# Scheme of Teaching for Academic Year 2021-22

# Odd Semester

### Physics Cycle

| Course Category | Course Code | Course Title | L-T-P | Credits | Contact hours |
|---|---|---|---|---|---|
| BS | 21PH101 | Engineering Physics | 4-0-0 | 4 | 4 |
| BS | 21MA102 | Calculus and Numerical Methods | 3-2-0 | 4 | 5 |
| ES | 21EE103 | Basic Electrical Engineering | 3-0-0 | 3 | 3 |
| ES | 21MD104A/B | Engineering Drawing | 1-0-5 | 3 | 6 |
| ES | 21CV105 | Engineering Mechanics | 3-0-0 | 3 | 3 |
| BS | 21PH106 | Engineering Physics Laboratory | 0-0-2 | 1 | 2 |
| HS | 21PE107 | Physical Education Activity (PEA) | 0-0-2 | 1 | 2 |
| PR | 21DT108 | Design Thinking Laboratory | 0-0-2 | 1 | 2 |
| | | | | | |
| | | **Total** | | **20** | **27** |

### Chemistry Cycle

| Course Category | Course Code | Course Title | L-T-P | Credits | Contact hours |
|---|---|---|---|---|---|
| BS | 21CH101 | Engineering Chemistry | 4-0-0 | 4 | 4 |
| BS | 21MA102 | Calculus and Numerical Methods | 3-2-0 | 4 | 5 |
| ES | 21EC103 | Basic Electronics Engineering | 3-0-0 | 3 | 3 |
| ES | 21ME104 | Elements of Mechanical Engineering | 3-0-0 | 3 | 3 |
| ES | 21CS105 | Programming for Problem solving | 4-0-0 | 4 | 4 |
| BS | 21CH106 | Engineering Chemistry Laboratory | 0-0-2 | 1 | 2 |
| ES | 21CS107 | Computer Programming Laboratory | 0-0-2 | 1 | 2 |
| PR | 21DT108 | Design Thinking Laboratory | 0-0-2 | 1 | 2 |
| | | | | | |
| | | **Total** | | **21** | **25** |

# Even Semester

### Chemistry Cycle

| Course Category | Course Code | Course Title | L-T-P | Credits | Contact hours |
|---|---|---|---|---|---|
| BS | 21CH201 | Engineering Chemistry | 4-0-0 | 4 | 4 |
| BS | 21MA202 | Differential equations and vector calculus | 3-2-0 | 4 | 5 |
| ES | 21EC203 | Basic Electronics Engineering | 3-0-0 | 3 | 3 |
| ES | 21ME204 | Elements of Mechanical Engineering | 3-0-0 | 3 | 3 |
| ES | 21CS205 | Programming for Problem solving | 4-0-0 | 4 | 4 |
| BS | 21CH206 | Engineering Chemistry Laboratory | 0-0-2 | 1 | 2 |
| ES | 21CS207 | Computer Programming Laboratory | 0-0-2 | 1 | 2 |
| | | | | | |
| | | **Total** | | **20** | **23** |

### Physics Cycle

| Course Category | Course Code | Course Title | L-T-P | Credits | Contact hours |
|---|---|---|---|---|---|
| BS | 21PH201 | Engineering Physics | 4-0-0 | 4 | 4 |
| BS | 21MA202 | Differential equations and vector calculus | 3-2-0 | 4 | 5 |
| ES | 21EE203 | Basic Electrical Engineering | 3-0-0 | 3 | 3 |
| ES | 21MD204A/B | Engineering Drawing | 1-0-5 | 3 | 6 |
| ES | 21CV205 | Engineering Mechanics | 3-0-0 | 3 | 3 |
| BS | 21PH206 | Engineering Physics Laboratory | 0-0-2 | 1 | 2 |
| HS | 21PE207 | Physical Education Activity (PEA) | 0-0-2 | 1 | 2 |
| | | | | | |
| | | **Total** | | **19** | **25** |

**Note:** BS: Basic Science Course, ES: Engineering Science Course, HS: Humanities Course, PR : Project Based Course, 21MD104/204 A: Manual Drafting, 21MD104/204 B : CAED

| Title | Engineering Physics | | |
|---|---|---|---|
| Course Code | 21PH101/201 | L-T-P- C | 4-0-0- 4 |
| Exam | 3 Hrs. | Hours/Week | 4 |
| SEE | 50 Marks | Total Hours | 50 |

**Prerequisite:** Knowledge of modes of transfer of heat, Basics of band theory of solids, working principle of capacitors, Fundamentals of translatory motion, oscillatory motion and elasticity, and geometrical optics.

**Course Objective:**

Objective of the course is to make students learn underlying principles and applications of physics in the respective fields and to develop effective solutions for engineering problems.

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

| # | Course outcomes | Mapping to PO's |
|---|---|---|
| 1 | Discuss the concepts of wave-particle dualism, electrical conductivity, crystallography, oscillations, and photonics. | 1,2 |
| 2 | Illustrate the laws of thermal and optical radiations, free electrons, waves, materials science, and rigid body dynamics. | 1,2 |
| 3 | Solve problems on quantum nature of radiation, interaction of radiation with matter, charge dynamics, and simple harmonic oscillations. | 1,2 |
| 4 | Interpret the theories of quantum mechanics, free electrons, crystallography, laser, and vibrations in advanced applications. | 1,2 |

| MODULE-1 | 10 Hrs |
|---|---|

Black body radiation spectrum, Wien's law and Rayleigh Jeans law (no derivations). Assumptions of quantum theory of radiation, Planck's law. Photoelectric effect. Application in quantum computing and solar appliances. de Broglie hypothesis of matter waves. Expression for de Broglie wavelength of electron. Applications in SEM, TEM, and advent of nanotechnology (Qualitative). Characteristics of matter waves:Phase velocity and group velocity; derivation of relation between group velocity and particle velocity and speed of light. Heisenberg's uncertainty principle. Its application to show the nonexistece of electron in nucleus of atoms. Wave function. Probability density and normalization of wave function (Max Born's interpretation. Setting up of one-dimensional time independent Schrodinger's wave equation.), eigen values and eigen functions. Application of Schrodinger wave equation- Eigen values and Eigen function for a free particle and a particle in a potential well of infinite depth.

*Numerical problems on de Broglie equations, Photoelectric effect and Eigenvalue equation*

**Self-learning topics**:

Experimental evidences of wave-particle dualism-Compton effect.

| MODULE-2 | 10 Hrs |
|---|---|

Free electrons in metals. Classical free electron theory-assumptions. Drift velocity, Mean free path, Mean collision time, Relaxation time. Expression for electrical conductivity in metals. Failures of classical free electron theory. Quantum free electron theory–assumptions. Fermi energy. Fermi-Dirac distribution function (Fermi factor). Merits of quantum free electron theory. Effects of impurity and temperature on electrical resistivity of metals. Application in material selection and development of conducting wires (transmission lines and winding wires), rheostats and resistors. Semiconductors-effects of impurity and temperature on their electrical resistivity: Applications in development of electronic devices (mention diodes, transistors, LEDs, etc.,)

Superconductors. Temperature dependence of electrical resistivity in superconductors. Meissner effect (qualitative). Critical magnetic field. Type I and Type II superconductors. BCS Theory. Applications of superconductors; superconducting magnets, MRI, SQUID (to mention) and Maglev Vehicle (qualitative discussion).

