Semester I

L	T	P	C
3	1	0	4

Course Title**: Mathematics I**
Course Code**: MA11101**
Pre-requisite**: Trigonometric formulae, concepts of lines, planes and spheres, integration and differentiation.**

Course Objective

Fundamental notions of solutions of the system of equations, vector spaces and linear transformation on these spaces have to be studied. Concept of ordinary and partial differential equations and their solutions with applications will be discussed. Students will learn numerical differential and numerical integration techniques, numerical methods for finding the roots of a given equation will also be studied.

Course Content

MODULE I: Linear algebra (9Hours)
Algebra of Matrices, rank and inverse of a matrix, solution of algebraic equations- consistency, Hermitian, skew Hermitian and unitary matrices, eigenvalues and eigenvectors. Vector space-linear dependence of vectors, basis, dimension, linear transformations.

MODULE II: Numerical Analysis (11 Hours)
Numerical Analysis: finite difference, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, Numerical differentiation, Numerical integration: Trapezoidal rule and Simpsons $1/3^{rd}$ rules , Numerical differentiation, Solution of polynomial and transcendental equation- bisection, Newton-Raphson and Regula-falsi methods ,Differential equations: Taylor's series method, Euler's and modified Euler's method, Runge-Kutta method.

MODULE III: Differential equations (10 Hours)
Introduction, formation of differential equation from a given n-parameters family of curve; solution using separation of variables, solution of homogeneous equation, First order differential equation-exact, integrating factor, linear and Bernoulli's equations, higher order differential equation with constant coefficients, Beam problem.

MODULE IV: Partial Differential Equation (10 Hours)
Partial differential equation: formulation and classification; linear partial differential equation of the first order (Lagrange's method), Non-linear PDE of the first order (Charpit's method), Method of separation of variable for solving first orderPDE, Heat equation wave equation and Laplace equation, classification of second order linear partial differential equations as hyperbolic, parabolic, elliptic.

Text/ Reference Books

1. S. L. Ross, Differential Equations, 3^{rd} edition, Wiley India, 1984.
2. I.N. Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1957.
3. G. Strang, Linear Algebra and Its Applications, 4^{th} edn. Brooks/Cole India,2006.
4. Conte and De Boor, Elementary numerical analysis: an algorithmicapproach,McGraw-Hill, 1972.
5. K. Hoffman & R Kunze, Linear Algebra, 2^{th} edn. Pearson Education India,2003.
6. Numerical Methods By M. K. Jain, S. R. K. Iyengar & R. K. Jain
7. S.S Sastry, Introductory methods of Numerical analysis, Fifth edition, PHILearning Pvt Ltd, 2012.
8. M.D Rai Singhania, Ordinary & Partial Differential Equations, 18^{th} edition, S. Chand & Company Ltd.
9. 2. Hoffman K & Kunze R, Linear Algebra, Prentice Hall of India, New Delhi(1971).
10. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, DoverPublications, 1993.
11. Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} edn., Wiley India,2009.

L	T	P	C
3	0	0	3

Course Title: **Engineering Chemistry**
Course Code: **CY11101**
Pre-requisite: **NIL**

Course Objective

To introduce students to Conventional and non-conventional Energy sources,Electrochemistry and Engineering materials

Course Content

MODULE I: ENERGY& FUELS (14 hours)
Sources of Energy, Fuels- classification, examples, relative merits, types of coal, determination of calorific value of solid fuels, Bomb calorimeter, theoretical oxygen requirement for combustion, proximate & ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems. Lubricants - Definition, theories of lubrication, characteristics of lubricants, viscosity, viscosity index, oiliness, pour point, cloud point, flash point, fire point, additives to lubricants, Solid lubricants. Renewable sources of Energy (Solar Energy): Photovoltaic Cells and how it converts Light into Electricity.

MODULE 2: ELECTROCHEMISTRY & CORROSION (8 hours)
Basic idea about Electrode Potentials and Cells, Galvanic *vs.* Electrolytic Cell, Nernst Equation, Battery, Fuel Cells. Corrosion- types, Electrochemical theory, Different forms of wet corrosion, Galvanic (or Corrosion) series, Corrosion control, Techniques of metal Coating (Organic, Inorganic), Cathodic protection, Corrosion inhibitors.

MODULE 3: SOLID STATE (12 hours)
The solid state, Structures of Simple ionic compounds, Close packing in solids, bcc,fcc, structures of rock salt - caesium chloride- spinel - normal and inverse Spinels, Stoichiometric Defect, controlled valency & Chalcogen semiconductors, Non - elemental semiconducting Materials, Preparation of Semiconductors-steps followed during the preparation of highly pure materials and further treatments. Semiconductor Devices-p-n junction diode. Steel and important alloys.

MODULE 4: NANOSCIENCE & TECHNOLOGY (8 hours)
Introduction, scope of Nanoscience & Technology, Types of nanomaterials, Categories of nanomaterials, Nanotechnology, Quantum dots, Organic nanoparticles, Inorganic-organic Hybrid nanoparticles, Nano-intermediates, Nanocomposite materials.

