With effect from the Academic Year 2023-24

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2023-24

BE (Civil Engineering)

SEMESTER – III:

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	22MTC10	Partial Differential Equations and Statistics	3	1	-	3	40	60	4
2	22CE C03	Surveying-I	3	-	-	3	40	60	3
3	22CE C04	Solid Mechanics	3	-	-	3	40	60	3
4	22CE C05	Fluid Mechanics	3	-	-	3	40	60	3
5	22CE C06	Building Construction Practices	2	-	-	3	40	60	2
6	22EG M03	Universal Human Values – II Understanding Harmony	-	1	-	2	-	50	1
7	22CE C07	Computer Aided Drafting Lab	-	-	2	3	50	50	1
8	22CE C08	Fluid Mechanics Lab	-	-	2	3	50	50	1
9	22EG M01	Indian Constitution & Fundamental Principles	2	-	-	2	-	50	NC
	22CE I01	MOOCs/Training/ Internship	2-3 weeks/ 90 hours						2
Clock hours per week: 23									

L: Lecture **T: Tutorial** **P: Practical/Drawing/Seminar/Project**

CIE: Continuous Internal Evaluation **SEE: Semester End Examination**

With effect from the Academic Year 2023-24

22MTC10

PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS

(For CIVIL/MECH/CHEM)

Instruction	3L + 1 T Hours per week
Duration of Semester End Examination	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To explain the expansion of functions in sine and cosine series.
2. To form PDE and to find its solution.
3. To know the model of wave and heat equations.
4. Able to analyze random phenomenon using basic probability.
5. To learn fitting of distribution and predicting the future values.

Course Outcomes: On successful completion of this course the students shall be able to

1. Calculate the Euler's coefficients for Fourier series expansion of a function.
2. Solve Linear and Non-Linear PDE's.
3. Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
4. Use the basic probability for fitting the Random phenomenon.
5. Analyze the random fluctuations of probability distribution and Principles of Least Squares approximationsfor the given data.

CO-PO Articulation Matrix

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	1	1	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	1	1
CO3	2	2	2	2	-	-	-	-	-	-	-	1	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1	1	1
CO5	2	2	2	1	-	-	-	-	-	-	-	1	1	1

UNIT-I: Fourier series

Periodic functions, Euler's formulae, Conditions for a Fourier series expansion, Fourier series of Functions having points of discontinuity, Change of interval, even and odd functions, Half range Sine & Cosine Series.

UNIT-II: Partial Differential Equations

Formation of Partial Differential Equations, Linear Equations of First Order (Lagrange's Linear Equations), Solution of First Order Non-linear Partial Differential Equation (Standard forms) and Charpits Method.

UNIT-III: Applications of Partial Differential Equations

Solution by Method of Separation of Variables, Solution of One dimensional Wave equation, Solution of One dimensional Heat equation, Solution of Two dimensional Laplace equation and its related problems.

UNIT-IV: Basic probability

Basic probability, Conditional probability, Baye's theorem. Random variable, Discrete probability distribution and Continuous probability distribution. Expectation, Addition and Multiplication theorem of expectation, properties of variance, Moments (Moments about the mean and moments about a point)

UNIT-V: Probability Distributions and Curve Fitting

Poisson distribution ,MGF and Cumulants of the Poisson distribution, Normal distribution, Characteristics of Normal distribution, MGF and CGF of Normal distribution, Areas under normal curve. Correlation, Coefficient of Correlation and Lines of Regression. Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and exponential curves.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
2. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

Suggested Reading:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. S. J. Farlow, "Partial Differential Equations for Scientists and Engineers", Dover Publications, 1993.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

With effect from the Academic Year 2023-24

22CE C03

SURVEYING I

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. To understand basic concepts of surveying and use of chains for developing the map of a given area
2. To perform levelling operations and developing contour maps
3. To know the concepts and use of Tacheometry technique in surveying
4. To give exposure to the latest instruments like Total Station and GPS for solving the surveying problems
5. To understand the importance of trigonometric levelling and applying the same for finding the elevations of objects by various methods.

Course Outcomes:

1. At the end of the course the student should have learnt
2. To select basic surveying instruments such as chains, tapes etc., to measure areas.
3. To apply the principles of levelling and prepare contour maps to estimate volumes of earthwork using Simpsons and/or trapezoidal rules.
4. To apply the principles of tacheometry on the field.
5. To operate modern instruments like Total Station and GPS in the field
6. To make use of principles of trigonometric levelling for measuring elevations of required objects

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1											
CO2	2	1	2											
CO3	2	1												
CO4	2	1	1	1										
CO5	2	1	1	1										

UNIT- I: Introduction and Basic Principles of Surveying

Concepts of surveying, principles of surveying, various classifications of surveying. Chain survey- Concepts of survey lines, offsets. Errors in chain survey. Measurement of area - Simpson's method, average ordinate, mid ordinate and trapezoidal rules. Basics of compass survey and plane table survey- accessories and methods.

UNIT – II: Levelling and Contours

Definition of levelling, terms used in levelling. Instruments of levelling, methods of booking levels, Height of Instrument and Rise and Fall methods. Concepts of balancing levels. Types of levelling, reciprocal levelling, profile levelling, precise levelling. Correction to refraction, errors in levelling. Definition of contours- Characteristics of contours, contour interval, methods of contouring-direct and indirect. Development and use of contour maps.

UNIT – III: Tacheometry

Tacheometry - Theory and use of stadia wires in levelling instruments and theodolite. Fixed hair tacheometers, and concepts and use of Tangential tacheometry. Concepts of Reduction Diagrams, tacheometric, tables, Principle and use of substance bar and concepts of Beaman's stadia arc.

UNIT – IV: Modern Surveying Instruments Total Station and GPS

Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total station-Parts of a Total Station – Accessories, Advantages and Applications, Field Procedure for total station survey, traversing by Total Station, Errors in Total Station Survey. Concepts of consecutive coordinates- Closing error adjustment and accuracy of a traverse – Gale's traverse table. Advantages of plotting traverse by co-ordinates, solutions to omitted measurements in traverse .Global Positioning: Systems- Segments, GPS measurements, errors and biases, surveying with GPS, co-ordinate transformation, accuracy considerations.

UNIT – V: Trigonometric Levelling

Trigonometrical levelling – Calculation of elevations and distances of accessible and inaccessible objects, numerical problems. Geodetic observations-refraction and curvature. Corrections, axis signal correction, determination of difference in elevation by single and reciprocal observations, numerical problems.

Text Books:

1. C. Venkataramaiah, "A Textbook of Surveying", Universities Press, Hyd, 2011.
2. R. Subramanian,''*Surveying and Levelling*", Oxford Higher Education, 2012.
3. B.C. Punmia & Ashok Jain, "Surveying", Vol II, 12th edition, Laxmi Publication, 2010.

Suggested Reading

1. AM. Chandra, "Plane Surveying", New Age International", 2007.
2. Arora, K.R," Surveying Vol II & III", Standard Book House & SBH Publishers & Distributors,1705, A Nai Sarak, New Delhi - 110 006, 12th edition, 2013.
3. S. K. Duggal, "Surveying", Tata McGraw-Hill Education Private Ltd, New Delhi India, 2013.

