B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE206: Soil Mechanics	**L**	**T**	**P**	**CE104: Mechanics of Solids**
	3	**1**	**2**	

Course Objective: To help students understand the importance of Soil Mechanics in Civil Engineering by studying soil properties and various aspects of soil behavior under different circumstances and loadings. This is a core subject for Civil Engineers.

S. No.	Course Outcomes (CO)
CO1	Understand the importance of Soil Mechanics. Determination of Index properties, use of functional relationships. Knowing basic concepts of clay minerals and soil structure.
CO2	Identification of soils by their classification and determination of the hydraulic conductivity of soils.
CO3	Determination of seepage through soils and determination of compaction characteristics.
CO4	Determination of stress distribution below ground level due to various surcharges at the ground surface. Determination of shear strength under various drainage conditions.
CO5	Determination of various consolidation parameters and compressibility, and their field applications. Determination of Factor of Safety for infinite and finite slopes and critical failure surface.

S. No	Contents	Contact Hours
UNIT 1	**Introduction**: Introduction to soil mechanics, Rock Mechanics, and geotechnical engineering, importance in civil engineering, nature of soil, soil formation, and soil type. **Simple Soil Properties:** Basic definitions, phase relations, index properties, basic concepts of clay minerals, and soil structure	10
UNIT 2	**Classification and Identification of Soil and Rock**: Field identification, Textural Classification, Indian Standard Soil Classification system, Group Index. Hydraulic Conductivity or permeability, Darcy's law, Discharge and Seepage velocities, Laboratory methods of determination, Factors affecting hydraulic conductivity, Hydraulic conductivity of layered soils, Neutral and effective stresses, Critical hydraulic gradient, Capillary water in soils.	8
UNIT 3	**Seepage:** Laplace's equation for simple flow problems, Flow nets, Seepage calculation from flow nets, Flow nets in anisotropic soil, Seepage pressure, Uplift pressure, Seepage through earth dams, Exit gradient, Piping, Criteria for design of filters. Compaction: General principles, Laboratory determination, Factors affecting compaction, Field compaction.	8

UNIT 4	**Stress Distribution**: Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under different loaded areas, Stress Distribution: Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under different loaded areas, Concept of pressure bulb; Newmark's influence chart, contact pressure. **Shear Strength**: Introduction, Mohr's circle of stress, Mohr-Coulomb failure theory, Shear strength parameters, Various Laboratory tests for measurement of shear strength, UU, CU, and CD tests and their relevance to field problems, Plotting of test data, Shear strength characteristics of clays, and sands.	8
UNIT 5	**Compressibility and Consolidation**: Importance of compressibility, effect of soil type, stress history, and effective stress on compressibility. Factors affecting consolidation and compressibility, Normally consolidated and over-consolidated soils, Void ratio-pressure relationship, Coefficient of compressibility and Volume change, Mechanism of consolidation, Terzaghi's theory of consolidation, Determination of Coefficient of Consolidation.	8
	Total	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Basic and Applied Soil Mechanics, 5th edition, New Age International Publishers, New Delhi, Ranjan, Gopal, and Rao, A.S.R.	2023
2	Geotechnical Engineering 6th edition, New Age International Publishers, New Delhi, Venkatramaiah, C.	2018
3	Soil Mechanics and Foundations 17th edition, Laxmi Publications (P) LTD, New Delhi, Punmia, B. C., Jain, Ashok Kumar, Jain, Arun Kumar.	2021
4	Principles of Geotechnical Engineering, 10th edition, Cengage Learning, New Delhi, Das, Braja M.	2022
5	Soil Engineering In Theory and Practice Volume 1, 4th edition or later, CBS Publishers & Distributors Pvt. Ltd., New Delhi, Singh, Alam.	2020

B.Tech. in Civil Engineering

Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
CE207: Surveying and Geoinformatics	3	0	2	NIL

Course Objective: To familiarize the students with the concepts of the subject and its related applications in Civil Engineering.

S. No	Course Outcomes (CO)
CO1	To develop an understanding of the basic concepts of surveying.
CO2	To understand the use of different surveying instruments.
CO3	To conceptualize how to use a set of survey techniques and equipment optimally.
CO4	Understand the basic concept of Remote Sensing and know about different types of satellites, sensors, and data.
CO5	Apply the concepts of photogrammetry and its applications, such as the determination of the heights of objects on terrain.

