IPS Academy, Institute of Engineering & Science
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New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Civil Engineering Department

Semester III [Second Year]

S.No.	Course Code	Course Title	Hrs./ Week			Credits
			L	T	P	
1	BSC-MA04	Program Specific Mathematics	2	1	-	3
2	PCC-CE01	Building Design and Drawing	3	-	-	3
3	PCC-CE02	Engineering Geology and Remote Sensing	3	-	-	3
4	PCC-CE03	Surveying and Geomatics	2	1	-	3
5	PCC-CE04	Strength of Materials	2	1	-	3
6	HSMC-HS03	Innovation and Creativity	1	-	-	1
7	LC-CE01(P)	Building Design and Drawing Lab	-	-	2	1
8	LC-CE02(P)	Engineering Geology and Remote Sensing Lab	-	-	2	1
9	LC-CE03(P)	Surveying and Geomatics Lab	-	-	2	1
10	LC-CE04(P)	Strength of Materials Lab	-	-	2	1
11	MPC-MLC01	Professional Laws, Ethics, Gender, Human Values and Harmony	1	-	-	Audit
Total			**14**	**3**	**8**	**20**
Total Academic Engagement and Credits			**25**			**20**

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PCC CE01	Building Design and Drawing	3L:0T:2P (5 hrs)	4 Credits

Pre-requisite(s): Engineering Graphics & Visualization

Objectives: Basic necessity for the Building Planning & Drawing is to develop drawing skills and enhance imagination and observation power of students.

Module 1 Drawing of Sub Structures Elements (10 Hrs)

Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation,

Module 2 Drawing of Super Structures Elements (10 Hrs)

Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.

Module 3 Building Planning (10 Hrs)

Provisions of National Building Code, Building bye-laws, open area, setbacks, FAR terminology, principle of architectural composition (i.e. unity, contrast, etc.), principles of planning, orientation.

Module 4 Building Services (10 Hrs)

Introduction of Building Services like water supply and drainage, electrification, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings.

Module 5 Building Planning & Lay out Details (10 Hrs)

Planning of residential buildings – Load bearing / Framed Structure – (a) Bungalows (b) Row houses, (c) Ownership flats, (d) Apartments. Layout details, Elevation, sectional details. Planning of public buildings - Functional requirements of public buildings.

Course Outcomes:

Students will be able to

CO 1. Understand the substructure of building and its drawing

CO 2. Know about the superstructure elements of building and their drafting.

CO 3. Understand the basic laws of building codes and principles of building.

CO 4.Understand about building services like water supply and drainage, electrification fire safety, thermal insulation etc.

CO 5. Understand about building planning and layout details

Text Books:

1. Layal JS, Dongre A, "Building Design and Drawing" Satya Prakashan Edition 2016.
2. Ghose D.N. "Civil Engineering Design and Drawing", CBS publisher. 2nd Edition, 2015
3. Agrawal S. C., Architecture and Town Planning, Dhanpat Rai & Co. 2013

Reference Books:

1. Malik & Meo; "Building Design and Drawing" Computech publication 2009
2. Shah, Kale & Patki; Building Design and Drawing; TMH 1st Edition 2001.
3. Gurucharan Singh & Jgdish Singh "Building Planning, Design and Scheduling" 2009.

Suggested List of Experiment:

1. Sketches of various building components.
2. One drawing sheet of various building components containing doors, windows ventilators, lintels and arches stairs foundations etc.
3. One drawing sheet each for services and interiors of buildings.
4. One drawing sheet containing detailed planning of one/two bed room residential building (common to all students)
5. One drawing sheet each of residential and institutional building (Each student perform different drawing).
6. Use of AutoCAD for preparation of drawings.

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PCC CE02	Engineering Geology and Remote Sensing	3L:0T:2P (5hrs)	4 Credits

Objectives: To provide surface and sub surface information and enhance the knowledge of Remote sensing & GIS for critical civil engineering problems.

Module 1 Geomorphology and Mineralogy (09 Hrs)

Introduction and scope of geology, branches of geology, origin of earth, Age of the earth and interior of the earth, Soil formation and soil profile, weathering and its types, formation of landforms and valleys, geological action of wind, river, ground water, and sea. Plate tectonics, Concept and causes of earthquakes, seismic zones in India, and volcanoes. Fundamentals of mineralogy, physical properties of minerals, study of common rock forming minerals, ore minerals and clay minerals importance to civil engineering.

Module 2 Petrology and building stones (08 Hrs)

Rock cycle, composition, classification and structures of igneous, sedimentary and metamorphic rocks, rocks of civil engineering importance, study of common rock types, brief geological history of India, important building stones, it's properties with strength and durability, availability and suitability of building stones.

