SYLLABUS OF
UNDERGRADUATE DEGREE COURSE

Civil Engineering

Effective for the students admitted in year 2021-22 and onwards.

B.Tech. : Civil Engineering
2nd Year - III Semester

f THEORY										
SN	Category	Course Code	Course Title	Hours			Marks			Credit
				L	T	P	IA	ETE	Total	
1	DC	3CE4-01	Fluid Mechanics	3	0	0	30	70	**100**	**3**
2		3CE4-02	Surveying	3	1	0	30	70	**100**	**4**
3		3CE4-03	Building Materials	2	0	0	30	70	**100**	**2**
4		3CE4-04	Architecture Drawing and Building Construction	3	0	0	30	70	**100**	**3**
5		3CE4-05	Engineering Geology	2	0	0	30	70	**100**	**2**
6	UC	3CE2-01	Engineering Mechanics	3	0	0	30	70	**100**	**3**
			Sub Total	**16**	**1**	**0**	**180**	**420**	**600**	**17**
PRACTICAL & SESSIONAL										
7	DC	3CE4-20	Fluid Mechanics Lab	0	0	2	60	40	**100**	**1**
8		3CE4-21	Surveying Lab	0	0	3	60	40	**100**	**1.5**
9		3CE4-22	Computer Aided Civil Engineering Drawing	0	0	3	60	40	**100**	**1.5**
		3CE4-23	Geology Lab	0	0	2	60	40	**100**	**1**
		3CE4-24	Civil Engineering Lab-I	0	0	2	60	40	**100**	**1**
10	UI	3CE7-30	Professional Training	0	0	2*	60	40	**100**	**1**
11	CCA	3CE8-00	SODECA/NCC/NSS/ANANDAM/IPR	-	-	-	-	100	**100**	**1**
			Sub- Total	**0**	**0**	**14**	**360**	**340**	**700**	**8**
		TOTAL OF III SEMESTER		**16**	**1**	**14**	**540**	**760**	**1300**	**25**

L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment, **ETE**=End Term Exam, **Cr**=Credits

***for calculation of contact hours**

B.Tech. : Civil Engineering
2nd Year - IV Semester

SN	Category	Course Code	Course Title	Hours			Marks			Credit
				L	T	P	IA	ETE	Total	
THEORY										
1	DC	4CE4-01	Geotechnical Engineering-I	3	0	0	30	70	**100**	**3**
2		4CE4-02	Mechanics of Solids	3	1	0	30	70	**100**	**4**
3		4CE4-03	Environmental Engineering	3	1	0	30	70	**100**	**4**
4		4CE4-04	Hydraulics Engineering	3	0	0	30	70	**100**	**3**
5		4CE4-05	Construction Management	3	0	0	30	70	**100**	**3**
6	UC	4CE2-01	Advanced Engineering Mathematics	3	0	0	30	70	**100**	**3**
			f Sub Total	**18**	**2**	**0**	**180**	**420**	**600**	**20**
PRACTICAL & SESSIONAL										
7	DC	4CE4-20	Environmental Engineering Lab	0	0	2	60	40	**100**	**1**
8		4CE4-21	Hydraulics Engineering Lab	0	0	2	60	40	**100**	**1**
9		4CE4-22	Civil Engineering Lab-II	0	0	2	60	40	**100**	**1**
10		4CE4-23	Geotechnical Engineering Lab -I	0	0	2	60	40	**100**	**1**
11	CCA	4CE8-00	SODECA/NCC/NSS/ANANDAM/IPR	-	-	-	-	100	**100**	**1**
			Sub- Total	**0**	**0**	**8**	**240**	**260**	**500**	**5**
		TOTAL OF IV SEMESTER		**18**	**2**	**8**	**420**	**680**	**1100**	**25**

L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment, **ETE**=End Term Exam, **Cr**=Credits

*****for calculation of contact hours

3CE4-01: Fluid Mechanics

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To get familiar with the fundamentals of fluid and fluid flow characteristics.
2. To introduce the students about properties of the fluids, behaviour of fluids under static conditions and to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its applications.

Course Outcomes

1. CO1: Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.
2. CO2: Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
3. CO3: Explain the concept of momentum and angular momentum equations and their applications.
4. CO4: Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pressure difference and velocity distribution in pipes.
5. CO5: Apply the knowledge to solve civil engineering problems relating to fluid flow.

S. No	Contents	Hours
1	Fluids: Definition, Type of fluids, Ideal fluids, real fluids, Newtonian and non-Newtonian fluids. Properties of Fluids: Units of measurement, Mass density, Specific weight, Specific volume, Specific Gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity	4
2	Principles of Fluid Statics: Basic equations, Pascal Law, Type of pressure:-atmospheric pressure, Gauge pressure, vacuum pressure, absolute pressure, manometers, Bourdon pressure gauge	5
3	Buoyancy; Forces acting on immersed plane surface. Centre of pressure, forces on curved surfaces. Conditions of equilibrium for floating bodies, meta-centre and analytical determination of meta centric height	7
4	Kinematics of Flow: Visualisation of flow, Types of flow: Steady and unsteady, uniform and non-uniform, rotational and irrotational flow, Laminar and turbulent flow, streamline, path line, streak line, principle of conservation of mass, equation of continuity, acceleration of fluid particles local and convective, velocity, acceleration, velocity potential and stream function, elementary treatment of flow net, vorticity, circulation, free and forced vortex. Fluid mass subject to horizontal and vertical acceleration and uniform rotation	8
5	Fluid Dynamics: Control volume approach, Euler's equation, Bernoulli's equation and its applications. Reynolds transport theorem, Venture-meter, Orificemeter, Orifices & mouthpieces, time of emptying of tanks by orifices, Momentum and angular momentum equations and their applications, pressure on flat plates and nozzles.	10
6	Laminar Flow through Pipes: Laminar flow through pipes, Relation between shear & pressure gradient. Flow between plates & pipes. Hagen Poiseuille equation, Equations for velocity distribution, pressure difference velocity distribution over a flat plate and in a pipe section, Darcy-Weisbach equation, friction factor , minor losses, pipe networks	8

	Total	42

SUGGESTED READINGS

1. Fox, Robert W., Alan T. McDonald, and John W. Mitchell. 2020. Fox and McDonald's introduction to fluid mechanics. John Wiley & Sons.
2. Streeter, V. L. Wylie, E. B. and Bedford K.W. 2010. Fluid Mechanics, Tata McGraw Hill, New Delhi.
3. Modi P.N. and Seth S. M. 2019. Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi.
4. Som S. K., Biswas G. and Chakraborty S. 2012. Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, Education Pvt. Ltd.
5. Pani B. S. 2016. Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd.
6. Jain A. K. 2016. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi.
7. Narayana Pillai N. 2009. Principles of Fluid Mechanics and Fluid Machines, (3rd. Ed.) University Press (India) Pvt. Ltd.

3CE4-02: Surveying

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To provide basic knowledge about principles of surveying, and its applications in various engineering domains
2. To provide a practical understanding of different types of survey works
3. To determine the required areas and volumes of land and materials needed in construction work.
4. To ensure that the construction takes place in the correct relative and absolute positions on the ground.
5. To provide an understanding of the working principles of survey instruments including conventional and modern practice.