With effect from the Academic Year 2023-24

22CE C04

SOLID MECHANICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. Understand the stress - strain behavior of different materials and temperature stresses, in compression and tension.
2. Analyze the statically determinate beams and sketch shear force and bending moment diagrams.
3. Understand the bending and shear stresses across various cross sections of beams.
4. Comprehend compound stresses, direct and bending stresses.
5. Analyze thin and thick cylinders for fluid pressures.

Course Outcomes: At the end of the course the students are able to

1. Evaluate the strength of various materials, against structural actions such as compression, tension.
2. To analyze statically determinate beams and sketch SFD and BMD.
3. Able to draw variation of shear and bending stresses.
4. Able to evaluate direct and bending stresses, compound stresses.
5. To design thin and thick cylinders for resisting internal and external pressures.

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	1

UNIT- I:

Simple Stresses and Strains: Various types of stresses and strains. Hooke's law, Modulus of Elasticity, Stress-Strain curve for ductile & brittle materials, Working stress and factor of safety. Deformation of bars of uniform, varying and tapering sections under axial loads, Elongation of bars due to self-weight, Compound bars and temperature stresses.

Elastic Constants: Poisson's ratio, volumetric strain and derivation of relationship between elastic constants.

UNIT- II:

Shear force and Bending moment: Different types of beams and loads, Shear force and bending moment diagrams for cantilever, and simply supported beams with and without over hangs subjected to different kinds of loads point loads, uniformly distributed loads, uniformly varying loads and couples- Relation between loading, shear force and bending moments.

UNIT- III:

Bending stresses in Beams: Assumptions in theory of simple bending- Derivation of bending equation, Moment of resistance -Calculation of stresses in statically determinate beams for different cross sections and types of loads.

Shear stresses in Beams: Equation of shear stress, shear stress distribution across rectangular, circular, triangular, I, T, and diamond sections.

UNIT- IV:

Direct and bending stresses: Basic concept, Eccentric loading, limit of eccentricity - core of sections-rectangular, circular, solid and hollow sections.

Compound Stresses and Strains: Stresses on oblique planes, principal plane and principal stresses. Mohr's circle of stress.

UNIT- V:

Thin cylinders: Thin cylinders subjected to internal fluid pressure, volumetric change, Wire winding of thin cylinders.

Thick cylinders: Lame's equations, stresses under internal and external fluid pressures.

Text Books:

1. B. C. Punmia," *Mechanics of Materials Vol. I &II"*, Laxmi publishers, Delhi, 2017.
2. S. Ramamrutham, "*Strength of Materials*", Dhanpat Rai & Sons, Delhi, 2014.

With effect from the Academic Year 2023-24

22CE C05

FLUID MECHANICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To understand fluid properties, fluid pressure and forces, basic concepts and continuity equation
2. To understand the fluid motion, energy equation, analyze the forces on various objects.
3. To know various measuring instruments in finding the fluid pressure, velocity, and discharge.
4. To understand and analyze different flow characteristics of laminar and turbulent flows
5. To understand water hammer effect in pipes and to understand dimensional analysis and models studies.

Course Outcomes: **At the end of the course, the student should have learnt**

1. To evaluate the various properties of fluid, analyse fluid flow and forces.
2. To apply the various laws and principles governing fluid flow to practical problems.
3. To measure pressure, velocity and discharge of fluid flow in pipes, channels, and tanks.
4. To apply laws related to laminar and turbulent flow in pipes.
5. To evaluate water hammer effect in pipes and to apply dimensional and model laws to fluid flow applications.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		1
CO3	3	2	1									1	2		1
CO4	3	2	1									1	2		1
CO5	3	2	1									1	2		1

UNIT-I

Fluid Properties: Definition of fluid, Properties of fluids- Density, Specific Weight, Specific Volume, Specific Gravity, Bulk Modulus, Vapour Pressure, Viscosity, Capillarity and Surface tension, Newton's law of Viscosity.
Fluid Statics: Pascal's Law, Hydrostatic Law, Absolute and gauge pressure. Forces on immersed bodies: Total pressure, centre of pressure, pressure on curved surface.
Buoyancy: Buoyancy, Metacentre, stability of submerged and floating bodies**.**
Fluid Kinematics: Classification of fluid flow- steady unsteady, uniform, non-uniform-, one-, two- and three-dimensional flows. Concept of streamline, stream tube, path line and streak line.
Law of mass conservation – continuity equation from control volume and system analysis. Rotational and Irrotational flows, Stream function, Velocity potential function, flownet.

UNIT-II

Fluid Dynamics: Convective and local acceleration, body forces and surface forces, Euler's equation of motion from control volume and system analysis.
Law of Energy Conservation: Bernoulli's equation from integration of the Euler's equation. Signification of the Bernoulli's equation, its limitations, modifications and application to real fluid flows.
Impulse Momentum Equation: Momentum and energy Correction factor. Application of the impulse momentum equation to evaluate forces on nozzles and bends. Pressure on curved surface- vortex flow- forced and free vortex.

UNIT-III

Measurement of Pressure: Piezometer and Manometers - Bourdon Gauge.
Measurement of Velocity: Pitot tube and Current meter.
Measurement of Discharge in pipes and tanks: Venturi-meter, Orifice-meter, nozzle meter, elbow meter and rotameter. Flow through mouthpiece and orifice.
Measure of Discharge in Free surface flows: Notches and weirs.

UNIT-IV

Flow through Pressure Conduits: Reynold's Experiment and its significance. Upper and Lower Critical Reynold's numbers, Critical velocity. Hydraulic gradient. Laminar flow through circular pipes. Hagen Poiseuille equation. Turbulent flow characteristics. Head loss through pipes. Darcy-Weisbach equation. Friction factor. Moody's diagram. Minor loss, Pipes in Series and Pipes in parallel.

UNIT-V

Unsteady Flow in Pipes: Water hammer phenomenon, pressure rise due to gradual and sudden valve closure, critical period of the pipeline, power transmission through pipes.

Dimensional Analysis and Models Studies: Dimensional analysis - Rayleigh Method, Buckingham method, geometric, kinematic and dynamic similarity, similarity laws, significance of Reynolds and Froude model law, different types of models and their scale ratios, distorted and undistorted models, scale effect in models.

Text Books:

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics Including Hydraulic Machines, Standard Book House, Delhi, 22nd Edition, 2019.
2. A.K. Jain, Fluid Mechanics including Hydraulic Machines By A.K. Jain Khanna Publishers, Delhi, First Reprint, 2016.

Suggested Books:

1 K.L. Kumar, Engineering Fluid Mechanics, Eurasia Publishing House, 2008.
2 R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand and Company, 2017.

With effect from the Academic Year 2023-24

22CE C06

BUILDING CONSTRUCTION PRACTICES

Instruction	2L Hours per week
Duration of Semester End Examination	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: To enable the student

1. To study about traditional building materials.
2. To study about new/composite building materials.
3. To understand the concepts of building planning and various practices adopted
4. To understand different types of roofs, doors,windows and stairs.
5. To understand different types of masonry adopted in construction sites.

Course outcomes: At the end of the course the student is able

1. To study about traditional building materials.
2. To study about new/composite building materials.
3. To understand the concepts of building planning and various practices adopted
4. To understand different types of roofs, doors,windows and stairs.
5. To understand different types of masonry adopted in construction sites.

