





### List of Subjects as Elective (1)

Sl. No.	Subject Code	Subject Name	L-T-P	Credit
1	CE4L003	Advanced Transportation Engineering	3-0-0	3
2	CE4L004	Rock Mechanics and Tunnelling	3-0-0	3
3	CE4L005	Maintenance and Rehabilitation of Concrete Structures	3-0-0	3
4	CE4L006	Computational Hydraulics	3-0-0	3
5	CE4L008	Hydraulic and Hydrologic Analysis and Design	3-0-0	3
6	CE4L022	Bridge Engineering	3-0-0	3
7	CE4L023	Prestressed Concrete	3-0-0	3
8	CE4L042	Advanced Foundation Engineering	3-0-0	3
9	CE4L043	Numerical Methods in Geotechnical Engineering	3-0-0	3
10	CE4L044	Soil Engineering	3-0-0	3
11	CE4L045	Earth Retaining Structures	3-0-0	3
12	CE4L053	Open Channel Hydraulics	3-0-0	3
13	CE4L054	Water Resources Systems	3-0-0	3
14	CE4L055	Design of Hydraulic Structures	3-0-0	3
15	CE4L062	Pavement Design	3-0-0	3

NB: Any other subjects of same or higher level floated by any other specialisations of SIF or any other Schools can also be taken as an elective, as suggested by faculty advisor/PG Coordinator

### List of Subjects as Elective (1 to 5)

Sl. No.	Subject Code	Name	L-T-P	Credit
1	CE6L304	Advanced Concrete Technology	3-0-0	3
2	CE6L305	Theory of Plates & Shells	3-1-0	4
3	CE6L306	Seismic Design of Structures	3-1-0	4
4	CE6L307	Bridge Engineering	3-0-0	3
5	CE6L308	Infrastructure Maintenance and Rehabilitation	3-0-0	3
6	CE6L309	Modern Construction Materials	3-0-0	3
7	CE6L310	Advanced construction Techniques	3-0-0	3
8	CE6L311	Construction Project Management	3-0-0	3
9	CE6L312	Advanced Design of RC Structures	3-1-0	4
10	MA6L002	Advanced Techniques in Operation Research	3-1-0	4
11	MA7L020	Nonlinear Functional Analysis	3-1-0	4
12	CE6L008	Hydraulics of Sediment Transport	3-0-0	3
13	CE6L017	Advanced Transportation Systems Analysis	3-0-0	3
14	CE6L018	Analysis and Design of Pavements	3-0-0	3
15	CE6L019	Pavement Evaluation, Maintenance and Rehabilitation	3-0-0	3
16	CE6L020	Dynamics of Soil and Foundations	3-0-0	3
17	CE6L021	Soil-Structure Interaction	3-0-0	3
18	CE6L022	Ground Improvement	3-0-0	3
19	CE6L023	Computational Geomechanics	3-0-0	3
20	CE6L024	Geotechnical Earthquake Engineering	3-0-0	3
21	CE6L025	Geotechnical Risk and Reliability	3-0-0	3
22	CE6L026	Advanced Soil Mechanics	3-0-0	3
23	CE6L027	Free Surface Flows	3-0-0	3
24	CE6L028	Applied Elasticity	3-0-0	3
25	CE6L029	Structural Health Monitoring	3-0-0	3

NB: Any other subjects of same level floated by any other specialisations of SIF or any other Schools can also be taken as an elective, as suggested by faculty advisor/PG Coordinators