Course Outcomes

1. CO1: Survey of an area under various topography and obstructions.
2. CO2: Prepare the plan or map of the area surveyed.
3. CO3: Development of contours and elevation profiles
4. CO4: Analyse, report, and wherever appropriate, distribute the survey errors.
5. CO5: Set out curve and building lay out.
6. CO6: Perform instruments checks to ensure they meet the specifications

S. No.	Contents	Hours
1	**Surveying Principles**: Definitions, Types of Surveys, Classification of surveys, Principle, distorted or shrunk scales, Overview of modern surveying data system- Geomatics, Errors and mistakes, Accuracy and precision in surveying, Types of measurables- distance, angles and elevation. Overview of historical Surveying Instruments - chains, tapes, and ranging, Field compass, Theodolite; Modern - Total station, GNSS Positioning. **Theodolite**: Types of theodolites, measurement of angles, temporary and permanent adjustments, closed & open traverse, omitted measurements, consecutive and independent co-ordinates, advantages and disadvantages of traversing closing error, Bowditch & Transit Rules	10
2	**Distance Measurements:** Overview of distance measurement techniques- Chains, Taping, errors in distance measurement and correction, Operations in planimetric mapping, measurements using offsets, Optical distance measurement (ODM), Electronic Distance Measurement (EDM), EDMI classification, Total station setup, Errors in EDMI	7
3	**Direction Measurements:** Definitions, Horizontal and vertical angles, Azimuth and bearings, Deflection angles, Computations of angles and interconversion, Overview of local attraction, Overview of instruments, Relation between angles and distances, Observing horizontal and vertical angles,	7
4	**Elevation Measurements:** Reference surfaces/Datum, Positioning- planimetric, Geodetic, height above ellipsoid, Definitions- Reduced Level, levelling, trigonometric heights, physical heights, lines and planes, level surfaces, elevation and altitude, Benchmarks, types of Benchmarks, Principle of optical levelling, Structure of levels (auto and dumpy), Reading a levelling staff, Methods of levelling, Accuracy standards for levelling. Level nets, loop closure, Contouring, Contour intervals, representation of reliefs, horizontal	11

	equivalent, contour interval, characteristics of contours, methods of contouring, contour gradient. DEM, DSM, DTM, Interpolation techniques in DEM generation, Overview of photogrammetry and laser scanning. Topographic mapping and map projections. Curves setting: Definition, elements of a simple curve, different methods of setting out a simple circular curve, elements of a compound curve, reverse curves, transition curves, their characteristics and setting out, vertical curves, setting out vertical curves, sight distances.	
5	**Control Survey & Traversing:** Control networks, Control establishment- GNSS positioning modes- PPS, PPK, RTK, overview of differential positioning. Triangulation and Trilateration, criterion for selection of layout of triangles. Traverse, types of traverses, referencing traverse stations, Traverse field notes, linear and angle misclosures, latitude and departure, relative precision, specifications in traversing, Traverse balancing- Bowditch's rule, Transit method, overview of least squares adjustment, rectangular coordinates from latitude and departure, Gale's Table	7
	Total	**42**

SUGGESTED READINGS

1. Charles D. Ghilani & Paul R. Wolf. 2018. Elementary Surveying, Pearson.
2. Barry Kavanagh. 2018. Surveying Principles and Applications, Pearson.
3. Schoffield W., Mark Breach. 2007. Engineering Surveying, CRC Press.
4. Subramanian, R. 2007. Surveying and Leveling, Oxford.
5. Kanetkar, T.P., and Kulkarni, S.L. 2006. Surveying and Leveling Part I and II, Pune Vidhyarthi Griha Prakashan .
6. Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar 2005. Surveying Vol. I and II, Laxmi Publications.

3CE4-03: Building Materials

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To introduce students to various construction materials, techniques and practices commonly used in civil engineering construction
2. To gain understanding of properties and usage of bricks, stones, timber and miscellaneous materials used in construction.
3. To expose students to the various building and general construction products and their associated quality, durability, warrantees, and availability.

Course Outcomes

1. CO1: Recognize the need and process of manufacturing of cement and brick.
2. CO2: Demonstrate knowledge of properties of various building materials
3. CO3: Develop understanding of material science and behaviour of various building materials used in construction.
4. CO4: Understand the properties of concrete, concrete mix proportion.

S. No.	Contents	Hours
1	**Stones**: Classification of rocks, test for stones, characteristics of a good building stone, deterioration of stones, common building stones of India, requirements as per Indian standards **Bricks:** Composition of good brick earth, harmful ingredients, manufacture of bricks, characteristics of good bricks, shapes, classification of bricks as per IS 1077-1985 and testing as per Indian standards. **Mortar:** Classifications, Properties and tests as per Indian standards **Timber:** Classification and identification of timber, defects in timber, characteristics of good timber, seasoning of timber, requirements as per Indian standards **Tiles:** Classification of tiles, test for tiles, characteristics of tiles as per Indian standards **Glass and glazing systems:** Classification, properties, and tests as per Indian standards	9
2	**Concrete Constituents:** Cement: Constituents of cement and their role, composition of cement (Bogue's equation) hydration of cement, structure of hydrated cement, heat of hydration. Tests of cement as per IS code. Aggregates: Sources, Classification, properties, and grading of aggregates. Tests on aggregates as per IS code.	7
3	**Concrete:** Introduction, properties of concrete, water/cement ratio and its role, gel/space ratio, workability, compressive strength, grades, Production of Concrete: Properties of fresh concrete including workability, air content, flow ability, methods to determine and factors affecting. Properties of hardened concrete such as strengths, permeability, creep, shrinkage, factors influencing, standard tests on fresh and hardened concrete as per IS code.	5
4	Quality control of concrete, Concrete mix design.	4

	Admixture in Concrete: Chemical and mineral admixtures (their types and use under different conditions). Use of fly ash and silica fume in concrete.	
5	**SPECIAL CONCRETE** Light weight concrete, definition and its properties, applications, high strength concrete, definitions, its properties and applications, mass concrete, waste material based concrete, shortcrete, fiber reinforced concrete: Materials. Fibers-types and properties, ferrocement, polymer concrete composites, heavy-weight concrete for radiation shielding.	3
	Total	28

SUGGESTED READINGS

1. Gambhir M. L. 2004. Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Shetty M. S. 2010. Concrete Technology: Theory and Practice, S. Chand & Company.
3. Ken Ward-Harvey.2009. Fundamental building materials, Universal Publisher (fourth edition).
4. Edward Allen, Joseph Iano .2014 Fundamental building materials, John Wiley & sons inc (Sixth Edition).
5. Mehta, Scarborough, Armpriest. 2016. Building Construction: Principles, Materials, & Systems, 2/e ISBN, Pearson publication 9789332575097

3CE4-04: Architecture Drawing and Building Construction

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To expose students to the concepts of architectural drawings and building construction.
2. Capable of working with an architect and contractor

Course Outcomes

1. CO1: Plan and draw constructional details of different building components
2. CO2: Prepare building plans and other components for a project
3. CO3: Capable of supervise building constructions

S. No	Contents	Hours
1	**Introduction to Architecture Drawing:** Types of buildings Proportion, orientation, criteria for location and site selection site plan, working drawing Building layout, Architectural, structural working drawings, Modular co-ordination and drawing on modules, **Sun Consideration :** Different methods of drawing sun chart, sun shading devices, design of louvers, energy conservation in buildings, passive solar cooling and heating of buildings. **Climatic and comfort Consideration** : Elements of climate, global climate, climatic zones of India, comfort conditions, biclimatic chart, climate modulating devices.	8
2	**Building Bye Laws and NBC Regulations :** Objective of by-laws, Regulation regarding; means of access, lines of building frontages, covered area, floor area ratio, open spaces around buildings, height & sizes of rooms, plinth regulation and sanitation provisions. **Principles of Planning :** Different factors affecting planning viz-aspect, prospect, furniture requirement, roominess, grouping, circulation, elegance, privacy etc.	9
3	**Functional design and Accommodation requirements** (A) **Residential Buildings :** Anthrometry, activities and their spatial requirements; Area planning, living area, sleeping area, service area; Bubble diagram showing sequence of arrangement of area, plan, elevation, sectional elevation. (B) **Non Residential Buildings :** viz-school buildings, rest house, primary health centres, post office, bank, college library, cinema theatres etc.	8
4	**Foundations:** Types spread, arch, combined, cantilevered, Raft, Grillage, Piles & wells, Footings in block cotton soil, Basement & Retaining walls **Masonry:** Stone & Brick**:** Brick masonry, Bonds and junctions, Walling, Mud wall, Sun-dried bricks, burnt bricks, stones walling, load bearing & non load bearing brick masonry for multistoried constructions, brick panel walling, reinforced masonry. Bonds & junctions **Prefabricated Construction:** Prefabricated components, Assembly at site, Low cost housing & hollow blocks.	8
5	**Damp Proof Course:** Points of its requirement in buildings, D.P.C. at Plinth level, in basement and roof tops etc. joints in prefabricated construction. Anti termite treatment	9