OUTCOME: Students would become familiar with the important practical applications of fuels, electrochemistry, and nanotechnology**.**

Text Books/ Reference Books

1) Engineering Chemistry, P.C. Jain, M. Jain, Dhanpat Rai Publishing Company,NewDelhi, 2005.
2) Wiley Engineering Chemistry, 2nd Edition, Wiley (India)
3) R1: A Textbook of Engineering Chemistry, Shashi Chawla, 3rd Edition,DhanpatRai & Co,New Delhi, 2007
4) R2: Engineering Chemistry, 2nd Edition, O.G. Palanna, McGraw Hill Education(India) Pvt. Ltd., Chennai, 2017
5) R3: Engineering Chemistry, B.K. Sharma, Krishna Prakashan Media (P) Ltd

L	T	P	C
3	0	0	3

Course Title**:** **Principles of Electrical and Electronics Engineering**

Course Code**:** **EE11102**

Pre-requisite**:** **Nil**

Course Objective

After completion of the course, students will be able to:

- Implement the knowledge of electrical circuits to solve different problems of the DC & AC circuits
- Demonstrate the connection & use of different measuring instruments.
- Explain the operation of transformers, electric generators & motors and discuss the importance & use of different special machines.
- Explain the operation of basic semiconductor devices, amplifier and its application in the digital communication systems.
- Recognize the necessity of sensors in different applications and explain the operation of some common type of sensors.

Course Content

MODULE I: Introduction to Electrical Circuits (12 Hours)

Types of sources and elements, Kirchoff's Laws, Mesh and node analysis of DC networks; Single phase A.C. circuits – concept of phasor, impedance, admittance, conductance and susceptance; Active, reactive and apparent power in AC circuits, power factor, Three phase A.C. circuits - phase sequence, power in three phase system. Measurement of voltage, current, power and energy; Introduction to electrical energy generation from different resources, transmission, distribution and utilization.

MODULE II: Introduction to Electrical Machines (10 Hours)

Working principles of Transformer and its applications, working principle of DC Machines and its applications; working principle of single phase and three phase AC Machines and its applications; working principle and applications of Special machines such as Stepper motor, Universal Motor, BLDC motor, PMSM motor, SRM motor.

MODULE III: Introduction to Electronics and its Applications (10 Hours)

Basic principle and operation of semiconductor devices-diode, bipolar junction transistor, field effect transistors, Basic concepts of rectifiers, voltage regulators, amplifier and their applications; Introduction to logic gates.

MODULE IV: Sensors (10 Hours)

Applications of sensors - Inertial sensing, linear and rotary displacement sensors, acoustic and thermal sensing - ultrasonic sensor, infrared thermography, navigation sensors - GPS, motion capture systems, force and torque sensors, tactile and pressure, gas sensors, potentiometer, optical encoder, photoelectric sensor, Hall effect sensor, inductive and capacitive proximity sensor, pressure sensor - piezoelectric sensor.

Text/ Reference Books

1. A. K. Sawhney, A course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 19th Edition, 2018.
2. A. Chakrabarti and S. Nath, Basic Electrical and Electronics Engineering, Tata McGraw-Hill Education, 2nd Edition, 2011.
3. J. W. Nilsson and S. Riedel, Electric Circuits, Pearson, 11th Edition, 2020.

4. R. L. Boylestead and L. Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11th Edition, 2015.
5. E. W. Golding and F. C. Widdis, Electrical Measurements and Measuring Instruments, Medtech, 6th Edition, 2019.
6. P.S. Bimbra, Electrical Machinery, R.C. Khanna & Vineet Khanna, First Edition, 2021.
7. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education India, Second Edition, 2015

L	T	P	C
3	1	0	4

Course Title: **Engineering Mechanics**
Course Code: **ME11101**
Pre-requisite: **Nil**

Course Objective

To understand the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems. To be able to analyze planar and spatial systems to determine the forces in members of trusses, frames. To understand the concept of moment of inertia and apply them to engineering problems. To be able to apply fundamental ideas of kinematics and dynamics to the analysis of simple practical problems.

Course Content

MODULE I: **(16 Hours)**

Introduction Concept of force, force system, Fundamental laws and principles, principle of transmissibility, particle, rigid body, accuracy limit and approximations.

Coplanar Concurrent Force System: Resultant of a force system, graphical principles parallelogram law, triangle law, polygon rule, analytical method, conditions of equilibrium, space diagram and free body diagrams, Lami's theorem.

Coplanar Non-Concurrent Force System: Moment of a force, Varignon's theorem, couple, properties of couples, resultant of non-concurrent force system, conditions of equilibrium, equilibrant, equilibrium of two-force system and three-force system, types of supports, types of loads.

Concept of Friction: Laws of dry friction, angle of friction, coefficient of friction, belt friction. Problems related to equilibrium of coplanar force system with friction, ladder problems, belt friction problems.

Plane Truss: Statically determinate trusses, analysis of a truss and frames- Method of joints, Method of section, Method of members.

MODULE II: **(10 Hours)**

Centroids and Second Moment of Areas:

(a) **Centroid**: Definition of centre of gravity, centroid of area, centroid of line, concept of line of symmetry, location of centroid by direct integration of rectangular, triangular, semi-circular and quarter circular areas, centroid of composite areas.

(b) **Second Moment of Area:** Definition, parallel axis theorem, polar moment of area, radius of gyration, second moment of area by direct integration of a rectangular, triangular, circular, semi-circular and quarter-circular area. Second moment of composite area.

MODULE III: **(8 Hours)**

Kinematics: Definition of kinematics, kinetics, displacement, velocity, acceleration, relationship between them, problems involving variable acceleration, equations of motion under constant acceleration, motion under gravity, projectile motion.

Application of Newton's Second Law: Newton's second law, definition of unit force, problems of rectilinear motion, motion of connected bodies.