Module 3 Structural geology (07Hrs)

Dip, strike, outcrops, classification and detailed studies of geological structures i.e. Folds, Faults, Joints, Unconformity and their importance in civil engineering**.**

Module 4 Applied geology (09 Hrs)

Surface and subsurface exploration Methods- Drill holes, test pits, trenches, shafts, adits, drifts. Drilling and excavation, engineering and hydrological properties of rocks, Application of geological condition on design and construction of tunnels, Dams, Reservoirs and canals. Preliminary detailed geological consideration for selection site for Dam, Tunnel, Reservoirs and Canals.

Module 5 Remote sensing & GIS **(10 Hrs)**

Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Vector and raster data, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, UTM Zones of GIS and application of GIS in civil engineering and resource mapping (site selection, water resources, rocks and soil)

Course Outcomes:

Students will be able to

CO1. To understand the fundamental structure of the earth and to relate Geology to practical applications in Civil Engineering, To understand the importance of ores and minerals from civil engineering perspective

CO2. To perceive the stratigraphy of India, the classification of rocks found in India and its physical Characteristics. To understand the properties of building stones and its classifications

CO3. To visualize the technical terms involved in structural geology in the real world scenario.

CO4. To understand the geotechnical considerations for selecting the suitable sites of different structure.

CO5. To introduce the concept of remote sensing & GIS for solving Civil Engineering problems

Text/Reference Books:

1. G.B.Mahapatra, " A Text Book of Geology" CBS publisher and distributor
2. G.B.Mahapatra, "Text Book of Physical Geology" CBS publisher and distributor
3. S.K.Garg "Physical and Engineering Geology " Khanna Publisher 2003
4. Parbin Singh "Engineering and General Geology"S.K.Kataria & Sons
5. K.M.Banger "Principle of Engineering Geology" Standard Publishers Distributors, 1981
6. Lillesand, Kiffer, Chipman "Remote sensing and Image interpretation"Wiley

Suggested List of Experiment:

1. Identification of Metallic and Non Metallic Minerals
2. Identification of igneous rocks, Sedimentary rocks and metamorphic rocks
3. Study of geological structures-Folds,Faults,Unconformities.
4. Identification of various geological structures & Cross Section from Geological maps.
5. Study of geological Models-Dip & Strike,Narrow George,Tunnels
6. Identification of drainage patterns and topography using toposheet
7. Identification & Study of geological features using of satellite data & Aerial Photographs
8. Land use / Land cover mapping

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PCC-CE03	Surveying & Geomatics	2L:1T:2P (5hrs)	4 Credits

Pre-requisite(s) – Basic Civil Engineering

Objectives: Students will be able to describe the function of surveying in civil engineering construction.

Module 1 Introduction to Surveying (10Hrs)

Introduction, Principles of surveying, types of errors in chain and tapes, corrections- length, slope, temperature, pull, sag.

Plane Table Surveying Methods of plane table Survey Radiation, intersection, traversing and resection; Two point and Three-point problems and their solutions by different methods, Strength of fix, Lehman's Rules

Module 2 Traversing (10Hrs)

Traversing with chain and compass: plotting and adjusting a traverse, Local attraction, Magnetic Declination etc.

Traversing with Theodolite: Types, Temporary Adjustment, latitude & Departure, plotting & Adjustment, Omitted Measurements, Trigonometric Levelling

Module 3 Tachometry survey (10Hrs)

Principle of stadia, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Use of Tachometry in Surveying: Tangential system, subtense system, instrument constant. Profile Levelling Longitudinal Section and Cross sections, Toposheets

Module 4 Curves (10Hrs)

Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves

Module 5 Hydrographic, Photogrammetry & Remote sensing Survey (08Hrs)

Hydrographic Survey: Soundings, methods of observations, computations and plotting.

Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry

Course Outcomes:

Students will be able to

CO1. 1.The student will be able to understand the basic principles of surveying and how they are implemented in practice.,

CO2. The student will be able to get acquainted to advanced and recent instruments used for surveying in field.,

CO3. To develop an understanding of traversing principles for control stations and its deployment to generate error free framework.,

CO4. To comprehend the fundamentals of GPS surveying and its real time application at survey field.

CO5. To develop an understanding for remote sensing, data acquisition and Geographical information system fundamentals for effective implementation in modern survey practices.

Text/Reference Books:

1. B.C Punmia , Surveying Vol-II & III ,Laxmi Publication.January 2015
2. S.K. Duggal, Surveying Vol. II McGraw Hill Publishing Company Ltd. 2019
3. Saikia MD, Das BM, Das MM, Surveying, McGraw hill 2017
4. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

Suggested List of Experiment:

1. To determine RL of an elevation using trigonometric surveying
2. To determine RL of an elevation using tachometric surveying
3. To determine instrument constant of the lens of a theodolite
4. Profile leveling using auto level
5. Fly leveling using auto level

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PCC CE 04	Strength of Materials	2L:1T:2P (5Hrs)	4 Credits

Pre-requisite(s) – Engineering Mechanics

Objectives: Students will be able to analyze isotropic structural members subjected to axial forces and temperature variations, statically determinate beams and circular shafts (determinate and indeterminate), Find principal stresses and strains in structural members.