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2				1						1	1	1
CO2	1	2				1						1	1	1
CO3	1	1	2		1							1	1	
CO4	1	1	2		1							1	1	
CO5	1	1	2		1							1	1	1

UNIT- I:
Traditional Building Materials: Cement, Sand, Coarse Aggregates, Mortar, Concrete, Steel.

UNIT- II:
Introduction to new materials/composites: Plastics, Tiles, AAC Blocks, CLC Blocks
Emerging Building Materials: Smart and Eco-Friendly materials - Sustainable materials - Recycled materials.

UNIT- III:
Concepts of Building Planning: Types of Buildings as per National Building Code, Functional needs and difference in their planning requirements – Principles of Planning - Building Byelaws – Planning of a building with byelaws.

UNIT- IV:
Plumbing services – HVAC services – Formwork & Shuttering – Plastering & Pointing - Types of roofs, doors, windows and staircases – Representation of Building materials and Plumbing services.

UNIT- V:
Masonry Construction: Introduction

Stone Masonry: Elevation, sectional plans and cross sections of walls of Ashlar, CRS I and II sort and RR stone masonry

Brick Masonry: Plan and isometric view of external main wall junctions, Stretcher Bond, Header Bond; English Bond& Flemish Bond – for half brick, one & one and a half brick wall.

Composite Masonry: Stone Composite Masonry, Brick Stone Composite Masonry, Cement Concrete Masonry, Hollow Clay tile Masonry, Reinforced Brick Masonry.

Text Books:

1. S.P. Arora & S. P. Bindra, "*A text book of Building Construction*", Dhanpat Rai Publications, 2010.
2. B.C Punmia, Ashok Kumar Jain &Arun Kumar Jain "*Building Construction*", Laxmi Publications (P) LTD, 2016.
3. A.M Neville., "Properties of Concrete", Pearson Education. 2012.
4. M.S. Shetty, and A. K. Jain, "Concrete Technology: Theory and Practice", S. Chand & Company, 2018.
5. R. Santhakumar, "Concrete Technology", Oxford University, Press 2018.

Suggested Reading:

1. P.C. Varghese, "*Building construction*" PHI, 2016.
2. CBRI Roorkee, "*Advances in Building Materials and construction*".
3. Sushil Kumar, "*Building Construction*", Standard Publishers, 1992.
4. National Building Code of India, 2006.

With effect from the Academic Year 2023-24

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(**B.E/B. Tech** - Common to all Branches)

Instruction	1Tutorial Hour per Week
CIE	50Marks
Credits	1

Introduction

This course discusses the role of human values in one's family, in society and in nature. During the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Objectives: Student is able to

1. Understand the concept of universal human values
2. Cultivate empathy and respect for diversity
3. Inspire the social responsibility and global citizenship

Course Outcomes: By the end of the course, STUDENT will be able to

1. Become familiar about themselves, and their surroundings (family, society, nature).
2. Develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives, and identities
3. Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
4. Recognize their role as global citizens.
5. Exhibit a sense of social responsibility.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	1	1	-
CO2	**-**	**-**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	-	1	-
CO3	**--**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	-	1	-
CO4	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	1	1	1
CO5	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**

Module -1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration.
- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module- 2: Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module-3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers.
  b. At the level of society: as mutually enriching institutions and organizations.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

Module -4: Understanding Harmony in Nature and Existence - Whole existence as Coexistence.

- Understanding the harmony in Nature.
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Holistic perception of harmony at all levels of existence.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Mode of Conduct (L-T-P-C 0-1-0-0)

- While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection, and self- exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentors, in a group sitting.
- **Tutorials (experiments or practical) are important for this course**. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included.
- The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on basic human values.
- **It is advised to share the experience of the Faculty to the class in a capsule form.**
- **Involve more in evaluating the student by different activities with proper RUBRCCS**

Assessment:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.

Example:

Module-1:	10 M
Module -2:	10 M
Module- 3:	10 M
Module-4:	10 M
Attendance & Attitude:	10 M

The overall pass percentage is 50%. In case the student fails, he/she must repeat the course.

Textbooks

1. "A Foundation Course in Human Values and Professional Ethics" by R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2022.

2. "Teacher's Manual for A Foundation Course in Human Values and Professional Ethics" by R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2022.

Suggested Reading

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth – by Mohandas Karamchand Gandhi

With effect from the Academic Year 2023-24

22CE C07

Computer Aided Drafting Lab

Instruction	2P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Outcomes: Using the basic tools of Autocad - the student will be able to

1. Create basic 2D geometry shapes.
2. Draft elevation and sections of doors and windows.
3. Develop plan, section and elevations of buildings.
4. Draft plan and section of a staircase.
5. Draft RCC detailing of beams and footings.

Course Outcomes: At the end of the course, using the basic tools of Autocad - the student is be able to

1. Create basic 2D geometry shapes.
2. Draft elevation and sections of doors and windows.
3. Develop plan, section and elevations of buildings.
4. Draft plan and section of a staircase.
5. Draft RCC detailing of beams and footings.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1				1										
CO2	1				2							1	1		1
CO3	1				2							1	1		1
CO4	1				2							1	1		1
CO5	1				2							1	1		1

Introduction to Computer Aided Drafting - features and environment, initial settings. Coordinates - absolute, relative cartesian and polar coordinates. Snap, object snap, grid, ortho and polar modes. Draw tools and editing tools. Zoom and pan. Creating and managing – text and Dimensions. Managing object properties and hatching. Creating and inserting blocks, working in view ports and Layers.

List of Experiments:

1. Creating basic 2D geometry shapes.
2. Drafting elevation and sections of windows
3. Drafting elevation and sections of doors.
4. Developing plan, section and elevation of a single room house.
5. Developing plan, section and elevation of a single bedroom house.
6. Drafting the plan and section of a staircase (without reinforcement).
7. Detailing of RCC beam and footing.
8. Interpretation of Civil Engineering Drawings.
9. Guest lecture on – digitization of Industrial legacy drawings.

Text Books:

1. S.P Arora and S.P Bindra, 'A text book of Building Construction', Dhanpat Rai & sons, 2010.
2. George Omura, Brian C. Benton, 'Mastering AutoCAD 2019 and AutoCAD LT 2019', Wiley, 2018.

Suggested Reading:

1. K.Veenugopal, 'Engineering Drawing and Graphics + Autocad', New Age International Pvt.Ltd, 2010.
2. Balagopal A and Prabhu T. S, 'Building Drawingand Detailing', Spades publishers, Calicut, 1987.

With effect from the Academic Year 2023-24

22CEC08

FLUID MECHANICS LAB

Instruction	2P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To understand the governing parameters for the discharge measurement for flows through various measuring devices.
2. To determine the Reynold's number to understand laminar and turbulent flow.
3. To understand Bernoulli's principle through experiment.
4. To determine Hydrostatic forces on flat and curved surfaces by conducting experiments.
5. To understand stability of floating bodies by conducting experiments.
6. To understand the viscosity of different fluid.

