Syllabus for B.Tech. - 1st Year
(Semester I and II)

Session –w.e.f. 2021-2022
### INDIRA GANDHI UNIVERSITY, MEERPUR, REWARI

**SCHEME OF STUDIES AND EXAMINATION**

**Bachelor of Technology**

Scheme effective from 2021-22

**SEMESTER 1**

(Common for all branches)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category</th>
<th>Course Notation</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
<th>Total Contact hrs/week</th>
<th>Credit</th>
<th>Examination Schedule (Marks)</th>
<th>Duration of Exam (Hours)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>Refer to Table 1</td>
<td>Physics-1</td>
<td>3 1 0</td>
<td>4 4</td>
<td>25 75 100</td>
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<td></td>
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<td>B</td>
<td>BSC-CH-101</td>
<td>Chemistry-1</td>
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<td>Mathematics-I</td>
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<td>3 3</td>
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<td>25 25 50</td>
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<td>BSC-CH-102</td>
<td>Chemistry Lab-1</td>
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<td>ESC-ME-103</td>
<td>Manufacturing Practices Lab OR Basics of Mechanical Engineering <em>(For CSE students Only)</em></td>
<td>75</td>
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**TOTAL CREDIT** 19.5  

600/700
# Scheme of Studies and Examination

**Bachelor of Technology**

Scheme effective from 2021-22

**Semester 2nd (Common for all Branches)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category Course</th>
<th>Course Notation</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours per week</th>
<th>Total Contact hrs/week</th>
<th>Credit</th>
<th>Examination Schedule (Marks)</th>
<th>Duration of Exam (Hours)</th>
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<td>Programming in C Lab</td>
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<td>4</td>
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<td>8</td>
<td>Humanities and Social science including Management courses</td>
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<td>HSMC-ENG-102</td>
<td>Language Lab</td>
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**TOTAL CREDIT** 18.5

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**Important Notes:**

1. Significance of the Course Notations used in this scheme
   - C = These courses are common to both the groups (Group-A and Group –B).
   - A = Other compulsory courses for Group-A.
   - B = Other compulsory courses for Group-B.
## Course code for different branches

### Table 1

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Name</th>
<th>Course Code</th>
<th>Branch</th>
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<tbody>
<tr>
<td>1.</td>
<td>Introduction to Electromagnetic Theory</td>
<td>BSC-PHY-101</td>
<td>• Electronics and Communication Engineering</td>
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<td>• Electronics and Computer Engineering</td>
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<tr>
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<td>• Electronics and Telecommunication Engineering</td>
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<td></td>
<td></td>
<td>• Mechanical Engineering</td>
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<td></td>
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<td></td>
<td>• Fire Technology and Safety Engineering</td>
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<td>• Automobile Engineering</td>
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<td>2.</td>
<td>Waves and Optics &amp; Quantum Mechanics</td>
<td>BSC-PHY-102</td>
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<td>3.</td>
<td>Semiconductor Physics</td>
<td>BSC-PHY-103</td>
<td>• Computer Science Engineering</td>
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<td></td>
<td>• Information Technology</td>
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<td>• Computer Science and Information Technology</td>
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<tr>
<td>4.</td>
<td>Mechanics</td>
<td>BSC-PHY-104</td>
<td>• Civil Engineering</td>
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<td>• Printing Technology</td>
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<td>5.</td>
<td>Optics, Optical Fibre, Magnetism and Quantum Mechanics</td>
<td>BSC-PHY-105</td>
<td>• Bio-Technology Engineering</td>
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<td>• Textile Chemistry</td>
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<td>• Fashion and Apparel Engineering</td>
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<td>Introduction to Electromagnetic Theory (IEMT) Lab</td>
<td>BSC-PHY-111</td>
<td>• Electronics and Communication Engineering</td>
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<td>• Mechanical Engineering</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Fire Technology and Safety Engineering</td>
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<td>7.</td>
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| 1.     | Math-I (Calculus and Matrices)                  | BSC-MATH-101  | • Mechanical Engineering  
• Electronics and Communication Engineering  
• Civil Engineering  
• Electrical Engineering  
• Electronics and Electrical Engineering  
• Printing Technology  
• Automobile Engineering  
• Mechanical and Automation Engineering  
• Electronics and Computer Engineering  
• Fire Technology and Safety Engineering  
• Electronics and Telecommunication Engineering  
• Textile Technology  
• Textile Chemistry  
• Fashion and Apparel Engineering |
| 2.     | Math-I (Calculus and Linear Algebra)            | BSC-MATH-103  | • Computer Science Engineering  
• Information Technology  
• Computer Science and Information Technology |
| 3.     | Math-I (Series, Matrices and Calculus)          | BSC-MATH-105  | • Bio-Technology Engineering |
| 4.     | Math-II (Multivariable Calculus, Differential equations and Complex Analysis) | BSC-MATH-102  | • Mechanical Engineering  
• Electronics and Communication Engineering  
• Civil Engineering  
• Electrical Engineering  
• Electronics and Electrical Engineering  
• Printing Technology  
• Automobile Engineering  
• Mechanical and Automation Engineering  
• Electronics and Computer Engineering  
• Fire Technology and Safety Engineering  
• Electronics and Telecommunication Engineering  
• Textile Technology  
• Textile Chemistry |
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<thead>
<tr>
<th>Sr. No.</th>
<th>Course Name</th>
<th>Course Code</th>
<th>Branch</th>
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<tbody>
<tr>
<td>1.</td>
<td>Programming for Problem Solving</td>
<td>ESC-CSE101</td>
<td>• Computer Science and Engineering</td>
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<td>For all remaining branches of B.Tech</td>
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<td>• Electronics and Electrical Engineering</td>
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1. **Mandatory Induction program**

