GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code:3140601
Semester IV
SURVEYING

Type of course: Professional Core course

Rational: To develop concepts of various types of land surveying and prepare and interpret maps and drawing.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Module. No.	Topics	No. of Hours	Weightage (%)
1	**Plane Table Survey**: Introduction, principle, instruments, setting up the plane table, methods of plane tabling, advantages, sources of Errors.	4	8
2	**Theodolite Traversing**: Introduction, definitions, the Vernier transit theodolite, temporary and permanent adjustment of theodolite, measuring horizontal and vertical angles, methods of traversing, closing error, computation of latitudes and departure, check in closed and open traverse, balancing of traverse, Gale's table.	8	15
3	**Trigonometric levelling**: Indirect levelling, heights and distances, methods, direct levelling on steep ground.	5	8
4	**Curves**: Introduction, classification of curves, Elements of a simple circular, designation of curve, methods of setting out a simple circular curve, elements of a compound and reverse curves, transition curve, types of transition curves, combined curve, types of vertical curves.	8	15
5	**Areas and Volumes:** Introduction, computation of area, computation of area from field notes and plotted plans, boundary area, area of traverse, Use of Plannimeter, computations of volumes, Volume from cross sections, Trapezoidal and Prismoidal formulae, Prismoidal correction, Curvature correction, capacity of reservoir, volume from borrow pits.	6	10
6	**Tachometric Surveying**: Introduction, purpose, principle, instruments, methods of tacheometry, stadia constants, anallatic lens, Subtense bar, field work in tacheometry, reduction of readings, errors and precisions.	8	15
7	**Geodetic Surveying:** Introduction, triangulation, principle and uses of triangulation, triangulation systems and its classification, well-conditioned triangles, strength of figure, selection of triangulation stations and their inter-visibility, stations marks, signals, towers and scaffolds, base line, site selection and base line measurement, tape corrections, the base net, extension of base line, satellite station and reduction to centre.	6	10
8	**Theory of Errors :** Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for	6	10

	giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.		
9	**Modern Surveying Instruments:** Introduction, electromagnetic spectrum, electromagnetic distance measurement, types of EDM instruments, electronic digital theodolites, total station, digital levels, scanners for topographical survey, global positioning system.	5	9

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	**10%**	**50%**	**10%**	**10%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of Experiment:
- Plane table traversing by intersection and radiation methods
- Techeometry Survey Project.
- Theodolite traversing and plotting of traverse by applying corrections in Gale's traverse table
- Setting out simple circular curve by different methods
- Setting out combined curve (Transition - Circular – Transition)
- Computation of area of submergence and storage volume from contour maps for reservoir projects.
- Introduction to modern surveying Instruments.

Reference Book:

Title	Author/s	Publication
Surveying and levelling	N. N. Basak	Tata Mcgraw Hill, New Delhi
Surveying -Volume I,II &III	Dr. K.R.Arora	Standard Book House, New Delhi
Surveying, Volume-I, II & II	B.C.Punmia	Laxmi Publications, New Delhi
Surveying and Levelling, Volume –I & II	T.P. Kanetkar and S.V Kulkarni	Pune Vidyarthi Griha Prakhashan, Pune
Surveying and Levelling	R.Subramanian	Oxford University Press, New Delhi
Surveying Vol. I and II	S. K. Duggal	Tata Mcgraw Hill, New Delhi
Advanced Surveying	R. Agor	Khanna Publishers, New Delhi
Surveying and Levelling	R. Agor	Khanna Publishers, New Delhi

Course Outcomes:

Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Conduct Plane table, Theodolite, Trigonometric levelling, Tachometric, Geodetic survey at identified site.	60
CO-2	Set out simple and transition curve at given location	10
CO-3	Compute area and volume using standard rule and equipments such as Plannimeter	10
CO-4	Apply principles of theory of error for correction of measurements	10
CO-5	Conduct the survey by modern tools such as Digital Level, Total station, GPS	10

Web Material Links:

- http://nptel.ac.in/courses/105107122/
- http://nptel.ac.in/courses/105107157/
- http://nptel.ac.in/courses/105101087/
- http://nptel.ac.in/courses/105104100/
- www.svnit.ac.in

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3140603
Semester IV
Subject name: Structural Analysis-I