	Lintels & Arches: Location and construction details in wood, brick, stone and R.C.C. **Stairs & Stair cases:** Suitability of location, stairs in multistoried buildings, Residential and public buildings, Fire escape, Stairs in timber, stone, brick, RCC and Metal Drawings in Plan elevation and sections. Hand rail & railings, description and sketches of lifts escalators. **Doors &Windows:** Details, location in buildings, sizes & construction for wooden & metal, Battened braced, framed, flush and paneled, sliding, folding telescopic, with louvers, collapsible. Windows in timber & Metal casement, double hung, Dormer, Corner, Fanlight, skylight, clear storey etc. Low cost ideas, Revolving doors, Aluminium door and windows. **Roofing and Flooring:** Types of Flooring, Flat roofs: Waffle floor, channels, cored units etc., inclined roofs. Form Work, Scaffolding, underpinning.	
	Total	42

SUGGESTED READINGS

1. Singh, Gurcharan. 1994. Building Construction Engineering, Standard Book House.
2. Sharma, S. K. 2012. Building Construction, S. Chand and Company.
3. Kumar, Sushil, 1990. Building Construction, Standard Publisher and Distributors.
4. Punima, B. C. 2002. Building Construction, Laxmi Publishing House.
5. Sharma and Kaul. 1987. A Text Book of Building Construction, S. Chand and Company.

3CE4-05: Engineering Geology

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. Identify the structure of earth; distinguish between different rocks and their properties; select sites for different structures in different zones and explore subsurface using different techniques.
2. To demonstrate the importance of geology to take Civil Engineering decisions to solve the earth related problems.
3. To introduce the fundamental of the engineering properties of earth materials for the use of Civil Engineering constructions.
4. To develop quantitative skills and a frame work for solving Engineering Geological problems.

Course Outcomes

1. CO1: Know about the various internal structures of earth and plate tectonic movements.
2. CO2. Characterize the engineering properties of rocks, minerals and soil.
3. CO3. Assess the natural occurring various geological hazards.
4. CO4. Use seismic and electrical methods to investigate the subsurface of the earth.
5. CO5. Apply Remote Sensing and GIS knowledge to investigate the Geological structures.

S. No	Contents	Hours
1	General Geology: Subdivision of Geology. Importance of Geology in Civil Engineering. Internal Structure of the Earth, physical properties of minerals, weathering and erosion. Geological work of wind, river and ocean. Stratigraphic aspects of rocks for civil engineers. Geological Time Scale.	6
2	Petrology: Origin & classification of rocks. Texture & Structures of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of rocks. Rocks and dimensional stones as a construction material. Suitability of rocks for different Civil Engineering purposes. Structural Geology: Causes & Classification of fold, fault, joints & unconformities. Outcrop pattern. Recognition of structure from rock outcrops.	6
3	Natural Disasters and Geological Investigations (in reference to Civil Engineering): Earthquake, causes, intensity scale and seismic zone of India. Site selection for dam, tunnels, multistorey buildings, reservoirs and bridge structures Sites improvement techniques practiced in different civil engineering projects. Introduction to drilling methods.	6
4	Geophysical Methods for Subsurface Exploration: Electrical resistivity methods, Geophysical survey: Seismic refraction techniques, Ground Penetrating Radar (GPR) survey	4
5	Remote Sensing: Introduction and applications in Civil Engineering. Image acquisition, image interpretation (visual and digital, digital terrain model, airborne lithological identification). Remote sensing techniques used in civil engineering domain.	6
	Total	28

SUGGESTED READINGS

1. Goodman, R. E. 1993. Engineering Geology - Rock in Engineering Construction", John Wiley and Sons.
2. Varghese, P.C. 2012. Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi.
3. Parbin Singh. 2009. A Text book of Engineering and General Geology, Katson Publishing House, Ludhiana.
4. David George .2009. Engineering Geology: Principles and Practice, Springer.
5. Marshak Stephen, Mitra Gautum. 2017. Basic Methods of Structural Geology, Pearson.

3CE2-01: Engineering Mechanics

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To enable students to apply fundamental laws and basic concepts of rigid body mechanics to solve problems of bodies under rest or in motion.
2. To enable the students to apply conditions of static equilibrium to analyze physical systems.
3. To compute the properties of areas and bodies.

Course Outcomes

1. Compute the resultant of system of forces in plane and space acting on bodies.
2. Predict the support-reactions and the internal forces of the members of various trusses and frames.
3. Analyze equilibrium problems with friction.
4. Apply transfer theorems to determine properties of various sections.
5. Analyze equilibrium of connected bodies with virtual work method.
6. Analyze the forces in the frames structure.

S. No	Contents	Hours
1	**STATICS OF PARTICLES** Vectorial representation of forces and moments Vector Operation - Concepts of particles and rigid bodies - Composition of concurrent forces in plane - Free body diagrams - Equilibrium of rigid bodies in two and three dimensions- Moment of a force about a point and about an axis, Couple moment Reduction of a force system to a force and a couple	10
2	**PROPERTIES OF SURFACES, MOMENTS AND PRODUCTS OF INERTIA** First moment of areas - Centre of area - Centre of gravity Moment of Inertia for areas (Second moment of area) - Parallel axis theorem - Perpendicular axis theorem - Moment of inertia for composite area - Product of inertia Mass moment of inertia	8
3	**FRICTION** Laws of coulomb friction - Coefficient of friction - Dry friction - Sliding (skidding) friction Ladder friction - Belt friction - Rolling resistance	4
4	**KINEMATICS OF PARTICLES** Principle of virtual work for a particle and rigid body Condition for equilibrium for a conservative system Stability - Particle dynamics in rectangular coordinates, cylindrical coordinates and in terms of path variables General motion of system of particles	8
5	**WORK ENERGY METHODS, IMPULSE AND MOMENTUM** Work Energy method Conservation of energy	8

	Impulse and momentum relationship - Impulsive force - Impact force Conservation of momentum - Moment of momentum equation	
6	**RIGID BODY MOTION** Translation and rotation of rigid bodies Kinetic energy of rigid body Work and energy relations Euler's equation of motion	4
	Total	42

SUGGESTED READINGS

1. Russell C Hibbeler and Ashok Gupta 2010. Engineering Mechanics: Statics and Dynamics (11th Edition), Published by Pearson Education Inc., Prentice Hall.
2. Meriam J.L and Kraige L.G. 2012. Engineering Mechanics, Volume I - Statics, Volume II -Dynamics, 7th Edition, John Wiley & Sons, New York.
3. Beer, Johnston, Cornwell and Sanghi. 2013. Vector Mechanics for Engineers: Statics and Dynamics, 10th Edition, McGraw-Companies, Inc., New York.
4. Rajasekaran S and Sankara subramanian G. 2013. Fundamentals of Engineering Mechanics, 3rd Edition, Vikas Publishing House Pvt. Ltd., India.

3CE4-20: Fluid Mechanics Lab

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. To get familiar students about the usage and working principle of different instruments used in fluid mechanics
2. Application of instruments to calculate various parameter such as fluid pressure, discharge, losses in pipes etc.
3. Calibration of instruments

Course Outcomes

1. CO1: Methods of discharge measurements on conduits and open channel flow.
2. CO2: Calibration flow measuring devices used in pipes, channels and tanks assessment
3. CO3: To calculate losses in flow.
4. CO4: Verification and characterization of fluids flow through experiments.