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 local Areas
- Familiarization to Dept./Branch & Innovations
Coursecode: BSC-PHY-101
Category: Basic Science Course
Course Title: Introduction to Electromagnetic Theory

<table>
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<tr>
<th>Scheme and Credits</th>
<th>L</th>
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Branches (B. Tech.):
- Electronics and Communication Engineering
- Electronics and Computer Engineering
- Electronics and Telecommunication Engineering
- Mechanical Engineering
- Fire Technology and Safety Engineering
- Mechanical and Automation Engineering
- Automobile Engineering

Class work: 25 Marks
Exam: 75 Marks
Total: 100 Marks
Duration of Exam: 03 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT – I
Electrostatics in vacuum and linear dielectric medium
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 Boundary conditions of electric field and electrostatic potential; energy of a charge distribution and its expression in terms of electric field.

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement.

UNIT - II
Magnetostatics
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.

Magnetostatics In a linear magnetic medium: Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on B and H. Solving for magnetic field due to simplemagnetslikeabarmagnet;magneticsusceptibilityandferromagnetic,paramagnetic and diamagnetic materials.

UNIT - III
Faraday’s law and Maxwell’s equations
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; energy stored in a magnetic field.

Continuityequationforcurrentdensities;Modifiedequationforthecurlof magnetic field to satisfy continuity equation; displacement current and magnetic field arising from time-dependent electric field; Maxwell’s equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector.

UNIT - IV
Electromagnetic waves
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 Reference Books

1. David Griffiths, Introduction to Electrodynamics, Pearson Education
2. ICFAI, Electricity and Magnetism, Pearson Education
3. Halliday and Resnick, Physics
4. W. Saslow, Electricity, magnetism and light
5. S.K. Chatterjee, Fundamentals of Electricity and Magnetism- PHI
6. A Mahajan, A Rangwala, Electricity and Magnetism
UNIT – I
Wave and Light Motion
Waves: Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator
Non-dispersive transverse and longitudinal waves: 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.
Light and Optics: Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster’s angle, total internal reflection, and evanescent wave.

UNIT – II
Wave Optics and Lasers
Wave Optics: 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. Fraunhofer 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.
Lasers: 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), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

UNIT – III
Introduction to Quantum Mechanics
Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.
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. Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope, tunneling in semiconductor structures.
UNIT – IV

Introduction to Solids and Semiconductors

Free electron theory of metals, Fermi level, density of states in 1, 2, and 3 dimensions, Bloch’s theorem for particles in a periodic potential, Kronig-Penney model, and origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. 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.

References:
1. E. Hecht, “Optics”, Pearson Education
2. D. J. Griffiths, “Quantum mechanics”, Pearson Education
Coursecode | BSC-PHY-103  
---|---  
Category | Basic Science Course  
Coursetitle | Semiconductor Physics  
Scheme and Credits | L | T | P | Credits | Semester-I/II  
| | 3 | 1 | 4 |  
Branches (B. Tech.) |  
- Computer Science Engineering  
- Information Technology  
- Computer Science and Information Technology  
Class work | 25 Marks  
Exam | 75 Marks  
Total | 100 Marks  
Duration of Exam | 03 Hours  

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**Prerequisite:** “Introduction to Quantum Mechanics” Desirable

**UNIT - I**  
**Electronic Materials**
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 band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

**UNIT - II**  
**Semiconductors**
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.

**UNIT - III**  
**Light-Semiconductor Interaction**
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.

**UNIT - IV**  
**Measurements & Engineered Semiconductor Materials**
Four-point probe and vander Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.
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. Hetero junctions and associated band-diagram.
1. Pierret, Semiconductor Device Fundamental.
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Pearson Education
4. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
5. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley
7. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
8. Online course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak Gupta on NPTEL
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**Prerequisites:** (i) High-school education

**UNIT I**

**Vector Mechanics of Particles**

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.