Module 1 Stress and Strain **(10 Hrs)**

Stress and strain (linear, lateral, shear and volumetric), Generalized Hooke's law. Elastic constants and their relationship for isotropic materials. Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self weight and temperature changes.

Principal planes and stresses: Normal and shear stresses on any oblique plane and concept of principal planes and principal stresses by analytical and graphical methods (Mohr's circle of stress 2D).

Module 2 Bending and Shear stresses **(10 Hrs)**

Theory of simple bending .Stresses in beams due to bending. Theory of pure bending, Flexure formula. Bending stress distribution diagram, Moment of resistance and section modulus. Bending stress distribution across a section of beam, Shearing Stress and shear stress distribution across a section in Beams. Determination of bending stresses in simply supported, Cantilever and Overhanging beams subjected to point load and uniformly distributed loading.

Module 3 Slope and Deflection of Determinate Beams **(10 Hrs)**

Double integration method (McCauley's method), Moment Area method, Conjugate beam method, Strain Energy Method, Castiglione's Method, Unit Load Method. Types of trusses, Assumption in truss analysis, method of joints, method of sections for forces in members of plan frames and trusses.

Module 4 Columns and Struts **(10 Hrs)**

Theory of columns, Slenderness ratio, Axially loaded columns, Critical load and buckling, Euler's formulae for column with hinged ends, equivalent length for various end conditions. Rankine's formula, Direct and Bending Stresses: Eccentrically loaded short columns including biaxial cases. Thin Pressure Vessels: cylinders and spheres. Stress due to internal pressure, Change in diameter and volume. Theories of failure.

Module 5 Torsion of shaft **(10 Hrs)**

Concept of pure torsion, Torsion equation. Stresses, strains and deformation in determinate and indeterminate shafts of hollow and solid sections of homogenous and composite materials subjected to torsion. Determination of shear stress and angle of twist of shafts of circular section. Unsymmetrical Bending: Principal moment of Inertia, Product of Inertia, Bending of a beam in a plane which is not a plane of, symmetry. Shear center; Curved beams: Pure bending of curved beams of rectangular, circular and trapezoidal sections, Stress distribution and position of neutral axis.

Course Outcomes:

Students will be able to

CO 1. To establish basic understanding of material properties, types of stresses, strain and draw Mohr's circle diagram.

CO 2. To understand the relation between loads, member forces, deformation and to discuss about bending and shearing stresses in various types of beam subjected to point load and uniformly distributed loading.

CO 3. To discuss the determination of slope and deflection of beam by different types of method viz . Double Integration Method, Macaulay's Method, Area Moment Method, Conjugate Beam Method etc.

CO 4. To comprehend the performance of columns with different end conditions and visualize the load carrying capacity of columns and struts. To provide fundamental concepts of thin pressure vessels

CO 5. To discuss the basic concepts of various types of structural members subjected to torsion and combine bending. To understand the determination of shear stress and angle of twist of shaft of various section and unsymmetrical bending cases in practice

Text/Reference Books:

1. Punmia B.C., "Mechanics of Materials", Laxmi Publications (P) Ltd,2001.
2. S. Ramamrutham, R. Narayanan, "Strength of Materials", Dhanpat Rai Publications.
3. Rajput R. K., "Strength of Materials", S. Chand,2007.
4. R. Subramaniam, "Strength of Materials", Oxford University Press,2010.
5. Sadhu Singh , "Strength of Material" , Khanna Publishers.

Suggested List of Experiment:

1. Study of Universal testing machine
2. To determine the compressive and tensile strength of materials.
3. To determine the Brinell hardness of materials.
4. To determine the Rockwell hardness of materials
5. To determine the toughness of the materials.
6. To determine the deflection of beam by the use of deflection-beam apparatus.
7. To conduct the torsion test on the given specimen for the Modulus of rigidity.
8. To determine the stiffness of the spring.

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MLC MLC01	**Professional Laws, Ethics, Gender, Human Values and Harmony**	**1L:0T:0P (1hrs)**	**Audit**

Objectives: To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession with some ideas of the legal and practical aspects of their profession.

Module 1 Professional Practice and Ethics **(10 Hrs)**

Respective roles of various stakeholders: Government Standardization Bodies, professional bodies , Indian Roads Congress, Clients/owners , Developers , Consultants , Contractors , Manufacturers/ Vendors/ Service agencies, Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics. Profession, Professionalism, Professional Responsibility Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence.