MODULE IV: **(8 Hours)**

Application of Work-Energy Principle: Definition of work, energy, power, efficiency, derivation of work-energy equation, problems of rectilinear motion, motion of connected bodies.

Application of Impulse-Momentum Equation: Definition of linear momentum, impulse, derivation of impulse-momentum equation, conservation of linear momentum, problems related to rectilinear motion, motion of connected bodies, conservation of momentum.

Text /Reference Books

1) Vector Mechanics for Engineers, Beer, F.P and Johnson Jr. E.R. Vol. 1 Statics and Vol. 2Dynamics, McGraw-Hill International Edition, 2019.

2) Engineering Mechanics – Statics and Dynamics, Irving H. Shames, IV Edition – PearsonEducation Asia Pvt. Ltd., 2005.

3) Engineering Mechanics, Meriam J.L. and Kraige L.G., Vol. 1 Statics and Vol. 2 Dynamics,Wiley-India, 5 Edition, 2017.

L	T	P	C
1	1	0	2

Course Title**: English Language and Literature**

Course Code**: HS11102**

Pre-requisite**: Nil**

Course Objective

The key objective is to develop in the under-graduate students of engineering a level of aptitude in English language learning incorporated through literature studies that will help them acquire the independent and effective communication skill required for academic and social needs.

Course Content

MODULE I: Basics of English Grammar (12 Hours)

Synonyms, Antonyms, One-word substitution, Idioms and Phrases, Article and Preposition**,** subject-verb agreement.

MODULE II: Language through Literature (07 Hours)

Essays:

1. **"***A Wedding in Russia"* by Sudha Murthy**.**
2. **"***English in India"* by R. K. Narayan.

Poems:

1. **"***If"* by Rudyard Kipling
2. **"***Because I could not stop for Death"* by Emily Dickinson.

MODULE III: Non-Detail Study

Short Stories:

O'Henry's **"***The Gift of the Magi*"

OR

R.K. Narayan *"An Astrologer's Day"*

OR

Edgar Allan Poe's **"***The Black Cat"*

OR

Katherine Mansfield *"The Fly"*

Text/ Reference Books

1. **Swan, Michael.** Practical English Usages. Oxford University Press.
2. **Wood, F.T**. A Remedial English Grammar for Foreign Students. Macmillan.
3. **Pleasures of Reading:** An Anthology of Poems, Orient Longman.
4. **Selected Essays and Short Storie**s, Oxford University Press.
5. **Selected Poems,** Oxford University Press.

L	T	P	C
0	0	2	1

Course Title: **Electrical and Electronics Engineering laboratory**

Course Code: **EE11201**

Pre-requisite: **Nil**

Course Objective

After performing the experiments, students will be able to:

Acquire knowledge on different electrical, electronic components, motors, sensors and measuring devices used in different home appliances and also in industrial applications. Students will also get adequate knowledge on electrical wiring and also get an overview of distribution system

Course Content

1. **Familiarization with Electrical and Electronic components**
    a. Different types of cables/wires and switches and usage of those
    b. Wiring tools, lighting and wiring accessories, various types of wiring
    c. Wiring of a multi-pin extension board
2. **Assembling of a given Electrical/Electronic circuit (e.g. power supply)**
    a. On a bread board
    b. Soldering on PCB;
3. **Wiring for light (e.g., fluorescent lamp/CFL/LED light) or Fan**
    a. controlled by one switch
    b. controlled by two SPDT switch
    c. controlled by one switch from board with MCB
4. **Study of Electric shock phenomenon and preventions**
    d. Earthing and its construction
    e. Usage of different types of protection devices such as fuses, MCB, ELCB etc.
5. **Study of measuring devices for current, voltage, power and energy measurement,**
    a. Ammeter, voltmeter, wattmeter and multi-meter
    b. Single phase and three phase energy meters
6. **Study of uncontrolled, semi-controlled and fully controlled devices and their Characteristics.**
7. **Study of logic gates such as AND, OR, NOR, NAND etc**.
8. **Hands on with Microcontroller and IoT devices e.g., PIC, ATMega, Arduino, Raspberry Pi and peripheral components**
9. **Hands on with sensors and development of applications as a short-term project e.g.**
10. **Hands on with Ultrasonic sensors; applications - distance measurement, water level Measurement.**
11. **Hands on with Infrared PIR motion sensor; applications - thermal imaging, military Applications.**
12. **Field visit for the demonstration of distribution transformer, DG, electrical distribution panel, earthing, lightening arrester etc.**

Text/ Reference Books

1. **K.B Raina**, Electrical Design Estimation and Costing, New Age Publication, 2nd Edition, 2018
2. **M.A Chaudhari and S.M Chaudhari,** Electrical Estimation and Costing, Nirali Pralashan, 3rd Edition, 2022
3. **3Surjit Singh,** Electrical Estimation and Costing, Dhanpatai & Co.,1st Edition 2015.
4. **A. K. Sawhney**, A course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 19th Edition, 2018.
5. **A. Chakrabarti and S. Nath**, Basic Electrical and Electronics Engineering, Tata McGraw-Hill Education, 2nd Edition, 2011.
6. **J. W. Nilsson and S. Riedel**, Electric Circuits, Pearson, 11th Edition, 2020.
7. **R. L. Boylestead and L. Nashelsky**, Electronic Devices and Circuit Theory, Pearson,11th Edition, 2015.
8. **E. W. Golding and F. C. Widdis,** Electrical Measurements and Measuring Instruments, Medtech, 6th Edition, 2019.
9. **P.S. Bimbra**, Electrical Machinery, R.C. Khanna & Vineet Khanna, First Edition, 2021.
10. **Vincent Del Toro,** Electrical Engineering Fundamentals, Pearson Education India,Second Edition, 2015