**UNIT II**

**Mechanics of Particles in Motion and Harmonic Motion**

Potential energy function; \( F = -\nabla V \), 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 maneuvers.

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

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

**UNIT III**

**Rigid Body Mechanics**

Definition and motion of 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.
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 co-planar manner: e.g., Rodex cutting 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.

**UNIT IV**

**Statics of Solids**

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two-dimensions; Friction: limiting and non-limiting cases; Force-displacement relationship; Geometric compatibility for small deformations; Illustrations through simple problems on axially loaded members like trusses.

**Suggested Reference Books**

2. Hibbler, Engineering Mechanics, Pearson Education
3. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Mechanics — MK Verma
6. An Introduction to Mechanics — D Kleppner & R Kolenkow
10. Mechanical Vibrations — JP Den Hartog
11. Theory of Vibrations with Applications — WT Thomson
Course code: BSC-PHY-105
Category: Basic Science Course
Course title: Optics, Optical Fibre, Magnetism and Quantum Mechanics

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**Objectives:**
Basic concepts of optics and its applications, electricity and magnetism, and quantum physics.

**UNIT – I**

**Optics**
Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel, diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications.
Polarisation: Introduction, polarization by reflection, polarization by double refraction, scattering of light, circular and elliptical polarisation, optical activity.

**UNIT – II**

**Fibre Optics and Lasers**
Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.

**UNIT – III**

**Electromagnetism and Magnetic Properties of Materials**
Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere’s, Faraday’s laws. Maxwell’s equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, applications of dielectric
Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

UNIT – IV

Quantum Mechanics
Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born’s interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in 1-D box.

Course outcomes
Students will be familiar with
- Bragg’s Law and introduced to the principles of lasers, types of lasers and applications
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials
- Simple quantum mechanics calculations

References:
Coursecode: BSC-PHY-111
Category: Basic Science Lab Course
Course title: Introduction to Electromagnetic Theory (IEMT) Lab

Scheme and Credits

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Branches (B. Tech.)
- Electronics and Communication Engineering
- Electronics and Computer Engineering
- Electronics and Telecommunication Engineering
- Mechanical Engineering
- Fire Technology and Safety Engineering
- Mechanical and Automation Engineering
- Automobile Engineering

Class work: 25 Marks
Exam: 25 Marks
Total: 50 Marks
Duration of Exam: 03 Hours

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and will have to perform at least ten subject related experiments in a semester.

Basic experiments on least count and error estimation (during orientation)
- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:
1. To study Hall effect in semiconductors and measure the Hall coefficient.
2. To find frequency of AC mains using sonometer.
3. To study the magnetic properties of materials using B-H curve.
4. To study the Curies temperature of materials using Dielectric set up.
5. To verify the inverse square law with the help of a photovoltaic cell.
6. To determine Planks constant using photocell.
7. To study the characteristics of Solar cell and find out the fill factor.
8. To design and study Active and Passive filters.
9. To find impedance and Q factor using LCR circuit.
10. To study resonance phenomena in LCR circuit.
11. To measure e/m of electron using helical method.
12. To find temperature co-efficient of platinum using Callender Griffith bridge.
13. To study the forward and reverse characteristics of P-N junction diode.
14. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.
Coursecode: BSC-PHY-112
Category: Basic Science Course
Coursetitle: Wave Optics & Quantum Mechanics Lab

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Branches (B. Tech.)
- Electrical Engineering
- Electronics and Electrical Engineering

Class work: 25 Marks
Exam: 25 Marks
Total: 50 Marks
Duration of Exam: 03 Hours

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and will have to perform at least ten subject related experiments in a semester.

