B. Tech. CIVIL ENGINEERING

SYLLABUS REVISION 2019-2023

SECOND YEAR

CIVIL ENGINEERING

Semester III – S. Y. B. Tech. Civil Engineering [Regular Students]

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Ordinary Differential Equations and Multivariate Calculus	2	1	0	3
2	BSC	Biology for Engineers	3	0	0	3
3	IFC	Computer Aided 3 D Geometric Modelling	2	0	0	2
4	SBC	Building Planning, Design and Drawing studio	0	0	4	2
5	PCC	Building Planning, Design and Construction	4	0	0	4
6	PCC	Strength of Materials	2	1	0	3
7	PCC	Fluid Mechanics	3	1	0	4
8	LC	Strength of Materials Lab	0	0	2	1
9	LC	Fluid Mechanics Lab	0	0	2	1
		Total	16	3	8	23

Semester III – S. Y. B. Tech. Civil Engineering [Lateral Entry Students]

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Linear Algebra and Univariate Calculus	4	1	0	5
2	BSC	Biology for Engineers	3	0	0	3
3	IFC	Computer Aided 3 D Geometric Modelling	2	0	0	2
4	SBC	Building Planning, Design and Drawing studio	0	0	4	2
5	PCC	Building Planning, Design and Construction	4	0	0	4
6	PCC	Strength of Materials	2	1	0	3
7	PCC	Fluid Mechanics	3	1	0	4
8	LC	Strength of Materials Lab	0	0	2	1
9	LC	Fluid Mechanics Lab	0	0	2	1
10	BSC	Foundation of Physics	3	0	0	3
		Total	21	3	8	28

Semester IV – S. Y. B. Tech. Civil Engineering [Regular Students]

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Vector Calculus and Partial Differential Equations	2	1	0	3
2	MLC	Professional Laws, Ethics, Values and Harmony	1	0	0	0
3	HSMC	Innovation and Creativity	1	0	0	1
4	IFC	Sensors and Automation	1	0	2	2
5	SBC	Design and Development of Physical models of Civil structures	0	0	2	1
6	PCC	Surveying and Geomatics	3	1	0	4
7	PCC	Concrete Technology	3	0	0	3
8	PCC	Structural Mechanics	3	0	0	3
9	PCC	Environmental Engineering	3	0	0	3
10	LC	Surveying Laboratory	0	0	2	1
11	LC	Concrete technology Lab	0	0	2	1
12	LC	Environmental Engineering Lab	0	0	2	1
		Total	17	2	10	23

Semester IV – S. Y. B. Tech. Civil Engineering [Lateral Entry Students]

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Multivariate Calculus and Differential Equations	4	1	0	5
2	MLC	Professional Laws, Ethics, Values and Harmony	1	0	0	0
3	HSMC	Innovation and Creativity	1	0	0	1
4	IFC	Sensors and Automation	1	0	2	2
5	SBC	Design and Development of Physical models of Civil structures	0	0	2	1
6	PCC	Surveying and Geomatics	3	1	0	4
7	PCC	Concrete Technology	3	0	0	3
8	PCC	Structural Mechanics	3	0	0	3
9	PCC	Environmental Engineering	3	0	0	3
10	LC	Surveying Laboratory	0	0	2	1
11	LC	Concrete technology Lab	0	0	2	1
12	LC	Environmental Engineering Lab	0	0	2	1
		Total	19	2	10	25

(MA) Ordinary Differential Equations and Multivariate Calculus

S.Y. B. Tech. Semester III (All Branches)

Teaching Scheme	Examination Scheme
Lectures: 2 hrs / week	Internal Test 1: 20 marks
Tutorials: 1 hr / week	Internal Test 2: 20 marks
	End Sem. Exam: 60 marks

Objectives: Basic necessity for the foundation of Engineering and Technology being mathematics, the main aim is, to teach mathematical methodologies and models, develop mathematical skills and enhance thinking power of students.

Unit I : Review of first order differential equations, Reduction of order, linear differential equations, homogeneous higher order linear differential equations, non-homogeneous higher order linear differential equations with constant coefficients and reducible to differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters), systems of differential equations, applications to orthogonal trajectories, mass spring systems and electrical circuits. **[11 Hrs]**

Unit II : Laplace Transforms, its properties , Unit step function, Dirac delta functions, Convolution Theorem, periodic functions, solving differential equations using Laplace transform.

[08 Hrs]

Unit III : Functions of several variables, level curves and level surfaces, partial and directional derivatives, differentiability, chain rule, local extreme values and saddle points, constrained optimization.

[07 Hrs]

Text Books :

- Thomas' Calculus (14^{th} edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
- Advanced Engineering Mathematics (10^{th} edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books :

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Multivariate Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer Science and Business Media.

- Differential Equations with Applications and Historical notes by George Simmons, Tata Mc-Graw Hill publishing company Ltd, New Delhi.
- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7^{th} edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Advanced Engineering Mathematics (2^{nd} edition) by Michael D. Greenberg, Pearson Education.
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

----------**Outcomes :**

Students will be able to

1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. Give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Note:

The Course Outcomes 1 to 3 will be judged by 75% of the questions and Course Outcomes 4 and 5 by 25 % of questions.

[2]==========

( ) Biology for Engineers **Credits: 3**

Teaching Scheme	**Examination Scheme**
Lectures: 3 hrs / week	Test 1: 20 marks
	Test 2: 20 marks
	ESE: 60 marks

Course Outcomes:

Students will be able to

1. understand basic biological principles and organizational structure of living systems at molecular level
2. comprehend basic biological principles and organizational structure of living systems at cellular level
3. know Energy transformations and information processing in biological systems
4. appreciate biological process with engineering perspective
5. impart knowledge about the common corridors of biology and engineering and biologically inspired technologies

Unit 1: (06 Hrs) Biomolecules and biopolymers: Structure and Function

Organic and inorganic molecules; Unique Properties of water, Vitamins and Minerals, Carbohydrates, Lipids, Amino Acids and proteins, Nucleic Acids (DNA and RNA)

Unit 2 : (06Hrs)

Levels of organization of life: Cell as a basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles – structure and function; Cell membrane

Levels of organization: cells, tissues, organs, systems & organism

Unit 3: (06Hrs)

Energy transformations in Chloroplast: Photosynthesis (photochemical & biochemical phase) and ATP generation, Aerobic and anaerobic systems

Energy transformations in Mitochondria: Cellular respiration (glycolysis and Kreb cycle) and ATP generation

Bioenergetics: Thermodynamic principles applied to biology, negative entropy changes in biological systems, Free Energy, Chemical Equilibrium

Unit 4: (06Hrs)

Expression and Transmission of Genetic Information: DNA replication, Enzyme driven process of DNA cloning, Protein synthesis- Transcription & translation

Techniques for optimization: At molecular level: Recombinant DNA Technology, DNA hybridization, PCR, DNA microarray

Unit 5: (06Hrs)

Transport Phenomena in Biological Systems: Membrane channels and ion channels; Fluid flow and mass transfer (nutrients & ions); In plants: Xylem and Phloem; In animals: Blood and Lymph Transport of gases: Oxygen and Carbon dioxide

Heat Transport - Body temperature regulation.

