

4th SEMESTER

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
Theory Papers				L	T	P		
1	BSM	BSM401	Mathematics-IV	2	1	0	3	3
2	HSM	HSM015	Civil Engineering- Societal & Global Impact	2	0	0	2	1
3	PCC	CEC406	Concrete Technology	2	0	0	2	2
4	PCC	CEC407	Fluid Mechanics	3	0	0	3	3
5	PCC	CEC408	Structural Analysis-I	3	0	0	3	3
6	PCC	CEC409	Surveying-II	2	0	0	2	3
7	PCC	CEC410	Soil Mechanics	3	0	0	3	3
8	GSC	ESP401	Essentials Studies for Professionals – IV	1	0	0	1	0.5
Practical / Sessional Papers								
9	PCC	CEC496	Concrete Technology Lab	0	0	2	2	1
10	PCC	CEC497	Fluid Mechanics Lab	0	0	2	2	1
11	PCC	CEC499	Surveying-II Lab	0	0	2	2	1
12	PCC	CEC490	Soil Mechanics Lab	0	0	2	2	1
13	GSC	BTHSDP481	Skill Development for Professionals –IV	0	0	1	1	0.5
Additional								
14	MOOCS	MOOCS	Massive Open Online Courses	-	-	-	-	-
15	IFC	IFC	Industry and Foreign Certification	-	-	-	-	-
16	MAR	MAR	Mandatory Additional Requirement	-	-	-	-	-
17	PROJ	PWCE48	Mini Project-II	-	-	-	-	1
TOTAL							30	24

Mathematics-IV

BSM401

L-T-P: 3-0-0

Credits: 3

Pre-requisite:

Basic Mathematics, Mathematics and Statistics-III

Introduction:

Topics in mathematics that every educated person needs to know to process, evaluate, and understand the numerical and graphical information in our society. Applications of mathematics in problem solving, finance, probability, statistics, geometry, population growth.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Apply numerical methods to solve engineering problems.

CO2: Learn the ideas of bivariate distributions with their properties and their applications in physical and engineering environment.

CO3: Apply statistical tools for analyzing data samples and drawing inference on a given data set.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3						3	3		
CO2	3			3							3	3		
CO3	2	3	2	3							3	3		
CO4	2	3	2	3							3	3		

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module-1: Numerical Methods

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. Numerical solution of a system of linear equations: Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method. Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods.

Module-2: Bivariate Probability Distributions

Bivariate distributions and their properties (discrete & continuous), marginal distribution, distribution of sums and quotients, conditional densities & independence. Related problems.

Module-3: Correlation and Regression

Correlation, Concept of Regression. Regression Lines. To find the regression equations. Properties of Regression coefficients. Principle of Least Squares, Method of fitting a straight line & a parabola to a given set of observations. Related Problems.

Module-4: Sampling Theory

Random sampling (SRSWR & SRSWOR), parameter, statistics and its sampling distribution. Standard error of statistic. Sampling distribution of sample mean & variance in random sampling from a normal distribution (statement only). Related problems.

Module-5: Statistical Inference

Estimation of parameters: Unbiased & Consistent estimators. Point & interval estimations. Maximum likelihood estimation of parameters (Binomial, Poisson, & Normal). Confidence intervals & related problems. Testing of Hypotheses: Its definition-Null & Alternative Hypothesis, Critical Region, Level of significance, Type I and Type II errors, Best Critical Region. Related problems. Large sample tests: Large sample test for single mean, difference of means, single proportion, difference of proportions, standard deviations. Small sample tests: Small sample test for single mean, difference of means & correlation coefficient. Test for ratio of variances - Chi-square test for goodness of fit & independence of attributes.

Text Books

1. S. Ross, A First Course in Probability, Pearson Education India
2. Miller & Freund's, Probability and Statistics for Engineers, Pearson Education.
3. Spiegel M R., Schiller J.J. and Srinivasan R.A.: Probability and Statistics (Schaum's Outline Series), TMH
4. Gupta & Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Numerical Methods, Khanna Publishers

References

1. Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution), New Age International
2. Balagurusamy: Numerical Methods, Scitech.