Basic experiments on least count and error estimation (during orientation)
- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:
1. To find out wavelength of monochromatic light using Newton’s ring experiment.
2. To find out wavelength of monochromatic light using Diffraction grating.
3. To find out wavelength of monochromatic light using Fresnel’s bi-prism.
4. To study interference phenomena using Michelson’s Interferometer and to find out wavelength of monochromatic light.
5. To find specific rotation of sugar using Polarimeter.
6. To find thickness of hair using He-Ne laser.
7. To find Cauchy's constants of a prism by using spectrometer.
8. To find resolving power of a telescope.
9. To determine Planks constant using photocell.
10. To study the characteristics of solar cell and find out the fill factor.
11. To verify the inverse square law with the help of a photovoltaic cell.
12. To study Zeeman splitting using EPS/ ESR.
Coursecode: BSC-PHY-113

Category: Basic Science Course

Course title: Semiconductor Physics Lab

Scheme and Credits

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Branches (B. Tech.)
- Computer Science Engineering
- Information Technology
- Computer Science and Information Technology

Class work: 25 Marks

Exam: 25 Marks

Total: 50 Marks

Duration of Exam: 03 Hours

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and will have to perform at least ten subject related experiments in a semester.

Basic experiments on least count and error estimation (during orientation)
- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:
1. To study the forward and reverse characteristics of P-N junction diode.
2. To study the characteristics of transistor in common base configuration.
3. To study the characteristics of transistor in common emitter configuration.
4. To study the characteristics of Junction field effect (JFET) transistor.
5. To study the characteristics of Metal oxide semiconductor field effect (MOSFET) transistor.
6. To study the characteristics of Solar cell and find out the fill factor.
7. To design and study Active and Passive filters.
8. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.
9. To determine Planks constant using photocell.
10. To measure e/m of electron using helical method.
11. To find capacitance of condenser using fleshing and quenching experiment.
12. To find temperature co-efficient of platinum using Callender Griffith bridge.
13. To find out low resistance by Carry Foster bridge.
14. To find resistance of galvanometer by post office box.
15. To compare the capacitance of two capacitors using De'Sauty Bridge.
Coursecode: BSC-PHY-114

Category: Basic Science Course

Course title: Mechanics Lab

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Branches (B. Tech.):
- Civil Engineering
- Printing Technology

Class work: 25 Marks
Exam: 25 Marks
Total: 50 Marks
Duration of Exam: 03 Hours

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and will have to perform at least ten subject related experiments in a semester.

Basic experiments on least count and error estimation (during orientation)
- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:

1. To find the moment of inertia measurement of a fly wheel.
2. To find acceleration due to gravity using bar pendulum.
3. To study resonance phenomena in mechanical oscillators.
4. To examine the behaviour of coupled pendulum.
5. To examine air track experiment and study Collisions between objects, governed by the laws of momentum and energy.
6. To find the modulus of rigidity of a wire using Maxwell’s Needle.
7. To determine the moment of inertia of the given disc using Torsion pendulum.
8. To perform experiment on Rotation and Gyroscopic Precession.
9. To measure spring constant using Hook’s Law.
10. To measure height of a distant object using sextant.
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Basic experiments on least count and error estimation (during orientation)
- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

**List of Subject related Experiments:**
1. To study Hall effect in semiconductors and measure the Hall coefficient.
2. To find frequency of AC mains using sonometer.
3. To study the magnetic properties of materials using B-H curve.
4. To study the Curies temperature of materials using Dielectric set up.
5. To verify the inverse square law with the help of a photovoltaic cell.
6. To determine Planks constant using photocell.
7. To study the characteristics of Solar cell and find out the fill factor.
8. To design and study Active and Passive filters.
9. To find impedance and Q factor using LCR circuit.
10. To study resonance phenomena in LCR circuit.
11. To measure e/m of electron using helical method.
12. To find temperature co-efficient of platinum using Callender Griffith bridge.
13. To study the forward and reverse characteristics of P-N junction diode.
14. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.
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| Course Outcome | 1. To analyse microscopic chemistry  
|               | 2. Understand the concept of hardness of water and phenomenon of corrosion  
|               | 3. Rationalise periodic properties  
|               | 4. Distinguish the ranges of the electromagnetic spectrum |

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**UNIT-I**

**Atomic and molecular structure:** Schrodinger equation (Introduction and concept only). Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations (derivation excluded). Molecular orbital energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene. Crystal field theory and the energy level diagrams for transition metal ions. Band structure of solids and the role of doping on band structures. **Periodic properties:** 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.  

**UNIT-II**

**Stereochemistry:** Representations of 3 dimensional structures, structural isomers and stereo isomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal Compounds. **Organic reactions and synthesis of a drug molecule:** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization (mechanism excluded). Synthesis of commonly used drug molecules (Asprin & Paracetamol).  