L	T	P	C
0	0	3	2

Course Title: **Engineering Chemistry Laboratory**
Course Code: **CY11201**

Pre-requisite: **NIL**

Course Objective

To learn basic analytical techniques useful for engineering applications, applications of Spectroscopic measurements

List of Experiments

1) Determination of alkalinity in a given water sample.
2) Determination of available chlorine in the given sample of bleaching powder.
3) Alkaline Hydrolysis of Benzamide to Benzoic Acid
4) Estimation of Fe(II) in Mohr's salt using standard $K_2Cr_2O_7$ solution.
5) Standardization of $KMnO_4$ by oxalic acid.
6) Estimation of Fe(II) in Mohr's salt using standard $KMnO_4$ solution.
7) Conductometric titration of an unknown acid solution using a standard basesolution.
8) Determination of total hardness of water
9) Estimation of sodium carbonate and sodium bicarbonate in a given mixture.
10) Calculation of Viscosity coefficient of sucrose using Ostwald's Viscometer
11) Standardization of $Na_2S_2O_3$ solution with standard $K_2Cr_2O_7$.

Text Books/ Reference Books

1) Vogel's Quantitative Chemical Analysis (6th Edition) Prentice Hall
2) Practical Chemistry by R.C. Bhattacharya

L	T	P	C
0	0	3	2

Course Title: **Engineering Graphics**
Course Code: **ME11202**
Pre-requisite: **Nil**

Course Objective

This course is designed to introduce the students to the "universal language of Engineers" for effective communication through drafting exercises of variousgeometries. To learn the technical drawing is an important part of the engineering profession. The objective of the course is to teach students to communicate using graphic techniques. To create awareness and emphasize the need for Engineering Graphics in all the branches of engineering. To follow basic drawing standards and conventions and to develop skills in three-dimensional visualization of engineering component. To graphically construct and understand the importance of mathematical curves in Engineering applications by solving specific geometrical problems in plane geometry involving lines, plane figures and engineering Curves.

Course Content

Introduction:

Overview of the course, Examination and Evaluation patterns.

Lines Lettering and Dimensioning:
Types of lines, Lettering, Dimensioning, Geometrical Constructions, Polygons, Scales, and Curves.

Orthographic projection:

Principles of Orthographic Projection, Projections ofPoints, Straight Lines and traces, Projections of Laminas, Projections of Solids.

Development of Surfaces:
Draw the development of surfaces for Prisms, Cylinders, Pyramid and Cones.

Section of Solids:

Sectional planes, Sectional views - Prism, pyramid, cylinder andcone, true shape of the section. Development of truncated objects.

Isometric views:

Isometric axis, Isometric Planes, Isometric View, Isometricprojection

Text /Reference Books

1) Bhatt N. D, Elementary Engineering Drawing, Charotar Publishing House, Anand,2002.
2) Dhawan, R. K., A Textbook of Engineering Drawing, S. Chand Publishing, 2012.
3) Narayana K L & Kannaiah P, Engineering Graphics, Tata McGraw Hill, NewDelhi,1992.
4) Luzadder W J, Fundamentals of Engineering Drawing, Prentice Hall of India, NewDelhi,2001.
5) Venugopal K, Engineering Drawing & Graphics, New Age International Pvt.Ltd., NewDelhi, 1994

L	T	P	C
0	0	2	1

Course Title**: Language Laboratory**

Course Cod**e: HS11201**

Pre-requisite**: Nil**

Course Objective

The prime objective of the course is to implement result-oriented learning that not only aids in language learning, but also enhances students' overall personality through advanced courses in grooming and personality development

Course Content

MODULE I: The sounds of English

- Practicing correct pronunciation through IPA (International Phonetic Alphabet), Stress, Intonation, Rhythm, and Speech Elocution.
- Vocabulary Building.
- **Exercises:**
  - Online Format: pre-designed to focus on development in vocabulary and other communication skills.
  - Offline Format: comprises group discussions, Story Writing, and other activities for communication building)

MODULE II: Communication Skills

- Practicing situational conversation
- Developing Reading Skills through lectures and monologue
- Exercises:
  - Online Format: pre-designed to focus on development in vocabulary and other communications skill.
  - Offline Format: comprises debates, Reading Practices and other activities for communication building)

Text/ Reference Books

1. **Lewis, Norman.** *Word Power Made Easy (Latest Edition, 2020).* Goyal Saab Publications
2. **Philip, Carr.** *English Phonetics and Phonology: An Introduction (2019).* Wiley-Blackwell

Semester II

L	T	P	C
3	1	0	4

Course Title: **Mathematics II**
Course Code**: MA12101**
Pre-requisite**: Functions, integration, basic of vectors, limit, continuity & differentiability.**

Course Objective

It will help to understand the electrical circuit analysis, conduction of heat in bodies, fluid flow in mechanics. Also helps to measure the degree of certainty/uncertainty of happening/non happening of event and analyze the distribution of continuous and discrete data. To be able to analyze the nature of functions and sequence & series of any data.