S. No	Contents	Contact Hours
UNIT 1	**Introduction: Importance of Surveying to Engineers;** Plane and Geodetic surveying, Classification of surveys, Basic Principles of Surveying, Types of maps, scales, and uses, plotting accuracy, map sheet numbering, coordinate and map projection. Organization of field and office work. Project Surveys, Hydrographic Survey, Astronomy and Map making in India: General requirement and specifications of Engineering project surveys, Reconnaissance, Principles and practices, construction surveys, location and layout surveys. Hydrographic survey, shoreline, tidal and river surveys, soundings in hydrographic survey, Terms in astronomical survey, basics of spherical trigonometry. Map in the making-survey of India publication, conventional symbol charts, and different types of maps.	8
UNIT 2	**Survey Instruments, Measurement of Distances, Angles, Azimuths:** Introduction to surveying equipment, chains, tapes, compasses, theodolites, tacheometers, EDM, total Stations, and other instruments, types of errors, sources of errors, and precautions. **Chain, Compass and Plane Table Surveys:** Chain survey procedures, errors and corrections, planning and carrying out a chain survey. Compass survey, types of compasses, and various terms related to magnetic compass, computing, and plotting a traverse. Plane table surveys and mapping.	8
UNIT 3	**Surveying Methods and Techniques -** Levelling and measurement of elevations, different methods of levelling. Methods of control establishment, traversing, triangulation, trilateration, computation of coordinates, trigonometrical levelling, theodolite surveying and tachometry, contouring,	8

	Curves: curve layout, horizontal, transition and vertical curves, Different types of survey projects.	
UNIT 4	**Geoinformatics:** Geospatial Sciences and Geospatial Technologies, Remote sensing, History of Remote Sensing, Remote sensing components, Sources of Energy, Electromagnetic spectrum, Spectral reflectance and reflectance curves, Radiation and Radiation Calculation, **Platforms and Sensors:** Orbital movement and Earth coverage. Types of Orbits, Types of resolutions, Active and passive remote sensing, Sensor's characteristics, Light and Earth surface Interactions, Indian Remote Sensing Satellite Program, Other satellites. GIS, Components of GIS, Raster and Vector data types, GIS Applications, Basic concepts of Geodesy and its Applications	8
UNIT 5	**Aerial Photography, Photogrammetry and Digital Image Processing:** Introduction, Early history of aerial photography, Basic principles of photogrammetry, image parallax, ground control for aerial photography, production of maps and ortho-photos, flight planning. Visual Image Interpretation: Introduction, fundamentals of Visual image interpretation, basic equipment used, elements of visual image interpretation, methods of search, and applications of visual image interpretation. **Digital Image Processing:** Introduction, image rectification and restoration, image enhancement, classification stage, training stage, hybrid classification, output stage, accuracy assessment, **Remote sensing data collection:** Types and Sources of Remote Sensing data, digital image data formats. Data Visualisation, DEMs, Image Processing Software.	10
	Total	**42**

REFERENCES

S. No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Punmia, B. C., "Surveying", Vol. II & III, Laxmi Publications, New Delhi(ISBN 69-85-0743-2)	2000
2	Kennie, T. J.M. and Petrie, G., "Engineering Surveying Technology", Blackie & Sons Ltd, London. (ISBN 39-12-6050-8)	1998
3	Bannister, A. and Baker, R., "Solving Problems in Surveying", Longman Scientific Technical, U.K. (ISBN 19-45-2494-7)	2000
4	Arora, K. R., "Surveying", Vol. II & III, Standard Book House, Delhi (ISBN 644-23-0774-4)	1999
5	Jensen, J.R., Digital Image Processing- A Remote Sensing Perspective, 4th ed., Pearson Education.	2000
6	Chandra, A.M. and Ghosh, S.K., "Remote Sensing and Geographical Information System", Narosa.	2000
7	Schowengerdt, R.A., "Remote Sensing – Models and Methods for Image Processing", Academic Press	2000

B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE208: Environmental Engineering -1	**L**	**T**	**P**	**CE205: Fluid Mechanics**
	3	**0**	**2**	

Course Objective: This course aims to conceptualize various aspects of water treatment schemes from its raw water source to the end user. The course helps in working out the raw water requirements, planning the layout of treatment schemes, and transmission and distribution of drinking water to end users, considering factors like reliability, cost-effectiveness, and adherence to quality and quantity parameters. The course emphasizes understanding the concept of water treatment processes and engineering unit operations to develop the effective design of treatment plants.