S. No	Contents	Hours
1.	Introduction to various Instruments.	
2.	Determination of metacentric height	
3.	Calibration of a venturi meter.	
4.	Determination of frictional losses in pipes of different diameters.	
5.	Determination of minor losses in pipes.	
6.	Calibration of v- notch and rectangular notch.	
7.	Reynolds dye experiment for flow characterization.	
8.	Determination of Cc, Cv and Cd of an orifice.	
9.	Verification of Bernoulli‘s theorem.	
10.	Calibration of orifice meter.	
11.	Verify the impulse momentum equation (impact of jet).	

SUGGESTED READINGS

1. Gupta V. P.“Laboratory manual of Fluid Mechanics and Machines” **CBS, 9788123900094.**
2. Modi P. N. and. Seth S. M Fluid Mechanics and Hydraulic Machines, 3rd Edition, Prentice-Hall of India, 2019.
3. Kumar D. S. Fluid Mechanics and Fluid Power Engineering, S.K. Katariya & Son’s.

3CE4-21: Surveying Lab

Credit: 1.5Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+3P

Course Objectives

1. To understand the importance of surveying in the field of civil engineering.
2. To study the basics of linear/angular measurement methods like chain surveying, compass surveying.
3. To study the significance of plane table surveying in plan making.
4. To know the basics of levelling and theodolite survey in elevation and angular measurements.
5. To understand tacheometric surveying in distance and height measurements

Course Outcomes

1. CO1: Calculate angles, distances and levels
2. CO2: Understand the working principles of survey instruments
3. CO3: Estimate measurement errors and apply corrections
4. CO4: Interpret survey data and compute areas and volumes

S. No	Contents	Hours
1	Preparing a plan of an area using distances / offsets with chain and tape	
2	To carry out profile levelling and plot longitudinal and cross sections for road.	
3	Elevation measurements using trigonometric heighting using Total station	
4	Geospatial data collection for planimetric mapping of an area using handheld GNSS Receiver.	
5	Plane table survey of an area.	
6	Setting out curves.	
7	PPK positioning with DGPS Receiver system for establishing control points.	
8	RTK positioning with DGPS Receiver system for an area survey.	
9	Total station setup using bearing and resection for locating objects	
10	Layout of building in the field using Total Station and development of a wireframe model.	

SUGGESTED READINGS

1. Charles D. Ghilani & Paul R. Wolf. 2018. Elementary Surveying, Pearson.
2. Barry Kavanagh. 2018. Surveying Principles and Applications, Pearson.
3. Schoffield W., Mark Breach. 2007. Engineering Surveying, CRC Press.
4. Subramanian, R. 2007. Surveying and Leveling, Oxford .
5. Kanetkar, T.P., and Kulkarni, S.L.,2006. Surveying and Leveling Part I and II, Pune Vidhyarthi Griha Prakashan .
6. Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, 2005. Surveying Vol. I and II, Laxmi Publications .

3CE4-22: Computer Aided Civil Engineering Drawing

Credit: 1.5Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+3P

Course Objectives

1. To learn the fundamentals of civil engineering drawings.
2. To impart knowledge and skill relevant to Building detailed drawing using computer software.
3. To make student able to learn to sketch and take field dimensions and to take data and transform it into graphic drawings and AutoCad skills

Course Outcomes

Upon successful completion of the course the students will be able to;

1. CO1: Prepare simple layout of buildings
2. CO2: Produce working drawings for individual components like doors and windows etc.
3. CO3:Develop line diagram, building section, elevation, key plan and sectional elevation.
4. CO4:Illustrate hand drafting any parts of a building and implement the regulations for layout of plan.
5. CO5:Draft the plan, elevation and sectional view of the buildings

S. No	Contents	Hours
1	To plan and draw working drawing of a Residential building with Site plan, Foundation plan, Plan, Two sectional elevations, Front elevation, Furniture plan, Water supply and sanitary plan, Electric fitting plan using drawing sheet	
2	To design and draw a building among Primary Health Center, Primary School, Rest House, Post Office, Bank, College Library and Cinema Theatre using drawing sheet	
3	To study and draw the labelled sketch of different Building Components on sheets with exposure to CAD: 1) Drawing of walls i. Brick and Stone masonry ii. Cross section of external wall from foundation to parapet iii. Partition wall, cavity wall 2) Pointing, Arches, Lintels and Floors 3) Doors and Windows 4) Stairs, Cross section of Dog legged stairs 5) Roofs: Flat and Pitched roof (Steel truss) 6) Development of Front Elevation and Sectional Elevation from a given plan 7) Development of Plan, Front Elevation and Sectional Elevation from line diagram	

SUGGESTED READINGS:

1. Shah, M. G. Building Drawing. McGraw-Hill.

2. AutoCad Reference Manual
3. Kulkarni, Dhananjay M., A. P. Rastogi, and Ashoke K. Sarkar. 2009. Engineering Graphics with AutoCAD by PHI Learning Pvt. Ltd.
4. Stefan Mordue. 2015. Building Information Modeling for Dummies.
5. Sharma & Gurucharan Singh. 2020. Civil Engineering Drawing Standard Publishers.
6. Sikka V. B. 2015. A Course in Civil Engineering Drawing, Kataria & Son's.
7. George Omura. 2021. Mastering AutoCAD.
8. Kulkarni, Dhananjay M., A. P. Rastogi, and Ashoke K. Sarkar. 2009. Engineering Graphics with AutoCAD by. PHI Learning Pvt. Ltd.

3CE4-23: Geology Lab

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. To make the students capable to study and identify properties of rock and minerals.
2. Student should acquire knowledge about engineering properties of rocks and their minerals

Course Outcomes

1. CO1: Student should be able to identify rocks and minerals
2. CO2: Student should be able to interpret map and able to measure strike and dip of the bedding planes.
3. CO3: Identified the various structural geological models.

S. No	Contents	Hours
1.	Identification of Minerals in Hand Specimen	
2.	Identification of Rocks in Hand Specimen	
3.	Physical Properties of Minerals	
4.	Physical Properties of Rocks	
5.	Subsurface analysis – Resistivity sounding.	
6.	Subsurface analysis – Seismic survey	
7.	Interpretation of Geological Map (10 Nos.)	
8.	Dip & Strike Problems (8 Nos.)	
9.	Identification of Geological features through wooden Models a) Structural Geological Diagrams b) Petrological Diagrams c) Engineering Geological Diagrams	

SUGGESTED READINGS

1. Chennakesavulu, N. 2009.Text book of Engineering Geology", MacMillan Ltd., New Delhi.
2. David George. 2009. Engineering Geology: Principles and Practice, Springer.
3. Parbin Singh. 2009. A Text book of Engineering and General Geology, Katson Publishing House,Ludhiana.
4. Marshak Stephen, Mitra Gautum. 2017. Basic Methods of Structural Geology, Pearson.

3CE4-24: Civil Engineering Lab-I

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. To facilitate the understanding of the behaviour of construction materials.
2. Understand the quality control tests for the various civil engineering materials by performing different lab tests on materials.

Course Outcomes

1. CO1: Evaluate various properties of the basic construction materials as per standards.
2. CO2: Ensure quality control while testing/ sampling and acceptance criteria.
3. CO3: Analyse the concrete mix design parameters..