Module 2 General Principles of Contracts Management **(10 Hrs)**

Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays.

Module 3 Arbitration **(10 Hrs)**

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996;UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance.

Module 4 Engagement of Labour & other construction-related Laws **(10 Hrs)**

Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece AICTE Model Curriculum for Undergraduate degree in Civil Engineering (Engineering & Technology) rate work.

Module 5 Law relating to Intellectual property (10Hrs)

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents,

Course Outcomes:

Students will be able to

CO1. To familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession.

CO2. To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labor.

CO3. To give an understanding of Intellectual Property Rights, Patents.

CO4. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.

CO5. To develop good ideas of the legal and practical aspects of their profession

Text/Reference Books:

1. Avtar singh, "Law of Contract" Eastern Book Co. 2002

2. Dutt, " Indian Contract Act", Eastern Law House 1994

3. Anson W. R.,"Law of Contract" Oxford University Press 1979

4. Wadhera, "Intellectual Property Rights" Universal Law Publishing Co. 2004

5. The National Building Code, BIS, 2017

6. RERA Act, 2017

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HSMC-HS03	Innovation and Creativity	1L:0T:0P (1hrs)	01

Prerequisite(s): Nil

CourseObjectives:

1. To give an insight into creativity and innovation
2. To develop an appreciation for innovation among students, and
3. To enhance sensitivity to creativity and innovation

UNITI: Overview of Creativity

Meaning and concept of creativity, Process, Nature and characteristics of creativity,Factors affecting creativity.

UNITII: Overview of Innovation

Difference between Invention & Innovation, Importance & Principles of Innovation, Process of Innovation, Domain wise Innovations, How to safe guard innovations.

UNITIII: Tools for Innovation

Traditional V/s Creative Thinking, Individual Creativity Techniques: Meditation, Self-Awareness, & Creative Focus Group Creative Techniques: Brain Storming, off The Wall Thinking

UNIT IV: Evaluation of Effectiveness of Innovation- Legal Aspects like IPR, patent filing, copyright, Patenting Procedures, Design patents etc.

UNITV: Innovation Management

Concept, Scope, Characteristics, Evolution of Innovation Management, Significance, Factors Influencing Innovation. Organizational Aspects- Economic Aspects like venture capital, angel investors.

Case Studies on Innovation business ideas i.e. Red Bus, Flipcart, Ola, Big Basket, Patented products, Chemical products and Materials, special patents of procedures.

Course Outcomes: Aftercompletionofthecoursethestudentwillbeableto

1. Analyzecreativityconceptsandprinciples &processforproblemsolving.
2. Understandinnovation&applycreativityfor innovation.
3. Understandinnovativeproductsorservices.
4. Applydesignthinkingtoolstechniques forIPR.
5. UnderstandtheconceptofInnovationManagement.

TextBooks:

1. S.Salivahanan, S.Suresh Kumar, D.Praveen Sam, "Introduction to Design Thinking",Tata Mc Graw Hill, First Edition,2019.

2. KathrynMcElroy,"PrototypingforDesigners:DevelopingthebestDigitalandPhysical Products", O'Reilly, 2017.

ReferenceBooks:

1. Michael G. Luchs, Scott Swan, AbbieGriffin, "DesignThinking – NewProduct Essentials from PDMA", Wiley, 2015.

2. VijayKumar,"101DesignMethods:AStructuredApproachforDrivingInnovationinYour Organization", 2012.

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BSC – MA04	Program Specific Mathematics (a) Numerical Methods and Laplace Transform	L:T:P 2:1:0

Course Objective: The main objective of this course is to teach mathematically modeling of a physical system, Identify appropriate numerical method to find solutions of simulated physical system and apply the numerical methods to solve Civil Engineering problems.

Module-1: Introduction: Basic concepts of Numerical Methods: Mathematical modeling; accuracy and precision; errors analysis. **(8 Hrs)**

Module-2 Roots of Equations: Graphical Methods; Bisection Method; Newton-Raphson Method; Multiple Roots. **(10 Hrs)**

Module-3: **Curve Fitting**: Least Square Regressions, Interpolation by Newton's Formulae, Lagrange Interpolating Polynomials, Spline Interpolation. **(8 Hrs)**

Module-4 Ordinary Differential Equations: Taylor's Series method; Euler's method; Modified Euler's method, Runge- Kutta method (Second and Fourth Order) **(10 Hrs)**

Module-5 Laplace Transform: Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations **(12 Hrs)**

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

CO1: Understand basic concepts of Numerical Methods.