**UNIT-III**


**UNIT-IV**

**Spectroscopic techniques and applications:** Basic concept of spectroscopy, Principle and Applications of different spectroscopic techniques (UV-Visible and IR spectroscopy). Nuclear magnetic resonance
and magnetic resonance imaging, Elementary discussion on Flame photometry.  

Suggested Text Books: 
1. University Chemistry, Bruce M. Mahan, Pearson Education. 
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell 
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan 
6. Physical Chemistry, by P. W. Atkins 

Course Outcomes
The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. 
- Understand the concept of hardness of water and phenomenon of corrosion. 
- 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 electron affinity.
Course code BSC-CHE-102
Category Basic Science Course
Course title Chemistry I(Practical)

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Course Outcome
5. Estimate rate constants of reactions
6. Synthesize a small drug molecule
7. Measure surface tension, viscosity and conductance
8. To analyse a salt sample
9. Determine hardness and chloride content of water

Duration of Exam
3 Hrs
Internal Practical 25 Marks
External Practical 25 Marks
Total 50 Marks

LIST OF EXPERIMENTS:-
1. Determination of surface tension of given liquid by drop number method.
2. Determine the viscosity of given liquid by using Ostwald’s viscometer / Redwood viscometer.
3. Calculate the Rf value of given sample using Thin layer chromatography / Paper chromatography.
4. Removal of Ca\(^{2+}\) and Mg\(^{2+}\) hardness from given water sample using ion exchange column.
5. Determination of chloride content in given water sample.
6. Calculate the strength of strong acid by titrating it with strong base using conductometer.
7. Calculate the emf value of given cell.
8. To prepare the of urea formaldehyde and phenol formaldehyde resin.
9. To determine the rate constant of a reaction.
10. To Prepare iodoform.
11. Calculate the saponification value / acid value of given oil sample.
12. Chemical analysis of two anions and two cations in given sample of salt.
13. Determination of the partition coefficient of a substance between two immiscible liquids.
14. To determine the total hardness of given water sample by EDTA method.
15. Study the adsorption phenomena using acetic acid and charcoal.
16. Lattice structures and packing of spheres.

Course 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 be able 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.

**Note:** At least 10 experiments are to be performed by the students.

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.
3. Pre-experimental & post experimental quiz/questions may be offered for each lab experiment to reinforce & aid comprehension of the experiment.

**Suggested Books:**

2. Essentials of Analytical Chemistry, Shobha Ramakrishnan, Pearson Education.
Math-I (Calculus and Matrices)  
BSC-MATH-101

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**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**Unit-I**

**Calculus:** Indeterminate forms and L'Hospital's rule, Maxima and Minima, Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders, Evolutes and Involutors, Evaluation of definite and improper integrals, Applications of definite integrals to evaluate surface areas and volumes of revolutions, Beta and Gamma functions and their properties.

**Unit-II**

**Sequences and Series:** 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.

**Unit-III**

**Multivariable Differential Calculus:** Limit, Continuity and Partial derivatives, Total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers, Gradient, Directional derivatives, Curl and Divergence.

**Unit-IV**

**Matrices:** Inverse and rank of a matrix, Rank-nullity theorem, System of linear equations, Symmetric, skew-symmetric and orthogonal matrices and Orthogonal transformation, Determinants, Eigenvalues and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem.

**Reference Books:**
Course Outcomes
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.
Math-I (Calculus and Linear Algebra)
BSC-MATH-103

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Unit-I
Calculus: Indeterminate forms and L'Hospital's rule, Maxima and Minima, Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders, Evolutes and Involutes, Evaluation of definite and improper integrals, Applications of definite integrals to evaluate surface areas and volumes of revolutions, Beta and Gamma functions and their properties.

Unit-II

Unit-III
Vector spaces I: 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, Matrix associated with a linear map, Composition of linear maps.

Unit-IV
Vector spaces II: Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric and Orthogonal Matrices, Eigenbases, Diagonalization, Inner product spaces, Gram-Schmidt orthogonalization.

Reference Books:

Course Outcomes
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.
Math-I (Series, Matrices and Calculus)  
BSC-MATH-105

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**Unit-I**


**Unit-II**

**Matrices & Its Application:** Elementary Matrices, Elementary Transformations, Inverse using elementary transformations, Rank of a matrix, Normal form of a matrix, Linear dependence and independence of vectors, Consistency of linear system of equations, Linear and Orthogonal Transformations, Eigen values and Eigenvectors, Properties of eigen values, Cayley-Hamilton Theorem, Diagonalization of Matrices.