S. No	Course Outcomes (CO)
CO1	To describe the qualitative and quantitative requirements of drinking water for a water supply scheme and the development of skills in identifying appropriate raw water sources.
CO2	To estimate the safe yield of groundwater wells and familiarize with using Renny walls as a source of raw water. Also, to design, test, and operate the pipe network to deliver treated drinking water.
CO3	To assess the capacity of the storage/distribution reservoir of treated drinking water. Also, familiarize with the requirements of water supply for small communities.
CO4	To understand fundamental concepts of various unit operations like aeration, coagulation & flocculation, settling, and filtration. Also, to understand the concept of the total energy line and the hydraulic requirements of any water treatment scheme.
CO5	To develop the layout and schematic diagrams for any water supply schemes and design the treatment units as per the CPHEEO Manual on Water Supply & Treatment.

S. No	Contents	Contact Hours
UNIT 1	**Water demands** estimates for projected population; Population forecasting using the logistic curve method; Sources of water and their characteristics; Quality and Quantity of surface and ground waters; physical, chemical, and biological water quality parameters; Drinking water quality requirements. **Factors governing the selection** of a source of water supply. The safe yield of a confined and unconfined aquifer, Radial collector wells. Intake structures and their design	8

UNIT 2	**Methods of treatment and flow sheets** as per the CPHEEO manual; Theory of Aeration, Coagulation & flocculation, Jar test, Settling, Types of settling (I to IV), Softening, Filtration, Disinfection, Concept of total energy line through unit operations; Hydraulics requirements, Schematic diagrams. Chemical computations in water treatment in respect to coagulation, alkalinity, and water softening.	8
UNIT 3	**Designs as per CPHEEO manual**: Design of spray-type aerator, Design of Mechanical Rapid Mix Unit, Design of Clariflocculator, Design of Sedimentation tank, Design of Settling tank, Design for tube settlers, Design for Rapid Gravity Filter.	8
UNIT 4	**Various types of conduits**, connections, and fittings. Design of economical size of rising main; Thrust Block, Laying and Testing of water supply pipelines. Types and capacities of pumps. Layout of distribution network, Storage capacity of distribution reservoir, and wastage of water in the distribution system. Hardy-Cross method, equivalent pipe method of pipe network analysis. Use of EPANET for water network analysis.	8
UNIT 5	**Plumbing systems in buildings and houses**: water connections, requirements for indoor water treatment units, and water supply for small communities. assessment of the need for the project, The Proposed Project, Institutional and Financial Aspects.	10
	Total	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Peavy, Howard S., Rowe, Donald R., and Tchobanoglous, George, "Environmental Engineering," McGraw-Hill Education (India) Pvt. Ltd., New Delhi.	1985
2	CPHEEO Manual on Water Supply & Treatment, Ministry of Urban Dev., GOI.	2009
3	Garg, S.K., "Water Supply Engineering, Vol 1", Khanna Publishers, New Delhi. (ISBN 0-07-6080479-3)	2022
4	Qasim, Syed, "Water Works Engineering: Planning, Design and Operation," Prentice Hall India Learning Private Limited.	2000

B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE209: Analysis of Structure - I	**L**	**T**	**P**	**CE104: Mechanics of Solid**
	3	**0**	**2**	

Course Objective: To familiarize the students with the concepts of Analysis of Determinate Structures.

S. No	Course Outcomes (CO)
CO1	Identify different forms of structural systems.
CO2	Construct ILD and analyze the beams and trusses subjected to moving loads.
CO3	Determine the deflections of trusses, beams, and frames using Energy Methods
CO4	Determine deflection of beams using the Double Integration Method, Macaulay's Method, Moment Area Method, and Conjugate Beam Method.
CO5	Analyze three-hinged arches and cables under different loading conditions.

S. No	Contents	Contact Hours
UNIT 1	**Introduction:** Types of structural forms, conditions of equilibrium, compatibility conditions, Degree of freedom, Linear and non-linear analysis, Static and kinematic indeterminacies of structural systems.	8
UNIT 2	**Influence Lines**: Concepts of influence lines, ILD for reactions, SF and BM for determinate beams, ILD for axial forces in determinate trusses. Moving Loads: Reactions, BM and SF in determinate beams, axial forces in determinate trusses for rolling loads using ILD.	8
UNIT 3	**Energy Principles and Energy Theorems**: Principle of virtual work, Betti's Law, Strain energy due to axial force, bending, shear, and torsion, and complementary energy. Determination of Deflection of beams, trusses, and frames using total Strain Energy, Castigliano's theorems, and Unit Load Method.	8
UNIT 4	**Deflection of Beams**: Analysis of the determinate beams with the application of the Double Integration Method, Macaulay's Method, Moment area method, and Conjugate beam method.	8

