1st Year Curriculum for B.E courses in Engineering

(Applicable from the academic session 2018-2019)

University Institute of Technology
The University of Burdwan
Golapbag (North), Burdwan - 713104

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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	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.E Degree inEngineering. A student will be eligible to get B.E Degree with Honours, if he/shecompletes an additional 20 credits. These could be acquired through Massive Open OnlineCourses (MOOCs).

C. MOOCs for B.EHonours

The additional 20 credits (for obtaining B.E with Honours) are to be gained throughMOOCs. The complete description of the MOOCs relevant for the first year course are givenin Annexure-I. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in Annexure-II (Noticedt.06/12/2017) concerning Mandatory Induction Program. It may alsorefer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering &Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. E Degree

All concerned are requested to follow the guidelines in Annexure-III concerning MandatoryAdditional Requirements.

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F. Subject Numbering Scheme

Specific code for the subject category-	BSC/ESC/PCC/PEC/OEC/HSM/MCC/PROJ
Additive	'-'
Code for the Department offering the subject	CSE/ECE/IT/AEIE/CE/EE/M/PH/CH/ME/HU
S-semester and N-specific code of the subject, where N=01,02,03,04….09 for theory and where N=51,52,53,54….59 for practical.	SN
For example in BSC-PH 101/201-Introduction to Electromagnetic Theory, BSC corresponds to the subject category, PH- corresponds to code for the department offering the subject,1 and 2 at the start corresponds to semester. Whereas 01 at the end corresponds to specific code of physics.	

List of Codes for Subject Category	
Code	**Category Name**
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
HSM	Humanities and Social Sciences including Management Courses
MCC	Mandatory Courses
PROJ	Project

List of Codes for Departments	
Code	**Name of the Department**
CSE	Computer Science and Engineering
ECE	Electronics and Communication Engineering
IT	Information Technology
AEIE	Applied Electronics and Instrumentation Engineering
EE	Electrical Engineering
CE	Civil Engineering
ME	Mechanical Engineering
M	Mathematics
PH	Physics
CH	Chemistry
HU	Humanities

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1st Year Curriculum for B.E courses in Engineering & Technology

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First Year First Semester

Mandatory Induction Program- 3 weeks duration

Branch	S1.No.	Category	Code	Course Title	Hours per week			Credits
					L	T	P	
CSE, IT and CE	1	Basic Science course	BSC-PH 102, 105	Physics	3	1	0	4
			BSC-PH 152, 155	Physics Laboratory	0	0	3	1.5
	2	Basic Science course	BSC-M 101, 102	Mathematics -I	3	1	0	4
	3	Engineering Science Courses	ESC-EE 101	Basic Electrical Engineering	3	1	0	4
			ESC-EE 151	Basic Electrical Engineering Laboratory	0	0	2	1
	4	Engineering Science Courses	ESC-ME 102	Engineering Graphics & Design	1	0	0	1
			ESC-ME 152	Engineering Graphics & Design Laboratory	0	0	4	2
					Total credits			**17.5**

Branch	S1. No.	Category	Code	Course Title	Hours per week			Credits
					L	T	P	
ECE, AEIE and EE	1	Basic Science courses	BSC-CH 101	Chemistry-I	3	1	0	4
			BSC-CH 151	Chemistry-I Laboratory	0	0	3	1.5
	2	Basic Science courses	BSC-M 101	Mathematics -I	3	1	0	4
	3	Engineering Science Courses	ESC-CSE 101	Programming for Problem Solving	3	0	0	3
			ESC-CSE 151	Programming for Problem Solving Laboratory	0	0	4	2
	4	Engineering Science Courses	ESC-ME 101	Workshop/Manufacturing Theory	1	0	0	1
			ESC-ME 151	Workshop/Manufacturing Practices	0	0	4	2
	5	Humanities and Social Sciences including Management courses	HSM-HU 101	English	2	0	0	2
			HSM-HU 151	Language Laboratory	0	0	2	1
					Total credits			**20.5**

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1st Year Curriculum for B.E courses in Engineering

(Applicable from the academic session 2018-2019)

First Year Second Semester

Branch	Sl. No.	Category	Code	Course Title	Hours per week			Credits
					L	T	P	
CSE, IT and CE	1	Basic Science Courses	BSC-CH 202	Chemistry-I	3	1	0	4
			BSC-CH 252	Chemistry-I Laboratory	0	0	3	1.5
	2	Basic Science Courses	BSC-M 201,202	Mathematics -II	3	1	0	4
	3	Engineering Science Courses	ESC-CSE 201	Programming for Problem Solving	3	0	0	3
			ESC-CSE 251	Programming for Problem Solving Laboratory	0	0	4	2
	4	Engineering Science Courses	ESC-ME 201	Workshop/Manufacturing Theory	1	0	0	1
			ESC-ME 251	Workshop/Manufacturing Practices	0	0	4	2
	5	Humanities and Social Sciences including Management courses	HSM-HU 201	English	2	0	0	2
			HSM-HU 251	Language Laboratory	0	0	2	1
					Total credits			**20.5**