Course Content

MODULE I: Laplace and Fourier Transform (13 Hours)
Laplace and inverse Laplace Transform, Existence of Laplace Transform, Linear property, Convolution Theorem, Solution of ordinary differential equation by Laplace Transform.

Fourier series, Fourier transforms, properties of Fourier Transform, sine and cosine transforms Inverse Fourier Transform, Z-transform.

MODULE II: Vector Calculus (8 Hours)
Vector Calculus: Scalar and vector fields, level surfaces, Directional derivative, Gradient, Divergence, Curl, Laplacian, irrotational, solenoidal vectors and scalar potential, line, surface and volume integrals, Green's, Stokes and Gauss divergence theorem (statement only).

MODULE III: Probability (10 Hours)
Random experiments, sample space, events, probability and conditional probability, Baye's theorem, Probability space, random variables, probability distribution and density functions, Expectation (mean and variance). Discrete distributions: Binomial and Poisson distributions Continuous distributions: normal distribution.

MODULE IV: Single variable calculus (9 Hours)
Rolle's Theorem, Mean Value Theorem, Maxima and Minima, Sequences, Limits of a sequence and its properties, Series of positive terms, Necessary condition for convergence, Comparison test, D Alembert's ratio test, Cauchy's root test, TaylorSeries.

Text/ Reference Books

1. G. B. Thomas Jr. and R. L, Finney, Calculus and Analytic Geometry, 9th edition,PearsonEducation, India, 1996.
2. Robert Bartle & Donald Sherbert, Introduction to Real Analysis, John Wiley&Sons(2014).
3. T. M. Apostol, Calculus- Vol 2, 2nd Edition, Wiley India, 2003.
4. D. Bhatta and L. Debnath, Integral Transforms and their applications, 3rdedn.,CRC,2014.
5. Gupta and Kapoor, Probability and Statistics
6. S.C Malik and S. Arora, Calculus
7. Johnson, R. A., Miller and Freund's Probability and Statistics for Engineers, 6thedition.PHI, 2004.
8. S. R. Ghorpade and B.V. Limaye, An Introduction to Calculus and Real Analysis,SpringerIndia, 2006.
9. Levin R. I. & Rubin D. S., Statistics for Management, 7th edition, PHI, New Delhi,2000.
10. S.M. Ross, Introduction to Probability and statistics for Engineers, 3rd edition,AcademicPress, Delhi, 2005.

L	T	P	C
3	0	0	3

Course Title: **Engineering Physics**
Course Code: **PH12101**
Pre-requisite: **Nil**

Course Objective

To understand the principles of dynamics and solve simple problems related to rectilinear and rotational motion, to analyze the principles of simple harmonic, damped and forced oscillatory motions and apply them for the solution of simple problems, to understand the principle of propagation of waves, to understand the basic properties and principles of LASER and analyze the working principle of a solid state and a gaseous LASER, to get a glimpse of the emerging field of quantum computation.

Course Content

MODULE I: Fundamentals of Dynamics: (14 Hours)
Review of Newtons Laws, Concepts of Inertial frames, force and mass. Galilean transformations and Gallilean invariance. Solution of the equations of motion in simple force fields in one, two and three dimensions using cartesian, cylindrical polar and spherical polar coordinate systems. External and Internal forces. Momentum and Angular Momentum of a system. Torque acting on a system. Conservation of Linear Momentum. Centre of mass and its properties. Two-body problem. Rotation of a rigid body about a fixed axis. Angular velocity and angular momentum. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Torque. Conservation of angular momentum.

MODULE II: Oscillations (12 Hours)
Differential equation of Simple Harmonic Oscillation and its solution. Kinetic energy, potential energy, total energy and their time average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance. Superposition of Two Collinear Harmonic oscillations having equal frequencies and different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillation for phase difference $\delta = 0, \pi/2, \pi$: Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their uses.

MODULE III: Wave motion (12 Hours)
Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive Waves. Wave Equation for travelling waves. Particle and Wave Velocities. Velocity of Transverse Vibrations of Stretched Strings, Standing Waves in a String. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Superposition of N Harmonic Waves. Phase and Group Velocities.

MODULE IV: LASER (3 Hours)
Properties of LASER beams: monochromaticity, coherence; working principle of LASER, different types of LASERs; solid state LASER (ruby), gas LASER (He-Ne).

MODULE V: (1 Hour)
Overview of Quantum Computation

Text /Reference Books

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, McGraw- Hill
2. The physics of Waves and Oscillations, N. K. Bajaj, McGraw Hill
3. Optics, Ajoy Ghatak, McGraw-Hill.
4. Quantum Information and Computation, CIT Lecture Notes by J. Preskill, http://theory.caltech.edu/~preskill/ph219/index.html#lecture

L	T	P	C
2	0	0	2

Course Title: **Computer Programming and Problem-Solving**
Course Code: **CS12103**
Pre-requisite: **Nil**

Course Content

MODULE I: **(3 Hours)**
Problem Solving Skills, Identify the Problem, Analyze the problem, Identify Decision Criteria, Develop Multiple Solutions, Choose the Optimal Solution, Problem Implementing Solutions.

MODULE II: **(3 Hours)**
Overview of C language, Basic Structure of C program, Constants, Variables and Data Types, User-defined Data Types, Operators and Expressions, Precedence and Associativity.

MODULE III: **(10 Hours)**
Input-Output Operations, Decision Making, Branching and Looping Statements, Arrays, Character Arrays and Strings.

MODULE IV: **(12 Hours)**
User-defined Functions, Structures, Unions, Debugging Strategies.