Course Outcomes: At the end of the course, the students can able to

1. Compute the co-efficient of discharge for flows through various flow measuring devices.
2. Differentiate between laminar and turbulent flows in Reynold's experiment and identify the governing parameters for both.
3. Apply the Bernoulli's energy principle in real field cases.
4. Apply the concept of hydrostatic forces on flat and curved surfaces.
5. Compute the centre of buoyancy, stability and metacentre of floating body.
6. Differentiate between viscous and non-viscous flows and identify the governing parameters for both.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1							1				1	2	1
CO2	3	1							1				1	2	1
CO3	3	1							1				1	2	1
CO4	3	1	1						1				1	2	1
CO5	3	1	1						1				1	2	1

LIST OF EXPERIMENTS

1. Determination of Cd, Cv, and Cc for circular Orifice (constant Head method).
2. Determination of Cd for mouthpiece (Falling Head method).
3. Determination of Cd for V notch.
4. Determination of minor losses and major loss in pipes.
5. Determination of Cd for venturi meter and orifice meter.
6. Determination of types of flow using Reynold's apparatus.
7. Verification of Bernoulli's principle.
8. Measurement of viscosity.
9. Stability of Floating Body.
10. Hydrostatics Force on Flat Surfaces/Curved Surfaces.

Text Books:

1. M.N. SheshaPrakash, "Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures", PHI Learning Private Limited, 2011.
2. R.V.Raikar, "Laboratory Manual Hydraulics and Hydraulic Machines-PHI Learning Private Limited,2012.

` With effect from the Academic Year 2023-24

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(BE/B.Tech - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	-
Credits	No Credits

Prerequisite: Knowledge of social studies.

Course Objectives

The course will introduce the students to:

1. Understand the history of framing of the Indian Constitution.
2. Awareness on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary
5. Educate on the local governance and problems in development of rural and urban areas.

Course Outcomes

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

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in district administration.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	1	-	-	1	1	1	1	-	-	-	-	-	1
CO2	-	-	2	-	-	3	2	2	1	-	-	-	-	-	2
CO3	-	-	1	-	-	1	1	-	-	-	-	-	-	-	1
CO4	-	-	1	-	-	1	1	-	-	-	-	-	-	-	1
CO5	-	-	2	-	-	3	2	1	1	-	-	-	-	-	2

Unit-I

Constitutional History and Framing of Indian Constitution

East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

Unit-II

Fundamental Rights, Duties and Directive Principles of State Policy

The Fundamental Rights**:** Features and significance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

Unit-III

Union Government and its Administration

Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role

and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

Unit-IV
Union Legislature and Judiciary
Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

Unit-V
Local Self Governments
Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

Text Books
1. **Indian Government & Politics**, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. **Indian Constitution at Work,** NCERT, First edition 2006, Reprinted in 2022.

Suggested Reading
1. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. Granville Austin, The Indian Constitution: the Cornerstone of a Nation, OUP, 2nd Edition 1999
4. M.V. Pylee, India's Constitution, S. Chand Publishing, 16th Edition, 2017
5. Rajeev Bhargava (ed), Politics and Ethics of the Indian Constitution, OUP, 2008

Online Resources:
1. http://www.nptel.ac.in/courses/103107084/Script.pdf

` With effect from the Academic Year 2023-24

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2023-24

BE (Civil Engineering)

SEMESTER – IV:

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	22CE C09	Hydraulic Engineering	3	-	-	3	40	60	3
2	22CE C10	Surveying II	3	-	-	3	40	60	3
3	22CE C11	Structural Analysis I	3	-	-	3	40	60	3
4	22CE C12	Reinforced Concrete Design - I	3	-	-	3	40	60	3
5	22CE C13	Concrete Technology	3	-	-	3	40	60	2
6	-	PE-1	3	-	-	3	40	60	3
7	22CE C14	Hydraulic Engineering Lab	-	-	3	3	50	50	1.5
8	22CE C15	Surveying & Geomatics Lab	-	-	3	3	50	50	1.5
9	22CE C16	Solid Mechanics Lab	-	-	3	3	50	50	1.5
Total			**18**	**-**	**9**	**-**	**340**	**510**	**21.5**
Clock hours per week: 26									

L: Lecture **T: Tutorial** **P: Practical/Drawing/Seminar/Project**

CIE: Continuous Internal Evaluation **SEE: Semester End Examination**

Professional Elective-1 (PE-1)

Subject code	Subject Name
22CE E01	Green Building Technologies
22CE E02	Principles of Geographical Information Systems
22CE E03	Ground Water Engineering

` With effect from the Academic Year 2023-24

22CE C09

HYDRAULIC ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objective of this course is to

1. Understand and analyze the open channel flows, steady uniform flow and computation of friction and energy losses.
2. Understand and analyze the non-uniform flows and flow profile, energy dissipation
3. Exposure to the basic principles of aerodynamic forces, boundary layer formation and effects.
4. Understand the turbines; design the impulse turbine and its performance.
5. Familiarize with reaction turbines and its design, understand performance of reaction turbines and centrifugal pump

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

1. Apply the concepts of open channel flow and design the efficient channel cross section.
2. Apply the concepts of non-uniform open channel flow to the field problems.
3. Interpret the basics of computation of drag and lift forces in the field of aerodynamics, boundary layer effect.
4. Design the impulse turbines, run the turbines under efficient conditions.
5. Design the reaction turbines, draw characteristic curves of turbines and centrifugal pump

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										2	2	1
CO2	3	2	1										2	2	1
CO3	3	2	2										2	2	1
CO4	3	2	2										2	2	1
CO5	3	2	2										2	2	1

UNIT–I:

Uniform Flow Through Open Channels: Introduction, Difference in pipe flow and open channel flow, classification of flow in channels, velocity and pressure distributions in channel cross-sections, energy and momentum correction coefficients, discharge through open channel by Chezy's and Manning's formula, most economical section of channels-rectangular, trapezoidal, circular and triangular channel sections, concept of critical depth and its computations, Significance of Froude number, specific energy and specific force.

UNIT–II:

Non-Uniform Flow through Open Channels:

Gradually Varied Flow: Dynamic equation of gradually varied flow, classification of channel bottom slopes and water surface profiles, back water curve and afflux, expression for length of back water curve-Direct step method.

Rapidly Varied flow: Hydraulic jump, conjugate depths, Expression for depth and length of hydraulic jump, loss of energy, introduction to surges.

UNIT–III:

Boundary Layer Theory: Introduction, development of Boundary layer on the thin flat plate, laminar and turbulent boundary layers, laminar sub layer, boundary layer thickness- displacement thickness, momentum thickness and energy thickness, hydro-dynamically smooth and rough boundaries. Effect of pressure gradient on boundary layer separation, location of separation point, methods of preventing the separation of boundary layer.

Drag and Lift: Fundamental concepts of drag and lift forces, co-efficient of drag and lift, principles of streamlinng,

Magnus effect.

UNIT-IV:

Impact of Jets: force exerted by the jet of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-angular momentum principle and torque.

Hydraulic Turbines-I: Introduction, classification, head and efficiencies, unit quantities, specific speed, power developed by turbine, principles and design of impulse turbine- Pelton wheel turbine, velocity triangles, characteristic curves.

UNIT-V:

Hydraulic Turbines-II: Reaction turbine - main components and working, work done and efficiencies, Design of Francis turbine and Kaplan turbine, unit quantities, specific speed, characteristic curves, draft tube theory, cavitation: causes, effects.

Centrifugal Pumps: Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps.

Text Books:

1. P.N.ModiandS.M.Seth,"*HydraulicandFluidMechanics*",StandardBookHouse,Delhi,2013.
2. K.Subramanya,"*FlowinOpenChannels*",TataMcGraw-HillEducation,2009.