Branch	Sl. No.	Category	Code	Course Title	Hours per week			Credits
					L	T	P	
ECE, AEIE and EE	1	Basic Science course	BSC-PH 203,204,205	Physics	3	1	0	4
			BSC-PH 253,254,255	Physics Laboratory	0	0	3	1.5
	2	Basic Science course	BSC-M 201, 202	Mathematics -II	3	1	0	4
	3	Engineering Science Courses	ESC-EE 201	Basic Electrical Engineering	3	1	0	4
			ESC-EE 251	Basic Electrical Engineering Laboratory	0	0	2	1
	4	Engineering Science Courses	ESC-ME 202	Engineering Graphics & Design	1	0	0	1
			ESC-ME 252	Engineering Graphics & Design Laboratory	0	0	4	2
					Total credits			**17.5**

Mandatory Induction program

(Please refer **Appendix-A** for guidelines. Details of Induction program also available in the curriculum of Mandatory courses.)

[Induction program for students to be offered right at the start of the first year.]

3 weeks duration
Physical activity
Creative Arts
Universal Human Values
Literary
Proficiency Modules
Lectures by Eminent People
Visits to localAreas
Familiarization to Dept./Branch & Innovations

Undergraduate Degree courses

Course code	BSC-CH 101/ 202, 151/252				
Category	Basic Science Course				
Course title	**Chemistry-I (Theory & Lab.)** **Contents** (i) Chemistry-I (Concepts in chemistry for engineering) (ii) Chemistry Laboratory				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –II
	3	**1**	**3**	**5.5**	
Pre-requisites (if any)	**-**				

(i)Chemistry-I (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 multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. 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 equilibria (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

University chemistry, by B. H. Mahan

Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
Fundamentals of Molecular Spectroscopy, by C. N. Banwell

Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Physical Chemistry, by P. W. Atkins

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:

Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

Rationalise 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

Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

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

Course code	BSC-PH 101/201, 102/202, 103/203, 104/204, 105/205				
Category	Basic Science Course				
Course title	**Physics (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I
	3	**1**	**3**	**5.5**	
	Course contents in Physics(Any one) (i) Introduction to Electromagnetic Theory (ii) Introduction to Mechanics (iii) Quantum Mechanics for Engineers (iv) Oscillation, Waves and Optics (v) Semiconductor Physics				

(i)Introduction to Electromagnetic Theory (BSC-PH 101/201)

[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 ferromagnetic, 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:

Halliday and Resnick, Physics
W. Saslow, Electricity, magnetism and light

Course Outcomes

To be uploaded

Laboratory - Introduction to Electromagnetic Theory[L: 0; T:0 ; P : 3 (1.5 credits)] Choice of 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.

(ii)Introduction to Mechanics (BSC-PH 102/202)

[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 withcenter 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

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

Course Outcomes

To be uploaded

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

Suggested list of experiments from the following:
Coupled oscillators;
Experiments on an air-track;
Experiment on moment of inertia measurement,
Experiments with gyroscope;
Resonance phenomena in mechanical oscillators.

(iii) Quantum Mechanics for Engineers (BSC-PH 103/203)[L : 3; T:1; P : 0 (4 credits)]

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

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

Eisberg and Resnick, Introduction to Quantum Physics

Suggested Reference Books

D. J. Griffiths, Quantum mechanics
Richard Robinett, Quantum Mechanics
Daniel McQuarrie, Quantum Chemistry

Course Outcomes

To be uploaded

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

Suggested list of experiments from the following:

Frank-Hertz experiment; photoelectric effect experiment; recording hydrogen atom spectrum

(iv)Oscillations, waves and optics (BSC-PH 104/204)[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 wave front 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

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

Suggested list of experiments from the following:

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.

Semiconductor Physics (BSC-PH 105/205)

Prerequisite: " Introduction to Quantum Mechanics" Desirable

Module 1: Electronic materials (8)

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (tointroduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirectbandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density ofstates, Occupation probability, Fermi level, Effective mass, Phonons.

Module 2: Semiconductors (10)

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

Module 3: Light-semiconductor interaction (6)

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulatedemission; Joint density of states, Density of states for photons, Transition rates (Fermi's goldenrule), 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 hallmobility; Hot-point probe measurement, capacitance-voltage measurements, parameterextraction 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-dimensionalsystems such as quantum wells, wires, and dots: design, fabrication, and characterizationtechniques. 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 Guptaon NPTEL

Paper code : PH 155/255
Branch : AEIE, ECE, CSE,IT
Subject : Semiconductor Physics Laboratory
Contact hours : [L : 0; T:0; P : 3 (1.5 credits)]

1. Measurement of Si Bandgap using Si Diode(temperature variation).
2. Measurement of Ge Bandgap using Ge thin film using four probe method
3. Study of Hall Effect.
4. Study of Photo detector's (to find out Quantum Efficiency).
5. Study of Solar Cells (to find out Fill Factor).

Course code	BSC-M 101(for ECE, AEIE,CE, EE)				
Category	Basic Science Course				
Course title	**Mathematics -1**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester - I
	3	**1**	**0**	**4**	
Pre-requisites (if any)	-				

(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

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, 11th Reprint, 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

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.