*Numerical problems on electrical conductivity, Fermi energy,and critical magnetic field*

**Self-learning topics:** High temperature superconductors.

| MODULE-3 | 10 Hrs |
|---|---|

Space lattice, Bravais lattice–unit cell, primitive cell. Lattice parameters. Directions and planes, Miller indices. Expression for interplanar spacing. Coordination number. Atomic packing factors (SC,FCC,BCC). Bragg's law. Bragg's spectrometer. Application of x-ray spectrometer in material characterizations.

Dielectric materials. Polarization and its types. Expression for internal field. Claussius-Mossotti equation (no derivation). Applications of dielectrics in capacitors, transformers, LCDs, and microwave tunable devices.

*Numerical problems on Miller indices, Interplanar space, Bragg's law and Claussius-Mossotti equation*.

**Self-learning topics:**

X-rays: properties and classification

| MODULE-4 | 10 Hrs |
|---|---|

Simple harmonic vibrations. Free vibrations. Damped vibrations-derivation of expressions for displacement of damped harmonic motion.Discussion of types of damped vibrations. Quality factor, relaxation time, logarithmic decrement. Forced vibrations-derivation of expression for amplitude and phase-variation with frequency. Applications in vibration analysis and drones. Resonance. Condition for amplitude resonance. Nondestructive testing and other applications of mechanical and electrical resonance.

Rigid body. Moment of inertia. Torsional pendulum-derivation of expression for time period of

oscillation and mention of its uses. Bending of beams- derivation of expression for bending moment of a beam. Cantilever-derivation for depression of loaded end of a single cantilever. Uses of cantilevers in structures and robotics.

*Numerical problems on Amplitude and phase of forced vibrations,time period of oscillation, bending moment and depression/Young's modulus of cantilever.*

**Self-learning topics:**

Sharpness of resonance; effect of damping

| **MODULE-5** | **10 Hrs** |
|---|---|

Interaction of radiation with matter. Expression for energy density in terms of Einstein's coefficients. Requisites of a Laser system. Conditions for laser action. Types of laser devices (to mention Solid, Gas and Semiconductor lasers), Semiconductor Laser- construction and working. Holography. Applications of lasers in industry and defence.

Optical fibers. Construction and principle. Ray propagation mechanism. Angle of acceptance and numerical aperture- their relationship with refractive indices of core and clad and condition for ray propagation. Modes of transmission-V-number and number of modes (expressions). Types of optical fibers. Attenuation. Applications in Point to point communication, computer networking,endoscopy, etc.

*Numerical problems on Boltzmann factor, V-number, Numerical aperture, and attenuation.*

**Self-learning topics**:

Development of solid, liquid, and gas lasers. Dispersion in optical fibers

**Text Books:**


1. Engineering physics: R K Gaur and S L Gupta, ISBN: 9788189928223, Dhanpat Rai Publishing Company (P) Ltd. Edition, 2011
2. Solid state physics: S O Pillai, ISBN-10: 9386070928, New Age International Pvt. Ltd, Eighth edition, 9 January 2018.


**Reference Books:**


1. Modern Physics, Kenneth S. Krane, ISBN-13: 9781118061145, John Wiley & Sons, Inc., 3rd Edition, 2012.
2. Introduction to Solid State Physics, Charles Kittel, ISBN: 978-1-119-45416-8, 8th Edition, Wiley.
3. Concepts of Modern Physics, Arthur Beiser, ISBN-10 : 0070151555, 5th Edition, Tata McGraw – Hill Edition
4. B.B. Laud - Lasers and non-linear optics, New Age International, *ISBN*: 9788122430561, 3rdEdition, 2015.
5. Fiber Optics: A K Ghatak and K Thyagarajan, ISBN-13: 978-0521577854, Cambridge University Press India Pvt. Limited, 1998.
6. E-resources; NPTEL courses on Engineering physics.

| Title | Calculus and Numerical methods | | |
|---|---|---|---|
| **Course Code** | **21MA102** | **L-T-P-C** | **3 – 1 – 0 - 4** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **5** |
| **SEE** | **50 Marks** | **Total Hours** | **70** |

**Prerequisite: Class 12 calculus**

**Course Objective:** To train the students to acquire knowledge in calculus and numerical methods so as to solve basic engineering application problems.

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

| # | Course outcomes | Mapping to PO's | Mapping to PSO's |
|---|---|---|---|
| 1 | Compute Taylor series, partial derivatives and solve simple problems connected with multiple integrals. | 1 | - |
| 2 | Inspect for the maximum output of a function (experimental data), analyse the region of integration connected with multiple integrals so as to determine the area, volume. | 1,2 | - |
| 3 | Apply the numerical methods to compute: The area of a region, root (input) of an equation for the given output, missing input or output of the given experimental data (interpolation/extrapolation). | 1 | - |
| 4 | Model the real life problems/engineering application problems and solve the same. | 1,2 | - |

| **MODULE-1** | **8 Hrs** |
|---|---|

Differential Calculus: Definition of average growth rate and its illustrative examples. Definition of differentiability. Statement of Taylor's theorem, Taylor series for a function of one variable - Illustrative examples.

Partial Differentiation: Definition of Partial derivative, Physical and geometrical interpretation of partial differentiation, Application oriented problems on the partial derivatives from engineering field, and Illustrative examples, Statement of Taylor theorem for a function of two variables and illustrative examples on Taylor series.

**Self-learning topics**:Evaluation of Jacobians, Expansion of a function as a Maclaurin series for function of one variable and two variables-illustrative examples.

| **MODULE-2** | **8 Hrs** |
|---|---|

Differential Calculus: Maxima & Minima for a function of two variables, finding extreme values of the function using Lagrange's multipliers method. Illustrative examples from engineering field. Mathematical modelling through differential equations of first order first degree and solution-modelling of population growth, finding initial velocity of the space vehicle so that it has to escape from earth.

**Self-learning topics:**Modelling of inflected diseases, carbon dating-half-life period, mixing problem involving one tank, two tank.

| **MODULE-3** | **8 Hrs** |
|---|---|

Numerical Methods: Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method, Numerical Interpolation-Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula.

**Self-learning topics:**Inverse Lagrange's interpolation formula, central difference formula- Bessel's formula, to find the relation between the input and output of an experimental data using suitable interpolation formula.

| **MODULE-4** | **10 Hrs** |
|---|---|

Multiple Integrals: Double integrals in Cartesian & Polar form, Application to find area. Evaluation of triple integrals in Cartesian & Spherical co-ordinate system.

**Self-learning topics:**Applications to find volume using double integral, to find centre of gravity, moment of inertia using multiple integrals.

| **MODULE-5** | **8 Hrs** |
|---|---|

Numerical Integration: Evaluation of a line integral by Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Weddle's rule. Illustrative examples from engineering field.

Numerical Double Integration: Computation of a double integral by Simpson's 1/3rd rule.

**Self-learning topics**:To solve the system of non-linear equations by Newton's method.

**Note -** Theorems and properties without proof. Applicable to all the Modules.

**Text Books:**


1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.


**Reference Books:**


1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
2. R K. Jain and S. R. K. Jain & S. R. K. Iyengar, Numerical methods, New age international pvt. Publishers, 6$^{th}$edition, 2014.
3. P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

| Title | Differential Equations and Vector Calculus | | |
|---|---|---|---|
| Course Code | 21MA202 | L-T-P-C | 3 – 1 – 0 - 4 |
| Exam | 3 Hrs. | Hours/Week | 5 |
| SEE | 50 Marks | Total Hours | 70 |

**Prerequisite: Knowledge of Class 12th calculus& vectors**

**Course Objective:** To train the students to acquire knowledge in differential equations and vector calculus so as to solve basic engineering application problems/real life application problems.