3. Baburam: Numerical Methods, Pearson Education
4. Veerarajan, Numerical Methods, Tata McGraw Hill

NPTEL/MOOCs Links:

<https://archive.nptel.ac.in/courses/111/105/111105090/>

Civil Engineering Societal and Global Impacts

HSM015

L-T-P: 1-0-0

Credits: 1

Pre-requisite: Fundamental ideas of Environmental Studies.

Introduction: The course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena. Civil Engineering projects have an impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation, Contribution to the GDP, and on a more perceptible level, the Quality of Life. It is important for the civil engineers to realize the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial.

Course Outcomes (CO): Upon successful completion of this course, students should be able to understand:

CO1: The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.

CO2: The extent of Infrastructure, its requirements for energy and how they are met: past, present and future.

CO3: The Sustainability of the Environment, including its Aesthetics.

CO4: The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial.

CO5: Applying professional and responsible judgement and take a leadership role.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3					3				2	
CO2	3	3	3	3					3					

CO3			3			3	3	3	3				2	
CO4		3	3	3	3	3								
CO5		3	3			3	3							

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Introduction to Course and Overview; Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis.

Module 2: Understanding the importance of Civil Engineering in shaping and impacting the world; the ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering.

Module 3: Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation(Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.

Module 4: Environment-Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

Module 5: Built environment-Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.

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

Text Books:

1. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economic and Working Environment, 120th ASCE Annual Conference and Exposition.
2. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
3. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
4. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options.
5. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014.

NPTEL/MOOCs Links:

<https://www.coursera.org/specializations/engineering-of-structures-around-us>

Concrete Technology

CEC406

L-T-P: 2-0-0

Credits: 2

Pre-requisite: Fundamental knowledge of building materials and Chemistry XII level.

Introduction: The concepts developed in this course will help in understanding the knowledge of concrete as a structural material, types of cement, tests on cement and cement paste, aggregates, concrete mix design etc.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Understand the chemical composition of cement, hydration of cement, strength, tests on cement and cement paste etc.

CO2: Gain knowledge on the classification and characteristics of good aggregates, grading, requirements and their tests etc.

CO3: Understand the properties and use of admixtures.

CO4: Know various properties of fresh concrete, their strength properties.

CO5: Understand the procedure for mix design along with various types of concrete.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

<u>CO</u>	<u>PO1</u>	<u>PO2</u>	<u>PO3</u>	<u>PO4</u>	<u>PO5</u>	<u>PO6</u>	<u>PO7</u>	<u>PO8</u>	<u>PO9</u>	<u>PO10</u>	<u>PO11</u>	<u>PO12</u>	<u>PSO1</u>	<u>PSO2</u>
CO1	3	3	3	3	3	3	3		3				3	
CO2	3	3	3	3	3	3	3		3				3	
CO3		3	3	3	3	3	3		3					
CO4		3	3	3	3	3	3		3				3	
CO5		3	3	3	3	3	3		3					2

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Concrete as a Structural Material, Chemical Composition of Cement, Hydration of Cement, Heat of Hydration and Strength, Tests on Cement and Cement Paste – fineness, consistency, setting time, soundness, strength. Types of Portland cement – ordinary, Rapid hardening, low heat, sulphate resisting, Portland slag, Portland pozzolana, super sulphated cement, white cement.

Quality of Water – Mixing Water, Curing Water, Harmful Contents

Module 2: Aggregates – Classification, Mechanical and Physical Properties, Deleterious Substances, Alkali-Aggregate Reaction, Sieve Analysis, Grading Curves, Fineness modules, Grading Requirements. Testing of Aggregates – Flakiness, Elongation Tests, Aggregate Crushing Value, Ten Percent Fines Value, Impact Value, Abrasion Value

Module 3: Admixtures – different types, effects, uses, Retarders and Super plasticizers.