MODULE V: **(12 Hours)**
Pointers, Dynamic Memory Allocations, File Management, Introduction to Preprocessor Commands and Macro Processing, argv, argc.

Text /Reference Books

1) C Programming by Deital and Deital.
2) Programming in ANSI C, E. Balaguruswamy, 5th Edition McGraw Hill.
3) The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, PrenticeHall.
4) Programming With C, Byron Gottfried, McGraw Hill.

L	T	P	C
3	1	0	4

Course Title: **Solid Mechanics**
Course Code: **ME12103**
Pre-requisite: **Nil**

Course Objective

To understand the concepts of internal forces (including SFD and BMD), force equilibrium, deformation, stress, strain, differential equilibrium equations, strain-displacement and constitutive (i.e., stress-strain) relationships for deformable bodies. Construct Mohr circle for plane stress and plane strain conditions, and analyse for principal stresses and strains, and their directions. To be able to apply the concepts of mechanics of deformable bodies to analyze basic structural elements such as bar, beam, shaft, and column.

Course Content

MODULE I: **(8 Hours)**

Stress And Strain

Introduction, stress, plane stress, equilibrium of an element in plane stress, Mohr circle representation of a plane stress, general state of stress, Analysis of deformations, strain components, relation between strain & displacement, strain component associated with arbitrary set of axes, Mohr circle representation of plane strain, general state of strain. Simple stresses and strains, Mechanical properties of materials, concept of stresses and strains, stress-strain diagrams and salient points, Hooke's law, Elastic constants and their relationship, bars of varying cross sections, elongation due to self-weight, thermal stresses, compound bars.

MODULE II: **(12 Hours)**

Bending moment and shear force diagrams:

Definition of bending moment and shear force at a section, sign convention, relationship between bending moment, shear and load intensity, SFD and BMD for statically determinate beams subjected to point loads, uniformly distributed loads and uniformly varying loads, and couples, loading diagram corresponding to the given shear diagrams.

Stresses in homogeneous beams:

Simple bending theory, assumptions, derivation of pure bending equation, definition of section modulus, moment of resistance, modulus of rupture, derivation of shear stress in beams, shear stress distribution across rectangular, triangular and circular sections.

MODULE III: **(10 Hours)**

Deflection of beams: Governing differential equation for deflection of straight beams having constant flexural rigidity, double integration and Macaulay`s methods for slopes and deflection. Energy methods: principle of superposition; work done by forces- elastic strain energy stored; Maxwell- Bettis theorem; Castigliano`s theorems; strain energy expressions; fictious load method; statically indeterminate problems, Torsion of circular shafts: Definition of pure torsion, assumptions, derivation of pure equation, transmission of power, polar modulus of section, modulus of rupture in torsion, strength and stiffness of solid and hollow shafts.

MODULE IV: **(12 Hours)**

Combined stresses: Stress at a point, principal stresses and principal planes for general two-dimensional stress systems, application to beams and shafts, concept of equivalent bending moment and torque.

Thin and Thick cylinders: Classification, stresses and deformations in thin cylinders subjected to internal pressure, derivation of lame's equation for thick cylinder.

Axially loaded compression members: Classification, definition of effective length, slenderness ratio,

critical load, derivation of Euler's equation for a column hinged at both ends, Rankine-Gordon formula, problems.

Text /Reference Books

1) An Introduction to Mechanics of Solids by S. H. Crandall et al., McGraw-Hill International editions, 2017.
2) Engineering Mechanics of Solids by E P Popov and T A Balan, Pearson Education, 2012.
3) Introduction to Solid Mechanics by I. H. Shames, 2nd Edition, 2009, Prentice Hall of India Private Ltd. New Delhi.
4) Mechanics of Materials; F. P. Beer, E. R. Johnston and J. T. DeWolf, 2019, McGraw-Hill International Edition.
5) S. S. Bhavikatti Strength of Materials, Vikas Publications

L	T	P	C
3	1	0	4

Course Title: **Solid Mechanics**
Course Code: **CE12101**
Prerequisite: **(ME11101) Engineering Mechanics**

Course Objectives

1. To learn the fundamentals of deformable body mechanics under externally applied forces.
2. To understand the strength characteristics of different materials and structural members Subjected to axial load, shear, torsion and bending.
3. To developed the requisite skill that helps in studying the advanced courses

Module I: **(9 hours)**

Tension, compression & shear: types of external loads – self weight – internal stresses – normal and shear stresses – strain – Hooke's law – Poisson's ratio – relationship between elastic constants – stress strain diagrams working stress – elongation of bars of constant and varying sections –strain energy in tension, compression and shear. Analysis of stress and strain: stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress.

Module II: **(14 hours)**

Bending moment and shear force: different types of beams - shear force and bending momentdiagrams for simply supported, overhanging and cantilever beams - relationship connecting intensity of loading, Slope and Deflection of Beams: differential equation of the elastic curve.

Module III: **(9 hours)**

Stresses in laterally loaded symmetrical beams: theory of simple bending - limitations - bending stresses in beams of different cross sections - moment of resistance - beams of uniform strength - beams of two materials - shearing stresses in bending.

Theory of columns: axial loading of short strut – long columns – differential equation of the elastic curve – Euler's formula – eccentric loading – direct and bending stresses.

Module IV: **(10 hours)**

Thin and thick cylinders: Lame's equation - stresses in thick cylinders due to internal and external pressures.