CO2: Identify appropriate numerical method to find solutions of simulated physical system

CO3: Evaluate curve fitting, Least Square Regressions

CO4: Recognize and apply the concept of Ordinary Differential Equations

CO5: Find Laplace transformation

Reference Books:

1. Chapra, Cannale, "Numerical Methods for Engineers", 6th edition, McGraw-Hill Int.,
2 Sastry S. S., "Introductory Methods of Numerical Analysis", 5th edition, Prentice Hall of India Delhi
3 N Krishna Raju Ku Muthu, Numerical Methods For Engineering Problems, 2nd edition, Macmillan
4 Children's Books Amos Gilat, "Numerical Methods for Engineers and Scientists", 3rd Edition, Wiley International, 2014
5. Ascher, U.M. and Greif, C., "A First Course in the Numerical Methods", SIAM Publication, 2011.
6 Khoury, Richard, Harder, Douglas Wilhelm, "Numerical Methods and Modelling for Engineering",

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Semester IV [Second Year]

S.No.	Course Code	Course Title	Hrs./ Week			Credits
			L	T	P	
1	BSC-MA03	Probability and Statistics	2	1	-	3
2	PCC-CE05	Fluid Mechanics	2	1	-	3
3	PCC-CE06	Material Technology and Mix Design	3	-	-	3
4	PCC-CE07	Structural Analysis	2	1	-	3
5	PCC-CE08	Railway and Bridge Engineering	2	-	-	2
6	HSMC-HS04	Entrepreneurship and Principles of Management	1	-	-	1
7	IFC-EC01	Interdisciplinary Foundation Course-I	2	-	-	2
8	LC-CE05(P)	Fluid Mechanics Lab	-	-	2	1
9	LC-CE06(P)	Material Technology and Mix Design Lab	-	-	2	1
10	SBC-CE01(P)	Digital Surveying Skills	-	-	4	2
11	SBC-CE02(P)	Design Studio-I	-	-	2	1
12	LLC-LLC02	Liberal Learning Course –II	-	-	2	1
13	MLC-MLC02	Constitution of India	1	-	-	Audit
Total			**15**	**3**	**12**	**23**
Total Academic Engagement and Credits			**30**			**23**

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PCC CE05	Fluid Mechanics	2L:1T:2P (5hrs)	4 Credits

Objectives: To provide fundamental knowledge of fluid, its properties and behavior under various situation of internal and external flows

Module 1 Review of Fluid Properties (10 Hrs)

Engineering units of measurement, mass, density, specific weight, specific volume, specific gravity, surface tension, capillarity, and viscosity, bulk modulus of elasticity, pressure and vapor pressure.

Fluid Static's: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and Tainter gates); Buoyancy and Floatation: buoyant force, Stability of floating and submerged bodies, Relative equilibrium, forces on immersed bodies.

Module 2 Fluid Kinematics and Fuid Dynamics (10 Hrs)

Types of flow, Introduction to basic lines-path lines, streaklines, streamlines ; continuity equation for one and three dimensional flow, circulation, stagnation point, separation of flow, velocity potential, stream function and flow nets. Euler's equation of motion, derivation of Bernoulli's equation and its application. The moment of momentum equation and energy equation.

Fluid Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.); flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturimeter, weirs and notches).

Module 3 Laminar Flow and Turbulent Flow (10 Hrs)

Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number. Velocity distribution, laminar flow through (circular pipes, parallel plates, porous media), Stokes law. Laminar and turbulent boundary layers and laminar sub layer, hydro dynamically smooth and rough boundaries.

Pipe flow problems : Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel, branching of pipes. Pipe Network: Transmission of power, Water Hammer.

Module 4 Uniform and Non uniform flow in open channels (8Hrs)

Channel geometry and elements of channel section, velocity distribution, energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, Chezy's and Manning's formulae, Economical sections. Basic assumptions and dynamic equations of gradually varied flow, rapidly varied flow, hydraulic jump in channel and its basic characteristics.

Module 5 Hydraulic Machines (12 Hrs)

Turbines: Classifications, definitions, similarity laws, specific speed and unit quantities, Pelton turbine-their construction and settings, speed regulation, dimensions of various elements, Action of jet, torque, power and efficiency for ideal case, characteristic curves. Reaction turbines: construction & settings, draft tube theory, runaway speed, simple theory of design and characteristic curves, cavitation.

Pumps: Centrifugal pumps and Reciprocating pumps: Various types and their important components, principle of working and characteristic curves.

Course Outcomes:

Students will be able to

CO1. To comprehend the properties of fluid and fluid statics, solve the problems of floating, submerged bodies, and immersed bodies.

CO2. Understand the types of fluid flow, principles of energy and momentum equations, application of Continuity equation Bernoulli equation and flow measuring devices.

CO3. Computation of laminar and turbulent flow and solve the problems of pipe network.

CO4. Understand the behavior of fluid in open channel with uniform and non-uniform flow and its practical applications in engineering.

CO5. To perceive the fundamental terminologies associated with fluid machines like turbines and pumps.