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

| # | Course outcomes | Mapping to PO's | Mapping to PSO's |
|---|---|---|---|
| C01 | Apply suitable methods to solve the simple problems of ordinary differential equations /partial differential equations and vector calculus, analytically / numerically | 1 | - |
| C02 | Examine the higher order problems(more difficult problems) that are connected with differential equations /partial differential equations and solve. | 2 | - |
| C03 | Introspect the geometry of the region to compute the vector integration problems of gauss divergence theorem, stokes theorem, greens theorem | 2 | - |
| C04 | Model the real-life problems/ Engineering application problems and hence solve the same. | 1, 2 | - |

## MODULE-1 — 8 Hrs

**Differential Equations of First order First Degree (DE):** Solution of exact differential equations,

**Higher Order Differential Equations** Linear differential equation with constant coefficients - Solutions of homogeneous equations. Particular solution of non - homogenous differential equations by inverse differential operator method for the following standard forms; exponential, polynomial, trigonometric and their product.

**Self – study:** Linear differential equations, Bernoulli's differential equations.

## MODULE-2 — 8 Hrs

**Differential Equations** - Method of variation of parameters to solve linear differential equation with constant coefficients.

**Applications of first** order, first degree differential equations: simple electric circuit, Newton's law of cooling, heat flow problems.

Applications of second order, first degree Differential equations - oscillations of a spring-case-modelling of forced oscillations with damping and its solution.

Orthogonal trajectories in Cartesian form, illustrative examples. Applications to find the orthogonal trajectories for equi-potential lines in an electric field between two concentric cylinders, streamlines of flow in the channel, curves of constant temperature in a body.

**Self – study:Matrix method to solve homogeneous differential equations of order 2, degree 1.**

| **MODULE-3** | **8 Hrs** |
|---|---|

**Numerical solution of first order, first degree ODE:** Taylor series method, Runge-Kutta (RK) method of fourth order, Milne's predictor corrector methods, Mixing problems involving two tanks-an application connected with simultaneous differential equations.

Self-Study - Numerical solution of Simultaneous differential equations, numerical solution of second order differential equations by RK method.

| **MODULE-4** | **8 Hrs** |
|---|---|

**Partial Differential Equations**: Solving PDE by variable separable method, To find all possible solutions of one-dimensional wave equation, solution of system of equations by Gauss Seidel iteration method.

Numerical solution of a Laplace equation, Poisson equation by finite difference approximation method--using standard five point formula, diagonal formula and iterative formulas.

**Self – study:** To find all possible solutions of one-dimensional heat equation, two dimensional Laplace's equation.

| **MODULE-5** | **10 Hrs** |
|---|---|

**Vector Calculus:** Velocity & acceleration of a vector point function, **movement of a force, velocity of a rotating body, rotation of rigid body,** Gradient, divergence & curl. Physical & Geometrical Interpretation of dot product, Gradient, divergence & curl, irrotational vectors, illustrative examples from engineering field.

Line integrals, surface integrals and volume integrals, Statement of Green's theorem, Stokes theorem and Illustrative examples from engineering field.

**Self – study:** Gauss divergence theorem, Illustrative examples from engineering field

**Note - Theorems and properties without proof. Applicable to all the Modules.**

**Text Books:**


1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.

**Reference Books:**


1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
2. R K. Jain and S. R. K. Jain & S. R. K. Iyengar, Numerical methods, New age international pvt. Publishers, 6thedition, 2014.
3. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.


| **Title** | **Basic Electrical Engineering** | | |
|---|---|---|---|
| **Course Code** | **21EE103/203** | **L-T-P** | **(3-0-0) 3** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **4** |
| **SEE** | **50 Marks** | **Total Hours** | **50** |

**Prerequisite:** Ohms law and Kirchhoff's laws. Current and power in pure R, L and C. Vector algebra. Basic knowledge in magnetic circuits and electromagnetic induction.

**Course Objective:**

The student will acquire basic knowledge of electrical power systems, protective devices, electric circuits, measuring systems and machines.

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

| # | Course outcomes | Mapping to PO's | Mapping to PSO's |
|---|---|---|---|
| 1 | Explain the basic concepts of electrical generation, transmission, distribution and basic electrical protection devices. | 1,2 | - |
| 2 | Describe the basic principle and construction of analog and digital measuring instruments. | 1,2 | - |
| 3 | Apply the fundamentals of single phase and three phase AC circuits and perform related calculations. | 1,2 | - |
| 4 | Apply the basic concepts of electrical machines. | 1,2 | - |

| **MODULE-1** | **8 Hrs** |
|---|---|

**Electric Energy systems:** Significance of electrical energy, sources of energy (Conventional/renewable), Single line/block diagram representation of a typical power system. Brief introduction to the electrical generation, transmission and distribution subsystems indicating typical voltage levels.

General concept of earthing, types of earthing, introduction to protective devices- Fuses, MCB, ELCB, MCCB, General types of wires and cables and selection, Electrical Tariff, Elementary calculation of energy consumption.

**Self-learning topics**:General safety precautions in handling electrical equipment.

| MODULE-2 | 8 Hrs |
|---|---|

**AC systems:** Generation of single/three phase voltages, Instantaneous/average/rms values. Definition of impedance, admittance, real power, reactive power, apparent power and power factor. Analysis of series R-L, R-C, R-L-C circuits, phasor diagrams. Illustrative examples involving series and parallel circuits.

**Self-learning topics:**Measurement of voltage, current, power and power factor in single phase AC system

| MODULE-3 | 8 Hrs |
|---|---|

**Three phase systems:**Star-Detla connection – calculation of voltage, current and power in a balanced three phase Star-Delta system.

**Electromechanical / Digital Instruments:** Construction, working and principle of operation of Dynamometer type wattmeter. Digital meters, Merits and demerits of digital meters over analog meters, digital multimeter and digital voltmeter.

**Self-learning topics:**Measurement of Voltage, current, power and power factor in three phase AC system. Digital/smart energy meter.

| MODULE-4 | 8 Hrs |
|---|---|

**Electrical Machines:** Specifications of machines, classification of machines, DC machines - Constructional features, working principle of generator, EMF equation, Working principle of motor, Torque equation, Types of motors and their Voltage & Current relations, applications, Illustrative examples.

**Self-learning topics:**Brushless DC Motors and their application

| MODULE-5 | 8 Hrs |
|---|---|

**Transformers:** Classification of transformers, applications of each type, construction of core and shell type transformers, principle of operation, EMF Equation, Transformation ratio, Power losses and efficiency, Illustrative examples on EMF equation and efficiency.

**Induction machines:** Induction Motors-Concept of rotating magnetic field, classification (Squirrel cage and Slip ring motors) Principle of operation and Constructional features, Slip and its significance, Single-phase induction motors, working principle, classification and applications.

**Self-learning topics**:Applications of transformers and induction motors, Electric motors used in Electric Vehicles.

**Text Books:**

3. Rajendra Prasad, *Fundamentals of Electrical Engineering*, Prentice-Hall of India Pvt. Ltd.,3rd editon, 2014.

**Reference Books:**

1. D. C. Kulshreshtha, *Basic Electrical Engineering*, McGraw Hill, 2nd edition, 2019
2. E. Hughes, *Electrical and Electronics Technology*, Pearson Education, 2010

3. K. Uma Rao and A. Jayalakshmi, *Basic Electrical Engineering*, Pearson Education, 2011.

| **Title** | **Engineering Drawing** | | |
|---|---|---|---|
| **Course Code** | **21MD104/204 A/B** | **L-T-P-C** | **(2-0-4-3)** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **06** |
| **SEE** | **50 Marks** | **Total Hours** | **78** |

Note – 1) **21MD104/204 A – Manual drawing (for ME/CV)**

**2) 21MD104/204 B – Compueter Aided Engineering Drawing (for ECE/EE/CS/IS/EI)**

**Course Objective:** To introduce the students to "universal language of Engineers" for effective communication and perform drafting exercises of geometrical shapes, solids and machine elements in different systems of Projection using BIS/ISO standards and conventions with the aid of manual drafting and CAD package to effectively take-up the basic industrial/societal drawing needs.