Module 4: Properties of Fresh Concrete – Workability, Factors Affecting Workability, Slump Test Compacting Factor Test, Flow Table Test, Segregation, Bleeding, Setting Time, Mixing and Vibration of Concrete, Mixers and Vibrators, Curing methods, Maturity.

Module 5: Strength of Concrete – Water/Cement ratio, Gel/Space ratio, Strength in Tension, Compression, Effect of Age on Strength, Relation between Compressive and Tensile Strength, Fatigue Strength, Stress Strain Relation and Modulus of Elasticity, Poisson's Ratio, Shrinkage and Creep, Compression Test on Cubes, Cylinders, Introduction to Non Destructive Tests (Rebound hammer & Ultrasonic pulse velocity)

Module 6: Mix Design by I.S. 20262 (2009), Light-weight, Polymer and Fibre-reinforced concrete, Special concrete; types and specifications, Fibre reinforced and steel Fibre reinforced concrete, Polymer concrete.

Textbooks:

1. Shetty, M. S., & Jain, A. K. (2019). Concrete Technology (Theory and Practice), 8e. S. Chand Publishing.
2. Neville, A. M., & Brooks, J. J. (1987). Concrete technology (pp. 242-246). England: Longman Scientific & Technical.

NPTEL/MOOCs Links:

NPTEL: <https://nptel.ac.in/courses/105102012>

LinkedIn: <https://www.linkedin.com/learning/practical-engineering>

Concrete Technology Lab**CEC496**

List of experiments:

1. Tests on cement – specific gravity, fineness, soundness, normal consistency, setting time, compressive strength on cement mortar cubes.
2. Tests on fine aggregate – specific gravity, bulking, sieve analysis, fineness modulus, moisture content, bulk density and deleterious materials.
3. Tests on coarse aggregate - specific gravity, sieve analysis, fineness modulus, bulk density.
4. Tests on Fresh Concrete: Workability: Slump, Vee-Bee, Compaction factor tests.
5. Hardened Concrete: Compressive strength on Cubes, Split tensile strength, Static modulus of elasticity, Flexure tests, Non-destructive testing (Rebound hammer & Ultrasonic pulse velocity).
6. Mix Design of Concrete.

NPTEL/MOOCs Links:

<https://nptel.ac.in/courses/105102012>

Fluid Mechanics**CEC407****L-T-P: 2-0-2****Credits: 3**

Pre-requisite: Fundamental knowledge of Physics and Mathematics XII level.

Introduction: The concepts developed in this course will help in understanding the concept of fluid statics, fluid kinematics and dynamics; fluid pressure, classifications of fluid flow etc.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:
CO1: Understand the basic concepts of fluid mechanics.

CO2: Gain knowledge on fluid statics and dynamics.

CO3: Understand the classifications of fluid flow.

CO4: Know one-, two- and three -dimensional continuity equations.

CO5: Understand the surface and body forces along with equations of motion.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

<u>CO</u>	<u>PO 1</u>	<u>PO 2</u>	<u>PO3</u>	<u>PO4</u>	<u>PO5</u>	<u>PO6</u>	<u>PO 7</u>	<u>PO8</u>	<u>PO9</u>	<u>PO10</u>	<u>PO11</u>	<u>PO12</u>	<u>PSO1</u>	<u>PSO2</u>
CO1	3	3	3	3	3		3		3				3	
CO2	3	3	3	3	3				3				3	
CO3		3	3	3	3		3		3				3	
CO4		3	3	3	3				3					
CO5		3	3	3	3		3		3					

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Module 2: Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Module 3: Fluid Kinematics-Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Module 4: Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturi meter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π -Theorem.

Textbooks:

1. Young, D. F., Munson, B. R., Okiishi, T. H., & Huebsch, W. W. (2010). A brief introduction to fluid mechanics. John Wiley & Sons.
2. Rajput, R. K. (2015). A textbook of fluid mechanics and hydraulic machines. S. Chand Publishing.