UNIT 5	**Arches and Cable Structures**: Analysis of the three hinged parabolic and circular arches with supports at the same and different levels. Analysis of cables under point loads and UDL, and determination of the length of cables for supports at the same and at different levels.	10
	Total	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Theory of Structures, Stephen P. Timoshenko and D. H. Young, McGraw-Hill International Book Editions.	1965
2	Theory of Structures (SMTS II), B. C. Punmia, A. K. Jain, A. K. Jain, Laxmi Publications Pvt. Ltd.	2004
3	Elementary Structural Analysis, A.K. Jain, Nem Chand & Bros. Publication.	2016
4	Structural Analysis, R.C. Hibbeler, Prentice Hall.	2012
5	Structural Analysis, Aslam Kassimali, Sengage Learning.	2011
6	Structural Analysis: A unified classical and matrix approach, A. Ghali, A M Neville and T G Brown, Spon Press.	2003
7	Strength of Materials: Vol. I: Elementary Theory and Problems, S. Timoshenko, CBS Publishers & Distributors Pvt. Ltd.	2004
8	Strength of Materials: Vol II, S. Timoshenko, CBS Publishers & Distributors Pvt. Ltd.	2002
9	Mechanics of Materials, James M. Gere and S. Timoshenko, CBS Publishers Pvt. Ltd.	2004
10	Structural Analysis – I, S.S. Bhavikatti, Vikas Publishing House.	2011

B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE 210: Hydraulics & Hydraulic Machines	**L**	**T**	**P**	**CE205: Fluid Mechanics**
	3	**0**	**2**	

Course Objective: After successful completion of this course, i) Students must be able to understand the different types of flow and flow profiles in an open channel and design of most economic channel sections of different shapes and ii) They are also able to understand the types of hydraulic machines like various types of turbines and pumps with the details like work done, efficiencies and their design.

S. No	Course Outcomes (CO)
CO1	Differentiate between Pipe flow and Open channel flow, and various types of flows in open channel flow, like Uniform flow, gradually varied flow, and Rapidly Varied flow.
CO2	Design the most economical channel. Understand specific energy and its applications in channel transitions.
CO3	Derive the GVF equation, the RVF equation, and their applications like the Backwater curve, Hydraulic Jump, etc.
CO4	Describe how to calculate the work done and various efficiencies of different types of Turbines.
CO5	Describe how to calculate the work done and various efficiencies of different types of Pumps.

S. No	Contents	Contact Hours
UNIT 1	**Flow in Open Channels** (Uniform Flow): Types of flow in channel, Geometrical properties of channel section, velocity distributions and pressure distributions in open channel flows, open channel equations for uniform flow, most economical channel sections.	8
UNIT 2	**Non-Uniform Flow in Open Channel**: Specific energy, critical depth, concept of specific energy, alternate depths, specific energy diagram. Differential equation of GVF, Different types of flow profiles, Flow controls. Hydraulic jump.	8

UNIT 3	**Open Channel Flow Measurements**: Flow over notches and weirs, Channel transitions (Hump and change in width), channel flumes Broad crested weirs, sharp-crested weir Broad crested weirs, sharp-crested weir, ogee spillway, sluice gate flow and critical depth flumes & their applications, Channel transitions (Hump and change in width), channel flumes.	8
UNIT 4	**Hydraulic Turbines and Impact of Jets**: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for Work done and efficiency-Angular momentum principle, Torque and head transferred in rotodynamic machines., Elements of hydroelectric power plants, head and efficiencies of hydraulic turbines, classification of turbines, Pelton wheel turbine, working proportions of Pelton wheel, Design of Pelton wheel runner, study and design of Francis turbine, Draft tube theory, Cavitation, Kaplan turbine, working proportions of Kaplan turbine, Efficiency, specific speed, unit quantities and velocity triangles.	10
UNIT 5	**Centrifugal and Reciprocating Pumps**: Introduction, components/ parts and working of a centrifugal pump, work done by the impeller; heads, losses and efficiencies; minimum starting speed; Priming; reciprocating pumps, air vessels.	8
	Total	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Bansal, R. K. "Fluid Mechanics and Hydraulics Machines", Laxmi Publications(P) Ltd. (ISBN 81 7008 311 7).	2008
2	R.K. Rajput, "A Text Book of Fluid Mechanics. Hydraulic Machines" S Chand & Company Ltd.	2004
3	Subramanya, K., "Theory And Application of Fluid Mechanics including Hydraulic Machines", TMH New Delhi (ISBN 0-07-460369-8).	2006
4	Subramanya, K., "Flow in Open Channels", TMH, New Delhi. (ISBN 0-07-462446-6).	1997

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B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure. Credit = 4**			**Pre-Requisite**
CE301: Geotechnical Engineering	**L**	**T**	**P**	**CE 206: Soil Mechanics**
	3	**0**	**2**	

Course Objective: To familiarize the students with concepts of the subject and its related applications in Civil Engineering.