Course code	BSC-M 102 (for CSE & IT)				
Category **Course title**	Basic Science Course **Mathematics (for Computer Science &Engg. students)** **Paper – 1 Calculus and Linear Algebra**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

Paper-1 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

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 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.

Course code	BSC-M 201(ECE, AEIE, CE, EE)				
Category	Basic Science Course				
Course title	**Mathematics -II** **(Calculus, Ordinary Differential Equations and Complex Variable)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-II
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

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

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.

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

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

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

E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

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

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

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.

Course code	BSC-M 202				
Category	Basic Science Course				
Course title	**Mathematics (for Computer Science &Engg. Students)** **Paper – 2 : Probability and Statistics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

Paper -2: 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.

Course code	ESC-CSE 101(ECE, AEIE, EE), ESC-CSE 151 (Lab for ECE, AEIE, EE)				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester – I
	3	**0**	**4**	**5**	[The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]
Pre-requisites (if any)	**-**				

Course code	ESC-CSE 201(for CSE, IT,CE), ESC-

	CSE 251 (Lab for CSE,IT, CE,)				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester – I
	3	**0**	**4**	**5**	[The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]
Pre-requisites (if any)	**-**				

(i)Programming for Problem Solving

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

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

Suggested Reference Books

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, numericalintegration):
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.

Course code	HSM-HU 101, HSM-HU 151 (for ECE, AEIE, EE) OR HSM-HU 201(CSE, IT, CE), HSM-HU 251				
Category	Humanities and Social Sciences including Management courses				
Course title	**English**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester – I/II
	2	**0**	**2**	**3**	
Pre-requisites (if any)	**-**				

English

Detailed contents

1. Vocabulary Building

1.1 The concept of Word Formation

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.4 Synonyms, antonyms, and standard abbreviations.

Basic Writing Skills

1 Sentence Structures

2 Use of phrases and clauses in sentences

3 Importance of proper punctuation

4 Creating coherence

5 Organizing principles of paragraphs in documents

6 Techniques for writing precisely

Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

Nature and Style of sensible Writing

1 Describing

2 Defining

3 Classifying

4 Providing examples or evidence

5 Writing introduction and conclusion

Writing Practices

1 Comprehension

2 Précis Writing

3 Essay Writing

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:

Practical English Usage. Michael Swan. OUP. 1995.
Remedial English Grammar. F.T. Wood. Macmillan.2007
On Writing Well. William Zinsser. Harper Resource Book. 2001

Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

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.

Course code	ESC-ME 102 (CSE, IT, CE)/// ESC-ME 202 (ECE, AEIE,EE)

Category	Engineering Science Courses				
Course title	**Engineering Graphics & Design (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester - I
	1	**0**	**4**	**3**	
Pre-requisites (if any)	**-**				

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 Drawingcovering,

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 Projectionscovering,

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 Solidscovering,

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 Solidscovering,

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 Graphicscovering,

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: Customisation& CAD Drawing

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

Module 8: Annotations, layering & other functionscovering

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:

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

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

Narayana, K.L. & P Kannaiah (2008), Text book on Engineering 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 modelling

Exposure to computer-aided geometric design Exposure to creating working drawings

Exposure to engineering communication

Course code	ESC-ME 101, 151 (ECE, AEIE, EE)/ ESC-ME 201, 251(CSE, IT, CE)
Category	Engineering Science Courses

Course title	Workshop/Manufacturing Practices (Theory & Lab.)				
Scheme and Credits	L	T	P	Credits	Semester-II
	1	0	4	3	
Pre-requisites (if any)	-				

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

Lectures & videos: (10 hours)

Detailed contents

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**

CNC machining, Additive manufacturing **(1 lecture)**

Fitting operations & power tools **(1 lecture)**

Electrical &Electronics **(1 lecture)**

Carpentry **(1 lecture)**

Plastic moulding, glass cutting **(1 lecture)**

Metal casting **(1 lecture)**

Welding (arc welding & gas welding), brazing **(1 lecture)**

Suggested Text/Reference Books:

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.

Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

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.

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.

Course code	ESC-EE 101, 151 (CSE, IT, CE)/// ESC-EE 201, 251 (ECE, AEIE, EE)				
Category	Engineering Science Course				
Course title	**Basic Electrical Engineering (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –I
	3	**1**	**2**	**5**	
Pre-requisites (if any)	-				

(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

D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.

D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

(iii)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

(ii)Basic Electrical Engineering Laboratory

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.

A Guide to Induction Program

Introduction

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer envi-ronment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make themwork for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the insti-tution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.[3]

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

2.9 Schedule

Duration	Time											
	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00
3 Weeks	Sports / Yoga			Preparation for Institute		Creative Arts /Values and Ethics		BREAK	Introduction to the course subjects/Remedial tutorials for English/ Remedial workshop for Basic computer knowledge		Sports / Yoga	

N.B:-Creative art and performing arts include drawing, music, painting and tabla training. The visit to the local place will be conducted on Saturdays/ Sundays and other holidays falling within this induction period.

Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing compe-tition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The ~~*Universal Human Values* c~~omponent, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.