NPTEL/MOOCs Links:

<https://nptel.ac.in/courses/105101082>

<https://www.coursera.org/learn/fluid-power>

Fluid Mechanics Lab**CEC497****Lists of Experiments:**

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualisation -Ideal Flow
10. Length of establishment of flow
11. Velocity distribution in pipes
12. Laminar Flow

NPTEL/MOOCs Links:

<https://nptel.ac.in/courses/105101082>

Structural Analysis-I**CEC408****L-T-P: 3-0-0****Credits: 3**

Pre-requisite: Solid Mechanics

Introduction: The course explains the basic concepts of structures and the response of the structures when subjected to external loading. The topics to be covered include the basic concepts of mechanics, analysis of determinate structures, deflection of determinate structures.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Formulate Equilibrium and compatibility equations for structural members.

CO2: Analyze one dimensional and two-dimensional problems using classical methods.

CO3: To analyze determinate structures: beam, truss and portal frames.

CO4: To find the deflection of determinate structures: beam, truss and portal frames

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

<u>CO</u>	<u>PO1</u>	<u>PO2</u>	<u>PO3</u>	<u>PO4</u>	<u>PO5</u>	<u>PO6</u>	<u>PO7</u>	<u>PO8</u>	<u>PO9</u>	<u>PO10</u>	<u>PO11</u>	<u>PO12</u>	<u>PSO1</u>	<u>PSO2</u>
CO1	3	3	3			3	3		3				3	
CO2	2	3	3			3	3		2				3	2
CO3	3	3	2			3	3		3		3		3	2
CO4	3												3	

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Review of basic concept of mechanics: Equilibrium, Free body diagram, Determinate and Indeterminate structures, Degree of indeterminacy for different types of structures: Beams, Frames, Trusses.

Module 2: Analysis of determinate structures: Portal frames, arches, cables Strain energy: Due to axial load, bending and shear, Torsion; Castigliano's theorems, theorem of minimum potential energy, principle of virtual work, Maxwell's theorem of reciprocal deflection, Betti's law.

Module 3: Deflection of determinate structures: Moment area and Conjugate beam method, Energy methods, Influence line diagrams: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shears. Unit load method for beams, Deflection of trusses and simple portal frames.

Text Books

1. Ramamrutham Theory of Structures.
2. C.S.Reddy Basic Structural Analysis By Tata McGraw Hill Publications.
3. Bhavikatti Structural Analysis Vol I And Vol II By Vikas Publishing House.

References

1. Statically Indeterminate Structures CK Wang By McGraw Hill Publications.
2. Engineering Mechanics of Solids E.P.Popov By Pearson Educations.

NPTEL/MOOCs Links:

<https://www.coursera.org/learn/engineering-of-structures-response-of-structures>

<https://www.coursera.org/learn/engineering-of-structures-tension>

Surveying-II

CEC409

L-T-P: 3-0-0

Credits: 3

Pre-requisite: Fundamental knowledge of Physics and Mathematics XII level.

Introduction: The concepts developed in this course will help in building the concept of surveying and leveling in civil engineering.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Understand the working of total stations

CO2: Learning to interpret images in remote sensing software

CO3: Learning to setting out of curves.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

<u>CO</u>	<u>PO1</u>	<u>PO2</u>	<u>PO3</u>	<u>PO4</u>	<u>PO5</u>	<u>PO6</u>	<u>PO7</u>	<u>PO8</u>	<u>PO9</u>	<u>PO10</u>	<u>PO11</u>	<u>PO12</u>	<u>PSO1</u>	<u>PSO2</u>
CO1														
CO2														
CO3														

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Traversing by Using Theodolite: Preparation of Gales Table from field data

Module 2: Traversing by using Total Station

Module 3: Use of Total Station for leveling and Contouring

Module 4: Setting out of Simple Curves

Module 5: Interpretation of images using Remote Sensing Software.