<b>Subject Code: CE1P001</b>	<b>Name: Engineering Drawing &amp; Graphics</b>	<b>L-T-P: 1-0-3</b>	<b>Credit: 3</b>
<p><b>Prerequisite: None</b></p> <p>Introduction to IS code of drawing; Conics and Engineering Curves - ellipse, parabola, hyperbola, cycloid, trochoid, involute; Projection of lines - traces, true length; Projection of planes and solids; solid objects - cube, prism, pyramid, cylinder, cone and sphere; Projection on Auxiliary planes; Isometric projection, isometric scale; Section of solids - true shape of section; Introduction to CAD tools - basics; Introduction of Development and Intersection of surfaces.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Bhatt, N.D., Elementary Engineering Drawing, Charotar Publishing House</li> <li>• Gill, P.S., Engineering Drawing &amp; Engg. Graphics, S. K. Kataria &amp; Sons</li> <li>• Lakshminarayan, L.V. &amp; Vaish. R.S., Engineering Graphics, Jain Brothers</li> </ul>			
<b>Subject Code: CE2L001</b>	<b>Name: Solid Mechanics</b>	<b>L-T-P: 3-1-0</b>	<b>Credit: 4</b>
<p><b>Prerequisite: None</b></p> <p>Stress analysis: forces and moments, theory of stress, principal stresses and stress invariants, compatibility equations, equilibrium equations; Strain analysis: deformation and velocity gradients, Lagrangian and Eulerian description and finite strain, small deformation theory, principal strains and strain invariants, compatibility conditions; Bending of Symmetric and non-symmetric sections; Thick cylinders and pressure vessels; Introduction of theory of elasticity Simple problems (semi-inverse method); Theories of failure; Stress concentration; Fatigue; Creep and relaxation.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Kazioni, S.M.A., Solid Mechanics, Tata McGraw Hill,</li> <li>• Popoo, E.P., Introduction to Mechanics of Solids, Prentice Hill of India</li> <li>• Crandall, S.H., Dahl, N.C., Lardner, T.J. and Sivakumar, M.S., An Introduction to Mechanics of Solids, Tata McGraw Hill</li> <li>• Jindal, U. C., Strength of Materials, Pearson</li> <li>• Timoshenko, Strength of Materials, CBS</li> </ul>			
<b>Subject Code: CE2L002</b>	<b>Name: Surveying</b>	<b>L-T-P: 3-0-0</b>	<b>Credit: 3</b>
<p><b>Prerequisite: None</b></p> <p>Introduction: Elements of surveying and mapping, types of surveys, Measurement of Distance, Direction and Elevation. Chain Surveying, Compass Surveying, Plane Table Surveying, Levelling and Contouring, Theodolite Surveying, Layout of curves, Tacheometry, Triangulation, Computation of Area and Volume, Total Station, Global Positioning System, Introduction to Remote Sensing and Geographical Information System.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Punmia, B.C., Surveying Vol. I, II and III, Laxmi Publication Pvt. Ltd.</li> <li>• Arora, K. R., Surveying Vol. I, II and III, Standard Book House.</li> <li>• Gopi, S., Sathikumar, R. and Madu, N., Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India.</li> </ul>			
<b>Subject Code: CE2P002</b>	<b>Name: Surveying Practice</b>	<b>L-T-P: 0-0-3</b>	<b>Credit: 2</b>
<p><b>Prerequisite: None</b></p> <p>Introduction, Types of Surveys, Chaining, Taping, Corrections, Angle and Direction Measurements, Prismatic compass, Measurement of bearing, Computations of angles from bearings, Theodolite Surveying, Temporary Adjustments, Traversing, Principle of Levelling,</p>			

Simple and Differential Levelling, Adjustments, Plane table Surveying, Different Methods, Two and Three Point Problems, Minor Surveying Instruments, Setting out Simple Works. Practicals: Chaining, Offsets, Field book entry, Triangulation AND Traversing, Compass Surveying AND Traversing, Plane Table Surveying , Two Point and Three Point Problems, Levelling, Level book entry, Preparation of contour Map, Study of Theodolites and Angle Measurements, Theodolite Traversing, Techeometric Traversing, Use of Distomat / Theomat, Interpretation of Aerial Photographs AND Satellite Imagery. Surveying through Total Station equipment.