S. No	Contents	Hours
1.	To determine the fineness of cement - IS 4031 (Part 1):1996	
2.	To determine, for the cement paste, the: (a) 'Standard Consistency' - IS 4031 (Part 4):1988 (b) 'Initial Setting time' - IS 4031 (Part 5):1988	
3.	To determine the 'Specific Gravity' of the cement particles - IS 4031 (Part 11):1988	
4.	Determination of 'soundness of cement' - IS 4031 (Part 3):1988; and the 'compressive strength of cement' - IS 4031 (Part 6):1988	
5.	To determine the 'Specific Gravity', 'Water Absorption' and necessary adjustment for 'Bulking' of Fine Aggregates (size<10mm) - IS 2386 (Part III):1963	
6.	To determine the 'Fineness Modulus' and 'Grain Size Distribution' of Fine Aggregates - IS 2386 (Part I):1963	
7.	Determination of water absorption, compressive strength and efflorescence of bricks	
8.	To determine the consistency of concrete mixes of given proportion by using: (a) Slump Test (b) Compaction Factor Test	
9.	Determination of compressive strength of concrete	
10.	To design a concrete mix of M-20 grade in accordance with IS 10262.	
11.	To design concrete mix of M-40 grade with super plasticizer in accordance with IS 10262.	

SUGGESTED READINGS

1. Indian standard codes IS 4031 (Part 1) – 1996, IS 4031 (Part 3 and Part 5) – 1988, IS 2386 (Part 1 to Part 6) – 1963, IS 383– 2016.
2. M.L. Gambhir , Neha Jamwal. 2017. Building and Construction Materials: Testing and Quality Control (Lab Manual Series).

4CE4-01: Geotechnical Engineering-I

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To familiarize the students with the concepts of the geotechnical engineering and its related applications in Civil Engineering.
2. Understand Mechanism of compaction, factors affecting, and effects of compaction on soil properties.
3. To explain role of water in soil behaviour and how soil stresses, permeability and quantity of seepage including flow net are estimated.

Course Outcomes

1. CO1: Fundamental knowledge of soil and soil mass.
2. CO2: Basic introduction and determination of index properties of soil.
3. CO3: Conduct experimental studies to determine soil properties.
4. CO4: Carried out the process of soil compaction and soil stabilization.

S. No	Contents	Hours
1	**Fundamental Definitions & Relationships:** Soil and soil mass constituents, Water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, unit weights, density index. Interrelationship of these terms. **Index Properties:** Determination of index properties of soil, water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index.	5
2	**Soil Classification:** Classification of soil for general engineering purposes, particle size, textural H.R.B. Unified and I.S. Classification systems. **Flow through Soils:** Soil water absorbed capillary and free water, Darcy's law of permeability of soil and its determination in laboratory: Field pumping out tests, factors affecting permeability, permeability of stratified soil masses. **Seepage:** Seepage pressure, Laplace's equation for seepage. Flownet and its construction. Uplift pressure, piping, principle of drainage by Electro Osmosis, pheritic line.	11
3	**Stresses in Soil Mass:** Total effective and neutral pressure, calculation of stresses. Influence of water table on effective stress, quicksand phenomenon. Shear Strength of Soils: Mohr's circle of stress, shearing strength of soil, parameters of shear strength, Coulomb's failure envelope, determination of shear parameters by Direct Shear Box. Triaxial and unconfined compression test apparatuses.	12
4	**Soil Compaction:** Principles of soil compaction, laboratory compaction tests, Proctor's test, Modified Proctor tests, Measurement of field compaction, field methods of compaction and its control, dry and wet of optimum. Factors affecting compaction.	8
5	**Soil Stabilization:** Soil stabilization, Mechanical Stabilization, Stabilization with cement, Lime and bitumen.	6
	Total	42

SUGGESTED READINGS

1. Ranjan G. & Rao. 2007. Basic and Applied Soil Mechanics. New Age International, New Delhi.

2. Muniram Budhu. 2011. Soil Mechanics and Foundation, John Wiley & Sons, Inc.
3. Holtz R and Kovacs, WD: Introduction to geotechnical engineering by, John Wiley New York, (ISBN 63-77-7894-5).
4. Braja M. Das. 2014. Principles of Geotechnical Engineering. Cengage learning Pvt. Ltd, 8th Edition.
5. Arora, K.R. Soil Mechanics & Foundation Engineering.
6. Gulhati, Shashi K & Datta Manoj. Geotechnical Engineering Principles and Practices, Pearson Education Ltd.
7. Coduto, Donald P. Geotechnical Engineering Principles and Practices, Pearson Education Ltd.
8. TW Lambe and RV Whitma. 2004. Soil Mechanics: John Wiley New York, (ISBN 85-17-0454-7).

4CE4-02: Mechanics of Solids

Credit: 4Max **Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To understand the basic concepts of the stresses and strains for deformable bodies
2. To appreciate the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements
3. Relationship between internal forces developed and deformations occurred in the physical object
4. To analyze and understand different internal forces and stresses induced due to representative loads on structural elements
5. To analyze and understand principal stresses due to the combination of two dimensional stresses on an element, and failure mechanisms in different materials
6. To evaluate the behavior of members under torsion (shafts), compression (columns and struts), bending (beams), and internal pressure (pressure vessels)

Course Outcomes

1. To evaluate the strength of various structural elements under internal forces such as compression, tension, shear, bending and torsion.
2. To suggest suitable material from among the available in the field of manufacturing
3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts.
4. To understand the basic concept of analysis and design of members subjected to torsion.
5. To understand the basic concept of analysis and design of structural elements such as columns and struts.

S. No	Contents	Hours
1	**Introduction** A revisit to method of sections, Existence of internal forces in bodies, Concept of stress and stress resultants, Stress components on plane surface (normal and shear stresses), Elements of stress tensor and their representation on infinitesimal element in rectangular coordinates, Stress tensor as matrix, Stress tensor's symmetry property, Introduce that Elements of stress tensor change by choosing different reference axes in the material, Representation of different states of stress on infinitesimal volume element: Plane stress, triaxial stress, biaxial stress, uniaxial stress, Uniaxial tension test on steel bar: Apparatus, gauge length, Engineering stress and true stress, notion of uniaxial strain, Engineering and true stress-strain diagram of mild steel in tension and compression, Young's modulus of elasticity, Typical engineering stress-strain diagrams in tension for structural steel, aluminum, rubber, wood etc, and in compression for copper, cast iron, Idealized constitute relations (behavior) diagrams of real materials: Perfectly rigid, perfectly plastic, Elasto-plastic etc, Proof-stress for relevant materials,	9

	Material properties, Homogeneity and isotropy properties, Poisson's ratio and its determination from uniaxial tension test, Definition of strain energy from stress-strain curve: Resilience and toughness of linear elastic materials, Generalized Hooke's law: Hooke's law for normal stresses, Shear strain, Hooke's law in shear, stress circle	
2	**Uniaxial loaded members** Axially loaded bars: Uniaxial state of stress on transverse sections, State of stress on inclined sections, maximum normal and shear stresses, Changes in lengths of axially loaded members- prismatic bars, cables; Changes in lengths under non-uniform conditions-bars with intermediate axial loads, bars consisting of prismatic segments, bars with continuously varying loads or dimensions; Thermal expansion of bars, thermal stresses in bars confined between a) rigid supports and b) partially yielding supports Stresses in Statically Indeterminate Structures, Strain energy - elastic and inelastic strain energy, strain-energy density, volumetric strain	5
3	**Torsion** Torsional deformations of a circular bar - shear stress and strains outside and within the bar and in circular tubes; angle of twist; limitations of the torsion formula; Hollow circular bar (tube) - shear stresses, torsion formula for thin-walled tubes; Torsion of stepped and composting shafts; Stresses and strains in pure shear- stresses on inclined planes, strains in pure shear; Strain energy in torsion (pure shear);	5
4	**Shear Forces and Bending Moments** Introduction to types of beams, different types of support reactions, types of loads, shear forces and bending moments, relationships between loads, shear forces, and bending moments – for distributed, concentrated and couple loading; Shear-force and bending moment diagrams for concentrated load, uniform load, several concentrated loads, combination of loads, couple loading **Stresses in Beams** Pure bending and non-uniform bending, Theory of flexure for initially straight beams, distribution of bending stresses across the beam cross-section, curvature of a beam, longitudinal strains in beams, normal stresses in beams, moment-curvature relationship, flexure formula and limitations; Strain Energy due to bending Shear stresses in beams of rectangular cross section, circular cross section, beams with flanges - shear formula; distribution of shear stresses on transverse section, maximum and minimum shear stresses and limitations; applications on built-up beams, Shear flow and shear center	10
5	**Analysis of Stress and Strain** Plane stress- stresses on inclined sections, transformation equations for plane stress;	5