Torsion: torsion of circular solid and hollow shafts – power transmission – strain energy in shear and torsion – close coiled and open coiled helical springs.

Unsymmetrical bending: shear center - determination of shear Centre for simple sections.

Text/Reference Books:

1. Rajput, R. K., Strength of Materials (Mechanics of Solids), S K Kataria and Sons.
2. Gere, J.M., Mechanics of Materials, Thomson, Singapore.
3. Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi
4. Timoshenko, S.P., and Young, D.H., Elements of Strength of Materials, East West Press,New Delhi.
5. Beer, F.P and Johnston, E.R., Mechanics of Materials, Tata Mcgraw hill, New Delhi.

Course Outcomes (COs)

1. Provide quick solutions to elementary problems of strength of materials.
2. Develop elementary skills of working stress design.
3. Acquire all necessary fundamentals needed for pursuing courses on structuralanalyses and design.

L	T	P	C
2	0	0	2

Course Title: **Health, Safety and Environment**
Course Code: **CY12102**
Pre-requisite: **Nil**

Course Objective

To help realize the importance of and their role in the protection and maintenanceof a healthy environment for sustainable development. To enable students to grasp the significance and issues related to ecosystems, biodiversity, and natural resources, as well as ways of managing/ protecting them. To make students aware of environmental policies and movements and the role of individuals and communities in environmental protection for the purpose of educating and inspiring young minds.

Course Content

MODULE I: **(8 Hours)**
Renewable and non-renewable resources, Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles. Concept of an ecosystem, Structure and functions of an ecosystem. Biodiversity Definition, Genetic, species and ecosystem diversity. Conservation: general information, types and importance. Biogeochemical cycles: Carbon, Nitrogen, Sulfur etc.

MODULE II: **(8 Hours)**
Environmental pollution Definition, causes, effects and control measures, Types of pollution:(general) for water, soil, marine, noise, nuclear and thermal pollution. Air pollution and control sources, pollutants and their health effects. Solid waste management Generation, on site handling and storage, transfer and transport. Role of an individual in prevention of pollution. Case studies. Legislation in India Conservation Act, Other acts, Issues involved in enforcement of environmental legislation, public awareness.

MODULE III: **(7 Hours)**
Human population and the environment Population growth and characteristics, commonly occurred diseases (air borne, water borne etc.), Environment and human health, water conservation, rain water harvesting etc. Millets- Types, advances in millet research as a sustainable food source.

MODULE IV: **(5 Hours)**
Basic objective of Disaster and safety management, floods, earthquakes, cyclone and landslides: Causes, Effects and Management.

Text/Reference Books

1) **Bharucha, E.,** Textbook of Environmental Studies, University Press, 2nd Edition,2018.
2) **Basu, M. and Xavier, S.,** Fundamentals of Environmental studies**,** CambridgeUniversity Press, 2015**.**

L	T	P	C
0	0	2	1

Course Title: **Engineering Physics Laboratory**
Course code: **PH12201**

Pre-requisite: **Nil**

Course objectives

The course focuses on developing students' practical skills in experimental physics through a range of hands-on activities. Students will learn techniques such as determining semiconductor properties using the Four Probe Method, measuring the Numerical Aperture of optical fibers, studying magnetic field variations with current- carrying coils, calculating Hall Coefficient and carrier properties using the Hall Effect, determining lens curvature with Newton's Ring apparatus,measuring susceptibility of liquids/solutions with Quincke's Method, determining Planck's Constant using LEDs, measuring magnetoresistance of semiconductors, and determining light wavelength with a Michelson Interferometer. These experiments enhance students' understanding of fundamental concepts and foster proficiency in experimental physics.

Course Content

1) Four Probe: This experiment involves using the Four Probe Method todetermine the band gapenergy and resistivity of semiconductors.
2) Fiber Optics: The objective is to measure the Numerical Aperture of an opticalfiber.
3) Magnetic Field: This experiment has two parts - studying the variation of the magnetic field with distance along the axis of a circular current-carrying coiland calculating the coil's diameter,and exploring the superposition of magnetic fields from two coils at different distances.
4) Hall Effect: The goal is to calculate the Hall Coefficient, Carrier Density, and Carrier Mobilityof sample material.
5) Newton's Ring: Using Newton's Ring apparatus, this experiment focuses on determining the radius of curvature of the lower surface of a plano-convex lens.
6) Quincke's Method: The objective is to measure the susceptibility of a liquid or a solution usingQuincke's Method.
7) Planck's Constant: This experiment involves determining Planck's Constantusing LEDs.
8) Magnetoresistance: The objective is to measure the magnetoresistance of semiconductors.
9) Michelson Interferometer: Using a Michelson Interferometer, the goal is todetermine the wavelength of sodium light.
10) Reference: Experimental Manuals.

L	T	P	C
0	0	4	2

Course Title: **Computer Programming Laboratory**

Course Code: **CS12202**

Pre-requisite: **Nil**

Course Content

- ✓ Input and Output programs
- ✓ Control Loop programs
- ✓ Conditional Execution programs
- ✓ Structure and Nesting programs
- ✓ Functions and Prototype programs
- ✓ Array programs
- ✓ Pointer programs

Text /Reference Books

1) C Programming by Deital and Deital.
2) Schaum's Outline of Programming with C by Byron Gottfried
3) Programming in ANSI C by E. Balagurusamy

L	T	P	C
0	0	3	2

Course Title: **Mechanical Workshop**
Course Code: **ME12204**
Pre-requisite: **Nil**

Course Objective

To impart knowledge and skill in using tools, machines, equipment and measuring instruments. The students will use different tools and equipment for work shop practice by taking safety precautions. Students will acquire skills for the preparation of different carpentry/fitting/welding models as well as application-oriented tasks.