Textbooks:

1. Basak, N. N. (1994). Surveying & Levelling. McGraw-Hill Education.

NPTEL/MOOCs Links:

<https://archive.nptel.ac.in/courses/105/104/105104101/>

Surveying-II Lab**CEC499**

- 0 Traversing by Using Theodolite: Preparation of Gales Table from field data
- 1 Traversing by using Total Station
- 2 Use of Total Station for leveling and Contouring
- 3 Setting out of Simple Curves
- 4 Interpretation of images using Remote Sensing Software.

Soil Mechanics**CEC410****L-T-P: 3-0-0****Credits: 3**

Pre-requisite: Fundamentals of Mathematics and Physics at XI and XII level are required.

Introduction: The course discusses the basic classification, characterization, hydraulic and mechanical properties of soils in depth.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Understand the different types of soil based on their formation mechanism and characterization.

CO2: Understand the principles of compaction and its control, permeability.

CO3: Understand the concept of seepage characteristics and effective stress.

CO4: Understand the concept of consolidation and ground settlements.

CO5: Identify shear strength parameters for field conditions.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO1	3	3							3				3	
CO2	3	3							3				3	2
CO3	2	3							3					2
CO4	3	3							2				3	
CO5	3	3							3				3	2

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Introduction—Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships—Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method.

Module 2: Plasticity Characteristics of Soil- Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils- Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups

Module 3: Permeability of Soil- Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

Module 4: Effective Stress Principle- Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Module 5: Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

Module 6: Stresses in soils – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.

Module 7: Consolidation of Soil -Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Module 8: Shear Strength- Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behavior of UU, CU and CD tests, pore pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test.

Text/Reference Books

1. Soil Mechanics by Craig R.F., Chapman & Hall
Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
2. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
3. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
4. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
5. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy
6. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
7. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

NPTEL/MOOCs Links:

NPTEL: <https://nptel.ac.in/courses/105101201>

Linkedin: <https://www.linkedin.com/learning/practical-engineering/groundwater-movement-and-the-quick-condition>

<https://www.linkedin.com/learning/practical-engineering/expansive-soils>

<https://www.linkedin.com/learning/autodesk-civil-3d-2021-essential-training/analyze-surface-slope>

Soil Mechanics Lab CEC490

Possible Experiments:

List of Experiment

1. Field identification of different types of soil as per Indian standards [collection of field samples and identifications without laboratory testing, determination of natural moisture content.
2. Determination of specific gravity of i) Cohesionless ii) cohesive soil
3. Determination of insitu density by core cutter method & sand replacement method.
4. Grain size distribution of cohesionless soil by sieving & fine-grained soil by hydrometer analysis.
5. Determination of Atterberg's limits (liquid limit, plastic limit & shrinkage limit).
6. Determination of co- efficient of permeability by constant head permeameter (coarse grained soil) & variable head parameter (fine grained soil).
7. Determination of compaction characteristics of soil.
8. Determination of compressibility characteristics of soil by Oedometer test (co-efficient of consolidation & compression Index).
9. Determination of unconfined compressive strength of soil.
10. Determination of Shear parameter of soil by Direct shear test.
11. Determination of undrained shear strength of soil by Vane shear test.
12. Determination of shear parameter of soil by Triaxial test (UU).
13. Standard Penetration Test.

NPTEL/MOOCs Links:

<https://nptel.ac.in/courses/105101160>

Essentials Studies for Professionals – IV

ESP401

L-T-P: 0-1-0

Credits: 0.5

Pre-requisite: Basic concepts in mathematics and economics.

Introduction: This course examines Taxes in India and market structure. The Topics to be covered (tentatively) include: National income, Market structure, Science & Technology, Logical Reasoning.

Course Outcomes (CO): In this course we will study the basic components of upcoming Science & technology. Students are expected to be capable of understanding the Indian Taxsystem, their advantages and drawbacks, how to implement in Indian Economy, how their drawbacks can be

overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Know about many books and authors.

CO2: Gain knowledge about important dances & festivals of Indian states.

CO3: Understand the values of Important about banks like payment banks, small banks & license system.

CO4: Know about many learning techniques.