**Course Outcomes:**

Upon completion of the course, students shall be able to;

| # | **Course outcomes** | **Mapping to PO's** | **Mapping to PSO's** |
|---|---|---|---|
| 1 | visualize geometrical solids in 3D space through exercises in Orthographic Projections | 5, 10 | - |
| 2 | develop the lateral surfaces of geometrical solids and transition pieces | | - |
| 3 | interpret isometric views and draw orthographic views of machine components and perspective projections | | - |

**Course contents:**

| **MODULE-1** | **20 Hrs** |
|---|---|

**Principles of orthographic Projections:** Different planes of projection and views taking point as an example with explanation about distance of a point from planes of projections. Concept of true length and true inclination of a line (emphasis on practical problems). Projection of Planes by Change of position method only (no combination of planes).

| **MODULE-2** | **24 Hrs** |
|---|---|

Front, top, profile and auxiliary views of geometric solids resting with their base completely on HP (no other positions).

Development of lateral surfaces, Introduction to Section Planes and section of regular solids, Parallel and Radial line methods.

| **MODULE-3** | **18 Hrs** |
|---|---|

Conversion of Isometric views into Orthographic views: Simple machine components. Isometric projections of geometric solids and simple machine components.

| **MODULE-4** | **16 Hrs** |
|---|---|

Perspective projections of regular geometric solids (1- point and 2-point perspectives).

**Text Books:**


1. Engineering Drawing: N.D.Bhatt & M.Panchal. 37th Edition 1996, Charotar Publishing House. Gujarat


**REFERENCES:**


1. Engineering Drawing & Design : Cencil Jensen, Jay D. Helsel, Dennis R. Short, Seventh Edition , Tata McGraw-Hill 2012.
2. Engineering Drawing: K.R. Gopal Krishna, 24th Edition 1999 Subhash Publications, Bangalore.

| Title | ENGINEERING MECHANICS | | |
|---|---|---|---|
| **Course Code** | **21CV105/ 205** | **L-T-P** | **(3-0-0)3** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **3** |
| **SEE** | **100 Marks** | **Total Hours** | **40 Hours** |

In the Course, the students are acquainted to analyses and predict various mechanical static and dynamic forces at rest and in motion. Students will accomplish to workout geometrical properties of planar elements and forces in space. Course Outcomes (COs) with mapping shown against the Program Outcomes (POs)}

**Course outcomes:** Upon completion of the course, students shall be able to:

| COs | Course outcomes | Mapping to PO's |
|---|---|---|
| 1 | Develop free body diagrams for different force systems and determine the resultant forces | PO1, PO2 |
| 2 | Apply equilibrium equations in statics | PO1, PO2 |
| 3 | Determine geometric properties like centroid and moment of inertia for planar elements | PO1, PO2 |
| 4 | Apply Newton's law in motion, and recognize different kinds of particle motions | PO1, PO2 |

## MODULE-1 — 10 Hrs

**Introduction:** Definition of force, characteristics of force — Basic idealizations of mechanics like particle, continuum, rigid body — Basic principles of Mechanics — Units of measurements. **Coplanar Concurrent Force System:** Coplanar forces — Coplanar concurrent force system — Resolution and composition of forces. Static Equilibrium of coplanar concurrent force systems**. Coplanar Non-Concurrent Force System:** Moment of a force-couple– and its characteristics - Varignon's Theorem of moments - Composition of coplanar non-concurrent Force Systems - Static equilibrium of coplanar non-concurrent Force Systems**.**

## MODULE-2 — 10 Hrs

**Support Reaction**: Different types of supports. Introduction to statically determinate and indeterminate beams. Determination of support reactions for statically determinate beams subjected to various types of loads. **Friction:** Concept of frictional force - Types of friction - laws of static friction. Static equilibrium of coplanar force systems involving friction, Friction in Block and ladders.

## MODULE-3 — 10 Hrs

**Centroid and Centre of Gravity:** Determination of the position of centroid of plane figures (rectangular, triangular, sector or segment of circle, semi-circular and quadrant) by the method of integration - Determination of the position of centroid of plane figures and built-up sections by the method of moments.

| MODULE-4 | 10 Hrs |
|---|---|
| **Second Moment of Areas (Moment of inertia):** Second moment of an area, moment of inertia, product of inertia, principal moments of inertia (concepts), polar moment of Inertia, Radius of gyration, Parallel axes and perpendicular axes theorems — Determination of moment of inertia and radius of gyration of plane figures (rectangular, triangular, sector or segment of circle, semi-circular and quadrant), composite areas and built- up sections. | |
| **MODULE-5** | **10 Hrs** |
| **Introduction to Dynamics** – Classification, Linear & Curvilinear motion, Projectiles, Law of conservation of momentum, Collision of elastic bodies, D'Alembert's Principle, Kinetics of rigid bodies - Numerical Examples | |

**SELF LEARNING ACTIVITIES- ENGINEERING MECHANICS**

- Visit a building and list the structural components and identify the nature of loading on them. The load may be a point load, a UDL, a UVL or a combination of these-discuss with the faculty.
- Visit a railway station/Bus stand and list the steel structural components-discuss the loading pattern with the faculty.
- Visit an automobile workshop and observe the components of a vehicle and discuss the types of loads with the faculty.
- Visit a substation and observe transmission towers, electric poles, guy wires-discuss with the faculty on wind load, tension in wires, forces on guy wires etc.,

**Text Books:**


1. I B Prasad, "A Textbook of Applied Mechanics Dynamics and Statics", Khanna Publishers. New Delhi. ISBN No. 978-81-7409-068-1, 19th Edition, Eleventh Reprint 2016.
2. R. K Bansal, "A Textbook of Engineering Mechanics", Laxmi Publications, New Delhi.2015.


**Reference Books:**


1. Rajashekaran S, and Sankar Subramanian, G., "Engineering Mechanics – Statics and Dynamics", VikasPublications.
2. Timoshenko and Young, "Engineering Mechanics" TMH publishing, India. Statics and Dynamics".2006.
3. Beer and Johnston, Vector Mechanics for Engineers Statics and Dynamics" (In SI Units) 8th Edition - 2007 – Mc.GrawHillPublications.
4. S.S.Bhavikatti ' Engineer Mechanics' , New Age International Publishers, 5th Edition.
5. Ramamrutham S: "Text book of Applied Mechanics", Dhanpat Rai and Sons, New India. 1997.

| Course Title | Engineering Physics Laboratory | | |
|---|---|---|---|
| **Course Code** | 21PH106/206 | **L-T-P-C** | **0-0-2-1** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **2** |
| **SEE** | **50 Marks** | **Total Hours** | **26** |

**Course Objective:** Objective of the course is to make learners able to apply and verify concepts of physics experimentally.