**Unit-III**

**Differential Calculus:** Limit, Continuity and Differentiability of function of single variable, Successive Differentiation, Leibnitz Theorem, Taylor's and Maclaurin's Series for Single Variable function, Partial derivatives, Homogeneous functions, Euler's Theorem, Jacobian, Maxima-Minima of function of two variables, Lagrange's Method of undetermined multipliers.

**Unit-IV**

**Integral Calculus:** Basic concepts of integration and properties of definite integrals, Applications of single integration to find volume of solids and surface area of solids of revolution, Double integral, Change of order of integration, Double integral in Polar Co-ordinates, Applications of double integral to find area enclosed by plane curves, Triple integral, Beta and Gamma functions.

**Reference Books:**
Course Outcomes The students will learn:

- To deal with the nature of infinite series that is essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner
- The tools of differentiation and integration of functions of univariate and multivariate that are used in various techniques dealing engineering problems.
- The mathematical tools needed in evaluating multiple integrals and their usage.
- To apply differential and integral calculus to find volume of solids and surface area of solids of revolution. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
Math-II (Multivariable Calculus, Differential equations and Complex Analysis)
BSC-MATH-102

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**Unit-I**

**Multivariable Integral Calculus:** Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre 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.

**Unit-II**

**Ordinary differential equations of first and higher orders:** 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, 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.

**Unit-III**

**Complex Variable – Differentiation:** 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.

**Unit-IV**

**Complex Variable – Integration:** 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.

**Reference Books:**
4. S. L. Ross, Differential Equations, Wiley India.

**Course Outcomes** 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.
Math-II (Probability and Statistics)
BSC-MATH-104

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Unit-I
Random variables and discrete probability distributions: Conditional probability, Probability spaces, Discrete random variables, Independent random variables, Expectation of discrete random variables, Sums of independent random variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality, The multinomial distribution, Poisson approximation to the binomial distribution, Infinite sequences of Bernoulli trials.

Unit-II
Continuous and Bivariate probability distribution: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities, Bivariate distributions and their properties, Distribution of sums and quotients, Conditional densities, Bayes' rule.

Unit-III
Basic Statistics: 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; Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Unit-IV
Applied Statistics: Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations; Small samples: 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.

Reference Books:
3. S. Ross, A First Course in Probability, Pearson Education.

Course Outcomes
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.
Math-II (Vector Calculus, Differential equations and Laplace Transform)
BSC-MATH-106

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**Unit-I**
**Vector Calculus:** Differentiation of vectors, Scalar and vector point functions, Gradient of a scalar field and Directional derivative, Divergence and Curl of a vector field and their physical interpretations, Integration of vectors, Line integral, Surface integral, Volume integral, Green, Stoke's and Gauss theorems (without proof) and their applications.

**Unit-II**
**Ordinary Differential Equations:** Exact differential equations, Equations reducible to exact differential equations, Applications of differential equations of first order & first degree to simple electric circuits, Newton's law of cooling, Heat flow and Orthogonal trajectories, Linear Differential equations of second and higher order, Complete solution, Complementary function and Particular integral, Method of variation of parameters to find particular integral, Cauchy's and Legendre's linear equations.

**Unit-III**
**Laplace Transforms and its Applications:** Laplace transforms of elementary functions, Properties of Laplace transforms, Existence conditions, Transforms of derivatives, Transforms of integrals, Multiplication by $t^n$, Division by $t$, Evaluation of integrals by Laplace transforms, Laplace transform of unit step function, Unit impulse function and Periodic function, Inverse transforms, Convolution theorem, Application to linear differential equations.

**Unit-IV**

**Reference Books:**
8. S. L. Ross, Differential Equations, Wiley India.

**Course Outcomes** The students will learn:
- The mathematical tools needed in evaluating vector calculus and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- To deal with the Laplace transform and its application that is essential in most branches of engineering
- The essential tool of partial differential equation in a comprehensive manner.
BASIC ELECTRICAL ENGINEERING

Theory :  75  
Class Work :  25  
Total :   100  
Duration of Exam :  3 Hrs.

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<tr>
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<tr>
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Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section A

DC Circuits

AC Circuits
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.

Section B

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

Polyphase Circuits
Three phase balanced circuits, voltage and current relations in star and delta connections. Power Measurement by two wattmeter method.

Section C

Electrical Machines

Section D

Measuring Instruments
Construction, operating and uses of moving iron type and moving coil type, induction type voltmeter, Ammeter, watt meter, energy meter.