Text/Reference Books:

1. R.K. Bansal, "Fluid Machines and Hydraulic Machines" Laxmi publications, 9th Edition, 2012.
2. Modi & Seth, "Hydraulics & Fluid Mechanics Including Hydraulics" Standard Book

House, 22nd Edition, 2019.

3. K.Subramanyam, "Fluid Mechanics & Hydraulic machines "Tata McGraw-Hill, 2nd Edition, 2018.
4. K.R. Arora, "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Book House, 9th Edition, 2005.
5. R.K. Rajput, "Fluid Mechanics and Hydraulic Machines"S. Chand Publishing, 6th Edition, 2016.

Suggested List of Experiment:

1. To determine the Metacentric height.
2. To determine the co-efficient of discharge C_d for Orificemeter and Venturimeter.
3. To study the losses due to friction in pipes.
4. To study the losses in pipe fitting, sudden enlargement and sudden contraction.
5. To determine the Reynolds's number and the type of flow either laminar or turbulent flow.
6. To find the co-efficient of Pitot tube.
7. To determine the coefficient of discharge through broad crested weir.
8. To study the performances characteristics of Pelton Wheel.
9. To study the performances characteristics of Francis Turbine.
10. To determine the characteristic of reciprocating pump.
11. To determine the characteristics of centrifugal pump.
12. To determine the efficiency of the Hydraulic Ram.

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Civil Engineering Department

PCC CE06	Material Technology and Mix Design	3L:0T:2P (5hrs)	4 Credits

Pre-requisite(s) – Basic Civil Engineering

Objectives: To provide fundamental knowledge of various conventional and modern construction materials, properties and their uses.

Module 1 Conventional Materials (10 Hrs)

Stones: Occurrence, varieties, Characteristics, IS specification and tests on stones, uses, quarrying and dressing of stones. Timber: Important timbers, their engineering properties and uses, defects in timber, seasoning and treatment. Glass: Types and properties, Brick: IS specifications and test; Classification of bricks, Improved brick from inferior soils, Hand moulding brick table, Clay-fly ash brick table, Flooring tiles and other tiles and their characteristics. Services: Water supply & Drainage, Electrification.

Module 2 Modern Materials (08 Hrs)

Properties, types and uses of following materials- Lime, Ferrous metals, Polymers, Plastics types, Mastic, Gypsum, Ferro Crete, Clay Tiles and glazed ware, Plaster of Paris. Aluminium and alloys– Properties. Advance Construction Materials: Use of fly ash in mortars, concrete, Fly ash bricks, Ceramics, and Refractory, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes.

Module 3 Foundation (10 Hrs)

Foundation: Type of soils, bearing capacity, soil stabilisation and improvement of bearing capacity, settlement and safe limits. Spread foundations, wall footings, grillage, foundations, well foundation, causes of failure and remedial measures; under reamed piles, foundation on shrinkable soils, black cotton soil, timbering for trenches, dewatering of foundations. Hyperbolic paraboloid footing, Brick arch foundation. Simple methods of foundation.

Module 4 Masonry, Walls, doors and windows (12 Hrs)

Masonry, Walls, doors and windows: Brick masonry, stone masonry, Brick and block masonry: Characteristics of good building casting and laying, masonry construction, Brick cavity walls,

Common defects in construction and their effect on strength and performance of walls, designed Brick masonry, precast stone masonry block, Hollow concrete block, Repairs techniques for masonry, plastering and pointing, white and color washing, distempering, dampness and its protection. Doors, Windows and Ventilators: Types, Functional requirements, size location, fittings, materials of doors and windows.

Module 5 Floors, Roofs and Tiles **(10 Hrs)**

Floors and Roofs : Flooring materials, tests and IS specifications, Types, minimum thickness, construction, Flooring functional requirements of flooring material, floor finishes, Roof construction – types and their suitability, Flat roofs, reinforced brick concrete, solid slab and timber roofs, pitched roofs, false ceiling, roof coverings, Tiles: Manufacturing , characteristics, Classification and uses, Fire protection, thermal insulation, Air Conditioning, Acoustics & Sound insulation, Repairs to damaged & cracked buildings, techniques and materials for low cost housing., Repairs techniques for floors & roofs.

Course Outcomes:

Students will be able to

CO1. To identify the various conventional construction materials, their properties and utility as building materials.

CO2. To identify different advanced construction materials and their feasibility as building materials.

CO3. To list out the properties which determine the foundation type in a given area.

CO4. To identify basic construction sequences for residential and commercial applications.

CO5. To identify the various floor, roof & tiles types, their utility and construction technique.

Text/Reference Books:

1. S. C. Rangwala, "Engineering Materials [Material Science]", Charotar Publishing House Pvt. Limited, 2008.
2. V.K. Kumawat, "Construction Materials and techniques", Tech-Max publications, pune. First Editon, March 2012.
3. S.P. Arora and S.P. Bindra, "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai Publications, 2010.
4. Sushil Kumar, "Building Construction", Standard Publishers Distributors, 2006.