Suggested Reading:

1. K. Subramanya, "*1000 Solved Problems in Fluid Mechanics*", TataMc-GrawHillPublications2005.
2. VenTeChow,"*Open-ChannelHydraulics",*McGraw-Hill,NewYork,1959.
3. K. Jain, "Fluid Mechanics: Including Hydraulic Machines", Khanna Publisher, 12th edition, 2016.
4. R. L. Streeter, G. Z. Watters, and J. K. Vennerd, "Elementary Fluid Mechanics", John Wiley International Publications, 7th Edition, 1996

` With effect from the Academic Year 2023-24

22CE C10

SURVEYING II

Instruction	3 Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. To understand the importance of various horizontal curves and the methods of setting
2. To understand the importance of transition curves and vertical curves and the methods of setting.
3. To understand the concepts of photogrammetric surveying
4. To know the simple concepts of Remote Sensing and image processing
5. To know the basics of adjustments of errors in survey and basics of LiDAR survey.

Course Outcomes: At the end of the course, student is able

1. To execute setting of simple and compound curves on the field by overcoming obstructions in curve ranging
2. To select suitable transition curves based on real world conditions and execute it on field
3. To apply the concepts of photogrammetry for solving problems in civil engineering
4. To choose appropriate remote sensing technique for data acquisition and image processing techniques for identification of ground features accurately
5. To be able to adjust the errors that are cropping while carrying surveying and adopt LiDAR survey for acquiring topographic data at high speed.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2													
CO2	2	2													
CO3	2	2			1										
CO4	2	2			1										
CO5	1	1													

UNIT- I: CURVE SETTING

Curves: Introduction, Designation of curves, Elements of simple curves. Setting out simple curves by angular methods-Rankine's principle. Compound curves-Elements – solutions to different cases. Reverse curves-parallel straights and non-parallel straights.

UNIT – II: TRANSITION CURVES AND VERTICAL CURVES

Transition curves: Requirements-super elevation-equilibrium cant – cant deficiency-centrifugal ratio, length of transition curve-arbitrary gradient, the time rate, rate of change of Radial Acceleration. Ideal transition curve - Clothoid-cartesian coordinates-computations of Deflection angles. Modified ideal transition curves- The cubic Parabola, the cubic spiral, Characteristics of Transition curves and setting out of transition curves.

Vertical curves: Introduction, concepts of grade and change of grade-types of vertical curves, computations and setting of vertical curves-elevations by tangent correction, chord gradient-influence of sight distances.

UNIT – III: PHOTOGRAMMETRIC SURVEYING

Photogrammetric Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial Photogrammetric, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes

UNIT – IV: REMOTE SENSING AND VISUAL IMAGE INTERPRETATION

Remote sensing: Definition, Energy Principles, radiation principles, principles and Use of EMR spectrum, Energy interactions in atmosphere- Scattering, Absorption, Energy interactions with h surface features and concepts of spectral reflectance curve. Spectral reflectors, Diffuse reflectors, spectral reflectance on –vegetation, soils, water, pavement surface, spectral response pattern-atmospheric influences, characteristics of ideal remote sensing system and applications remote sensing to civil engineering problems.

Visual Image Interpretation: Introduction, fundamentals of visual image elements, image interpretation strategies and keys, wavelength of sensing, temporal aspects of image interpretation. Introduction to types of digital image processing.

UNIT – V: THEORY OF ERRORS AND LIDAR SURVEY

Theory of errors: Theory of errors and survey adjustments introduction, types of errors, laws of weights, Principles of Least squares, most probable value, method of displacements, Method of correlates, probable errors, distribution error. **LiDAR Survey:** Introduction to LiDAR survey and fundamental concepts.

Text Books:

1. K. R. Arora, "*Surveying, Vol-I, II and III*", Standard Book House, 2015.
2. Gopi Satheesh and R.Sathikumar, "*Advanced Surveying: Total Station, GIS and Remote Sensing*", Pearson India, 2006.
3. T. Lillesand, R. W. Kiefer, "Remote Sensing and Image Interpretation", Jhon Willey & Sons, 2015.

Suggested Reading:

1. K. Manoj K. Arora and R. C. Badjatia*," Geomatics Engineering*", Nem Chand & Bros, 2011
2. A. M. Chandra, "*Higher Surveying",* Third Edition, New Age International (P) Limited, 2002.
3. M. Anji Reddy, "*Remote sensing and Geographical information system*", B.S. Publications, 2001.

` With effect from the Academic Year 2023-24

22CE C11

STRUCTURAL ANALYSIS-I

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the students

1. Comprehend the concept of determination of flexural deflections statically determinate beams using various methods.
2. Analyze the indeterminate beams.
3. Understand the behavior of circular shafts subjected to torsion and also to the combined effect of bending and torsion.
4. Compute the strain energy in bars subjected to the action of various types of loads and significance and analysis of types of springs.
5. To compute maximum load carrying capacity of various columns.

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

1. Compute slopes and deflections in determinate beams, under various types of static loads, using a suitable method.
2. Analyze the propped cantilevers and fixed beams subjected to various types of loads.
3. Analyze and design circular shafts subjected a given torque and bending.
4. To determine the strain energy in members under various loading situations, and to analyze various types of springs.
5. Analyze various types of columns with different end conditions.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO2	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO3	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO4	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2

UNIT-I:

Slopes and Deflections: Determination of Slope and deflections by double integration method and Macaulay's Method for cantilever, simple supported beams and overhanging beams carrying point loads, uniformly distributed loads, uniformly varying loads and couples. Application of Moment area method and Conjugate beam method for determination of Slope and deflections in simple cases.

UNIT - II:

Propped Cantilevers: Analysis of propped cantilever beams with elastic and rigid props for point loads and uniformly distributed loads, and determination of slope and deflections.

Fixed beams: Analysis of fixed beams subjected to point loads, uniformly distributed loads, uniformly varying loads. Slope and deflections in fixed beams with and without sinking of supports.

UNIT - III:

Torsion: Theory of pure torsion, Torsion equation, solid and hollow circular shafts, strength and stiffness of shafts, Transmission of power. Shafts in series and Shafts in parallel. Combined torsion and bending. Equivalent Bending and Torsional Moments.

UNIT - IV:

Strain energy: Strain energy, proof resilience and modulus of resilience. Strain energy in bars subjected to gradually applied loads, suddenly applied and impact loads. Strain energy due to shear, bending and torsion.

Springs: Types of springs and significance, analysis of Closed and open coiled helical springs under axial load and twist.

UNIT- V:

Columns and Struts: classification of columns, Euler's theory for different end conditions of columns, effective length factors, radius of gyration and slenderness ratio, limitations of Euler's theory. Empirical formulae- Rankine's - Gordon's formula, Secant and Prof. Perry's formulae.

Text Books:

1. B .C. Punmia, "*Mechanics of Materials Vol. I &II* ", Laxmi publishers, Delhi, 2011.
2. S. Ramamrutham, "*Strength of* Materials", Dhanpat Rai & Sons, Delhi, 2012.