Electrical Installations
Components of LT Switchgear: Introduction to 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

1. E. Hughes, “Electrical and Electronics Technology”, Pearson Education.

**Course Outcomes:**
- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and Transformers.
- To study various type of measuring instruments.
- To introduce the components of low voltage electrical installations
BASIC ELECTRICAL ENGINEERING LABORATORY

Class Work:  25  
Exam :  25  
Total :  50

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<td>Category</td>
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<td>Basic Electrical Engineering (Laboratory)</td>
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Notes:
(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

List of Experiments:
2. To verify KCL and KVL.
3. To verify Thevenin’s and Norton theorems.
4. To verify Maximum power transfer and Superposition theorems.
5. To perform direct load test of a transformer and plot efficiency Vs load characteristic.
7. Measurement of power in a 3-phase system by two wattmeter method.
10. 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.
11. Torque Speed Characteristic of shunt dc motor.
12. Speed control of dc motor.

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.
Course Outcomes:

The course will enable the students:

- 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
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems.
- To apply programming to solve simple numerical method problems, namely differentiation of function and simple integration.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit 1

Introduction to Programming:
C Programming: Keywords, Variables and Data Types: basic, derived and user defined, Type Conversions, Header Files, Basic Input and Output Functions and Statements, Compilation, Syntax and Logical Errors in compilation, Object and Executable Code, Storage Classes, Arithmetic Expressions and Precedence.

Unit 2

Preprocessors, Conditional and Branching Statements, Loops/Iterative Statements, Writing and evaluation of conditionals and consequent branching.

Unit 3

Arrays (1-D, 2-D), Character Arrays and Strings, Arrays with Pointers, Functions (including using built in libraries), Parameter passing in functions, Call by Value, Call by Reference, Passing arrays to functions, Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

Unit 4


Suggested Text Books:

Suggested Reference Books
Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
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.

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
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: To be able to create, read and write to and from simple text files.
### Course Outcomes:
The course will enable the students:
- To learn various number systems
- 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
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems

**Note:** Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**Unit 1**
Introduction to computers and its functional units, Number System: Binary, Octal, Decimal, Hexadecimal and their inter conversion methods. Operations on number systems: Addition, Subtraction, Complement etc.

**Unit 2**
Introduction to Programming: Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. C Programming: Keywords, variables, data types, header files, basic input and output functions and statements, Compilation, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence.

**Unit 3**
Conditional statements, branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

**Unit 4**
Arrays (1-D, 2-D), Character arrays and Strings, Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

**Suggested Text Books:**
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 runtime
• 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

Tutorial 1: Problem solving using computers:
Lab 1: 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
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
UNIT-1

Manufacturing Processes:
Introduction to Manufacturing Processes and their Classification, additive manufacturing Industrial Safety; Introduction, Types of Accidents, Causes and Common Sources of Accident, Methods of Safety, First Aid, Objectives of Layout, Types of Plant Layout and their Advantages.

UNIT-II

Carpentry, Fitting & Forming Processes

UNIT-III

Casting and Machine Tools

UNIT-IV

Welding:

Suggested Text/Reference Books:
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.
List of Experiments/ Jobs
1. To study different types of measuring tools used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.
2. To study different types of machine tools (lathe, shaper, planer, milling, drilling machines)
3. To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off.
4. To study different types of fitting tools and marking tools used in fitting practice.
5. To prepare lay out on a metal sheet by making and prepare rectangular tray pipe shaped components e.g. funnel.
6. To prepare joints for welding suitable for butt welding and lap welding.
7. To study plastic moulding and glass cutting process
8. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
9. To prepare simple engineering components/shapes by forging.
10. To prepare mold and core assembly.
11. To prepare horizontal surface/vertical surface/curved surface/slats or V-grooves on a shaper/planner.
12. To prepare a job involving side and face milling on a milling
13. To study electric machines, electronic components and power tools.

Note:
At least ten experiments/jobs are to be performed/prepared by the students in the semester.

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.
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I


Unit-II


Unit-III

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches. Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit-IV

Stresses and Strains: Introduction, Concept & types of stresses and strains, Poison's ratio, stresses and strains in simple and compound bars under axial, flexure & Torsional loading, Hooks law, Stress-strain diagrams, Elastic constants & their relationships. Bending Moment & Shear Force: Definitions, SF and BM diagrams for simply supported and cantilever beam, Calculation of maximum SF and BM under (i) concentrated load (ii) uniformly distributed load, problems.