Suggested List of Experiment:

1. Tests on Bricks.
2. Tests on Cement.
3. Tests on Aggregates.
4. Determination of compressive strength of concrete with different cement grades.
5. Determination of workability of concrete.
6. Non-destructive testing of concrete by Rebound hammer test.

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PCC CE07	Structural Analysis	2L:1T:0P (3Hrs)	3 Credits

Pre-requisite(s): Strength of Materials

Objectives: To provide a base for structural design & evaluating whether a structure will be able to withstand external forces and internal stresses

Module 1 Virtual Work and Energy Principles (8 Hrs)

Principles of Virtual work applied to deformable bodies, Concept of Strain Energy, Strain Energy for Axial Loading, Bending, Strain Energy in a Beam subjected to Bending Moment, Complementary Energy, Maxwell's Reciprocal Theorem, Betti's Law, Castigliano's First Theorem

Module 2 Fundamental Notions of Structural Analysis (10 Hrs)

Structure and its Categories, Determinacy and Indeterminacy, Static and Kinematic Indeterminacy for Beams, Trusses and Frames (Both Plane and Space, Pin-Jointed and Rigid-Jointed)

Module 3 Analysis of indeterminate Structures-I (10 Hrs)

Analysis of Beams, Trusses and Frames using Consistent Deformation Method, Clapeyron's Theorem, Column Analogy Method

Module 4 Analysis of Indeterminate Structures-II (10 Hrs)

Analysis of Beams, Trusses and Frames (WITHOUT SWAY) using Slope Deflection Method, Moment Distribution Method

Module 5 Rolling Loads and Influence Lines (10 Hrs)

Rolling Loads, Influence Lines, Influence Lines for Support Reactions, Shear Force, Bending Moment for Determinate and Indeterminate Structures, Muller-Breslau Principle

Course Outcomes:

Students will be able to

CO1. To interpret and apply the principles of virtual work and strain energy to the deformable bodies and to apply various energy theorems to the structures.

CO2. To imbibe the basic notion about a structure and determining its indeterminacy

CO3. To implement the Method of Consistent Deformation, Clapeyron's Theorem, Column Analogy Method for the analysis of indeterminate structures

CO4. To execute the analysis of indeterminate structures using Slope Deflection Method and Moment Distribution Method

CO5. To incorporate the fundamental techniques of ILD's for determinate structures and to comprehend it towards the indeterminate structures

Text/Reference Books:

1. Ramamrutham , S., Narayan, R., "Theory of Structures", Dhanpat Rai Publishing Company (2017)
2. Gupta, S. P., Pandit, G. S., "Theory of Structures Vol.I", Tata McGraw Hill Publishing Company Limited (2019)
3. Bhavikatti, S. S., "Structural Analysis-I", Vikas Publishing House Pvt. Ltd.
4. Reddy, C. S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company Limited (2014)
5. Punmia, B. C., :"Theory of Structures", Firewall Media (2005)
6. Hibbeler, R. C., "Structural Analysis", Pearson Education Asia Publication (2008)
7. Wang, C. K., "Intermediate Structural Analysis", Tata McGraw Hill Publishing Company Limited (2010)
8. Timoshenko, S. P., Young, D. H., "Theory of Structures", Tata McGraw Hill Publishing Company Limited (2013)
9. Utku , S., Norris, C. H., Wilbur, J. B., "Elementary Structural Analysis", Tata McGraw Hill Publishing Company Limited (2015)

Suggested List of Experiment:

1 To verify Maxwell's Law

2 To verify Muller-Breslau's Principle

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PCC CE08	Railway and Bridge Engineering	2L:0T:0P (2 Hrs)	2 Credits

Objectives: The objective of this course is to educate students about railway engineering, bridges and tunnels and making them able to design systems and solve complex problems.

Module 1 Introduction to Railway Engineering (10 Hrs)

Introduction to railway engineering, gauges and permanent way, wheel and axles, coning of wheels, track resistances, hauling capacity, track modulus, stresses in track, stresses in components of track; Rails: creep in rails, wear and failures in rails, jointed/welded rails, Sleepers: types and comparison of sleepers, requirements of a good sleeper, sleeper density; Rail fastenings: types, fish plates, fish bolts, spikes, bearing plates, chain keys, check and guard rails; Ballast: requirement of good ballast, various materials used as ballast, quantity of ballast.

Module 2 Track Geometrics, Components and Signaling Systems (8 Hrs)

Alignment of track, geometric design, Horizontal curve and super-elevation, Speeds on track, transition curve and widening of track; Turnouts: Components, crossing & design of turnout, track junction & design Formation; Signals: Types of signals in stations and yards, principles of signaling; train control systems, interlocking of track, high speed tracks.