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

| # | Course Outcomes | Mapping to POs |
|---|---|---|
| 1 | Demonstrate experimentally the properties of semiconductors, dielectrics, elastic bodies, vibrations, radiation, and optical phenomena. | 1,9 |
| 2 | Calculate the physical quantities using the experimental data. | 1,9 |

**A. Guided laboratory**

1. Verification of Stefan's law of radiation
2. Determination of Planck's constant using Light Emitting Diodes.
3. Determination of dielectric constant by charging and discharging of a capacitor.
4. Estimation of frequencies of vibrating string and AC using Sonometer.
5. Determination of resonance frequency and inductance using LCR circuits.
6. Determination of Young's modulus using single cantilever.
7. Determination of wavelength of LASER by diffraction technique.
8. Determination of numerical aperture and modes of transmission of optical fiber.

**B. Open ended laboratory (few examples are given bellow)**

1. Measurement of effective resistance of series combination of three resistors
2. Measurement of effective capacitance of parallel combination of three capacitors.
3. Measurement of effective emf of series combination of three cells.

| DESIGN THINKING LABORATORY | | | | |
|---|---|---|---|---|
| **Course Code:** | 21DT108 | | **L-T-P-C** | 0-0-2-1 |
| **Exam Hours:** | 00 | | **Hours/Week** | 2 |
| **SEE:** | 00 | | **Total Hours** | 28 Hours |

| | |
|---|---|
| **Course Objective:** | Aims to blends theory and practice of design thinking from a systems-level, multi-sector and cross-disciplinary perspective. Focused on Human Centered Design (HCD), Design Thinking and Social Research Method, participants are introduced to a variety of practices, processes and tools that community-change agents use to inform, inspire and create lasting, meaningful solutions. |
| **Course Outcomes (CO's):** | Upon Completion of the course, students shall be able to: |

| **CO's** | **Statement** | **PO's** |
|---|---|---|
| 1. | Develop awareness regarding the sector in the regions and the sustainable development goals | PO7, PO9, PO10 |
| 2. | Acquire essential skills such as interpersonal skills, communication skill to indulge with different stakeholders of the community to identify the problems | PO8, PO9, PO10 |
| 3. | Apply research methods to organise, analyse and define the problem | PO2, PO4 |
| 4. | Design solutions to the challenges identified along with the stakeholders of the community | PO1, PO6, PO9, PO10 |
| 5. | Build prototype using rapid prototyping tools for the ideas that can solve the identified problem | PO1, PO3, PO5, PO11, PO12 |

**Course Contents:**

| **Week** | **Session** | **Key Topics** |
|---|---|---|
| **1.** | Introduction to Social Innovation Program | • Introduce the Social Innovation Program<br>• Course Outcomes (Knowledge, Skill & Attitude)<br>• Pre-requisites<br>• Deliverables - Journey from Idea to Preincubation<br>• Design challenge - design a better commute for partner |
| 2. | Introduction to Sustainable | • Introduction to the MDGs. |

| | | |
|---|---|---|
| | Development Goals | • Introduction to the SDGs.<br>• What is required to achieve the SDGs by 2030?<br>• SDG on my Plate |
| 3. | Introduction to Design Thinking | • What is Design Thinking?<br>• Phases in Design thinking<br>•When to use Design Thinking?<br>•Design Thinking Challenge |
| 4. | Introduction to Product design and development | • Product Design and Development Cycle<br>•Design Thinking in product design<br>•Design Challenge |
| 5. | Introduction to Research Secondary Research & Primary Research | • How to use Google scholars to find research papers<br>• How to search effectively using Google search engine<br>• Activity- Secondary research on sectors<br>• How to empathise with your users?<br>• Interview Techniques<br>• How to conduct surveys<br>•Field Activity: Identifying an organisation/company/industry for the project and conducting field research (Physically / Online) |
| 6. | Research analysis and designing the problem brief & Ideation | • Cause and effect analysis<br>• Stakeholder analysis<br>• Defining the problem brief<br>• Activity - Analysis of the field activity<br>• Silent Ideation using Miro |
| 7. | Sketching your Ideas | • One point perspective<br>• Two point perspective<br>• Three point perspective |
| 8. | Computer Aided Modelling | • Introduction to Onshape<br>• Creating files for 3D printing<br>• Creating files for Laser Cutting<br>• Creating files for Vinyl Cutting |

| | | |
|---|---|---|
| 9. | User Interface Design | • Introduction to User Interface design<br>• Low fidelity prototype, Medium Fidelity, High Fidelity Prototype<br>• Introducing to Adobe XD<br>• Creating screens in Adobe XD |
| 10. | Planning and Prototype | • Project planning using clickup<br>• Create 3D model of the design<br>• 3D print the parts<br>• Laser cut the parts<br>• Assembling the electronics<br>• What is a pitch deck<br>• Introduction to Canva<br>• Creating Pitch decks for the prototypes |
| 11. | Pitch Deck | • What is a pitch deck<br>• Introduction to Canva<br>• Creating Pitch decks for the prototypes |
| 12. | Social Innovation Expo | Social Innovation Project pitching event and exhibition |

# ENGINEERING CHEMISTRY

**Course Code: 21CH101/201** **LTPC: 4-0-0-4** **Exam hours: 3 hours**
**Hours/week: 4** **SEE: 50 Marks** **Total hours: 50**

**Course Objective**: The objective of this course is to build a strong foundation and basic skills in Engineering Chemistry for technological competence in industries.

**Course Outcomes:**

After the completion of the course, students shall be able to:-

| | | |
|---|---|---|
| CO1 | Describe the construction and working of chemical cells and batteries. | PO1, PO2 |
| CO2 | Illustrate the different types of chemical processes and their importance in the field of engineering. | PO1, PO2 |
| CO3 | Distinguish among properties & applications of polymers, water and chemical energy. | PO1, PO2 |

| | | |
|---|---|---|
| CO4 | Apply various principles to solve numerical problems related to chemical energy, water and others. | PO1, PO2 |

## Course Contents:

**MODULE-1**

**Fuels and combustion**

Fuels-Definition, Classification based on the physical state and occurrence with examples, Calorific value –definition, classification - Gross and Net calorific values, units in S.I system. Characteristics of an ideal fuel. Experimental determination of calorific value of a solid fuel using Bomb Calorimeter. Numerical problems on GCV and NCV.

**Chemical processing of Petroleum:** Petroleum cracking – Definition. Types of cracking-thermal and catalytic cracking. Fluidized catalytic cracking. Reforming of petrol with reactions (Isomerisation, cyclisation, aromatisation and dehydrogenation). Octane number & Cetane number. Knocking of petroleum, knocking mechanism. **Prevention of knocking** – anti knocking agents (TEL & MTBE). Power alcohol, biodiesel and Synthetic petrol -preparation by Bergius Process. **10 hours**

**MODULE-2**

**High Polymers**

**Introduction,** definition and classification with examples. **Glass transition temperature (Tg)** - definition, factors affecting Tg and significances of Tg.

**Resins and plastics** – Types of plastics- thermoplastics & thermosetting plastics-differences. Compounding of resins in to plastics. Synthesis, properties and Industrial applications of PMMA, Polyurethane, Polycarbonate and Kevlar.

**Adhesives** –Meaning, Preparation, properties and applications of Epoxy resins & Phenol-formaldehyde resins.

**Biodegradable polymers-** Introduction, types of biodegradable polymers, preparation, properties and applications of polylactic acid (PLA).

**Elastomers**- Definition, types-natural and synthetic rubber. Preparation of natural rubber from latex, deficiencies of natural rubber, compounding and vulcanization of natural rubber.

**Synthetic rubber**- Advantages of synthetic rubber over natural rubber. Preparation, properties and industrial applications of SBR rubber, Thiokol, butyl rubber and silicon rubber**.**

**10 hours**

**MODULE-3**

**Water and its treatment**

Introduction, sources of water, impurities in water, standards of water for industrial supply. Hardness of water, determination of total hardness by EDTA method. Boiler feed water and boiler problems, **Boiler scales and sludge's**, External treatment of boiler feed water- Hot Lime - Soda process and Ion exchange method. **Internal treatment of water** – phosphate conditioning & Calgon treatment.