Communication: Cell junctions, Cell-cell communications – cell signaling, Hormones, Pheromones and cell behavior

Defense mechanisms:

In plants: Herbivory, secondary metabolites

In animals: Innate and Adaptive immune systems

Unit 6: **(06Hrs)**

Engineering perspectives of biological sciences:

Biology and engineering crosstalk – At Cell level: Hybridoma technology

At tissue level: Plant Tissue Culture, Animal Tissue Culture; Tissue Engineering: Principles, methods and applications Introduction to Biomimetics and Biomimicry, nanobiotechnology

References:

[1] Lodish H, Berk A, Zipursky SL, et al. (2000) Molecular Cell Biology. W. H. Freeman.
[2] Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Lehninger principles of biochemistry. New York: Worth Publishers.
[3] Rao CNR, et.al. Chemistry of Nanomaterials: Synthesis, Properties and Applications.
[4] Eggins BR. (1006) Biosensors: An Introduction. John Wiley & Sons Publishers.
[5] Palsson B.O. and Bhatia S.N. (2009) Tissue Engineering. Pearson.
[6] Yoseph Bar-Cohen (2005). Biomimetics- Biologically Inspired Technologies
[7] Joseph D. Bronzino, John Enderle, Susan M. Blanchard (1999) Introduction to Biomedical Engineering.
[8] Routledge Taylor and Francis group (2012). Introduction to Bio-medical Engineeering technologies

[3]==========

IFC-I – Computer Aided 3 D Geometric Modeling

Teaching Scheme

Lectures: 2Hrs/week

Examination Scheme: 100 marks

T1 and T2: 20 Marks each,

End Sem Exam: 60 marks

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

1. Think logically & understand the basic concepts of solid modelling
2. Apply knowledge of mathematics, science, and engineering while creating parametric geometric model
3. Create 3D model and assembly model using any professional software
4. Generate 2D part and assembly drawings with BOM details using any professional software
5. Interface 3D part model with API to automate design process

Syllabus Contents:

Unit I: Geometric Modelling:

Introduction to CAD/CAM, 2D vs 3D Geometric model, Introduction to Wireframe, surface and solid modelling techniques. Geometry vs Topology, Requirements of Geometric Modelling, Geometric Modelling Methods: Constructive Solid Geometry (CSG), Boundary Representation (B-rep), Feature based Modelling, Direct (History less) modelling, behaviour modelling, 3D scan modelling. **[6hrs]**

Unit II: Parametric solid modelling:

Fundamentals apply/modify constraints and dimensions, transform the parametric 2-D sketch into a 3D solid. Introduction to Graphical User Interface (GUI) of any commercially used solid modelling software. Create 3D model using Sketch features and Placed features. **[8hrs]**

Unit III : Advance Features:

3D modelling using Modifying and copying featurs. Use of datum featres: Datum points, axis, curve, planes etc. Parametric equation of various curves. **[8hrs]**

Unit IV : Assembly modelling:

Assembly modeling approaches. Degrees of Freedom. Defining relationship between various parts of machine, creation of constraints, and generation of exploded view. **[6hrs]**

Unit V : Generation of Drawings:

Production drawing Generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning and tolerancing. **[4hrs]**

Unit VI : Design automation using Application Program Interfacing (APIs):

Need of design automation. Concept of OOPS,Class and Objects. CAD customisation by interfacing CAD software to OOPs language. **[8hrs]**

Text Books:

1. N. D. Bhatt and V.M. Panchal, Machine Drawing, Charoter Publications
2. User manuals and tutorials of professional CAD software

Reference Books:

1. Ibrahim Zeid, Mastering CADCAM, McGraw-Hill

2. ASME Y14.5 – 2009 (ME 16008)

[4]==========

(CE) Building Planning, Design and Drawing Studio

Teaching Scheme:
Studio: 4 hrs/week

Examination Scheme:
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

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

1. Prepare freehand sketches/ drawings for different components of buildings.
2. Design and Prepare set of multi-layer architectural and working drawing for various types of buildings.
3. Draw various types of building drawing using AUTOCAD

SECTION I

Term Work

It shall consist of the following

(A) Free hand sketches: (Minimum Two from each)

- Types of Stone masonry - 2 plate
- Types of Brick masonry - 2 plates
- Types of foundation – 1 plate
- Types of door – detailed plan, elevation and section – 1 plate
- Types of window – 1 plate
- Types of stairs – 2 plates
- Types of arch – 1 plate

(B) Measured Drawing of any one building

SECTION II

(C) Students will prepare working drawings of any one - residential, commercial or public building

Working drawing: Scale 1: 50 or suitable

- Layout plan
- Plan/typical floor plan(by hand as well as by Auto CAD)
- Elevation (by hand as well as by Auto CAD)
- Foundation plan
- Sectional Elevation
- Parking plan
- Axonometric view/perspective view
- Water supply and drainage layout

(D) Report file: It shall consist of

- Data given for the project

- Analysis of the program
- Planning considerations and line plans
- Approximate cost of the building.

[5] ==========

(CE-) Building Planning, Design and Construction

Teaching Scheme:
Lectures : 4 hrs/week

Examination Scheme:
Test/Assignments/Quizzes-40 Marks,
End - Sem Exam – 60 Marks

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

1. Identify and analyze different building components, their properties, and their applications in construction.
2. Design residential /public buildings/ commercial buildings and various building services.
3. Apply principles of planning, Develop basic planning skills.

Unit 1 **(9hrs)**

Introduction to building construction:

Super structure and Substructure,

Footings and foundation

Bearing capacity of soil and rock, necessity and concept of site investigation, Foundation types – shallow and deep and their suitability, Damp proof course, plinth filling and soling, under pinning

Unit 2 Masonry Construction **(8 hrs)**

(a) Stones and stone masonry:

Stones – Requirements of good building stones, IS specification and tests on stones ; Stone masonry – principal terms, Detailing of constructions, types of mortar, Pointing – Purpose and types.

(b) Brick and block masonry:

Characteristics of good building bricks, IS specifications and test; Classification of bricks-silica, refractory, fire etc; Brick work – terms, types of bonds – English, Flemish, Stretcher, Header; Construction procedure, supervision, Openings in walls, mortar preparation; Block masonry – Hollow, solid, cavity wall construction; Scaffolding – types.

Unit 3 **(8hrs)**

Building materials

(A) Materials of doors and windows, types, glazing, method of fixing doors and windows, fixtures and fastenings.

(B) Flooring materials tests and IS specifications:

Ground and upper floors; Flooring- functional requirements of flooring material, varieties of floor finishes and their suitability, construction details for concrete, tiles and stone flooring.

Unit 4 **(8 hrs)**

(A) Roofing materials:

GI, AC, fibre sheets, Mangalore tiles; Roof construction – types and their suitability, method of construction- Composite construction. types of trusses, types of shell structures, space and frame structures.

(B)Protective coatings:

Plastering types and application, mortar; Painting and varnishing, types and application ; White washing, distempering, oil paints ; Wall cladding – materials, methods of fixing, wall papering and glazing work, shotcreting.

Unit 5 **(9 hrs)**

Principles of Building planning and Development Control Rules: Principles of planning of Buildings, Principles of Architectural design – form, function, utility, aesthetics. Integrated approach in Built Environment, Building Rules and Byelaws. Necessity of laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), marginal distances, building line, control line, height regulation, room sizes, types of area calculations – built-up area, floor area, carpet area, Rules for ventilation, lighting, drainage, sanitation and parking of vehicles. **Noise and acoustics,** conditions of good acoustics, sound absorbents, and acoustics for various types of buildings

Unit 6 **(8 hrs)**

Building Types and layout details

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.

Text Books:

- Shah M.G., Kale C.M. and Patki S.Y., "Building drawing an Integrated approach to Built environment", Tata McGraw Hill (Fifth edition).

- Mentt, “Building Design and Constructions”, Tata McGraw Hill (Second edition)
- Punmia B C “ Building Construction

Reference Books:

- Schild E, Casselmann H.F., Dahmen G., Pohlenz R. “Environmental Physics in Construction”, Granada Publishing, London.
- National Building Code of India 2005, Bureau of Indian Standard, New Delhi
- Jain V.K. “Fire safety in Buildings” new Age International Publisher
- Barrid, “Building Construction” Tata McGraw Hill, New Delhi
- Ghosh,”Materials of Construction” Tata McGraw Hill
- CBRI, Roorkee , “Building Construction manual ‘.
- TTTI Chandigrah, “Civil Engineering Materials”, Tata McGraw Publication
- Callender,” Times Savers Standards of Architectural Design Data”, Tata McGraw Hill

[6]==========

(CE) STRENGTH OF MATERIALS

Teaching Scheme: **Examination Scheme:**

Lectures: 2 Hrs/ week **T1 and T2 -** 20 marks each

Tutorial : 1 Hr/ week **End Sem. Exam.** - 60 marks

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

CO_1: Analyze structural members subjected to axial forces and temperature variations.

CO_2: Analyze statically determinate beams /shafts subjected to flexure and shear and torsion

CO_3: Compute principal stresses in element subjected to combined loading.

CO_4: Analyze axially loaded columns by different methods

Unit 1: **[5Hrs]**

Simple stresses and strains

a) Stress and strain -linear, lateral, shear and volumetric, Generalized Hooke’s law. Elastic constants and their relationship for isotropic materials

b) Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self-weight and temperature changes.

Unit 2: **[5Hrs]**

a) Shear force and bending moment diagrams for determinate beams

Concept and definition of shear force and Bending Moment. Beams under various types of loading

b) Stresses in beams due to bending

Theory of pure bending, Flexure formula. Bending stress distribution diagram, moment of resistance and section modulus.

Unit 3: **[5Hrs]**

a) Stresses in beams due to Shear

Shear stress distribution diagram for common symmetrical sections (with at least one axis of symmetry), maximum and average shear stress.

b) Torsion of circular shaft

Stresses, strains and deformation in determinate and indeterminate shafts of hollow and solid sections of homogenous and composite materials subjected to torsion

Unit 4: **[5Hrs]**

Slope and Deflection of Determinate Beams

a) Double integration method (McCauley's method).

b) Moment Area method , c) Introduction to Castegliano

Unit 5: **[5Hrs]**

Axially loaded columns.

a) Critical load and buckling, Euler's formulae for column with hinged ends, equivalent length for various end conditions. Rankine's formula

b) Direct and Bending Stresses: Eccentrically loaded short columns including biaxial cases.

Unit 6: **[5Hrs]**

Principal planes and stresses

Normal and shear stresses on any oblique plane and concept of principal planes and principal stresses by analytical and graphical method-Mohr's circle. Combined Effects of axial force, bending moment, shear force and Torsional moment. Theories of failure: Maximum normal stress, Maximum shear stress and Maximum strain energy theory

Text Books:

1. Beer and Johnston, "Mechanics of Material", Tata Mc Graw Hill publication
2. F. L. Singer and Pytel, "Strength of Material", Harper and Row publication

Reference Books:

1. Gere and Timoshenko, "Mechanics of Materials", CBS publishers.
2. J.B. Popov, "Introduction to Mechanics of Solids", Prentice Hall publication
3. James M.Gere, "Mechanics of Materials", Brooks/Cole Thomson Learning,(Fifth edition)

[7]==========

[CE 20007] FLUID MECHANICS

Teaching Scheme **Examination Scheme:**

Lectures: 3 Hrs/ week **T1 and T2 -** 20 marks each

Tutorial: 1Hrs/ week **End Sem. Exam. -** 60 marks

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

CO_1: Demonstrate different terminologies related to fluid mechanics.

CO_2: Select suitable flow measurement device for pipe and open channel.

CO_3: Apply the Continuity equation, Bernoulli equation and Momentum equation.

CO_4: Compute friction losses in pipes and flow around immersed bodies.

CO_5: Formulate and solve problems of dimensional analysis and model studies.

Unit 1: **[9 Hrs]**

A) Properties of Fluid:

Physical properties of fluids:, Newton's law of viscosity, methods of measurement of viscosity classification of fluids,

B) Fluid Statics:

The basic equation of hydrostatics, concept of pressure head, measurement of pressure datum (absolute, gauge), application of the basic equation of hydrostatics.

types of manometer and its applications. Introduction to pressure transducers and its applications. total pressure, centre of pressure, pressure diagrams and its applications.

C) Buoyancy and Floatation:

Principle of floatation and buoyancy, equilibrium of floating bodies, stability of floating bodies, metacentre, metacentric height and its determination (experimental and analytical), relative equilibrium of liquids: fluid masses subjected to uniform linear acceleration and rotation.

Unit 2: [9 Hrs]

A) Fluid Kinematics:

Methods for describing the motion of fluid; type of flow, continuity equation, velocity potential, stream function and flow net, methods of drawing flow net, use and limitation of flow net,

B) Fluid Dynamics:

Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration, Bernoulli's equation, kinetic energy correction factor, hydraulic grade line and total energy line, linear momentum equation and momentum correction factor, angular momentum, application of continuity, Bernoulli and momentum equations.

C) Flow Measuring Devices:

Flow through Orifices and Mouthpieces under free and submerged conditions, Venturi meter, orifice meter, nozzle meter, rotameter and pitot tube.

Flow over notches and weir and its application. Discharge over a sharp crested rectangular, triangular notch, trapezoidal notch, Cippoletti notch.

Unit 3: [8 Hrs]

A) Flow through Pipes:

Energy losses in pipe flow, Flow through simple, compound, parallel, branched pipes and siphons, Dupit's equation, Hydraulic transmission of power through pipes, introduction to three reservoir problem and pipe network.

B) Boundary Layer Theory:

Development of boundary layer on a flat plate, Nominal, displacement, momentum and energy thicknesses. Laminar, turbulent and transitional boundary layer,

Application of momentum equation for boundary layer development, local and mean drag coefficient, Hydrodynamically smooth and rough boundaries, Boundary layer separation and its control.

Unit 4: **[8 Hrs]**

A) Laminar Flow:

Reynolds' Experiment, Laminar flow through a circular pipe, Flow between two fixed parallel plates, Couette flow, Stoke's law, Darcy's law.

B) Turbulent Flow:

Characteristics of turbulent flow, Prandtl's mixing length theory, velocity distribution in turbulent flow, Prandtl's velocity distribution equation, Karman Prandtl velocity distribution equations for smooth and rough boundaries, Equation for mean velocity for pipes Nikuradse's experiments on artificially roughened pipe, Friction factor for commercial pipes. Moody's diagram.

Unit 5: **[8 Hrs]**

A) Fluid Flow around Submerged Objects:

Practical problems involving fluid flow around submerged objects; definitions and expression for drag, lift, drag coefficient, lift coefficient; types of drag, drag on sphere, cylinder, flat plate and aerofoil. Karmann's vortex street, effects of free surface and compressibility on drag, development of lift on cylinder and aerofoil, Magnus effect, polar diagram.

B) Dimensional Analysis and Model studies:

Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using Bukingham's Pi theorem, important dimensionless parameters and their significance. Geometric; Kinematic and Dynamic similitude; Model laws, Type of models, Applications of dimensional analysis and studies to fluid flow problems.

Unit 6: **[8 Hrs]**

A) Fundamentals of Open Channel Flow:

Difference between pipe flow and open channel flow. Types of open channel flow. Concept of specific energy and specific force. Type of channel transition, Continuity Equation and Momentum Equation for open channel flow, introduction to hydraulic

jump.

B) Introduction to Hydraulic Machinery:

Concept of impact of jet. Jet impinging on a stationary plate, jet impinging on a moving plate (straight and inclined). Jet striking the plates mounted on a circular wheel. Classification of Hydraulic of Turbines. Types of Pumps and applications.

In tutorial students should solve overall 14 numerical problems and at least two numerical problems based on each unit.

Text Books:

1. Modi, P. N. and S. N. Seth "Hydraulics and Fluid Mechanics", Standard book house, New Delhi, ISBN: 978-81-89401-26-9
2. R. J. Garde and Mirajgaonkar, "Fluid Mechanics Through Problems", New Age International.
3. R.K. Bansal "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P), New Delhi.

Reference Books:

1. Streeter V.L. Wylie E. Benjamin, "Fluid Mechanics", Mc Graw Hil, London, 1998.
2. Bernard Massey and John Ward Smith, "Mechanics of Fluids", Taylor and Francis, 8 Edition (2006) London and New York.
3. Douglas J. F. Gaisorek J. M., Swaffield J. A., "Fluid Mechanics" Addison-Weisley Harlow 1999.
4. Shames I. H., "Mehcanics of Fluids", Mc Graw-Hill, New York 1992

[8] ==========

[CE 20008] STRENGTH OF MATERIALS LAB

Teaching Scheme:

Practical: 2Hrs/ week

Examination Scheme:

Continuous Evaluation - 40 marks

End Semester Evaluation - 60 marks

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

CO_1: Test different properties of materials as per IS codes.

CO_2: Interpret the test results according to IS requirements.

CO_3: Decide suitability of material for practical purposes.

The laboratory work consists of any 8 experiments from PART A. PART B is compulsory.

PART – A List of Experiments

1: Tension test on Mild steel and Tor steel

2: Shear test on Mild steel and Aluminum

3: Torsion test on Mild steel and Cast iron

4: Hardness test on Mild steel, Cast iron, Copper, Aluminum and Brass

5: Bending test on timber and plywood

6: Flexure test on Mild steel plate

7: Compressive strength of timber

8: Tests on bricks:

a) Water absorption

b) Compressive strength

c) Efflorescence Test

9: Tests on ceramic tiles:

a) water absorption

b) Flexural strength

c) Mohs hardness test

10: Tests on paving blocks:

a) water absorption

b) Compressive strength

PART B - At least four assignments based on strength of Materials course

End Semester Oral Examination will be based on Term Work

---

[9] **[CE 20009] FLUID MECHANICS LABORATORY**

Teaching Scheme:

Lectures: 4 Hrs/ week

Examination Scheme:

Term Work: 50 Marks

Oral: 50 Marks

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

CO1: Identify, name, and characterize flow patterns and regimes.

CO2: Calibrate various flow measuring devices

CO3: Compute minor, major losses in pipes, Chezy's and Manning's constant in open channels.

CO4: Apply Bernoulli theorem, Momentum theorem

List of Experiments: (Perform at least 12 experiments out of the following)

1) Measurement of viscosity
2) Study of pressure measuring devices
3) Study of stability of floating bodies
4) Study of laminar flow in Reynolds apparatus
5) Calibration of Venturimeter
6) Calibration of Orifice meter
7) Verification of Bernoulli's theorem
8) Calibration of Orifice
9) Study of laminar flow in Heleshaws apparatus
10) Flow net by electrical analogy for flow below weir (with and without sheet pile)
11) Calibration of Notch (rectangular or triangular)
12) Study of minor losses in pipe flows
13) To find the Mannings N and Chezy's C uniform flow in open channel
14) Creation of hydraulic jump and calculate the losses in hydraulic jump in open channel.
15) Study of laminar and turbulent flow through pipes
16) Flow around a circular cylinder

SEMESTER IV CIVIL ENGINEERING

---

[1] (MA) Vector Calculus and Partial Differential Equations

S.Y. B. Tech. Semester IV (All Branches)

Teaching Scheme	Examination Scheme
Lectures : 2 hrs / week	Internal Test 1: 20 marks
Tutorials : 1 hr / week	Internal Test 2: 20 marks
	End Sem. Exam: 60 marks

Objectives: Basic necessity for the foundation of Engineering and Technology being mathematics, the main aim is,

to teach mathematical methodologies and models, develop mathematical skills and enhance thinking power of students.

Unit I: Double integrals in Cartesian and polar co-ordinates, iterated integrals, change of variables, triple integrals in Cartesian, spherical and cylindrical co-ordinates, substitutions in multiple integrals, Applications to Area, Volume, Moments and Center of Mass. **[10 Hrs]**

Unit II: Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss, arc length parameterization, applications. **[07 Hrs]**

Unit III: Partial differential equations with separation of variables, boundary value problems: vibrations of a string, heat equation, potential equation, vibrations of circular membranes. **[09 Hrs]**

Text Books :

- Thomas' Calculus (14^{th} edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
- Advanced Engineering Mathematics (10^{th} edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books :

- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Functions of several variables by Wendell Fleming, Springer-Verlag, New York.
- Partial Differential Equations (4^{th} edition) by Fritz John, Springer.
- Advanced Engineering Mathematics (7^{th} edition) by Peter V. O' Neil, Thomson. Brooks / Cole, Singapore.
- Advanced Engineering Mathematics (2^{nd} edition) by Michael D. Greenberg, Pearson Education.
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

Outcomes : Students will be able to

1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based

on applications of core concepts)

4. Give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Note :

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 will be judged by 25 % of questions.

==========

[2] MLC– Professional Laws, Ethics, Values and Harmony Credits: 0

Audit Course
Teaching Scheme: 1hr/week

Examination Scheme-
Total - 100 Marks
Continuous evaluation
Assignments /
Presentations/Test

Course Outcomes: Student will be able to

1. Grasp the meaning of the concept - Law
2. Get an overview of the laws relating to Engineers
3. Apprehend the importance of being a law abiding person
4. Self-explore by using different techniques to live in harmony at various levels
5. Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life..

Unit 1 **(02 hrs)**

Concept of Law

Understanding Essentials of a Valid Contract and
the basics of contract law protecting rights and obligations

Unit 2 **(03 hrs)**

Law of Torts

Introduction to the Law of Torts and the basics to protect oneself and the company

Law affecting the Workplace

Employers Responsibilities / Duties
Hiring Practices

Introduction to Intellectual Property Law

Unit 3 **(01 hr)**

Professional Code of Conduct for Engineers
Relationship between Law and Ethics

Unit 4 **(02 hrs)**

Self Awareness

Understanding oneself and others; Johari Window- Concept, explanation, implementation

Unit 5 **(02 hrs)**

Needs & Self

Needs and its importance, helping to systematical actualization to live in harmony at personal and professional life

Unit 6 **(02 hrs)**

Ethics and values

Professional ethics and their importance for students; Understanding the importance of values & their application in everyday life

References

- Business Law- By Saroj Kumar
- Law of Contract- By Avtar Singh
- Business Law- By G K Kapoor
- Business & Commercial Laws – By Sen & Mitra
- Business Law for Engineers- by Calvin Frank Allen

- Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
- Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi
- Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
- Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). Professional Ethics & Human Values. Prentice Hall: New Delhi
- Jayshree Suresh, Raghavan B.S.(2016). Human Values & Professional Ethics: S Chand & Company.Pvt.Ltd: New Delhi.

==========

[3] Innovation and Creativity

==========

[4] IFC II: Sensor and Automation [by Inst]

IFC-II [Course Code] Sensors and Automation
(Offered by Department of Instrumentation and Control)

Teaching Scheme:		**Examination Scheme:**
Lectures: 1hour / week		**Test 1:**
Practical: 2hrs/week		**Test 2:**
		End-Sem Exam:

Course Outcomes:

1. Interpret the characteristics of the transducers/sensors [PEO3][PO-b]
2. Select transducers/sensors for specific applications [PEO3] [PO-l]
3. Understanding of working principle of Programmable Logic Controller (PLC) and Distributed Control Systems (DCS) [PEO1] [PO-a]
4. Understanding the concept of Industrial Automation

Unit-1 Basics of Sensors [07 hours]

Concepts and terminology of transducer, sensor, sensor classifications and characteristics (Static and dynamic), Working principle, characterization and applications of: strain gauges, LVDT, capacitive, RTD, thermocouple, thermistor, Solid-State, pressure, optical, chemical sensors, integration of sensors for IOT and Industry 4.0 applications.

Unit-2 Industrial Automation [07 hours]

Industrial Automation: concept, automation components, necessity and working principle, block schematic of Programmable Logic Controller (PLC). Input & Output modules (AI, DI, AO, DO), Introduction to Ladder Programming, introduction to Distributed Control Systems (DCS). Industrial automation leads to Industrial IOT and Industry 4.0.

List of Practical

1. Case study /Characterization of RTD/semiconductor Temp IC
2. Characterization of level sensors
3. Characterization of strain gauge/ Displacement measurement using LVDT/ Encoders
4. Characterization of PH, Conductivity, color sensor
5. Introduction to PLC programming languages (ladder programming)
6. Ladder Programming for relay, coil, On/OFF, Sequencing of motors,;
7. Ladder Programming with Timers/Counters
8. Ladder Programming for Pick and Place type of robotics application

Text Books:

1. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis” by, Tata McGraw Hill Education, Second ed., 2004.
2. C.D. Johnson, “ Process Control Instrumentation Technology” by, Pearson Education Limited , eighth ed., 2014

==========

[5] (SBC) Design and Development of Physical Models of Civil Structures

Teaching Scheme: **Examination Scheme:**

Practical : 2Hrs/ week **Mid Sem. Exam : 40 marks**

End Sem. Exam. - 60 marks

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

CO1: Prepare conceptual drawing or sketch of physical model

CO2: Develop model relevant to Civil Engineering.

CO3: Demonstrate usefulness of the model by experimenting/ describing future scope for its further development.

Unit 1: Introduction [4Hrs]

Types of models. Importance of physical models in Engineering. Different types of structures in Civil Engineering.

Scope and limitations for the preparation of physical models in Civil Engineering. Site visit

Unit 2: Concept for development of model[4Hrs]

Literature review, survey for the requirements of models,

Concept for the development of model.Points to be considered for the development of model. Scope of the physical model.

Unit 3: Selection of materials and tools for the model. [4Hrs]

Preparation of conceptual drawing for the physical model. Preparation of final draft, Final drawing for the physical model, approximate estimate and approval for the model.

Unit 4: Development of the model [4Hrs]

Unit 5: Demonstration/ checking/ testing of model[4Hrs]

suggestions for correction/ further development

Unit 6: Presentation of models[4Hrs]

Exhibition of models. Examination of model

Text Books:

1. W.B. Mckay, " Building Construction Vol-I" Fifth Edition, Orient Longman Limited

London,1995.

Reference Books:

---

[6] **[CE 20011] SURVEYING AND GEOMATICS**

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hrs/ week **T1 and T2 -** 20 marks each

End Sem. Exam. - 60 marks

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

CO1: Demonstrate various methods of linear and angular measurements

CO2: Analyse surveying data of different types

CO3: Conduct field work and application of scientific methodology in handling field data

CO4: Apply various surveying techniques for civil engineering problems

Unit 1: Linear Measurements [7Hrs]

Introduction, Principles of surveying, types of errors, ranging, chaining, offsetting, plotting chain survey data, errors in chain and tapes, corrections- length, slope, temperature, pull, sag. instruments for measuring right angles- open cross staff, optical square, use of prismatic compass, bearing of lines, Local attraction, traversing with chain and compass, plotting and adjusting a traverse, Magnetic Declination etc. measurement of area- planimeter

Unit 2: Levelling and Angular Measurements [7Hrs]

Principle axes of Dumpy Level: study of Dumpy Level, study of auto level, testing and adjustment of axis of bubble tube and line of collimation, rise and fall method, reciprocal leveling, curvature and refraction corrections, distance to the visible horizon. Study of Vernier and Micro Optic Theodolite: introduction to 20" Vernier Theodolite. Principle axes of Theodolite: Testing and Permanent adjustments of Transit Theodolite

Unit 3: Plane Table Survey [7Hrs]

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

Tacheometry

Principle of stadia, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Use of Tacheometry in Surveying, Tacheometric Contour Survey. Contouring use of contour maps, direct and indirect methods of contouring. Profile Levelling Longitudinal Section and Crosssections, Toposheets

Unit 4: Theodolite Traversing[6 Hrs]

Uses of Theodolite: Measurement of Horizontal angles, horizontal angles by repetition and by reiteration (errors eliminated), vertical angles, magnetic bearings, prolonging a line, lining in, setting out angles. Theodolite Traversing: Computation of Consecutive and independent Coordinates, adjustment of closed traverse, by transit rule and Bowditch's rule, Gales Traverse table, omitted measurements, area calculation by independent coordinates. Open Traverse – Its uses, measurement of deflection angles using transit Theodolite, open traverse survey, checks in open traverse

Unit 5: Geodetic Surveying [6 Hrs]

Objects, Methods in Geodetic surveying, Trilateration, Classification of triangulation systems, Triangulation figures, Strength of figure & derivation for well conditioned triangle, Selection of stations, intervisibility& height of stations, Towers signals & their classifications, Phase of signals & their corrections. Satellite stations, Reduction to center, Reduction to mean sea level and extension of base

Unit 6: Advance Surveying Techniques[7Hrs]

Global Positioning System(GPS): Applications to Civil Engineering, concept of Global Positioning Systems [GPS] and differential GPS, , Electromagnetic Distance Meters (E.D.M.), measurement principle of EDM instruments, Total Station and its uses, fundamental parameters of Total Station, etc. etc.

Introduction to remote Sensing and GIS

Utility mapping: Lider, GPR, Intriduction to drone.

Text Books:

1. Basak N. N. “Surveying and Levelling”, Tata McGraw-Hill Publishing Company Limited.
2. Kanetkar T.P. and Kulkarni S.V. “Surveying and Levelling – Part1”, Pune Vidyarthi Griha Prakashan, Pune.
3. Kanetkar T.P. and Kulkarni S.V. “Surveying and Levelling – Part2”, Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Duggal S. K. “Surveying Volume I”, Tata McGraw-Hill Publishing Company Limited.
2. Duggal S. K. “Surveying Volume II”, Tata McGraw-Hill Publishing Company Limited.
3. Bannister A, Raymond S & Baker R. “Surveying”, Pearson Education Ltd.
4. Subramanium R., “Surveying & Levelling”, Oxford University Press.
5. Clark David, “P lane and Geodetic Surveying for Engineers Volume–I”, CBS, 6/E.
6. Clark David, “ Plane and Geodetic Surveying for Engineers Volume –II”, CBS, 6/E
7. Clendinning J. “Principles of Surveying”, Blackie
8. Punmia B. C. “Surveying-I”, Laxmi Publications (P) Ltd. New Delhi
9. Punmia B. C., Jain A, Jain A., “Surveying-II”, Laxmi Publications (P) Ltd. New Delhi
10. Jensen, John R. “Remote sensing of the environment: An earth resource perspective” 2/e. Pearson Education India, 2009.
11. Reddy, M. Anji. “Geoinformatics for environmental management.” BS publications, 2004.

[7]==========

[CE ------] CONCRETE TECHNOLOGY

Teaching Scheme:

Lectures: 3 Hrs/ week

Examination Scheme:

T1 and T2 - 20 marks each

End Sem. Exam. - 60 marks

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

CO_1: determine properties of various ingredients of concrete

CO_2: evaluate various factors affecting quality of fresh and hardened concrete

CO_3: design concrete mix as per the field requirement using various codes

CO_4: assess the effect of various parameters on durability of concrete

Unit 1: Ingredients of Concrete [6 Hrs]

Cement :-Manufacture of Portland cement, Chemical composition, Hydration of cement, Classification and types of cement, Tests on cement.

Aggregate :-Classification, Mechanical and Physical properties, Deleterious Materials, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial and Recycled aggregate. Water :-Mixing Water, Curing water, Tests on water

Unit 2: Fresh Concrete [6 Hrs]

Workability: Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete Curing, Methods of curing, Influence of temperature, Maturity rule, Steam curing

Unit 3: Concrete mix design [6Hrs]

Factors to be considered, Statistical quality control, Methods of Mix Design IS(10262), and DOE, High strength concrete, Acceptance criteria for concrete as per IS specifications

Unit 4: Hardened Concrete and Durability of concrete [8 Hrs]

A)Strength of concrete – General, Factors affecting strength, Micro cracking and stress strain relation, other strength properties, Relation between tensile and compression strengths, impact strength, Resistance to abrasion.

2) Elasticity , Creep, and Shrinkage , Non Destructive Testing Rebound hammer, Ultra Sonic Pulse Velocity, Impact echo test.

B) Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination

Unit 5: Admixtures in Concrete [4Hrs]

Functions, Classification, Types ,Mineral and Chemical. a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS Specifications (9103), Compatibility of Admixtures, Marsh Cone test. b) Mineral Admixtures: Fly

ash, Silica Fume, GGBS, Rice husk ash.

Unit 6: Special Concretes [6 Hrs]

Special Concretes: Light weight concrete, Polymer concrete, Fibre reinforced concrete, High performance concrete, Pumped concrete, Ready mixed concrete, Roller compacted concrete, Ferro- cement

Text Books:

1) Neville M., Brooks J. J., "Concrete Technology", Pearson Education India, third edition,
2) M. S. Shetty, “Concrete Technology”, S. Chand Publications, 2005
3) M. L. Gambhir, “Concrete Technology”, Tata McGraw Hill Publications, Fifth edition 2013

Reference Books:

12. Neville A. M., "Properties of Concrete", Pearson Education India,

13. R.S. Varshney, “Concrete Technology”, Oxford and IBH.

14. P. Kumar Mehta, “Microstructure and properties of concrete”, Prentice Hall. Tata McGraw H

15. IS codes

==========

[CE] STRUCTURAL MECHANICS

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hrs/ week **T1 and T2 -** 20 marks each

End Sem. Exam. - 60 marks

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

CO_1: convert physical model into mathematical model

CO_2: define and differentiate statically and kinematically determinate and indeterminate structures

CO_3: analyse indeterminate structures for primary and secondary effects

CO_4: evaluate the forces developed in the structures due to moving loads

Unit 1: [7Hrs]

a) Basic concepts of Structural Analysis – Types and Classification of structures based

on structural forms. Skeletal Structures, Surface Structures, 3D Structures.

b) Concept of indeterminacy and degrees of freedom - Static and Kinematic degree of Indeterminacy.

c) Application of Energy Methods in Structural analysis - Castigliano's theorems for rectangular portals, Unit Load Method for beams and rectangular portals

Unit 2: **[7 Hrs]**

a) Analysis of indeterminate structures by application of Castigliano's Theorem, Beams and Rectangular portal frames

b) Analysis of Indeterminate Beams by Compatibility Methods

c) Maxwell's theorem of reciprocal displacements and Betti's law.

Unit 3: **[7Hrs]**

a) Deflections of Determinate Trusses by Castigliano's Theorem and virtual work principle.

b) Analysis of Redundant Trusses by Castigliano's Theorem and virtual work principle. Lack of fit and temperature changes in members, sinking of supports

Unit 4: **[7Hrs]**

Analysis of continuous beams (with indeterminacy up to 3 degrees) including sinking and rotational yielding at supports by

a) Slope deflection method

b) Moment Distribution method

Unit 5: **[7 Hrs]**

Analysis of continuous beams up to three spans using matrix methods

a) Flexibility method

b) Stiffness method

Unit 6: **[7Hrs]**

a) Influence lines

Basic Concept of Influence lines. Application of MullerBreslau's principle.

b) Rolling loads

Use of Influence line diagram for determination of SF and BM in beams due to UDL, series of concentrated loads and conditions for maximum SF and maximum BM values. Condition for maximum BM under a chosen load, determination of absolute

maximum SF and BM. Absolute maximum BM diagram, Concept of Equivalent UDL.

Text Books:

1. Gupta, S. P. and Pandit, G. S., "Theory of Structures, Vol. I", Tata McGraw Hill Publishing Company Limited.
2. R.C. Hibbeler, " Structural Analysis", Pearson Education Asia Publication, 6/e
3. Reddy, C. S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company Limited.
4. C. K. Wang, "Intermediate structural analysis", McgrawHill Book Comp.

Reference Books:

4. Timoshenko, S. P. and Young, D. H., "Theory of Structures", McGrawHill Publication, 2/e
5. Utku , S., Norris, C. H. and Wilbur, J. B., "Elementary Structural Analysis", McGrawHill Publication, 4/e
6. T.G.H. Megson, "Structural and Stress Analysis", ButterworthHeinemann Publication

---

[9]

(CE-21009) Environmental Engineering

Teaching Scheme
Lectures : 3 hrs/ week
Tutorial : 1 hr/ week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam : 60 marks

Course outcomes:

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

1. To demonstrate a firm understanding of water quality, quantity and supply system.
2. To visualize water and wastewater quality parameters and their characteristics.
3. To understand relevant water and wastewater treatment processes, their design criteria and pplicability.
4. To make decisions regarding the treatment plant site selection, operation and maintenance and the need of advanced treatment.
5. To aware the cause and consequences of water pollution.

Course Contents

UNIT I: **7 hours**

Characteristics of water, physical, chemical and biological standards. Water quality standards as per IS10500: 2012, U.S.EPA and WHO. Quantity of water, rate of water consumption for various purposes,

factors affecting, fire demand, Sources of water and their yield, population forecast, Principles of water treatment processes, Theory operation and design of aeration system, Solids separation: coagulation and flocculation theory, zeta potential and its significance, mean velocity gradient, "G" and power consumption, common coagulants, coagulant aids, principle of sedimentation, Design of settling tanks and clariflocculator, tube settlers.

UNIT II: 7 hours

Filtration: theory, Mechanism of filtration, slow and rapid gravity filter, under Drainage system, operation troubles, Back washing of filters, Design of filters, filter materials, multimedia filters. Disinfection, factors affecting disinfection, type of disinfectants, Theory and application of chlorine, break point chlorination, Ozone and ultra violate rays. Distribution system.

UNIT III: 7 hours

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Design of circular sanitary sewers. Sewer materials and sewer appurtenances.

Characteristics of sewage: Physical, chemical and biological characteristics, Sampling, analysis of sewage for pH, Suspended Solid, Total Solids, COD, BOD, TOC, Chlorides, Nitrate, ammonical Nitrogen and sulphates. Process flow diagram for sewage treatment.

Self purification of natural streams, effluent discharge standards as per BIS 2490, Oxygen Sag Curve, Streeter - Phelps equation.

Sewage treatment: Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.

UNIT IV: 7 hours

Theory & design of secondary treatment units: Biological principle, important microorganisms in waste water & their importance in waste water treatment systems, bacterial growth, general growth pattern, growth in terms of bacterial numbers and bacterial mass. Kinetics.

Activated sludge process: Types of ASP, Design of ASP, sludge volume index, sludge bulking and control.

Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures.

UNIT V: 7 hours

Theory & design of anaerobic treatment units: Septic tanks, suitable conditions & situations, biological

principle, method of treatment & disposal of septic tank effluent. Design of septic tank along with up flow filters and soak pit.

Anaerobic digester: Principal of anaerobic digestion, stages of digestion, factors governing anaerobic digestion, Methods of sludge treatment and disposal, advantages & disadvantages. Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages.

UNIT VI: 7 hours

Low cost treatment methods:

Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated lagoons.

Introduction and theory of Phytoremediation technology for wastewater treatment. Introduction and theory of root zone cleaning system.

Text books:

G.M. Fair, J.C. Geyer, D.A. Okan, Elements of Water Supply and Wastewater Disposal, John Wiley and Sons Inc., 1971.

2. M.J. Hammer, Water and Waste Water Technology, John Wiley and Sons, New York, 1986.

3. Environmental Engg. – Davis - McGraw Hill Publication

4. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication

Reference Books:

1. CPHEEO: Manual on water supply and treatment, Ministry of Urban Development, 1991.

2. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India.

3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.

4. Waste Water Engg. – B.C. Punmia & Ashok Jain - Arihant Publications.

5. Water Supply & Waste Water Engg.- B.S.N. Raju – TMH publication.

6. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.

[10]==========

[CE] SURVEYING LABORATORY

Teaching Scheme: **Examination Scheme:**

Practical: 2 Hrs/ week **continuous evaluation -** 20 marks each

End Sem. Exam. - 60 marks

Laboratory Outcomes: Atthe end of the course, the students are able to

CO_1:perform linear, angular and height measurements

CO_2:analyse surveying data

CO_3:select different surveying techniques

Term work

It shall consist of List of practical exercises and projects for surveying as detailed below

Study of chain and compass.

1. Chain and compass Traverse Survey
2. Study and use of dumpy level, auto level to determine elevation of various points.
3. Measurement of horizontal and vertical angles by transit Theodolite.
4. Measurement of horizontal angles by repetition method.
5. Computation of horizontal distances and elevations by Tacheometry
6. Radiation & intersection methods in plane table survey.
7. Setting out a given building from a given foundation plan.
8. Study and use of one second Theodolite and measurement of horizontal angle.
9. Setting out a given horizontal angles and measurement of Vertical angles using one second Theodolite.
10. Finding out elevation of high object by Trigonometrical Leveling using one second Theodolite.
11. Study and use of Total Station
12. Study and use of GPS.
13. Study and use of drone

Practical examination and oral will be based on above term work

---

[11]

(CE 16012) Concrete Technology Laboratory

Teaching Scheme: Practical: 2 Hrs/week

Examination Scheme:

Continuous evaluation: 40 Marks

End-Sem Exam: 60 Marks

Course Outcomes:

Upon completion of the course the student will be able to

1. Determine the quality of ingredients of concrete as per IS codes.
2. Design a concrete mix as per the requirement at the field using various codes.
3. Asses the suitability of NDT methods on field.

Laboratory consists of any 8 experiments from PART A whereas PART B is compulsory.

PART A: List of Experiments

1. Test on Cement: Fineness, Standard Consistency, and Setting time,

2. Test on Cement: Soundness and Compressive strength

3. Test on Aggregate: Sp. Gravity, porosity, bulk density and void ratio of CA and FA

4. Test on Aggregate : Sieve analysis of FA and CA, Flakiness Index of CA

5. Test on Aggregate: Aggregate Impact value and Aggregate crushing value.

6. Test on fresh concrete: Workability tests (slump, compaction factor, veebee, flow table)

7. Test on fresh concrete: Effect of Admixtures on workability and setting time of concrete (Super plasticizers and retarders)

8. Concrete mix design: Using IS code / DOE method.

9. Test on hardened concrete: Compressive strength, split Tensile strength and Modulus of Rupture, Young's modulus of concrete.

PART B: Site Visit

1. NDT Project (using rebound hammer and ultrasonic pulse velocity tests) on any site with a short report.

2. Site visit to study advances in Concrete Technology (like RMC, Pumped concrete etc.) with a short report.

---

[12]

CE : Environmental Engineering Lab

Teaching Scheme

Practicals : 2 hrs/ week

Examination Scheme

Continuous assessment: 40 marks

ESE Oral Exam : 60 marks

Course Outcomes:

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

1. Perform the analysis of water by following the standard methods of sampling and testing.
2. Perform the characterisation studies of water and determine the suitability of a water sample as drinking water source.
3. Understand the importance of the laboratory analysis as a controlling factor in the treatment of water.

The practical examination shall consist of viva-vice based on following experiments and their applications.

The term work shall consist of a record of laboratory experiments as mentioned below and detail Design report of water Treatment Plant for given population of town

List of Experiments:

1. Determination of hardness
2. Determination of turbidity
3. Determination of alum dose by jar test
4. Determination of chlorine dose and chlorine demand
5. Determination of fluoride by U-V spectrophotometer
6. Determination of MPN

B) Site visit to water treatment plant.

A report based on the visit to water treatment plant would be submitted and would form a part of the term work.

C) Design of various components of water treatment plant

Design of various components of water treatment plant would be carried out based on the theory covered in CE- 301 Environmental Engineering.

OR **C) Study of Software or programming for analysis of water distribution system**

Programmes available for the design of various water treatment plants would be used or Computer Programmes to Design various units of water treatment plant would be written in any suitable programming language.

D) At least six assignments on the syllabus

Note: The term work shall consist of record of above Practical Journal B and D.

Oral /Practical examination will be based on above exercises.

COURSES FOR LATERAL ENTRY STUDENTS –

Semester III
(MA) Linear Algebra and Univariate Calculus

Teaching Scheme
Lectures: 4 hrs / week
Tutorial: 1 hr / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Objectives: Basic necessity for the foundation of Engineering and Technology being mathematics, the main aim is, to teach mathematical methodologies and models, develop mathematical skills and enhance thinking power of students.

Unit I: Matrices and linear equations: basic properties of matrices, row operations and Gauss elimination, Determinants and their basic properties. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Rank of a matrix. Applications to systems of linear equations. **[15 Hrs]**

Unit II: Rank-nullity theorem, Eigen values, Eigen vectors and their basic properties, diagonalization. **[12 Hrs]**

Unit III: Review of limits, continuity and differentiability, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection. **[12 Hrs]**

Unit IV : Surface area, integrals by special techniques: reduction formulae, arc length, solids of revolution, improper integrals, tests for convergence, Gamma and Beta functions. **[13 Hrs]**

Text Books :

- Thomas' Calculus (14^{th} edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
- Advanced Engineering Mathematics (10^{th} edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books :

- Introduction to Linear Algebra (2^{nd} edition) by Serge Lang, Springer.
- Elementary Linear Algebra (10^{th} edition) by Howard Anton and Chris Rorres, John Wiley and sons.

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Calculus and Real Analysis (1^{st} edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.
- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7^{th} edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Differential Calculus by Shanti Narayan, S. Chand and company, New Delhi.
- Applied Mathematics Vol. I (Reprint July 2014) by P.N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan Pune.
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

Course Outcomes : Students will be able to

1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. Give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Note:

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 by 25 % of questions.

SEMESTER III
Foundation of Physics
S. Y. B. Tech. (Direct SY)
Course code: PH20001 (FP)

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Mid Sem: 30, Quiz: 20 marks
End-Sem Exam- 50 marks

Unit 1 **[7 Hrs]**

Oscillations, Waves & Light

SHM, characteristics of SHM, Waves, Travelling waves and its equation**,** Types of waves, Principle of Superposition, Stationary waves**,** Light as an EM Wave, graphical representation of EM wave, Interference of light due to thin film (uniform thickness), Antireflection coating, Total Internal reflection, Introduction to Optical fiber and its design.

Unit 2 **[6 Hrs]**

Atomic Nucleus and Nuclear energy

Atomic Nucleus, Nuclear force, Static properties of nucleus, Mass defect and Binding energy, Law of radioactive decay, Half-life, Applications of radioactivity, Nuclear reactions, Q-value of nuclear reaction, Nuclear fission, chain reaction and Nuclear energy.

Unit 3 **[6 Hrs]**

Electrostatics

Coulomb's law in vector form ,the electric field, Continuous charge distribution (Line, Surface& Volume)**,** Divergence of E, application of Gauss's law (simple 2 D problems)**,** The curl of E (Faraday's Law), the concept of electric potential V, Potential due to continuous charge distribution.

Unit 4 **[5 Hrs]**

Magneto statics

Steady state current (line current, Surface current and volume current), current densities, Magnetic field due to steady current (Biot-Savart's law), divergence and curl of B, Statement of Ampere's Law (with simple examples).

Unit 5 **[5 Hrs]**

Elements of Thermodynamics

Concept of Temperature, Terminology in Thermodynamics, Thermodynamic work, Caparison for Heat and Work, First Law and its applications, Heat engine and Thermal efficiency, Second law, Entropy, Disorder of system, Third law and Principle of Unattainability Absolute Zero (Nernst's Theorem).

Unit 6 **[7 Hrs]**

Modern physics

Drawbacks of Classical Mechanics, Plank's quantum hypothesis, Dual nature of matter, De-Broglie's hypothesis, light as a particle(Compton's experiment), De-Broglie's wavelength, Heisenberg's uncertainty principle(position and momentum), Wave function, its properties, conditions and its physical significance, Free particle solution of wave function.

References:

1. Engineering Physics, Avadhanulu and Kshirsagar.
2. Halliday-Resnick (Sixth edition) "Optics", Brij Lal (S. Chand publication)
3. Classical Electrodynamics, David Griffith (Pearson India limited)
4. H .C. Verma & Halliday-Resnick (Sixth edition), B. B. Laud
5. Modern Physics, S. Chand Publication.
6. Concepts of Modern Physics, Arthur Beiser, Tata McGraw – Hill Edition.

Course Outcome: Students will be able to

- Understand the classical and wave mechanics to implement for the problems.
- Understand the laws of thermodynamics to implement in various thermodynamic systems and processes.
- Understand the basic principles of electromagnetism and formulate it to solve the engineering problems.
- Aware of the limits of classical physics and will be able to use it in the appropriate field to solve the problems.

SEMESTER IV

(MA) Multivariate Calculus and Differential Equations

S.Y. B. Tech. (for Students Directly admitted to S.Y. after their Diploma)
Semester IV (All Branches)

Teaching Scheme	Examination Scheme
Lectures : 4 hrs / week	Internal Test 1: 20 marks
Tutorials : 1hr / week	Internal Test 2: 20 marks
	End Sem. Exam: 60 marks

Objectives : Basic necessity for the foundation of Engineering and Technology being mathematics, the main aim is, to teach mathematical methodologies and models, develop mathematical skills and enhance thinking power of students.

Unit I : Review of first order differential equations, linear differential equations, homogeneous higher order linear differential equations, non-homogeneous higher order linear differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters). **[09 Hrs]**

Unit II : Laplace Transforms, its properties, Unit step function, Dirac delta functions, Convolution Theorem, periodic functions, solving differential equations using Laplace transform. **[07 Hrs]**

Unit III : Functions of several variables, level curves and level surfaces, partial and directional derivatives, differentiability, chain rule, local extreme values and saddle points. **[07 Hrs]**

Unit IV : Double integrals in Cartesian and polar co-ordinates, iterated integrals, change of variables, triple integrals in Cartesian, spherical and cylindrical co-ordinates. **[12 Hrs]**

Unit V : Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss. **[10 Hrs]** **Unit VI :** Partial differential equations with separation of variables, boundary value problems: vibrations of a string, one dimensional heat equation. **[07 Hrs]**

Text Books :

- Thomas' Calculus (14^{th} edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
- Advanced Engineering Mathematics (10^{th} edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books :

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Multivariate Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer Science and Business Media.
- Differential Equations with Applications and Historical notes by George Simmons, Tata Mc-Graw Hill publishing company Ltd, New Delhi.
- Functions of several variables by Wendell Fleming, Springer-Verlag, New York.
- Partial Differential Equations (4^{th} edition) by Fritz John, Springer.
- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7^{th} edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Advanced Engineering Mathematics (2^{nd} edition) by Michael D. Greenberg, Pearson Education.
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

Outcomes : Students will be able to

6. know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
7. understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
8. analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
9. give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
10. apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Note :

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 will be judged by 25 % of questions.