Type of course: Professional Core course

Prerequisite: Mechanics of Solid

Rationale: This subject is conceptual applications of principles of mechanics of rigid and deformable bodies in Engineering. This subject helps in determining statics response of statically determinate and indeterminate framed structures. In addition to this, the topics related to stability checks for structure subjected to lateral loads, buckling behaviour will also helps the students in developing the basic concepts of structural analysis. Use of professional software in structural analysis is a need of the day. Though it's use will be limited to small problem in this course, but students starts to use professional software will help them much in the later course.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Unit-1 : Fundamentals of Statically Determinate Structures:** **Basics:** Types of statically determinate & indeterminate structures, static and kinematic indeterminacy, stability of structures, principle of superposition, Maxwell's reciprocal theorems. **Framed structure :** Computation of internal forces in statically determinate framed structures such as plane truss, plane frame, grids, **Arches and Cables :** Calculation internal forces in three hinge arches with circular and parabolic shapes subjected to various types of loading. Forces and end actions in cables due to various types of loading. **Thin cylinder:** Analysis of thin cylinder and spherical vessels under pressure.	14	25
2	**Unit-2 : Strain energy & Displacement of Statically Determinate structures** **Strain Energy :** Resilience, strain energy due to axial loads & flexure, proof resilience, modulus of resilience, impact loads, and sudden loads	14	25

	Displacement : Differential equation of elastic curve, relation between moment, slope and deflection, Displacement of beam by Macaulay's method, Moment Area Method, Conjugate Beam Method and by strain energy using first principle (i.e equating strain enery to work done)		
3	**Unit-3 : Direct and Bending stresses + Column & Struts** **(A) Direct and Bending stresses** **Basics:** Members subjected to eccentric loads, middle third rule, kernel of section, stress distribution **Applications of Direct & Bending stresses :** (1) chimney subjected to wind pressure, (2) Retaining walls subjected to earth pressure and (3) Dams subjected to hydraulic pressure. **(B) Columns and Struts** Basics: Buckling of columns, different end conditions, effective length, least radius of gyration **Applications:** Euler's and Rankine's formulae, columns with initial curvature, eccentrically loaded columns, columns with lateral loading.	14	25
4	**Unit-4 : Statically Indeterminate beams** **Basics :** Types of statically indeterminate beams, Consistent Deformation method, Basic principles for fixed beam, basics of moment distribution method. **Propped Cantilever beam :** Analysis of propped cantilever beams & beams of varying moment of inertia using Consistent Deformation Method **Fixed beam :** Computation of fixed-end actions for various types of loads and secondary effects using basic principles, beams of varying moment of inertia. **Continuous beams:** continuous beam up to 3 spans by Moment Distribution Method.	14	25
5	**Unit-5: Computer Applications in Structural Engg. (for Laboratory only)** Use of professional software such as STAAD-Pro, SAP, ETABS etc. for determining response of frames structure of the topics related to this course		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**30**	**20**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Junarkar S.B. & Shah H.J.; Mechanics of Structures Vol-I; Charotar publishing house, Anand

2. Wang C. K.; Intermediate Structural Analysis; Tata McGraw Hill book Company, New Delhi

3. Popov E.P.; Engineering Mechanics of Solids; Prentice Hall of India, New Delhi

4. Ryder G.H.; Strength of Materials; Mcmillan

5. Gere & Timoshenko; Mechanics of Materials; CBS Publishers & Distributors, Delhi

6. Hibbler R C; Mechanics of Materials; Pearson Education

7. Hibbler R C; Structural Analysis; Pearson Education

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply principles of statics to determine reactions, internal actions in statically determinate framed structures including arches & cables.	20
CO-2	Compute strain energy stored member subjected to axial & flexural forces.	10
CO-3	Determine displacement in a statically determinate beams by different methods	20
CO-4	Perform stability checks to various structures such as chimey, retaining wall, dam subjected to gravity and lateral loading.	20
CO-5	Differentiate the buckling behaviour of columns & struts with different end conditions.	10
CO-6	Determine response of structure using professional software.	20

List of Experiments/Tutorials:

1. The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.

2. Few problems will have to solve with professional software and compare results.
3. Experiments may be designed and carried out related to the topics of the course.
4. Practical examinations shall consist of oral based on term-work and above course.

Major Equipment/Software:

1. Any professional software of Structural analysis

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3140609
Semester IV
Civil Engineering - Societal & Global Impact

Type of course:

Rational:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
2	0	0	2	70	30	0	0	100

Content:

Module. No.	Topics	No. of Hours
1	Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis	3
2	Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering	3
3	Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability	8
4	Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and nonstationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability	7
5	Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and	5

	methodologies for ensuring Sustainability	
6	Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development	4

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**30**	**20**	**0**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. *Žiga* Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
6. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. P 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.