	Principal stresses and maximum shear stresses; Mohr's circle for plane stress; Hooke's law for plane stress; Relation between various elastic constants, Tri-axial stress - maximum shear stresses, Stresses and strains in the thin walls of spherical pressure vessels and cylindrical pressure vessels; Members subjected to combined loadings, Concept of theory of failure.	
6	**Deflections of Beams** Differential equations of the deflection curve; Deflections by integration of the second-order bending-moment (moment-curvature) equation; deflections by integration of the shear-force and load equations (fourth-order equation); Using method of superposition for obtaining deflections in complex loading and support conditions	4
7	**Columns** Buckling and Stability- Critical Load, Equilibrium, Euler buckling theory - Columns with pinned ends, column fixed at the base and pinned at the top, column with both ends fixed, effective length of columns, critical stress Columns with eccentric axial loads, the Secant formula for columns	4
	Total	42

SUGGESTED READINGS

1. Hibbeler, R.C. 2016. Mechanics of Materials. (10th Edition, 5 January 2016), Pearson; ISBN-10: 0134319656; ISBN-13: 978-0134319650
2. Popov, E.P. 1999. Engineering Mechanics of Solids. 2nd Edition, Prentice-Hall (India).
3. Beer, F.P., Johnston, Jr., E.R., DeWolf, J.T. and Mazureu, D.E. Mechanics of Materials, 5th Edition, McGraw Hill
4. Crandall, S.H., Dahl, N.C. and Lardner, T.J. An Introduction to the Mechanics of Solids, 2nd Edition, McGraw Hill
5. Rattan, S.S. 2013. Strength of Materials, McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (6th Reprint, 2013)
6. Punmia, B.C., Jain, A.K., "Mechanics of Materials" Laxmi Publication

4CE4-03: Environmental Engineering

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To understand various sources of water supply and assessment of water quantity and quality.
2. To be familiar with water distribution Network and water treatment procedures
3. Students will be acquainted with wastewater characteristics, pollution and wastewater treatment.
4. To identify the sewage problems in locality and provide solutions.ignition etc.

Course Outcomes

Student will be able to -

1. CO1: Understand treatment of water and justify type of pipes, joints in pipe & various valves useful in water supply.
2. CO2: Apply different analysis techniques for the measurement of physical and chemical
3. parameters of water and wastewater.
4. CO3: Understand the design of water treatment units.
5. CO4: Draw layout of distribution system.
6. CO5: Understand the design of sewerage system and waste water treatment units.

S. No	Contents	Hours
1	Sources of Water Supply: Surface water, ground water, springs, wells & galleries. Quantity and Quality of Water: Quantity of water per capita, variation in seasonal and hourly consumption. Forecasting of population. Standards of purity for public water supply (I.S. and WHO standards). Raw Water: Lakes and river intakes, raw water pumping. Treatment of Water: Aeration, screening, simple sedimentation, Quiescent and continuous flow types of tanks. Coagulation of water, principle of coagulation, coagulation followed by sedimentation, mixing basins.	9
2	Filtration: Slow sand filters, rapid sand filters, comparison of two filters. Disinfection: Treatment with excess lime, ozone, ultraviolet rays, boiling, chlorine and compound of chlorine for disinfection. Water Softening: Zeolite process, its limitation & advantages.	8
3	Pipes for Water Supply: Different types of pipes used in water supplies. Joints in Pipes: Bell& spigot joint, cement joint, mechanical joint, flanged joint. Valves: Air valve, reflux valve, safety valve, sluice valve. System of Supply: Constant & intermittent supply of water & its disadvantage. Layout of distribution system.	8
4	Sewage Disposal: Introduction, systems of sewage disposal, conservancy system & water carriage system. Separate, Combined and partially separate system, their advantage & disadvantage. Suitability of separate sewerage system for India. Manhole, drop manhole. Shape of sewers. Laying the sewers.	7
5	Design of Sewers: Quantity of sewage, provision for future population, Quantity of storm water, design of sewers, Estimating storm water by time of concentration method. Testing of sewer line. Cleaning of sewers. Preliminary Treatment: screening, disposal of screening, skimming tank, grit chamber, disposal of grit. Sewage Treatment: Principle of sewage, sedimentation, filtration, intermittent sand filter,	10

	introduction of trickling filter. Advantage & disadvantage of trickling filter.	
	Total	42

SUGGESTED READINGS

1. Hussain, S.K. 2017. Text book of water supply & Sanitary Engineering. Oxford & IBH Publishing co. Pvt. Ltd., New Delhi.
2. Rangewala, S.C. 2016. Fundamentals of water supply & sanitary engineering. Charotar Publisher House, Anand.
3. Garg, S.K. 2015. Water supply & sanitary engineering. Khanna Publishers. New Delhi.
4. Birdie, G. S. and Birdie. 2010. Water Supply and Sanitary Engineering.
5. Gray N.F. 2006. Water Technology. Elsevier India Pvt. Ltd., New Delhi.
6. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
7. Metcalf and Eddy. 2010. Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi.
8. Syed R. Qasim. 2010. Wastewater Treatment Plants, CRC Press, Washington D.C.
9. Garg, S.K. 2015 . Environmental Engineering, Khanna Publishers, New Delhi, Vol. II
10. Duggal K.N. 2014. Elements of Environmental Engineering S.Chand and Co. Ltd., New Delhi
11. Punmia, B.C., Jain, A.K., and Jain.A.K. 2010. Environmental Engineering, Vol.II, Laxmi Publications.
12. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.
13. Davis M. L. and Cornwell D. A. 2012 . Introduction to Environmental Engineering.

4CE4-04: Hydraulics Engineering

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To impart basic knowledge about the open channel flows with analysis of uniform flow, gradually varied flows and rapidly varied flows.
2. Expose to basic principles of working of hydraulic machineries.
3. To understand the engineering hydrology and canal hydraulics

Course Outcomes

1. CO1: Describe the basics of open channel flows, its classifications.
2. CO2: Analysis of uniform flow in steady state conditions with specific energy concept and its application.
3. CO3: Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods.
4. CO4: Acquired knowledge about hydraulic machines like pumps and turbines.
5. CO5: Analyze surface hydrological data and drawing hydrograph and other useful parameters and design economical channel section.

S. No	Contents	Hours
1	Dimensional Analysis & Models: Dynamical Similarity and Dimensional Homogeneity Model experiment, geometric, Kinematic and Dynamic similarity. Reynold's, Froude's, Weber's, Euler and Mach numbers. Distorted river models and undistorted models, proper choice of scale ratios. Scale effect. Principle of dimensional analysis Rayleigh method, Buckingham theorem.	7
2	Turbulent flow, Reynolds equations, Prandtl's mixing length theory, Equations of velocity distribution and friction coefficient Boundary Layer Theory: Concept of boundary layer, laminar and turbulent boundary layers, boundary layer thickness, von Karman integral equation, laminar sub-layer, hydro-dynamically smooth and rough boundaries, separation of flow and its control, cavitation.	6
3	Open Channel: Flow Uniform, Non-Uniform and variable flow. Resistance equations of Chezy' and Manning. Section factor for uniform flow. Most efficient rectangular, triangular and trapezoidal sections. Velocity distribution in open channels. Gradually Varied Flow: Prismatic channels, Specific energy of flow. Critical depth in prismatic channels. Alternate depths. Rapid, critical and sub critical flow, Mild, steep and critical slopes. Classification of surface curves in prismatic channels and elementary computation.	8
4	Rapidly Varied Flow: Hydraulic jump or standing wave in rectangular channels. Conjugate or sequent depths Losses in jump, location of jump. velocity distribution in open channels. Impact of Free Jets: Impact of a jet on a flat or a curved vane, moving and stationary vane. Introduction of Hydraulic machine – Type of pumps and turbines and its brief description. Draft tube and its principle.	7
5	Hydrology: Definition, Hydrologic cycle, Application to Engineering problems, measurement of rainfall, rain gauge, peak flow, flood frequency method, catchment area formulae, Flood hydrograph, Rainfall analysis, Infiltration, Runoff, Unit hydrograph and its determination,	8