Text Books:
3. Elements of Mechanical Engineering - D.S. Kumar, S.K. Kataria and Sons

Reference Books:
UNIT-I
Module 1: Introduction to Engineering Drawing
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
Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT-II
Module 3: Projections of Regular Solids
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
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
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;

UNIT-III
Module 6: Overview of Computer Graphics
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]

UNIT-IV
Module 7: Annotations, layering & other functions
Applying dimensions to objects, applying annotations to drawings; layers to create drawings, 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. Drawing of Engineering objects like coupling, crankshaft, pulley.
Module 8: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components, 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:
1. Shah, M.B. & Rana B.C., Engineering Drawing, Pearson Education
5. (Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes
All phases of manufacturing or construction require the conversion of new ideas and design concepts
into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical,
architectural and industrial) in which the skills of the CAD technicians play major roles in the design
and development of new products or construction. Students prepare for actual work situations through
practical training in a new state-of-the-art computer designed CAD laboratory using engineering
software. This course is designed to address:
• to prepare you to design a system, component, or process to meet desired needs within realistic
  constraints such as economic, environmental, social, political, ethical, health and safety,
  manufacturability, and sustainability
• to prepare you to communicate effectively
• to prepare you to use the techniques, skills, and modern engineering tools necessary for Engineering
  practice The student will learn:
• Introduction to engineering design and its place in society
• Exposure to the visual aspects of engineering design
• Exposure to engineering graphics standards
• Exposure to solid modeling
Course Code: HSMC-ENG-101  
Category: Humanities  
Course Title: English Language Skills  

L  T  P  Credits   Internal Assessment: 25 Marks  
2  0  0  2   External Assessment: 75 Marks  
Total: 100 Marks   Duration of Exam: 03 Hours

Course Objective:  
To equip the students with English language skills needed in academic and professional world and to inculcate human/ethical values in them.

Course Outcome:  
The students will acquire basic proficiency in English with special emphasis on reading and writing skills, and writing practices along with an inclination to become better human beings.

Course Contents:

Section: A  
Basic Writing skills

Subject Verb Agreement, Noun Pronoun Agreement, Governance of Nouns through Prepositions, Basic Verb Patterns (V, SV, SVO, SVOO, SVC, SVOC, SVOA)

Section: B  
Vocabulary Building & Creating Grammatical Cohesion

One word substitution, Phrasal Verbs, Commonly used Idioms, Foreign words, Referring Time in Language (Tenses), Use of Active and Passive Voice

Section: C  
Phonetics

Basic concept –Vowels, Consonants, Phonemes, Syllable, Transcription of words

Section: D  
Reading and Writing Practices

(a) Literary Texts:
   i. “Patriotism beyond politics and Religion’ by Abdul Kalam Azad
   iii. “An Outline of Intellectual Rubbish” by Bertrand Russell
   iv. “Mother Teresa” by Khushwant Singh

(b) Writing official Letters- Issues Concerning Students’ academic and social life
(c) Essay Writing
(d) Paragraph Writing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Recommended Readings:

1. Nitin Bhatnagar and Mamta Bhatnagar, Communicative English for Engineers and Professionals. Pearson Education.
Course Objective:
The course aims at developing the desired English language skills of students of Engineering and Technology so that they become proficient in communication to excel in their professional lives. The course has been so designed as to enhance their linguistic and communicative competence.

Course Outcome:
The students will acquire basic proficiency in English with special emphasis on listening, comprehension and speaking skills both at social and professional platforms.

Course Contents:

i. Listening comprehension
ii. Recognition of phonemes in International Phonetic Alphabet
iii. Self introduction and introduction of another person
iv. Conversation and dialogues in common everyday situations
v. Communication at work place (Standard phrases and sentences in various situations)
vi. Telephonic communication
vii. Speeches for special occasions (Welcome speeches, Introduction speeches, Felicitation speeches and Farewell speeches)
viii. Tag Questions
ix. Formal Presentations on literary texts prescribed in theory paper

Note: Three hour time to each segment is recommended for instruction and practice.

Scheme of End Semester Practical Exam:

1. A small passage may be read out to the examinees and they will have to write the answers to the questions asked at the end of the passage. Questions will be short answer type.
2. Examinees may be asked to identify the sounds of phonemes in given words.
3. Examinees may be asked to introduce themselves or others, participate in role play activities in mock situations, give short responses, engage in hypothetical telephonic conversation or supply the tag questions to statements etc.
4. Examinees may also be asked to deliver speeches on given situations or make presentation on the literary texts prescribed in Unit IV of theory paper.

Recommended Readings: