive bonding, riveting.

Advanced Manufacturing Methods: Introduction to Wire-cut Electric discharge machining (WEDM), Ultrasonic machining (USM) and Laser Beam machining (LBM).

2. CNC machining, Additive manufacturing:

Introduction to CNC machining and Additive manufacturing, their types and applications.

3. Fitting operations &power tools:

Clamping tools, Gauges and cutting tools, Introduction to power tools.

4. Electrical and Electronics:

Introduction toElectrical and Electronics

5. Carpentry:

Types of wood, seasoning of wood and defects in wood.

6. Plastic Moulding, Glass cutting:

Introduction and classification of Plastic moulding: Injection moulding and Blow moulding, Glass cutting.

7. Metal Casting:

Cupola furnace, casting defects, testing of castings.

8. Welding (arc welding & gas welding), Brazing:

Resistance welding and its principle, Spot welding, Seam welding, Butt-welding, Projection welding, Arc welding and its principle, Metal arc welding, Carbon arc welding, Submerged arc welding, MIG welding, TIG welding, function of flux, Gas welding, types of flames, Brazing.

Suggested Text/Reference Books:

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

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

(ii) Workshop Practice:(60 hours) [L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics**(8 hours)**
5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic moulding & Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more

of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

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<table>
<tr><td colspan="2">Course code</td><td colspan="5">ESC 101</td></tr>
<tr><td colspan="2">Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td colspan="2">Course title</td><td colspan="5">Basic Electrical Engineering (Theory & Lab.)</td></tr>
<tr><td colspan="2" rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td>3</td><td>1</td><td>2</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisites (if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Assessment Methods (Internal: 30; External: 70)</td><td>Theory</td><td colspan="5">Internal Examination:
Two minor tests each of 20 marks
Class Performance measured through percentage of lectures attended (4 marks)
Assignments, quiz etc. (6 marks)
End semester examination:
Nine questions are to be set by the examiner.
Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions.
Rest of the eight questions is to be set with a fair weightage of all the units.
All questions will carry equal marks.
The Students will be required to attempt 05 questions in all.</td></tr>
<tr><td>Course Assessment Methods (Internal: 30; External: 70)</td><td>Lab.</td><td colspan="5">Internal practical evaluation is to be done by the course coordinator.
The end semester practical examination will be conducted jointly by external and internal examiners.</td></tr>
</table>

(i)Basic Electrical Engineering [L : 3; T:1; P : 0 (4 credits)]

Detailed contents :

Module 1 : DC Circuits (8 hours)

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 (8 hours)

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 hours)

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 hours)

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 hours)

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

Module 6: Electrical Installations (6 hours)

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

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(iii) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.
(iv)E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(v) 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

(ii)Basic Electrical Engineering Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

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	**MC102**				
Category	**Mandatory Courses**				
Course title	**Environmental Sciences**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	**0**	**0.0**	
Pre-requisites (if any)	-				
Course Assessment Methods (Internal: 30; External: 70)	**Internal examination:** • **Two minor tests each of 20 marks** • **Class Performance measured through percentage of lectures attended (4 marks)** • **Assignments, quiz etc. (6 marks)** **End semester examination:** • **Nine questions are to be set by the examiner.** • **Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions.** • **Rest of the eight questions is to be set with a fair weightage of all the units.** • **All questions will carry equal marks.** • **The Students will be required to attempt 05 questions in all.**				

Course Outcomes

1. Students will be able to enhance and analyze human impacts on the environment.
2. Integrate concepts & methods from multiple discipline and apply to environmental problems.
3. Design and evaluate strategic terminologies and methods for subs table management of environmental systems.
4. Field studies would provide students first-hand knowledge on various local environment aspects which forms an irreplaceable tool in the entire learning process.

Course Contents

UNIT-I

Multidisciplinary nature of Environmental studies: Definition, scope and importance, need for public awareness; Concept, Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem ,Ecological succession ,Food chains, Food webs and ecological pyramids; Introduction, types, characteristics features, structure and function of Forest ecosystem, Grassland ecosystem ,Desert ecosystem, Aquatic ecosystem (Ponds, Stream, lakes, rivers, oceans, estuaries); Biodiversity: Introduction, Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values; Biodiversity at global, national and local level, India as a mega-diversity nation, Hot-spot of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-II

Renewable and non-renewable resources, Natural resources and associated problems ,Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their

effects on forests and tribal people; Water resources: Use and over utilization of surface and ground water, floods, droughts conflicts over water, dams benefits and problems; Mineral resources: Use and exploitation, environmental effects of extracting and mineral resources; Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity; Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies; Land resources: Land as a resource, land degradation, main induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources, Equitable use of resources for suitable lifestyle.

UNIT-III

Definition of Environment Pollution; Causes, effects and control measures of: Air Pollution, Water Pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes effects and control measures of urban and industrial wastes; Role of and individual in prevention of pollution, Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies; different laws related to environment: Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.; Issues involved in enforcement of environmental legislation, Public awareness

UNIT-IV

Social issues and the Environment: From unsustainable to Sustainable development, Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problem and concern, case studies; Environment ethics: Issues and possible solutions; Wasteland reclamation; Consumerism and waste products; Human Population growth, variation among nation, Population explosion- Family Welfare Programme, Environment and human health , Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Books:

1. Fundamental concepts in Environmental studies by Dr. D.D. Mishra. S. Chand publications.
2. Essentials of Ecology and Environmental Science by Dr. S .V .S. Rana, PHI Learning Pvt. Ltd, Delhi
3. Environmental Chemistry by Anil Kumar De, Wiley Eastern Limited.
4. Environmental Science by T.G. Miller, Wadsworth Publishing Co, 13th edition.
5. Ecology and Environment by P. D. Sharma, Rastogi publications

Course code	**MC103**				
Category	**Mandatory Courses**				
Course title	**Indian Constitution**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	**0**	**0.0**	
Pre-requisites (if any)	**-**				
Course Assessment Methods (Internal: 30; External: 70)	**Internal examination:** • **Two minor tests each of 20 marks** • **Class Performance measured through percentage of lectures attended (4 marks)** • **Assignments, quiz etc. (6 marks)** **End semester examination:** • **Nine questions are to be set by the examiner.** • **Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions.** • **Rest of the eight questions is to be set with a fair weightage of all the units.** • **All questions will carry equal marks.** • **The Students will be required to attempt 05 questions in all.**				

Course Contents- Basic features and fundamental principles

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21