Suggested Reading:

1. S.B. Junnarkar*," Mechanics of structures (Vol-I &Vol-II)",* Charotar Publishing house, Anand, 2002.
2. D.S. Prakash Rao, "*Strength of Materials-A Practical Approach",* Universities Press, 1999.
3. E.P. Popov, "*Engineering Mechanics of solids*", 1993.
4. G.H. Ryder, "*Strength of Materials",* 3 Edition in SI units, Macmillan India Ltd, Delhi, 2012.
5. A. Pytel and F. L. Singer, "*Strength of Materials",* Harper & Row, 4 Editions, New york.1999.

` With effect from the Academic Year 2023-24

22CE C12

REINFORCED CONCRETE DESIGN – I

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS:456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method and check for serviceability.
3. Design RC beams for shear, torsion and bond.
4. Analyse and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC short columns for axial loads and moments and axially loaded isolated footings.

Course Outcomes: At the end of the course, student is able to

1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS:456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method and check for serviceability.
3. Design RC beams for shear, torsion and bond.
4. Analyse and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC short columns for axial loads and moments and axially loaded isolated footings.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1								3	2	1
CO2	2	2	2	1	1								3	2	1
CO3	2	2	2	1	1								3	2	1
CO4	2	2	2	1	1								3	2	1
CO5	2	2	2	1	1								3	2	1

UNIT - I: Introduction to Reinforced Cement concrete: Concept of reinforced concrete - basic requirement of RC structures-Stresses, loads & combinations- Design Philosophies: Development of design philosophies – Introduction to working stress method and Limit state method - classification of limit states – characteristic loads - partial safety factors – Factors for material and load - design stress – stress and strain diagram of concrete and steel - Merit and demerits. Introduction to IS: 456- General design requirements and specifications. Working Stress method: Assumptions made in design of flexural members –Theory of bending in RC beams - Balanced, under and over reinforced sections. Analysis and design for flexure of singly reinforced rectangular beams-Analysis and design T-beams using WSM.

UNIT- II: Limit state method of design: Assumptions made in design of flexural members - Stress block parameters - Analysis and flexural design of singly reinforced, doubly reinforced rectangular beams and singly reinforced flanged beams. Limit state of serviceability: Short term, long term, total deflection - check for deflection - cracking - IS code provisions.

UNIT - III: Limit state of collapse in shear and torsion: Types of shear reinforcement – analysis and design for

shear and torsion in beams - Bond - development length and curtailment of reinforcement in beams and detailing of bars: IS code provision.

UNIT - IV: Analysis and design of slabs as per IS 456: Solid rectangular slabs – one-way slabs (cantilever, simply supported and continuous), two-way slabs (simply supported and continuous slabs) subjected to uniformly distributed loads - Detailing of reinforcement and check for serviceability in slabs, Design of stairs - Design and detailing of dog legged slab type staircase.

UNIT - V: Analysis and design of columns as per IS 456: Short and long columns - End conditions, effective length of columns - assumptions made in design - design and detailing of axially loaded rectangular and circular columns with lateral reinforcement - Design of axially loaded short columns subjected to uniaxial and bi-axial moments using interaction diagrams, Design of isolated footings as per IS 456: Design and detailing of axially loaded rectangular and circular footings.

Text Books:

1. N. Subramanian, "*Design of Reinforced Concrete Structures*" Oxford University Press. First Published in 2013, Second impression 2014.
2. S. Unni Krishnan Pillai and Devadas Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Co Ltd, (Third Edition), 2009.

Suggested Reading:

1. V. L. Shah and S. R. Karve, "Limit State Theory and Design of Reinforced Concrete", Structures Publications, 7th Edition,2014.
2. A.K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand & Brothers-Roorkee; Seventh edition, paperback – 2012.
3. Sushil Kumar, "Treasure of RCC Designs", Standard Book House; Edition: 19th, Year-2014 edition (1 December 2009).
4. N. Krishna Raju, "Design of Reinforced Concrete Structures", CBS Publishers and Distributors, New Delhi, 4th edition, 2016.

` With effect from the Academic Year 2023-24

22CE C13

CONCRETE TECHNOLOGY

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Outcomes: To enable the students to

1. Learn the properties & conduct tests on various ingredients of concrete.
2. Understand the behavior of concrete in fresh and hardened states.
3. Understand the Mix design of concrete using various design methods.
4. To learn the durability of concrete & acquire knowledge on the properties and effective usage of various admixtures.
5. Gain knowledge of various special concretes and their applications

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

1. Understand the properties of concrete making materials and production of concrete.
2. Analyze the properties of fresh and hardened concretes.
3. Design the concrete mix using various methods for a specified grade.
4. Evaluate durability of concrete and apply suitable admixtures in concrete making.
5. Evaluate and choose appropriate concrete for field application.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

UNIT- I:

Concrete Materials & Production of Concrete: Manufacturing process of cement, Types of cements, Properties of cement and aggregate (fine & coarse), tests conducted on cement and aggregate (fine & coarse). Production of concrete – Various methods of batching, mixing, compaction and curing. Water cement ratio, gel space ratio, Segregation and bleeding of concrete.

UNIT- II:

Fresh concrete: Workability, factors affecting workability, measurement of workability using slump cone, compaction factor.

Hardened concrete: Behavior of concrete under various types of loading - compression, Tension and flexure. Non - destructive testing methods. Time dependent behavior of concrete –Maturity, shrinkage & creep. Stress-Strain behavior of concrete.

UNIT - III:

Durability of concrete:

Durability – Factors affecting Durability, Cracking of Concrete - types of cracks, causes, remedies. Deterioration of concrete and its prevention.Behavior of concrete under various types of extreme environments, Freezing and Thawing, Acid attack on concrete, Efflorescence, fire resistance.

Concrete Admixtures:

Classification of admixtures, Mineral and Chemical admixtures, Influence of various admixtures onproperties of concrete.

UNIT - IV:
Concrete Mix Design: Basic considerations, Factor to be considered in choice of mix design, Different mix design methods – I.S. code method and ACI methods. Quality control of Concrete**.**

UNIT- V:
Special Concretes: Properties & applications of High Strength Concrete, High Performance Concrete, Polymer Concrete, High Density Concrete, Light Weight Concrete, and Ferro cement, Recycled Aggregate Concrete, Self Compacting Concrete (SCC) , Fly Ash Concrete,.Ready Mix Concrete (RMC), Self healing Concrete (Bacterial Concrete).

Fiber Reinforced Concrete(FRC): Types of fibers, Constituent materials , Mechanism, Properties & Applications of Steel Fiber Reinforced Concrete , Geopolymer concrete.

Text Books:
A.M Neville., "Properties of Concrete", Pearson Education. 2012.
M.S. Shetty, and A. K. Jain, "Concrete Technology: Theory and Practice", S. Chand & Company, 2018.
R. Santhakumar, "Concrete Technology", Oxford University, Press 2018.

Suggested Reading:
A.M. Neville and J.J. Brooks, "Concrete Technology", Dorling and Kindersley Publications, 2002.
P. K. Mehta, and J. M. M. Paulo, "Concrete- Microstructure – properties and Material", Mc. Graw Hill Publishers, 2017.
N. Krishnaraju, "Design of Concrete Mixes", CBS Publishers and Distributors, 2010.

` With effect from the Academic Year 2023-24

22CE E01

PROFESSIONAL ELECTIVE-I

GREEN BUILDING TECHNOLOGIES

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. To understand the basic principles of green building technologies and their significance.
2. To understand the judicial use of energy and its management.
3. To know about the Sun-earth relationship and its effect on climate.
4. To enhance awareness of end-use energy requirements in the society.
5. To know about the suitable technologies for energy management and audit procedures.