CO5: Know about different short cut techniques to solve any kind of aptitudes.

CO6: Know about different short cut techniques to solve any kind of reasoning.

CO7: Know about different short cut techniques to solve any kind of communicating problems.

CO8: Know about different short cut techniques to solve any kind of societal problems.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

<u>CO</u>	<u>PO1</u>	<u>PO2</u>	<u>PO3</u>	<u>PO4</u>	<u>PO5</u>	<u>PO6</u>	<u>PO7</u>	<u>PO8</u>	<u>PO9</u>	<u>PO10</u>	<u>PO11</u>	<u>PO12</u>	<u>PSO1</u>	<u>PSO2</u>
CO1	3	3	3		3							3		
CO2	3			3								3		
CO3	3	3	3									3		
CO4	3	3	3		3							3		
CO5	3	3	3		3							3		
CO6	3			3								3		
CO7	3	3	3									3		
CO8	3	3	3		3							3		

3 – High; 2 – Medium; 1 – Low

Course Contents:

Section A: Employment Enhancement Skills-IV

Module-1: GK&CA, Modern History & National Movement. Indian Geography at a glance (Physical, Regional & Economic) Tax: Concept of TAX, objective of TAX, Direct & Indirect Tax, Progressive, Regressive & Proportional tax.

Module-2: Calendar, capitals of countries, currency of countries, important dates, Sports football, hockey etc. recent events & awards too.

Module-3: Important books & authors, Important Hydropower dams, atomic power plants, important national parks, Minister & portfolio & constituencies, Population census, Persons in

news most famous, popular recent only,

Module-5: Important dances & festivals of Indian states, International Head Quarters & world organization, important president & pm elected from various countries

Module-6: Important about banks like payment banks, small banks & license system, Awards, Sports, Books & author, National & International affairs.

Section B: Skill Development for Professional – IV

Module-1: Quantitative Aptitude: Permutation & Combination. Probability- basic concepts of probability, different theorems & applications, binomial, poisson & normal Distributions. Geometry- Concept of different shapes like triangle, quadrilateral, rectangle, square, circle etc. different theorems & their applications. Mensuration-Formulae on triangles, square, Rhombus, parallelogram, sphere, circle, cone, pyramid etc. Application based problem solving. Coordinate Geometry- Locus, Straight lines, Circle etc.

Module-2: Reasoning: Puzzles: Seating Arrangement

a) Circular seating arrangement

b) Square seating Arrangement

c) Line Arrangement, Calendar and Clock, Miscellaneous Problems

Sentence: a) Sentence Corrections b) Fill the blanks with appropriate words/articles/ preposition/ verbs/adverbs/conjunction. **d) Reading Comprehension (Advance Level) d) Vocabulary**

Logical Reasoning: Alphanumeric series, Analogies, Artificial Language, Blood Relations, Calendars, Cause and Effect, Clocks, Coding-Decoding, Critical path, Cubes and cuboids. Data Sufficiency, Decision Making, Deductive Reasoning/Statement Analysis, Dices, Directions Embedded Images, Figure Matrix, Input-Output, Mirror and Water Images, Odd One Out, Picture Series and Sequences, Paper Folding, Puzzles, Pattern Series and Sequences, Order & Ranking, Seating Arrangements, Shape Construction, Statement and Assumptions, Statement and Conclusions, Syllogism.

Module-4: Advanced Data Interpretation level-IV Newspaper reading: The Hindu & Economic Times

Text Books

1. The Oxford Handbook of Tax System in India: An Analysis of Tax Policy and Governance (Oxford Handbooks) by Mahesh C. Purohit, Vishnu Kanta Purohit
2. Taxation of Income from Non Resident Indian under DirectTaxLaw-2019
Edition by Ram Dutt Sharma

References

1. Marketing Management| marketing cases in the Indian context| Fifteenth Edition By Pearson by Philip Kotler, Keven Lane Keller
2. A Modern Approach to Logical Reasoning, by R.S.Aggarwal