**Desalination** – Meaning, purification of water by reverse osmosis.

**Potable water** – Meaning, Standards of potable water, treatment of water for town supply**.** BOD, COD- definition, experimental determination of COD value with problems. **10 hours**

## MODULE-4

### Electrochemistry

Introduction, electrochemical cells – Definition, Types of electrochemical cells, Construction, working & representation of galvanic cell. Modern sign conventions, single electrode potential, standard electrode potential. E.M.F of a cell, derivation of Nernst Equation.
**Concentration cell-** Definition with example, derivation of emf of concentration cell. Types of electrodes. **Secondary reference electrodes** – calomel electrode, ion selective electrodes- glass electrode. Determination of pH of a solution using glass electrode. Potentiometric estimation of FAS using $K_2Cr_2O_7$ solution. Numerical problems on E, $E^0$, $E_{cell}$, $E^0$cell and concentration cells.

### Metal finishing

Introduction, technological importance of metal finishing. Significance of polarization, decomposition potential and over voltage.

**Electroplating –** Definition, factors affecting the nature of electro deposit - metal ion concentration, current density, complexing agents, organic additives, $p^H$, temperature & throwing power. Electroplating of Copper by cyanide bath method.
**Electroless plating -** Definition, distinction between electroplating and electroless plating. Advantages of electroless plating. Electroless plating of Nickel. **10 hours**

## MODULE-5

### Chemistry of nanomaterials (CNM)

Introduction to nanomaterials. Properties of nanomaterials, Classification.

**Synthesis:** top-down and bottom-up approaches. Chemical methods of synthesis- solution combustion and hydrothermal methods. Characterization techniques like PXRD, SEM, and TEM (only introduction). Applications and disadvantages of nanomaterials.

### Battery technology

**Batteries**- Definition, difference between battery and cell. Battery characteristics. Classification of batteries – primary & secondary batteries. Secondary batteries - construction, working and industrial applications of Lead- acid battery.

**Modern batteries:** Construction, working and industrial applications of Zinc-air battery, Nickel metal hydride battery and Li batteries.
Fuel Cells- Introduction, definition, construction, working and industrial applications of $H_2$-$O_2$ fuel cell & methanol-oxygen fuel cell. Differences between battery and fuel cell. **10 hours**

### TEXT BOOKS

1. Engineering Chemistry by M.M. Uppal, Khanna Publishers (2001 edition).

2. A text Book of Engineering Chemistry- by P C Jain and Monica Jain, Dhanapatrai Publications, New Delhi.(2015 edition)

### REFERENCE BOOKS

1. Principles of Physical Chemistry B.R.Puri, L.R.Sharma & M.S.Pathania, S.Nagin Chand &Co.,

(2008 edition).
2. Text Book of Polymer Science by V.R.Gowarikar, N.V.Viswanathan and J.Sreedhar, Wiley-Eastern Ltd (2006 edition).
3. Industrial Chemistry by B.K.Sharma, GOEL Publishing House (2014 edition).
4. Industrial Electrochemistry, Second Edition by Derek Pletcher & Frank C. Walsh publisher: Chapman & Hall, USA (1993 edition)

| **Title** | **BASIC ELECTRONICS ENGINEERING** | | |
|---|---|---|---|
| **Course Code** | **21EC103/203** | **L-T-P** | **3-0-0-3** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **3** |
| **SEE** | **50 Marks** | **Total Hours** | **40** |

**Prerequisites (if any):** Semiconductor diode, Zener diode, Half- Wave rectifier, LC tank circuit,

Number Systems – Binary, Octal and Hexadecimal, OR,AND, NOT gates

**Course Objective:** Study of basic electronics devices, circuits and system including digital devices, microprocessor and microcontroller, operational amplifier, communication and display devices.

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

| # | Course outcomes | Mapping to PO's | Mapping to PSO's |
|---|---|---|---|
| 1 | Apply the knowledge of semiconductor devices to understand the working of electronics devices and circuits to study their operating conditions. | 1,2,5 | 1 |
| 2 | Explain the applications of electronic devices and their working. | 1,2 | 1 |
| 3 | Illustrate the working principles of digital circuits, microprocessor and microcontroller. | 1,2 | 1 |
| 4 | Describe the working principle of analog devices and communication system. | 1,2 | 1 |

| **MODULE-1** | **08 Hrs** |
|---|---|

**Analog Devices:**

BJT: Input and output characteristics of CE configuration, JFET: Working principle, Drain and transfer characteristics, applications. MOSFET: Enhancement and depletion type N-channel, P-channel MOSFETs, Drain / Transfer Characteristics. Other devices: SCR, Photodiode and Solar cell - working principles and applications.

| **MODULE-2** | **08 Hrs** |
|---|---|

**Electronics Circuits:** Bridge Full-Wave rectifier: Circuit diagram, working, input and output waveforms, Rectifier with C filter, Zener voltage regulator. Transistor amplifier -Fixed bias, Collector to emitter bias, Voltage-Divider Biasing Circuit, CE amplifier, RC phase shift oscillator, Colpitt's oscillator and Crystal oscillator. (Substitution Problems).

| MODULE-3 | 08 Hrs |
|---|---|
| **Digital Electronics:** NAND, NOR, Ex-OR gates, Half Adder, Full Adder, Encoder, Decoder, SR Flip Flop, JK Flip-Flop, D-Flip Flop, T- Flip-Flop, Introduction to Microprocessors and Microcontrollers,8051 Microcontroller architecture. | |
| **MODULE-4** | **08 Hrs** |
| **Operational Amplifier:** Characteristics (Ideal and Practical), Inverting and Non-inverting Amplifier, Voltage follower, Summing Amplifier and Subtractor, Numerical examples as applicable.<br>**Display instruments:** Cathode Ray Oscilloscope, Digital Oscilloscope. | |
| **MODULE-5** | **08 Hrs** |
| **Communication Systems:** General communication system, Need for modulation – Amplitude Modulation, Frequency modulation (Substitution Problems). FM Radio, Digital modulation Techniques - ASK and FSK, Cellular Networks, Blue tooth, Internet of Things. (Block Diagram approach only). | |

**Text Books:**

1. **David. A. Bell,** "Electronic Devices and Circuits", 5th Edition, 2008, Oxford UniversityPress.
2. **M. Morris Mano,**"Digital Logic and Computer Design", 5th edition, 2002,PHI.

**Reference Books:**

1. **SantiramKal**, "Basic Electronics: Devices, Circuits and IT Fundamentals", 2009,PHI.
2. **Ramakant A. Gayakwad,** "Op-amps and linear integrated circuits", 4th edition, 2000, Prentice Hall.
3. **George Kennedy, "**Electronic communication systems", 6th edition, 2017, McGraw HillIndia.
4. **Muhammad Ali Mazidi,** "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd Edition, 2011,Pearson.

| **Title** | **ELEMENTS OF MECHANICAL ENGINEERING** | | |
|---|---|---|---|
| **Course Code** | **21ME104/204** | **L-T-P-C** | **(3-0-0) 3** |
| **Exam** | **3 Hrs.** | **Hours/Week** | **03** |
| **SEE** | **50 Marks** | **Total Hours** | **39** |
| | | | |

**Course Objective:**

To introduce fresh entrants of all undergraduate Programmes the principles and fundamentals of Mechanical Engineering.