S. No	Course Outcomes (CO)
CO1	Introduction to the purpose and significance of soil exploration in geotechnical engineering.
CO2	To understand lateral earth pressure problems and plastic equilibrium in soils, including active, rest, and passive states.
CO3	To analyse the stability of infinite and finite slopes using various methods.
CO4	To understand the concept of shallow and pile foundations, their mechanism and design.
CO5	Introduction to machine and well foundations and their applicability on expansive soils.

S. No	Contents	Contact hours
UNIT 1	**Soil Exploration:** Purpose; Planning and reconnaissance; Various methods; Bore holes and depth of exploration; Sampling and samplers: Standard penetration test: Correlations between penetration resistance and strength parameters; Static cone test: Dynamic cone test; Plate Load test; Interpretation of test results; Indirect methods of soil exploration.	8
UNIT 2	**Earth Pressures and Retaining Structures:** Lateral earth pressure problems; Plastic equilibrium in soils, active and passive states; Earth pressure at rest, Rankine's theory of active and passive earth pressures; Active and passive earth pressure of cohesive soils: Coulomb's earth pressure theory: Graphical constructions to evaluate earth pressures; effect of surcharge and earthquake loading; earth pressure due to inclined backfills: Stability Analysis of retaining walls, choice of backfill material and importance of drainage; Bracings for open cuts. recommended design diagrams of earth pressure for typical soils; Earth pressure on cantilever and anchored sheet pile walls: Arching and its practical implications.	8
UNIT 3	**Stability of Slopes:** Factor of safety; Stability of infinite slopes; Stability of finite slopes; The Swedish circle method; Bishop's simplified method; Friction circle method; Taylor's stability number; Acceptable values of	8

	factor of safety: Critical conditions for the stability of earth dams; Road and earth dam embankments; Modes of failure and the usual protective measures; Slope inclinations usually adopted.	
UNIT 4	**Shallow Foundations:** Common types with illustrations of situations where each one of them is adopted; Terminology: Rankine's analysis; Terzaghi's bearing capacity theory; Types of failures; Bearing capacity computations in cohesionless and cohesive soils; General bearing capacity equation, Meyerhof's analysis, Effect of water table on bearing capacity; Bearing capacity on layered soil: Use of field test data; Foundation settlements; Components and limits of settlements'; Estimation of settlement of footings / rafts by using field and laboratory test data: Corrections for rigidity and 3-dimensional consolidation effects. **Pile Foundations:** Classification and uses of piles; Selection and installation of piles; Load carrying capacity of piles, dynamic and static formulae; Single pile and group actions; Pile load tests; Negative skin friction, Settlement of pile groups; Laterally loaded piles.	8
UNIT 5	**Well Foundations:** Situations where adopted; Types of wells or caissons; Elements of wells; Methods of construction: Tilt and shifts: Remedial measures; Depth and size of wells on the basis of scour depth: Bearing capacity and settlement; Terzaghi's lateral stability analysis. **Introduction to Machine Foundations:** Types of machines and their foundations; Terminology: Design criteria: Field methods of determining design parameters-Cyclic plate load test; Block vibration test; Response of block foundations under vertical vibrations. **Foundation on Expansive Soils:** Identification of expansive soil: problems associated with expansive soils: Design considerations of foundations on expansive soils; Under-reamed piles.	10
	TOTAL	**42**

List of experiments:

1. To determine shear strength parameters of soil direct shear test.
2. To determine shear strength parameters of soil using triaxial shear test.
3. To determine shear strength parameters of soil vane shear test.
4. To determine shear strength parameters of soil using unconfined compressive shear test.
5. To perform modified Proctor's test
6. To determine coefficient of consolidation of the soil
7. To determine permeability of soil by constant head permeameter.
8. To determine permeability of soil by falling head permeameter.

References

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Basic and applied soil mechanics by Gopalranjan and Rao, ASR (revised edition), New Age International, New Delhi. (ISBN 0-17-946826-2).	2000

2	Introduction to geotechnical engineering by Holtz R and Kovacs, WD, John Wiley New York. (ISBN 0-07-04452-2).	1999
3	Foundation analysis and design by Bowles., McGraw Hill (ISBN 0-07-037154-6).	1998
4	Soil Mechanies and Foundation engineering by VNS Murthy, Sai Kripa (ISBN 0-071-0498722-1).	2018
5	Scott, R.F., Foundation Analysis, Prentice Hall (ISBN 0-07-05429-5).	1981
6	Shukla, S.K Core Concepts of Geotechnical Engineering. ICE Publishing, London, UK.	2015