Course Content

Introduction to Mechanical Workshop:
Study of Materials, tools, equipment, measuring instruments in Mechanical Workshop, Study of Safety Rules.

Carpentry:
Planning, chiseling, marking and sawing practice, one typical joint- Tee halving/Mortise and Tenon/ Dovetail.

Fitting:
Chipping, filing, cutting, drilling, tapping and threading about male and female joints, stepped joints- one simple exercise of single V joint for welding exercise.

Sheet Metal Work:
Selection of different gauge sheets, types of joints, fabrication of a tray or a funnel.

Lathe Exercise:
Study of the basic lathe operations, a simple step turning exercise.

Welding Practice:
Study and practice of manual metal arc welding (MMAW). Exercise of Butt joint/Lap Joint/Corner Joint/Tee Joints.

Text /Reference Books

1) Chapman W.A.J., Workshop Technology. Parts 1 & 2, 4th Edition, Viva Books P. Ltd., New Delhi, 2002.
2) Hajra Choudhury, Workshop Technology Vol 1 & 2, Media Promoters & Publishers Pvt. Ltd, Bombay, 2004.
3) Miami, Welding Handbook, American Welding Society, 2000.

Course Title: **Solid Mechanics Laboratory**
Course Code: **ME12203**
Pre-requisite: **Nil**

L	T	P	C
0	0	3	2

Course Objective

To determine the behavior of materials by conducting Tension, Compression & amp; Shear tests. To be able to evaluate the Impact Strength of Material, hardness of a given material. To be able to determine Elastic constants of a given material using flexural and torsion tests.

Course Content

Exp-1) Tension test on MS rod.

Exp-2) Shear Test on MS rod.

Exp-3) Torsion test on MS Specimen

Exp-4) Hardness tests on metals

Exp-5) Impact tests on metals

Exp-6) Bending test on steel beams

Exp-7) Spring test – open and close coil springs,

Exp-8) Study of extensometers and strain gauges

Exp-9) Truss analysis.

Exp-10) Shear force and Bending moment experiment.

Exp-11) Buckling behaviors of column.

L	T	P	C
0	0	3	2

Course Title: **Solid Mechanics Laboratory**
Course Code: **CE12201**
Prerequisites: **(CE12101) Solid Mechanics**

Course Objectives

1. To conduct tension test on steel, aluminum, copper and brass
2. To conduct compression tests on spring, wood and concrete
3. To conduct flexural and torsion test to determine elastic constants
4. To determine hardness of metals

List of Experiments

1. To study the stress -strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test on U.T.M.
2. To study the stress - strain characteristics of (a) Copper and (b) Aluminum by conducting tension test on Hounsfield Tensometer.
3. To find the Compressive strength of wood and punching shear strength of G.I. sheet by conducting relevant tests on Hounsfield Tensometer.
4. To find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminum (d) Copper by conducting hardness test.
5. To determine the Modulus of rigidity by conducting Torsion test on (a) Solid shafts (b) Hollow shaft.
6. To find the Modulus of rigidity of the material of a spring by conducting Compression test.
7. Ductility test for steel.
8. Shear test on Mild Steel rods.

Text /Reference Books

1. Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi, 1996.

Course Outcomes (COs)

1. Conduct tension test on steel, aluminum, copper and brass
2. Conduct compression tests on spring, wood and concrete
3. Conduct flexural and torsion test to determine elastic constants.
4. Determine hardness of metals

L	T	P	C
0	1	2	2

Course Title**: Human Values and Effective Communication**

Course Code**: HS12202**

Pre-requisite**: Nil**

Course Objective

The prime objective of the course is to implement result-oriented learning that not only aids in language learning but also enhances students' overall personality through advanced courses in grooming and personality development.

Course Content

Module-I

- **Communication:** definition, process of communication, types and forms of communication, barriers to communication, role and importance in the corporate world, tools of communication and group discussion.
- **Writing:** definition, process of writing, different forms of writing
- Skills for Professional Conversations

Exercise:

Online Format: pre-designed to focus on development in vocabulary and other communication skills.

Offline Format: comprises Extempore, Film Appreciation, Poetry Appreciation, Letter Writing, Paragraph Writing, Essay Writing, and other activities for communication building and improving writing skills

Module-II

- Learning public speaking and body language through role play
- *Communication for practical purposes:* Developing reading, writing, listening, and speaking skills, Importance & barriers to them.
- Interview: definition, types, forms, plan and preparation.
- Presentation: definition, types and forms
- Proposal: definition, types and forms
- Public speaking: types and forms. Visual communication: types and forms

Exercises:

Online Format: Pre-designed to focus on development in vocabulary and other communication skills.

Offline Format: Comprises role play to learn language skills in professionalscenarios, public speaking, and other communication-building activities.

Text/Reference Books

1. **Lewis, Norman.** *Word Power Made Easy (Latest Edition, 2020).* Goyal SaabPublications
2. **Philip, Carr.** *English Phonetics and Phonology: An Introduction (2019).* Wiley-Blackwell
3. **Raman, M & S. Sharma**. *Technical Communication: Principles and Practice*. (2015).OUP, New Delhi.