**Course Outcomes (COs)**{with mapping shown against the **Program Outcomes (POs)}**

**Upon completion of the course, students shall be able to:**

| # | Course outcomes | Mapping to PO's | Mapping to PSO's |
|---|---|---|---|
| 1 | Explain the working of steam boilers, steam turbine, gas turbine, hydraulic turbine, IC engines and Electrical Vehicle. | 1,2 | - |
| 2 | Describe the mechanism of power transmissions, bearings, purpose and methods of lubrication. | 1,2 | - |
| 3 | Identify engineering materials, their properties, manufacturing methods, automation of manufacturing process encountered in engineering practice. | 1,2 | - |
| 4 | Differentiate various non conventional machining and working on refrigeration and air conditioning. | 1,2 | - |

| Module -I | Hours |
|---|---|
| **Introduction to Mechanical Engineering- Thermal, Design and Manufacturing Engineering.**<br>**Boilers and Properties of steam:** Formation of Steam with constant pressure, Type and properties of steam-Specific volume, Internal energy, and Dryness fraction (numerical problems). Basic principle of water tube boiler & Fire tube boiler, list & functions of boiler mountings & accessories (no construction Details). | **08 Hrs.** |
| **Steam Turbines**–working Principle of Impulse & Reaction turbine.<br>**Gas turbines cycles**- working principle of Open &Closed cycle gas turbine.<br>**Hydraulic turbines**–working principle & operation of Impulse & Reaction turbines. | |
| **Self study:**<br>Energy Conversion: Sources of Energy, Energy alternatives<br>**Activity:**<br>Laboratory visit (Fluid Mechanics and Machinery Laboratory) | |
| **Module - II** | |
| **I.C. Engines** –Heat Engine, I. C Engines – Classification, Parts, Terminology, 4 stroke petrol and diesel engine. Numerical problems on IP, BP, FP, Efficiency.<br>**Electrical Vehicle Technology**: Basic concepts<br>**Power Transmission:** Gears - spur gears, bevel gears, helical gears, worm gear sets, rack and pinion, simple and compound gear trains, Belt and chain drives. Expression of Velocity Ratio for Gears drives, Belt drives, chain drives and gear trains, Numerical problems on Velocity ratio. | **08 Hrs.** |
| **Self study:**<br>Various pollutants from the IC Engine Emission and Effect on the environment. Electric vehicle Components.<br>**Activity:**<br>Comparative study of I C Engine and Electrical vehicle system. Preparation and Presentation of a Report. | |
| **Module - III** | |
| **Lubrication and Bearings**: Purpose of lubrication, Types and properties of lubricants, | **08 Hrs.** |

| | |
|---|---|
| Drop Feed and Splash lubrication, Introduction to Bush bearing and Anti friction Bearings**.**<br>**Materials and Mechanical properties -** Engineering Materials; Metals and their alloys, ceramics, polymers, composite materials. Concepts of Stress, Strain, stress-strain diagram for Ductile and Brittle Material When subjected to Tension. Factor of safety (F.O.S.). Numerical problems on Stress, Strain and Change in length. | |
| **Self study:**<br>Tension, Compression, and Shear, Strain, stress-strain diagram for Ductile and Brittle Material When subjected to Compression.<br>**Activity:**<br>Demonstration on Tensile & Compression Testing using UTM. | |
| **Module – IV** | |
| **Manufacturing Processes**: Introduction and classification of manufacturing processes. Casting-Principles of Sand casting, Permanent Mould casting, Hot chamber Die- casting process, Advantages, Limitation and Applications.<br>**Metal Forming:** Principles of Rolling, Extrusion (Direct & Indirect Extrusion). Forging operations.<br>**Joining process**: Brief description of Electric Arc Welding, Gas Welding, Brazing and Soldering. | **08 Hrs.** |
| **Self study:**<br>Plastic processing: Injection Moulding of plastics. Cold chamber Die- casting process**.**<br>**Activity:**<br>Workshop visit (Demonstration on Sand mould Casting, Forging and Welding) | |
| **Module - V** | |
| **Non-conventional Machining**- EDM, ECM and LBM. **Automation**: Concept of CNC system and Automation, advantages and disadvantages. | **07 Hrs.** |
| **Refrigeration & Air Conditioning:** unit of refrigeration, Refrigeration effect, Ton of Refrigeration, COP. **Refrigerants**- Types & properties of refrigerants. Parts of refrigerator, Working principle of Vapour compression and Vapour absorption refrigerators. , Introduction to Air conditioning, working principle of room / window Type air conditioning system. | |
| **Self study:**<br>Principle of Conventional Machining process, Basic machining operations**.**<br>**Activity:**<br>Preparation of report and Presentation on Advanced Manufacturing Methods.<br>Visit to Refrigeration unit. | |

**TEXT BOOK:**


1. Elements of Mechanical Engineering by V. K. Manglik, PHI, 2014, ISBN: 978-81-203-5025-0


**REFERENCES:**


1. Elements of Mechanical Engineering - K P Roy, S K H Choudry, A K H Choudry, Roy Media promoters and publishers, Mumbai, 7th edition, ISBN : 4567145216, 1234567145210.
2. Basic Mechanical Engineering - Basanth, Agrwal& C.M. Agrawal 2008. Wiley India Pvt. Ltd 2008, ISBN 13, : 9788126518784
3. An Introduction to Mechanical Engineering,- Jonathan Wickert, 2nd edition, Cengage Learning 2006, ISBN-10: 1-111-57682

4. Electric and Hybrid vehicles by A. K. Babu Khanna Publications

| PROGRAMMING FOR PROBLEM SOLVING | | | | |
|---|---|---|---|---|
| **Course Code** | : 21CS105/205 | | **L-T-P-C** | : 4-0-0-4 |
| **Exam. Hours** | : 03 | | **Hours / Week** | : 04 |
| **SEE** | : 50 Marks | | **Total hours** | : 50 |

| | |
|---|---|
| **Course Objective :** | Aims to provide fundamental programming concepts which are essential to develop program for a given problem. |

| | |
|---|---|
| **Course Outcomes (COs) :** | Upon Completion of the course, students shall be able to: |

| COs | Statement | POs |
|---|---|---|
| 1. | Describe the basic concepts of C programming | PO1 |
| 2. | Apply the knowledge of C programming constructs for a given problem | PO1, PO2 |
| 3. | Analyse the given problem to determine the output and correctness of the programs given | PO1, PO2, |
| 4. | Develop a program to find a solution for the given requirements | PO1, PO2, PO5, PO9, PO10 |

**Course Contents:**

**MODULE – 1**

**Algorithm and Flowchart, Introduction:** Importance of C, Basic structure of C program, executing a C program, Characters set, C tokens, Variables, Data types, Operators, Expressions**,** Evaluation of expressions, Operator precedence and associativity, Type conversion,Defining Symbolic constants ,Simple programs.

*Self Study* : Extended data types

**10 Hrs**

**MODULE – 2**

Managing Input and Output Operations, Decision making and Branching**.**elseif…ladder statements, The ?: operator, Simple programs.