10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.
12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30
13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.
14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

Course Outcomes:

Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Outline the role of Civil engineering in evolution and revolution of mankind and globally present status of development in India.	10
CO-2	Estimate the level of resource utilization for present and future infrastructural projects using various tools/methods	10
CO-3	Infer the necessity of different conventional as well as futuristic infrastructural projects.	30
CO-4	Incorporate the goal of sustainable development to minimize the potential impacts on the global environment.	20
CO-5	Associate various measures for enhancing the build environment, thereby improving quality of life of the occupants.	20
CO-6	Evaluate the potential of Civil Engineering for employment creation and its contribution to the GDP.	10

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3140610
Semester – IV
Subject Name: Complex Variables and Partial Differential Equations

Type of course: Basic Science Course

Prerequisite: Geometry, trigonometry, calculus and ODE.

Rationale: This subject is a powerful tool for solving a wide array of applied problems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	2	0	5	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
01	Polar Form of Complex Numbers, Powers and Roots, Complex Variable – Differentiation : Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	12	28%
02	Complex Variable - Integration : Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Uniform Convergence.	08	20%
03	Laurent's series; Zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Residue Integration Method, Residue Integration of Real Integrals.	06	14%
04	First order partial differential equations, solutions of first order linear and nonlinear PDEs, Charpit's Method	06	14%
05	Solution to homogeneous and nonhomogeneous linear partial differential equations second and higher order by complementary function and particular integral method. Separation of variables method to simple problems in Cartesian coordinates, second-order linear equations and their classification, Initial and boundary conditions, Modeling and solution of the Heat, Wave and Laplace equations.	10	24 %

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	**28**	**35**	0	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table. This subject will be taught by Maths faculties.

Reference Books:
(1)   Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons.
(2)   Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage.
(3)   Dennis G. Zill, 4th edition, Advanced Engineering Mathematics, 4th Edition, Jones and Bartlett Publishers.
(4)   Dennis G. Zill, Patrick D. Shanahan, A First Course in Complex Analysis with Applications, Jones and Bartlett Publishers.
(5)   S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
(6)   Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill.
(7)   J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw Hill.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	convert complex number in a polar form, plot the roots of a complex number in complex plane, find harmonic conjugate of analytic functions and apply conformal mapping in geometrical transformation	28%
CO-2	evaluate complex integration by using various result, test convergence of complex sequence and series and expand some analytic function in Taylor's series	20%
CO-3	find Laurent's series and pole of order, and apply Cauchy Residue theorem in evaluating some real integrals	14%
CO-4	form and solve first order linear and nonlinear partial differential equations	14%
CO-5	apply the various methods to solve higher order partial differential equations, modeling and solve some engineering problems related to Heat flows, Wave equation and Laplace equation	24 %

List of Open Source Software/learning website:
         MIT Opencourseware. NPTEL.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140611
Semester – IV
Subject Name: Fluid Mechanics & Hydraulics

Type of course: Professional Core Course

Prerequisite: System of units, Laws of motion, Basic idea of force, Concept of centroid & Moment of Inertia

Rationale:
1. To develop a basic understanding about the properties of fluids, their behavior under static and dynamic conditions.
2. To enable the students to apply the basic principles of Fluid Mechanics to solve real life problems

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Module 1:Properties of Fluids Mass density, specific weight, specific gravity, specific volume, vapour pressure, compressibility, elasticity, surface tension, capillarity; Newton's law of viscosity, Types of fluids, dynamic viscosity, kinematic viscosity, variation of viscosity with temperature; Basic applications of fluid mechanics	4
2	Module 2: Fluid Statics Measurement of Pressure: Pressure variation in static fluid, Pascal's law, Units and scale of pressure measurement- Atmospheric pressure, Absolute pressure, Gauge pressure, and Vacuum pressure, Hydrostatic paradox, Piezometer, U-Tube manometer, Single column manometer, U-tube differential manometer, Inverted U-tube differential manometer, micromanometers. Hydrostatic force on plane and curved surface: Total pressure and center of pressure, pressure diagram, Total pressure on plane surfaces and curved surfaces depth of center of pressure, Practical applications of Total pressure and Center of pressure. Buoyancy and Flotation: Buoyant force, Buoyancy and Center of Buoyancy, Archimedes Principle, Metacentre and Metacentric height, Equilibrium of floating and submerged	12