Course Outcomes: At the end of the course, the student should

1. Be able to identify the fundamentals of energy use and energy processes in building.
2. Be able to identify the energy requirement and its management.
3. Apply the knowledge about Sun-earth relationship vis-a-vis its effect on climate.
4. Be able to deal with the end-use energy requirements.
5. Be familiar with the audit procedures of energy.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1			1	2	1				1	2		2
CO2	1	1			1	1	2	1				1	2		2
CO3	1					1	2	1				1	1		1
CO4	2	2					2	1				1	1		1
CO5	1											1			

UNIT- I:

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT- II:

Indoor environmental requirement and management: Thermal comfort – Ventilation and air quality – Visual perception – Illumination requirement - Auditory requirement.

UNIT- III:

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT- IV:

End-use, energy utilization and requirements: Lighting and day lighting - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT- V:
Energy management options: Energy audit and energy targeting – Technological options for energy management. Certification- Study of the LEED and TERI (GRIHA) parameters and certification of Green Buildings

Text Books:

1. Charles J. Kibert*,"Sustainable Construction - Green Building Design and Delivery*", John Wiley & Sons, New York, 2008
2. Norbert Lechner,"*Heating, Cooling, Lighting - Sustainable Design Methods for Architects*", Wiley, New York, 2015.
3. James Kachadorian, "*The Passive Solar House: Using Solar Design to Heat and Cool Your Home*", Chelsea Green Publishing Co., USA, 1997.

Suggested Reading:

1. Michael Bauer, Peter Mosel and Michael Schwarz, "Green*Building – Guidebook for Sustainable Architecture",*
   Springer, Heidelberg, Germany, 2010.
2. Mike Montoya,"*Green Building Fundamentals*", Pearson, USA, 2010.
   Regina Leffers*, "Sustainable Construction and Design*", Pearson / Prentice Hall, USA, 2009

22CE E02
PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEM

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course objectives: To enable the student

1. Understand the basics and applications of GIS, and concepts of Maps , projections
2. Understands the basic difference between vector GIS and raster GIS.
3. Understand the various types of data, realize the importance of spatial data and also in a position to apply methods of data compression techniques. 4.Identify various types analysis functions used integrated analysis GIS data
4. Understand the basics of use of GIS softwares and apply the principles of cartographic modelling to watershed modeling, environmental modeling and watershed management.

Course Outcomes: At the end of the course, the student

1. Is able to apply the principles of GIS to various field problems and take decisions under uncertain conditions.
2. Is able to understand advantages and disadvantages of using vector GIS and raster GIS.
3. Is able to apply the methods of data Compression using GIS. 4. Can perform the data modeling and analysis using GIS.
4. Is able to apply the Cartographic modelling techniques for Watershed modeling, Environmental Modeling and for Watershed Management, visibility analysis..

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2					2	2	2			
CO2	2	2			2										
CO3	2														
CO4	2	2	2	2	1				1	1	1	1			
CO5	2	2	2	2	1				1	1	1	1			

UNIT– I:

Introduction: Definition of GIS , History of development , Components of GIS-Data, Technology, System and Users, Map- introduction, scale, types of maps, mapping process-planning, data acquisition , cartographic production phase, product delivery, Plane coordinate system -rectangular, polar , Linear coordinate transformation system, Geographic coordinate system,

Map projections -Properties-area, shape, distance and direction, Classification -cylindrical, Conical, Azimuthal, Aspects of Projections-Normal, Transverse, oblique, View Points -Gnomonic, Orthographic and stereographic, Map projections for GIS, Datums-Geodetic and vertical , relationship between Coordinate system and map projections, UTM Projections

UNIT-II:

GIS Data: Nature of Geographic data-Geographic position, attributes, spatial relationship, time, Data types–spatial non spatial (attribute data)–data-structure, data format – point, line Polygon, Spatial data models - Raster data- data compression-point coding Run length coding, Quadtrees, Vector models- The spaghetti model, topological models, Triangulated irregular network model, Data files strucutre in computer – Hierarchical, Network, Relational data base , object based data models Concepts of Geo referencing, Existing digital data – cartographic database. Digital elevation data

UNIT-III:

GIS Data analysis function : Introduction , organising Geographic data -data layers, coverage Classifications of analysis functions Spatial data analysis, data retrieval, query (SQL)–Organizing data for analysis, classification of GIS analysis function, maintenance and analysis of spatial data – transformation, conflation, Edge matching and Editing, Maintenance and analysis for non-spatial attribute data- Attribute editing and Attribute query functions.

UNIT-IV:

Integrated analysis functions: Retrieval and classification function: Overlay operations, neighborhood operations, connectivity function, output formatting – Map annotations ,text pattern and line styles, graphic symbols, cartographic modeling by GIS analysis procedure with an example.

Presentation of Geo-data Analysis: Types of output data–types of errors elimination and accuracies – sampling - components of data quality.

UNIT-V:

Software scenario – Functions: Introduction of Arc GIS, QGIS sfotwares,

Cartographic modelling - concepts, applications to Watershed modeling, Watershed Management, Environmental modeling – Visibility analysis. Vehicle tracking.

Text Books:

1. C.P.LO, Albert K.W. Yeung " Concepts And Techniques of Geographic information systems" Prentice Hall of India Private Limited New Delhi,2016
2. P.A. Burrough, "*Principles of Geographical Information Systems for Land Resources Assessment (Monographs on Soil and Resources Survey)",* Oxford University Press, 1986.
3. Lillesand and Kiefer, "*Remote Sensing and Image Interpretation*", Wiley; Sixth edition, 2011.

Suggested Reading:

1. Heywood, S. Cornelius and Steve Carver, "*An Introduction to Geographical Information Systems*", Pearson, 4th Edition, 2012. 2. B. Bhatta, "*Remote Sensing and GIS*", Oxford, Second edition, 2011. 3. S. Kumar, "*Basics of Remote Sensing and GIS*", Laxmi Publications, First edition, 2016.
2. S. Aronoff, "*Geographic Information Systems: A Management Perspective*", WDL Publications Ottawa, 1991.
3. Michael N Demers ,"Fundamentals of Geographic system" Jhon Wiley sons, INC, 4th edition,2008

` With effect from the Academic Year 2023-24

22CE E03

GROUND WATER ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course objectives: The student should able to understand

1. Basics of groundwater hydrology, familiar with aquifer parameters.
2. Unsteady flow and its flow computation.
3. Exploring groundwater through surface and subsurface methods.
4. Artificial recharge and causes, methods of recharge.
5. Various models in groundwater, quality of groundwater, pollutant transport.

Course outcomes: The student should able to

1. Assess groundwater potential and head.
2. Estimate hydraulic conductivity and storage coefficient for time variant flow.
3. Investigate groundwater availability for a given area.
4. Plan and design artificial recharge.
5. Construct model and analyze groundwater flow.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										2		1
CO2	3	2	1										2		1
CO3	3	2	1			1	1						2		1
CO4	3	2	1			1	1						2		1
CO5	3	2	1										2		1

UNIT- I:

Introduction: Occurrence of groundwater, problems and perspectives regarding groundwater in India, groundwater basin, ground water in hydrologic cycle, vertical distribution of ground water, Hydrologic balance equation, types of aquifers. Darcy's law and limitations, aquifer parameters, specific yield, safe yield, three-dimensional groundwater flow equation, Steady radial flow to a well in unconfined and confined aquifers.