**Subject Code: CE2L003**

**Name: Introduction to Civil Engineering and Construction Materials**

**L-T-P: 3-0-0**

**Credit: 3**

**Prerequisite: None**

Introduction to Civil Engineering; Major Divisions; Civil Engineering Infrastructures; Ethics in Civil Engineering; Properties of construction material and their evaluation; test methods and specifications; Cement - chemical composition, properties such as setting, strength, fineness, hydration; Aggregates - sources, properties, chemical reactivity; Concrete - constituents, proportioning, properties in fresh and hardened state, characteristic strength, quality control, transportation and placing, testing, porosity; Admixtures - chemical, mineral; Steel - properties, types of steel, steel in civil engineering; Bricks - manufacture, properties and classification; masonry bonds; Wood - Structure, defects & preservation; Paints, New materials - Fibre reinforced plastics (FRPs), epoxy-coated bars, Geo-synthetics etc., Construction methodologies and equipment.

**Books:**

- Taylor, G.D., Materials of Construction, Prentice Hall
- Mehta P.K. and Montiero, P.M.J., Concrete - Material, Microstructure and Properties, Tata Mcgraw Hill
- Gambhir, M.L., Concrete Technology, Tata Mcgraw Hill
- Neville, A.M. and Brooks, J.J., Concrete Technology, ELBS/Longman
- Neville, A.M., Properties of Concrete, 4th Edition, ELBS/Longman
- Dayaratnam, P. Brick and Reinforced Brick Structures, Oxford and IBH
- Ghose, D.N., Construction Materials, Tata Mcgraw Hill
- Relevant IS codes for testing and specifications

**Subject Code: CE2L004**

**Name: Structural Analysis**

**L-T-P: 3-1-0**

**Credit: 4**

**Prerequisite: None**

Stability and Determinacy of Structures; Analysis of Statically Determinate Structures; Review of shear force and bending moment diagrams in beams and frames; Plane trusses: Deflection of trusses; Deflection of beams and frames; Influence line diagrams and moving loads; Analysis of Statically Indeterminate Structures; Force and stiffness methods of analysis; Plane trusses by using method of consistent deformations, Beams and frames: Plane trusses by using direct stiffness method; Curved beams, arches and rings;

**Books:**

- Wang, C.K., Intermediate Structural Analysis, McGraw Hill
- Vazirani, V.N. and Ratwani, M.M., Analysis of Structures Vol-1, Vol-2, Khanna Publishers
- Ramamrutham, S. and Narayan, R., Theory of Structures, Dhanpat Rai

<b>Subject Code: CE2L005</b>	<b>Name: Hydraulics</b>	<b>L-T-P: 3-1-0</b>	<b>Credit: 4</b>
<p><b><u>Prerequisite: None</u></b></p> <p>Basic properties of water; Determination of hydrostatic forces; Kinematics of flow; Potential flow; Continuity, Energy and Momentum principles; Open channel flow; Uniform and gradually varied flows; Dimensional analysis; Hydraulic similitude and Modelling; Flow in pipes and Pipe networks; Hydraulics machines; Pumps and Turbines.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Subramanya, K., Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill</li> <li>• Kundu, P.K., Cohen, I.M. and Dowling, D.R., Fluid Mechanics, Academic Press, Elsevier</li> <li>• White, F.M., Fluid Mechanics, Tata McGraw Hill</li> <li>• Streeter, V.L., Fluid Mechanics, Tata McGraw Hill</li> </ul>			
<b>Subject Code: CE2L006</b>	<b>Name: Transportation Engineering</b>	<b>L-T-P: 3-0-0</b>	<b>Credit: 3</b>
<p><b><u>Prerequisite: None</u></b></p> <p>Different Modes of Transportation; Highway Development in India; Highway Alignment, Survey and Detailed Project Report; Geometric Design of Highways: cross-sectional elements, horizontal and vertical alignments; Elements of Traffic Engineering; Pavement Materials: subgrade soil, aggregates, bituminous binders; Pavement Design: design of flexible and rigid pavements, Elements of Highway Construction: embankment, subgrade, subbase and base courses, bituminous surface courses, concrete pavements, soil stabilization; Drainage; Evaluation and Maintenance of highways.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand &amp; Bros</li> <li>• Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers</li> <li>• Chakraborty, P. and Das, A., Principles of Transportation Engineering, Prentice Hall of India</li> </ul>			
<b>Subject Code: CE2P001</b>	<b>Name: Transportation Engineering Laboratory</b>	<b>L-T-P: 0-0-3</b>	<b>Credit: 2</b>
<p><b><u>Prerequisite: None</u></b></p> <p>Tests on Bitumen: Penetration Test, Viscosity Test, Ductility Test, Softening Point Test; Tests on Aggregates: Crushing test, Abrasion Test, Impact Test, Shape Test; CBR test on Soil, Dynamic Cone penetrometer Test, Roughness measurement of road surface, Traffic Studies: Classified Traffic Volume Count, Speed Studies etc.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Khanna, S. K. and Justo, C.E.G., Highway Material Testing, Nem Chand &amp; Bros.</li> <li>• Khanna, S.K, Justo, A and Veeraragavan, A, Highway Materials and Pavement Testing, Nem Chand &amp; Bros.</li> <li>• Kadiyali, L. R., Traffic Engineering and Transportation Planning, Khanna Publishers</li> </ul>			
<b>Subject Code: CE3L001</b>	<b>Name: Design of Reinforced Concrete Structures</b>	<b>L-T-P: 3-1-0</b>	<b>Credit: 4</b>
<p><b><u>Prerequisite: None</u></b></p> <p>Introduction to the design of Concrete structures: Structural Systems, Materials, Loadings and Structural Analysis, Working Stress Design, Ultimate Load Design, Limit State Design; Working Stress Design: Beams for Bending Moment and Shear Force; Limit State Design: Beams for Bending Moment, Shear Force, Bond and Torsion. Axially and eccentrically loaded Columns. Beam-Columns for combined compression and flexure. One and two-way Slabs, Structural Components: Isolated and Combined Footings; Lintels, Stair Cases, Retaining Walls.</p>			