	bodies, Metacentric height evaluation –theoretical and experimental method.	
3	Module 3:Fluid Kinematics & Dynamics Fluid flow methods of analysis of fluid motion, Streamlines, Path lines, Streak lines and Stream tubes. Types of fluid flow-Steady and unsteady flow, Uniform and non-uniform flow, Laminar and turbulent flow, Reynolds number, Reynolds experiment, Rotational and Irrotational flow, Subcritical, critical and Supercritical flow, Compressible and Incompressible flow, One, Two and three dimensional flow velocity potential and stream function, flow net, Euler's equation, Bernoulli's equation and its applications.	**8**
4	Module 4: Flow Measuring Devices Measurement of discharge- Venturimeter, Orificemeter, Nozzlemeter, Rotometer. Measurement of velocity-Pitot tube. Orifice- classification hydraulic coefficients, Experimental determination of hydraulic coefficients, Small and large orifice,. Mouthpiece- classification, External cylindrical mouthpiece, Convergent –divergent mouthpiece, Borda's mouthpiece. Notches and weirs-discharge over rectangular notch and triangular notch. Velocity of approach	**8**
5	Module 5: Flow Through Pipes Introduction-Continuity equation-Energy equation-Momentum equation Major and minor energy losses, hydraulic gradient and total energy line, pipes in series and parallel, pipe networks by Hardy Cross method Viscous flow-Couette flow, Hagen-Poiseuille equation-flow between parallel plates. Turbulent flow in pipes-Prandtl's mixing length theory Smooth and rough boundaries-water hammer phenomenon	**12**
6	Module 6: Open Channel Flow Basic concept of open channel flow- Steady uniform flow-Velocity distribution-Optimum shape of cross section for uniform flow- Energy equation-specific energy-specific energy diagram-discharge diagram-Application of specific energy and discharge diagrams. Non-Uniform steady flow-equations for gradually varied flow- Direct Step method, Rapidly varied flow- Hydraulic jump.	**10**
7	Module 7: Dimensional Analysis and Similitude Fundamental dimensions-Physical Quantity and Dimensions-Dimensional Homogeneity-Non Dimensional parameters, Theorem dimensional analysis, Choice of variables,	**6**

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Determination of Dimensionless parameters. Model Similitude-Physical models-geometric-kinematic and dynamic similarity,	

Suggested Specification table with Marks (Theory): (For PDDC only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**20%**	**20%**	**20%**	**10%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Engineering Fluid mechanics, K.L. Kumar, 8th Edition S. Chand & Company Ltd.
2. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
4. Fluid Mechanics, A.K. Jain, 4th edition, Khanna Publishers.
5. Theory and Applications of Fluid Mechanics by K Subramanya, McGraw Hill Publication
6. Fluid Mechanics by A.K. Jain, Khanna Publishers, New Delhi
7. Hydraulics and Fluid Mechanics by P.N. Modi and S.M. Seth, Standard Book House, New Delhi
8. Fluid Mechanics by Victor L. Streeter, E. B. Wylie by, McGraw Hill Publication
9. Fluid Mechanics by Frank M White , McGraw Hill Publication

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

Sr. No.	CO statement	Marks % weightage
CO-1	Analyze forces on floating bodies and understand fluids in relative equilibrium	20
CO-2	Calibrate and demonstrate fluid flow measuring devices like venturimeter, orificemeter, notches, orifice, mouthpieces.	25
CO-3	Analyze fluid flow through pipes in series, parallel and pipe networks under laminar and turbulent flow conditions	20
CO-4	Analyze open channel flow and design optimal sections; calculate forces on sluice gates considering specific energy and momentum principle.	25

CO-5	Carry out model studies for fluid flow problems	10

List of Experiments:

1. Measurement of viscosity
2. Study of pressure measurement devices
3. Hydrostatic force and center of pressure on flat/curved surfaces
4. Stability of Floating body
5. Study Characteristics of Laminar and Turbulent flows (Reynolds experiment)
6. Verification of Bernoulli Theorem
7. Determine Hydraulic coefficients of a small circular orifice.
8. Calibration of flow measuring devices (Venturimeter, Orificemeter, Rectangular and V-notch)
9. Pipe friction
10. Uniform flow in Open Channel
11. Similitude and Model Studies

Major Equipment:

1. Viscometer
2. Piezometers, Manometers, pressure gauges
3. Floating body
4. Reynolds experimental setup
5. Hydraulic bench with modular attachments for various experiments
6. Pipe friction apparatus
7. Open channel with necessary attachments for Uniform flow and Hydraulic Jump experiment

List of Open Source Software/learning website:

1. http://www.nptel.iitm.ac.in/courses/