**10 Hrs**

**MODULE – 3**

Decision making and Looping**,** Jumps in Loops, programming examples,Nested loops,Arrays: One-dimensional Arrays, Two-dimensional Arrays, , Program to merge two arrays in sorted order, programming examples

*Self-Study*: Multidimensional array

**10 Hrs**

**MODULE – 4**

Character Arrays**,** Arithmetic operation on characters, String handling functions, User-defined Functions, Elements of User defined function, Category of functions, Parameters passing in functions: call by value and call by reference, Nesting of function, Recursion, Passing arrays to functions, Passing strings to functions.

| | |
|---|---|
| *Self-Study*: Additional built-in string functions | |
| | **10 Hrs** |
| **MODULE – 5** | |
| **Structures**: Defining a structure, Declaring a structure variable, Accessing structure members, Structure initialization, Operations on individual members, Arrays of structure, Structure within structure.<br>**Pointers:** Understanding pointers, Accessing the address of a variable, Declaring pointer variables, Initialization of pointer variables, Accessing a variable through its pointers, Pointer expressions, Pointers increments and scale factor, Pointers and arrays, Pointers as function arguments, Pointers to function. | |
| | **10 Hrs** |
| **Text Books:** | |
| 1. | Balagurusamy E, "Programming in ANSI C", 7th Edition, Tata Mc Graw Hill, 2013. |
| **Reference Books:** | |
| 1. | Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language", 2nd Edition, PHI, 2012. |
| 2. | Programming Techniques through C, M. G. V.Murthy, Pearson Education, 2014 |
| **MOOCs** | |
| 1. | http://nptel.ac.in/courses/106104128/ |

## ENGINEERING CHEMISTRY LABORATORY

**Course Code: 21CH106/206** **LTPC: 0-0-2-1**
**Exam hours: 3 hours** **Hours/week: 2** **SEE: 50 marks**

**Course objectives**:
To provide students with practical knowledge of quantitative analysis of materials by volumetric and instrumental methods for the determination of constituents present in a sample.

**Course outcomes**

After the completion of the course students shall be able to:-

| | | |
|---|---|---|
| CO1 | Analyse the hardness of water, CaO in cement, COD of waste water, percentage of iron and copper content in the given samples. | PO1 |
| CO2 | Apply the analytical techniques like conductometry, colorometry and potentiometry for accurate chemical analysis. | PO2 |

**LIST OF EXPERIMENTS**

**PART- A (Volumetric Analysis)**

1. Estimation of $KMnO_4$ using Mohr's salt crystals.

2. Determination of Total hardness of a given sample of hard water using EDTA.
3. Determination of Calcium oxide in the given sample of cement by EDTA method.
4. Determination of percentage of iron in the given sample of haematite ore solution using potassium dichromate crystals by external indicator method.
5. Determination of COD of the given industrial waste water sample.
6. Determination of percentage of copper in brass using standard sodium thiosulphate.

**PART- B (Instrumental Methods)**

1. Determination of pKa value of weak acid using pH meter.
2. Estimation of FAS using $K_2Cr_2O_7$ by Potentiometric Method.
3. Estimation of copper using Colorimeter.
4. Estimation of HCl using standard NaOH by conductometric method.
5. Determination of viscosity coefficient of a given liquid using Ostwald's Viscometer.

**Reference Books:**


1. Engineering chemistry lab manual, written by faculty, Department of chemistry, MCE Hassan.
2. Vogels text book of quantitative inorganic analysis, revised by J. Bassett, R.C. Denny, G.H. Jeffery, 4th Ed.
3. Applied chemistry theory and practice by O. P. Vermani and A. K. Narula, second edition.

## COMPUTER PROGRAMMING LABORATORY

| | |
|---|---|
| **Course code: 21CS107/207** | **LTPC : 0-0-2-1** |
| **Hours/week: 2** | **Total hours : 28** |
| **SEE: 50 Marks** | **Exam. Hours: 3** |

**Course Objective:**Design, develop and document programs using C.

**Course Outcomes (COs):**

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

| | | |
|---|---|---|
| 1. | Implement program using C for the given problem. | PO3, PO2 |
| 2. | Test and debug a given program for the various test cases. | PO1, PO2 |

## Demonstration Experiments

| | |
|---|---|
| 1. | Demonstration of Scratch Tool. |
| 2. | a. Write a C program to read length of the sides of a triangle and find its area.<br>b. Write a C program to read radius of a circle and find its area and circumference |
| 3. | An employee gets DA 90% of basic salary; HRA 15% of basic salary, CA 5% of basic salary. And also employee has to pay income tax of 10% of gross salary (Grass salary= Basic Salary+ DA+HRA+CA). Write a C program to read the basic salary of an employee and find the take home salary of the employee ( Take home salary = gross salary – income tax) |
| 4 | Heights of three students in a class are h1, h2 and h3. Write a C program to find the tallest among three students using nested if else statement. |
| 5 | Read first name, middle name and last name of a person. Write a C program to concatenate first name with middle name without using built in function. And concatenate the resultant string with last name using built in function. |

## Guided Laboratory Experiments

| | |
|---|---|
| 1. | Quadratic equation is given by $ax^2+bx+c=0$, where a, b and c are the coefficients provided where $a\neq0$.The formula to find roots of quadratic equation is $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$. Write a C program to find all the roots and test it for all three cases(based on discriminant value) |
| 2. | A shop keeper requires performing simple calculations like addition, subtraction, multiplication and modulo division for his daily business. Write a C program to design a simple calculator for shop keeper. |
| 3. | An electric power distribution company charges its domestic consumers as follows:<br>Consumption Units — Rate of Charge<br>0-200 — Rs. 0.50 per unit<br>201-400 — Rs.100 plus Rs.0.65 per unit excess of 200<br>401-600 — Rs.230 plus Rs.0.80 per unit excess of 400<br>601 and above — Rs.390 plus Rs.1.00 per unit excess of 600<br>Write a C program to read the customer number, power consumed and display the amount to be paid by the customer. |

| | |
|---|---|
| 4. | Sine series is given by $x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+$ - - - - - upto n terms, where x is an angle in radian. Write a C program to find sine value for a given angle. Also verify calculated sine value using built in function.[where radian= $\frac{\pi}{180} * degree$] |
| 5. | A person wants to register his newly purchased car. He is passionate to have a palindrome number for car registration. Write a C program to check whether the number allotted is palindrome or not. |
| 6. | Given a list of n student's weight, write a C program to find a student with given weight. If found, display the position of the student in the list else display suitable message. |
| 7. | Given two matrices, write a C program to check whether the matrices are multipliable, if so find the product matrix, otherwise display suitable message |
| 8. | Given a matrix, write a C program to find its transpose. Also find sum of upper triangle elements and sum of lower triangle elements of the transposed matrix. |
| 9. | Write a C program to read a string, find number of vowels and consonants in it. |
| 10. | Given a list of N student's names, write a C program to arrange names in alphabetical order. |
| 11. | Develop a C function to check whether a given number is prime or not. Write a C program to read a range of numbers and print all the prime numbers in that range using the above function. |
| 12. | Develop a function to find the factorial of a given number. Using the above function write a C program to find nCr and nPr where $nCr = \frac{n!}{r!(n-r)!}$ and $nPr = \frac{n!}{(n-r)!}$ |
| 13. | Develop a C function to swap two numbers. Write a C program using the above function to sort a given set of integers. |
| 14. | Define a structure data type called student containing members: name, usn, marks of CIE1, CIE2, CIE3, activity1 and activity2. Write a C program that would assign values to individual members and display them along with the total internal marks of all students where total internal marks is sum of best of two CIE marks, acitvity1 and activity2. |
| 15. | The mark scored by 'n' number of Students for the course 20CS105 in section 'A' is stored in an array. Write a C program to find sum and average of marks using pointers. |
| **Open Ended Laboratory Experiments (Activity)** | |
| 1. | Develop a C program to solve a puzzle/game like tic-tac-toe |
| 2. | Develop a C program to check whether two strings are anagram or not |
| 3. | Develop a C program to generate bill in a grocery store |
| 4. | Develop a C program to generate magic square. |
| 5. | Develop a C program to solve 4 queens problem. |