Module 3 Introduction to Bridge Engineering (10 Hrs)

Selection of site, alignment, collection of bridge design data: essential surveys, hydraulic design, scour depth of bridge foundation, economical span, clearance, afflux, type of road & railway bridges, design loads and forces, impact factor, Indian loading standards for railways bridges and highway bridges, bridge super structure and sub-structures, abutments, piers, wing walls, return walls, approaches, floors & flooring system, choice of super structure.

Module 4 Construction & Maintenance of Bridges (10 Hrs)

Different types of foundation, piles and wells, sinking of wells, coffer-dams, choice of bridges and choice of materials, details of construction underwater and above water, sheet piles coffer dams, erection of bridges, girders, equipments and plants, inspection and data collection, strengthening of bridges, bridge failure, maintenance of bridges

Module 5 Introduction to Tunnel Engineering & Construction of Tunnels (8 Hrs)

Selection of route, engineering surveys, alignment, shape and size of tunnel, bridge action, pressure relief phenomenon, tunnel approaches, Shafts, pilot shafts, construction of tunnels in soft soil, hard soil and rock, different types of lining, methods of lining, mucking operation, drainage and ventilation.

Course Outcomes:

Students will be able to

CO1. To establish a basic understanding of various means of transportation and study about different terminologies related to railway engineering and components of a railway track.

CO2. To understand geometric design of tracks, their components & signaling systems.

CO3. To categorize different types of bridge foundations, bridge construction materials and bridge launching techniques. To understand bridge failures and their subsequent maintenance.

CO4. To understand the various foundations used in bridges, constrction and maintenance of bridges.

CO5. To visualize various parts of tunnels and understand the process of tunneling.

Text/Reference Books:

1. Rangwala SC; Railway Engineering; Charotar Publication House, Anand
2. Railway Engineering by Arora & Saxena - Dhanpat Rai & Sons
3. Principles and Practice of Bridge Engineering S.P. Bindra - Dhanpat Rai & Sons
4. Bridge Engineering - J.S. Alagia - Charotar Publication House, Anand
5. Railway, Bridges & Tunnels by Dr. S.C. Saxena
6. Harbour, Docks & Tunnel Engineering - R. Srinivasan
7. Traffic Engineering & Transport Planning by L. R. Kadiyali – Khanna Publishers

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SBC CE01(P)	Digital Surveying Skills	0L:0T:4P (4 Hrs)	2 Credits

Pre-requisite(s): Survey and Geomatics

Objectives: The Objective of this course is to get familiar the students with various modern surveying instruments along with their handling and operation.

List of Experiments

1. Horizontal Measurements using Digital Levels.
2. Horizontal and Vertical Measurement using Digital Theodolite and Tacheometer.
3. Measurement of Distances using EDM.
4. Measurement of coordinates using Total Station Survey including digital drafting.
5. Position allocation using GPS Surveying.

Course Outcomes:

Students will be able to

CO1. To apply basic surveying methods in digital level techniques.

CO2. To use digital theodolite for taking angular measurements.

CO3. To measure distance using EDM and its validation using conventional methods.

CO4. To operate Total Station for taking precise measurement involved in the field of surveying.

CO5. To understand working of GPS and its application in position allocation.

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SBC CE02(P)	**Design Studio-I**	**0L:0T:2P (2hrs)**	**1 Credit**

Pre-requisite(s): Building Design and Drawing

Objectives: Basic necessity for the Design Studio is to develop and enhance practical exposure and approach of students towards field of Construction.

List of Experiment:

1. Planning of a Small House
2. Drawing of house in single line drawing
3. Drawing of house in double line drawing
4. Drawing showing Details of Doors, Windows Light Points & Stairs
5. Drawing showing Details of Beams & Columns

Course Outcomes:

Students will be able to

CO 1. Understand the planning part of the house.
CO 2. Understand how to show the planning on paper.
CO 3. Understand how to show the walls etc in the drawing.
CO 4. Understand how to show Doors, Windows, light points & Stairs in the drawing
CO 5. Understand how to show Beams & Columns in the drawing.

Text Books:

1. Layal JS, Dongre A, "Building Design and Drawing" Satya Prakashan Edition 2016.
2. Ghose D.N. "Civil Engineering Design and Drawing", CBS publisher. 2nd Edition, 2015
3. Agrawal S. C., Architecture and Town Planning, Dhanpat Rai & Co. 2013

Reference Books:

1. Malik & Meo; "Building Design and Drawing" Computech publication 2009
2. Shah, Kale & Patki; Building Design and Drawing; TMH 1st Edition 2001.
3. Gurucharan Singh & Jgdish Singh "Building Planning, Design and Scheduling" 2009