	Estimation of runoff.	
6	Canal Hydraulics: Types of canals, parts of canal irrigation system, channel alignment, assessment of water requirements, estimation of channel losses, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory), cross section of channels.	6
	Total	42

SUGGESTED READINGS

1. Modi P.N. and Seth. 2013. Hydraulics and Fluid Mechanics including Hydraulic Machines. Standard Book House New Delhi. 19th edition.
2. S K Som 2012. Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd.
3. Ven Te Chow. 2009. Open Channel Hydraulics, McGraw Hill, New York.
4. Mays L. W. 2005. Water Resources Engineering, John Wiley and Sons (WSE), New York.
5. Garg S.K. and Rajeshwari Garg. 2021. Elementary Irrigation and Water Resources Engineering.
6. Mays L. W. 2005. Water Resources Engineering, John Wiley and Sons (WSE), New York.

4CE4-05: Construction Management

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

To introduce the students:

1. The economics and flow of a civil construction project,
2. from planning to execution to dismantling,
3. with involvement of different stakeholders and optimization of project resources at different phases of construction
4. so as to help a student to be able to conveniently plug-in at any stage of future construction project

Course Outcomes

Student will be able to -

CO1: Understand and appreciate construction project handling and economics

CO2: Appreciate and estimate time-value of money and assets

CO3: Perform cost estimation of construction components

CO4: Plan a basic construction project and perform network analysis

CO5: Exercise levelling resources on basic small-scale projects

CO6: Have knowledge of construction industry quality, safety aspects, claims and dispute mechanisms.

S. No	Contents	Hours
1	**Introduction to Construction Projects** Introduction to Construction Projects, Types and features, Phases of Construction Project, Project Stakeholders. (agencies involved and their methods of execution) **Economics and Cost Estimation** Project Cost Estimation from Client's perspective: Rate Analysis and Specifications, Time Value of Money, Economic Decision Making. **Tendering and Contracts** Tendering Process and Construction Contract, Cost Estimate from Contractor's Perspective (Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail etc)	8
2	**Project Planning and Network - I** Project Resources, Project Plan, Work Breakdown Structure (WBS), Steps in Project Planning: a) Prepare WBS, b) Obtain durations, cost expenditure and resource requirement for each activity, c) Obtain relationship between activities Planning Terminology: Event, Activity, Network, Precedence, Logic, Duration, Forward/Backward Pass, Float/Slack Time, Critical Path, Network Diagrams: Types like Arrow Networks (traditional AOA), Node Networks (modern AON), and superiority of Node networks, Preparation of Network Diagrams; Precedence Tables, Contiguous and Interruptible Activities,	6

3	**Project Planning and Network - II** Network Analysis CPM: Critical path method with AOA and AON networks PERT: Where to use and where not, Distributions, data binning and histogram examples, Most likely and expected durations, Probability density (PDF) and cumulative probability (CPF) functions, Standard normal distribution and z-tables, PERT calculations by drawing CPM network such as a) Determine the duration (or finish date) of the project, given the probability/likelihood b) Determine the probability of finishing the project, given the deadline	8
4	**Project Scheduling and Control** Resource Scheduling, Resource Levelling, Resource constraints and conflicts, line of balance technique, Resource categories such as a) Labor (planning, organizing, staffing, motivation), b) material (concepts of planning, procurement and inventory control) and c) equipment; Funds: cash flow, sources of funds Network crashing (compression the schedule) Broad classification of resource scheduling: a) Resource levelling and b) resource allocation, Solve examples on resource levelling Classification of costs, Time-Cost trade-off, Duration Shortening, Time-Cost Monitoring and Control using S-curve, Earned-value Analysis	10
5	**Construction Claims and Disputes** Construction Claims and Disputes, Claim Identification, Compensations, Disputes Causes, Dispute Resolution Mechanisms, Legal Proceedings. **Construction Quality and Safety** Quality control: Concept of quality, PDSA Cycle, Quality of constructed structure, Quality control and management, Use of manuals and checklists for quality control, Role of inspection, Basics of statistical quality control Quality control in RC structures: Quality of grouting and welds; Introduction to construction audit Safety and health on project sites: accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health	10
	Total	42

SUGGESTED READINGS

1. Barrie, D.S., Paulson B.C., Professional Construction Management, McGraw Hill.
2. Mubarak S.A.. Construction project scheduling and control. 4th Edition John Wiley & Sons.
3. Jha K.N., Construction Project Management: Theory and Practices, Pearson Press, 2nd Edition.
4. Chitkara, K.K., Construction Project Management, Tata McGraw Hill.
5. Joy, P.K., Handbook of Construction Management.
6. King & Hudson, Construction Hazard and Safety Handbook, Butterworths.
7. Antill J.M., Woodhead R.W., Critical Path Methods in Construction Practice, Wiley.

4CE2-01: Advanced Engineering Mathematics

Credit: 3Max **Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course Objectives

1. To familiarize the students with linear algebra and transform calculus
2. To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated

Course Outcomes

After completing this course, students will be able to understand and solve

1. CO1:Construct analytic functions and use their conformal mapping property in application problems.
2. CO2:Apply transform methods for solving linear differential equations in engineering applications

S. No	Contents	Hours
1.	**Introduction to Linear Algebra**: Algebraic Structures, Sets, Groups, Vector Spaces, Subspaces, Linear independences Linear Transformations, Addition, scalar multiplication and product of linear transformations, Polynomials of linear transformations, Constant coefficient linear differential operator, Null Space of linear transformations, Inverse of a linear transformation,	8
2.	**Laplace Transform**: Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transforms by different methods, convolution theorem. Evaluation of integrals by Laplace transform, Solving ODEs by Laplace transforms method	8
3.	**Solution of IVP using Laplace Transforms**: Introduction to Initial Value Problems (IVP), Functions of exponential order, Convergence behavior of piecewise continuous function of exponential order, Salient features of Laplace Transforms: Linear, one-to-one, existence valid for only functions of exponential order Laplace Transforms of differentiation and integration, Shifting Theorems, Laplace Transform tables Coupled Linear Differential Equations: Forced-damped vibration (derive equations for two-particle-mass system), Free-undamped vibrations, and then Uncoupling those LDEs using Laplace transform and further solving using inverse Laplace transform	8
4.	**Fourier Series and Fourier Transforms**: Fourier series: Introduction, derivation and physical interpretation; Fourier series expansion of periodic functions: Square wave, triangular wave, sawtooth wave, Fourier Complex Sine and Cosine transforms, properties of Fourier Transforms, inverse Fourier transforms, Convolution theorem, Parseval's theorem	10

	Application of fourier transforms to differential equations (heat equation and wave equations)	
5.	**Z-Transforms**: Definition, properties and formulae, Convolution theorem, inverse Z-transform, Application of Z-transform to solve difference equation	6
	Total	40

SUGGESTED READINGS

1. Robert G. Kuller, Donald R. Ostberg, Fred W. Perkins, Donald L. Kreider. 1966. An Introduction to Linear Analysis. Addison-Wesley Pub. Co., 1966
2. Erwin Kreyszig . 2017. Advanced Engineering Mathematics. John Wiley and Sons, 10th Edition,New Delhi.
3. Grewal B.S. 2017. Higher Engineering Mathematics. Khanna Publishers, 44th Edition, New Delhi.
4. Bali N., Goyal M. and Watkins C. 2009. Advanced Engineering Mathematics. Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi.
5. Glyn James. 2011. Advanced Modern Engineering Mathematics. Pearson Education, 4th Edition, New Delhi.
6. Peter V.O'Neil 2012. Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi.
7. Ramana B.V. 2010. Higher Engineering Mathematics, Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi.