UNIT- II:

Unsteady radial flow to a well: Non equilibrium equation for pumping tests. This method of solution, Cooper Jacob method, Chow's methods of solution. Law of times, well flow near aquifer boundaries, Image well theory, multiple well systems, well losses, pumping and recuperation tests.

UNIT- III:

Geophysical Exploration:

Surface investigations: Surface investigations of ground water – electrical resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, dowsing, remote sensing.

Subsurface Investigations: Test drilling, resistivity logging, temperature logging, caliper logging, Interpretation of logs and selecting the groundwater potential zones.

Unit- IV:

Artificial Recharge of groundwater: Methods of recharge, water spreading, sewage discharge, recharge through pits and shafts, recharge through well, induced recharge.

Sea water intrusion in coastal aquifers, occurrence, Ghyben – Herzberg relation, shape of fresh – salt water interface, Length of the intruded sea water wedge. Prevention and control of sea water intrusion.

Unit-V:

Modelling techniques: Introduction, ground water models, sand models, viscous fluid models, membrane models, thermal models, electric-Analog models. Numerical modelling, finite difference method.

Quality of groundwater: Groundwater Contamination, sources of groundwater contamination, groundwater quality criteria, advection process, diffusion and dispersion process, pollutant transport equation and modelling of pollutant transport.

Text Books:

1. D.K. Todd, "*Ground Water Hydrology*", John Wiley & Sons, Inc., USA, 2015
2. H.M. Raghunath, "*Ground Water*", Wiley Eastern Limited, New Delhi, 2007.

Suggested Reading:

1. Bouwer, "*Ground Water Hydrology*", Mc. Graw Hill, Newyork, 2013
2. A. K. Rastogi, "*Numerical Groundwater Hydrology*", Penram International Publishing, Mumbai, 2007.J.
3. Bear, "*Hydraulics of Ground*

` With effect from the Academic Year 2023-24

22CEC14

HYDRAULIC ENGINEERING LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives:

1. To understand uniform and non-uniform flows and the importance of Froude number in open channel flows.
2. To measure the discharge in venturiflume open channel.
3. To determine super elevation in a curved channel and coefficient of discharge in a hemi spherical tank.
4. To determine the force exerted by fluid jet on vanes, efficiency and performance of turbines and centrifugal pumps.

Course Outcomes: At the end of the course, the students can able to

1. Compute roughness coefficient in uniform flows and Froude number, energy losses in non-uniform flows.
2. Determine the coefficient of discharge of a venturi flume in open channels.
3. Compute super elevation in curved channel and coefficient of discharge in a hemi spherical tank.
4. Determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1						1				1	2	1
CO2	3	1							1				1	2	1
CO3	3	1	1						1				1	2	1
CO4	3	1							1				1	2	1
CO5	3	1	1						1				1	2	1

List of experiments

1. Uniform flow in channels - Determination of Manning's Rugositycoefficient, Chezy's constant.
2. Curved Channel flow - Determination of super elevation
3. Hydraulic Jump - Determination of Froude number, loss of energy, type ofjump.
4. Venturiflume - determine coefficient of discharge in open channel.
5. Impact of Jets - Determination of force on flat vane and curved vane.
6. Unsteady flow in a hemi -spherical tank.
7. Pelton Wheel turbine-Determine the efficiency and construct performance characteristics of Pelton wheel turbine.
8. Francis Turbine- Determine the efficiency and construct performance characteristics of Francis turbine.
9. Kaplan Turbine- Determine the efficiency and construct performance characteristics of Kaplan turbine.
10. Centrifugal Pump- Determine the efficiency and construct operating characteristics curves for constant speed pump.

Text Books:

1. M.N. Shesha Prakash, "Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures", PHI Learning Private Limited, 2011.
2. R.V.Raikar, "Laboratory Manual Hydraulics and Hydraulic Machines-PHI Learning Private Limited,2012

` With effect from the Academic Year 2023-24

22CE C15

SURVEYING AND GEOMATICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: To enable the student

1. To know the use of simple survey instruments in the field.
2. To develop topo maps from the field data.
3. To get exposure to modern surveying instruments for solving the problems
4. To understand the concepts of automation in surveying.
5. To be in a position to set the curves by using various methods and identifying the data required to be computed for the same.

Course Outcomes: At the end of the course the student should have learnt

1. To use simple as well as modern surveying instruments.
2. To develop L.S and C.S for road works, Canal works, using Auto levels and to develop contour map of the given area.
3. To use Total Station for locating ground details and plotting.
4. To set simple curves using Total Station.
5. To locate ground features using GPS.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1						1						
CO2	2	1	2						1			1			
CO3	2	1	2						1						
CO4	2	1	1	1					1						
CO5	2	1							1						

LIST OF EXPERIMENTS:

1. Ranging, running perpendicular lines and types of offsets by using chain, tape, cross staff.
2. Use of prismatic compass for measuring the area of a given land by using compass traverse.
3. Introduction to plane table work. - Radiation and intersection methods.
4. Introduction to levelling - Fly levelling using Auto level.
5. Development of L.S. and C.S after obtaining levels by using Auto levels.
6. Developing contour maps.
7. Measurement of horizontal angles using theodolite.
8. Study of Total station operations.
9. Traversing by Total station.
10. Setting of simple curve with the help of Total Station.
11. Study of GPS operations.
12. Establishing control points using GPS.
13. Demonstration of Remote Sensing Data processing software

Suggested Reading:

1. B. C. Punmia and A. K. Jain," *Surveying and Levelling", Vol. I and II*, Laxmi Publications, 2016.
2. Subramanian, *"Surveying and Levelling*", Oxford Higher Education, 2012.

` With effect from the Academic Year 2023-24

22CE C16

SOLID MECHANICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: To know and understand the mechanical characteristics of various engineering materials by conducting different tests.

1. Mechanical properties of engineering materials under different structural actions like direct tension, compression, flexure and torsion.
2. Measurement of deflections and hence there by finding elastic properties.
3. To assess the behavior of steel rods under impact loads and shear.
4. To conduct torsion test and to conduct deflection test on helical spring and
5. To conduct compressive strength on brick and concrete cube

Course Outcomes: At the end of the course, the students will be able

1. To understand the stress strain behavior of mild steel bar under direct tension.
2. To compute the modulus of elasticity of given materials by conducting deflection tests on different types of beams.
3. To determine the impact/ shear strength of steel specimen.
4. To determine the rigidity modulus of a given material by conducting torsion test and deflection test on helical spring.
5. To determine the compressive strength of brick and concrete cube.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO2	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO3	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO4	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO5	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1

List of Experiments:

1. Direct tension test on mild steel bar.
2. Deflection test on Simply Supported beam.
3. Deflection test on Cantilever beam.
4. Deflection test on Propped cantilever beam.
5. Deflection test on Continuous beam.
6. Impact test.
7. Shear strength of a steel bar.
8. Torsion test.
9. Deflection test on helical spring.
10. Compression test on brick and concrete cube.

Suggested Reading:

1. William Kendrick Ha, "*Laboratory Manual of Testing Materials*", Bibliolife, 2009.