4CE4-20: Environmental Engineering Lab

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. To understand the basic characteristics of water and waste water
2. To analyse the physical, chemical and bacteriological characterization of water and waste water

Course Outcomes

1. CO1: Apply different analysis techniques for the measurement of physical and chemical
2. parameters of water and wastewater
3. CO2: Recommend the degree of treatment required for the water
4. CO3: Quantify the pollutant concentration in water and wastewater
5. CO4: Microscopic studies of water and waste water.

S. No	Contents	Hours
Part A	Physical, chemical and bacteriological characterization of water and chemical dose determination for water treatment by performing following laboratory experiments: 1. To determine the pH value and the turbidity of a given sample of water 2. To determine the conductivity of a given water sample 3. To determine the free residual chlorine and chloride concentration in a given sample of water 4. To determine the optimum coagulant dose 5. To determine the temporary and permanent hardness in a given water sample. 6. To determine the dissolved oxygen (DO) in a given sample of water. 7. Microscopic studies of water	
Part B	Physical, chemical and bacteriological characterization of wastewater and strength assessment of wastewater by performing following laboratory experiments: 1. To determine the acidity and alkalinity of a wastewater sample 2. To determine total, suspended, dissolved and settable solids in a wastewater sample 3. To determine volatile and fixed solids in a wastewater sample 4. To determine the chloride concentration in a wastewater sample. 5. To determine the sulphate concentration in a wastewater sample. 6. To determine the B.O.D. of a given wastewater sample. 7. To determine the C.O.D. of a given wastewater sample. 8. Microscopic studies of a wastewater	

SUGGESTED BOOKS

1. Manual on Water Supply and Water treatment. Ministry of Urban Development, Govt. of India, New Delhi.
2. Garg, S.K. Water supply & sanitary engineering. Khanna publishers. New Delhi.

3. Standard methods for the examination of water and wastewater. 2012. 21st Edition, Washington: APHA.
4. Dr D. R. Khanna and Dr R. Bhutiani . 2008. Laboratory Manual of Water and Wastewater Analysis.
5. Sawyer, C. N., McCarty, P. L., and Perkin, G.F. 2002. Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc.
6. B. Kotaiah and Dr. N. Kumara Swamy. 2007. Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed.

4CE4-21: Hydraulics Engineering Lab

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. To understand the basic concepts of hydraulics
2. To develop an understanding of the model studies of hydraulic structures and design of open channel sections under different situations

Course Outcomes

1. CO1: Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
2. CO2: Analyze the water surface profiles under different flow situations

S. No	Contents	Hours
1	To prepare the slope calibration chart for an experimental flume.	
2	To study the velocity distribution in open channel flow.	
3	To determine the Manning's roughness coefficient of an experimental flume over different roughness beds.	
4	To conduct the laboratory flume experiment for construction of specific energy curves for various discharges.	
5	To conduct the laboratory flume experiment for plotting of gradually varying flow (GVF) profiles.	
6	To compare the experimental GVF profiles with computed GVF profiles.	
7	To conduct the laboratory flume experiment for determination of energy loss in various types of hydraulic jumps.	
8	To determine the coefficient of discharge of sharp crested weir and broad crested weir.	
9	To determine the coefficient of discharge of venturi flume.	
10	To determine the coefficient of discharge of parshall flume.	

SUGGESTED READINGS

1. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2003.
2. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012.
3. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009
4. Dr. G L Asawa (2019). "Laboratory Work In Hydraulic Engineering", New Age International (P) Ltd., Publishers, ISBN 9788122418101
5. Raikar R.K (2012)"Laboratory Manual Hydraulics and Hydraulic Machines" Prentice Hall India Learning Private Limited.

4CE4-22: Civil Engineering Lab-II

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. To impart knowledge and skill relevant to the mechanical properties of materials subjected to different types of loading.

Course Outcomes

1. CO1: Apply the knowledge of testing steel rod subjected to tension and torsion.
2. CO2: Explain the hardness of different metals.
3. CO3: Exert the knowledge about the testing of helical spring and carriage spring.
4. CO4: Acquire the knowledge about double shear test on metal and impact test on metal.

S. No	Contents	Hours
1	Tests on Mild steel–To obtain stress-strain relationship, determine material constants a) Young's Modulus, b) Poisson's ratio, and to characterize, yield stress and strain, ultimate stress, stress at fracture, fracture strain	
2	Tension test on Tor steel (HYSD bars) and proof stress	
3	Torsion Test on Mild Steel Circular Bar	
4	Bend and Rebend Test on structural reinforcement steel bars	
5	Impact test on metal specimen (Izod and Charpy)	
6	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinnel and Rockwell Tests	
7	Modulus of Rupture of Wooden Beam	
8	Characterization of concrete using NDT methods: a) Ultrasonic Pulse Velocity (UPV) test (for Elasticity modulus) (IS 516 - Part 5, Sec 1 :2018), b) Rebound Hammer test (for strength) (IS 516 - Part 5, Sec 4 :2020), and finally using c) compressive strength test in CTM (IS 516)	
9	Compressive strength of bricks(IS 3495-Part 1)	

SUGGESTED READINGS

1. Strength of Materials Laboratory Manual, Anna University, Chennai-600025.
2. IS 432(Part I) -1992 – Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
3. Rajput.R.K. 2014. Strength of Materials, S.Chand & Company Ltd., New Delhi.
4. **S.D. Hasan. 2020.** Civil Engineering Materials and their testing. ISBN **9788173197390**
5. Sood, Hemant. Laboratory manual on testing of Engineering materials. **New Age International (P) Ltd. ,** ISBN **9788122407570**
6. M.L. Gambhir , Neha Jamwal .2017. "Building and Construction Materials: Testing and Quality Control (Lab Manual Series)".

4CE4-23: Geotechnical Engineering Lab -I

Credit: 1Max **Marks: 100(IA: 60, ETE: 40)**

0L+0T+2P

Course Objectives

1. Introduce the students about the basic concepts and principles of soil mechanics.
2. Determine the index and engineering properties of soil.

Course Outcomes

1. CO1:Conduct experimental studies to determine soil properties.
2. CO2:Evaluate the compaction, consolidation characteristics of soils in engineering practices.
3. CO3: Determine the shear strength of soils.

S. No	Contents	Hours
	Laboratory Work: The students will be introduced to Index and Engineering properties of soils to complement the theory component of the course by performing experiments. They will perform related experiments as per BIS specifications.	
1.	Determination of field density by Core cutter & Sand replacement method	
2.	Grain size Analysis by Mechanical & Hydrometer Method.	
3.	Determination of Specific Gravity by Pycnometer.	
4.	Determination of Liquid Limit, Plastic limit & Shrinkage limit.	
5.	Determination of Permeability by constant head & variable head permeameter.	
6.	Consolidation Test	
7.	Unconfined Compression Test.	
8.	Direct Shear Test.	

SUGGESTED READINGS

1. Ranjan G. & Rao. 2007.Basic and Applied Soil Mechanics. New Age International, New Delhi. (ISBN 785-45-7080-1)
2. Introduction to geotechnical engineering by Holtz R and Kovacs, WD, John Wiley New York.(ISBN 63-77-7894-5)
3. Braja M. Das. 2014. Principles of Geotechnical Engineering, Cengage learning Pvt. Ltd, 8th Edition.
4. William A Kitch. 2011. Geotechnical Engineering Lab manual" Kendall/Hunt Publishing Co ,U.S.; New edition, ISBN-13 : 978-0757595332