**Books:**

- Gambhir, M.L., Design of Reinforced Concrete Structures, PHI Learning
- Varghese, P.C., Limit State Design of Reinforced Concrete, PHI Learning
- Pillai, S.U. and Menon, D., Reinforced Concrete Design, Tata McGraw Hill
- Punmia, B.C., Jain A.K. and Jain A.K., Reinforced Concrete Structures Vol-I and II, Laxmi Publications
- Park, R. and Pauley, T., Reinforced Concrete Structures, Willey International

<b>Subject Code: CE3L002</b>	<b>Name: Soil Mechanics</b>	<b>L-T-P: 3-1-0</b>	<b>Credit: 4</b>
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**Prerequisite: None**

Introduction, formation of soils, index properties and classification of soils, soil compaction, proctor and modified compaction, field control of compaction, effective stress, stress point and stress path, soil-water-system - surface tension and capillarity, Darcy's law, permeability of soils, methods of determining coefficient of permeability, seepage analysis, flow nets, piping, quick sand condition, compressibility and consolidation of soils, normally and over consolidated soil, time rate of consolidation, determination of coefficient of consolidation, shear strength of soils, direct shear and triaxial tests, Mohr-Coulomb strength criterion, CU, CD and UU tests, pore pressures, Skempton's pore pressure coefficients.

**Books:**

- Murthy, V.N.S., Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering by Marcel Dekkar, Inc., USA
- Das, B.M., Principles of Geotechnical Engineering, PWS Publishing Company, Boston, USA.
- Terzaghi, K., Ralph B.P. and Mesri, G., Soil Mechanics in Engineering Practice, John Wiely and Sons, Inc.
- Muniram, B., Soil Mechanics and Foundations, John Wiely and Sons, Inc.
- Lambe, T.W., Whitman, R.V., Soil Mechanics, John Wiely and Sons, Inc. Canada.
- Parry, R.H.G., Mohr Circles, Stress Paths and Geotechnics, E & FN SPON publishers.

<b>Subject Code: CE3L003</b>	<b>Name: Water Resources Engineering</b>	<b>L-T-P: 3-0-0</b>	<b>Credit: 3</b>
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**Prerequisite: None**

Concepts of hydrologic cycle; Measurement and analysis of precipitation and runoff; Hydrograph analysis; Irrigation requirement of crops; Design of canals; Design and drawing of weirs and barrages; cross drainage works; Classification; analysis; design and drawing of Gravity and Earth dams; Design and drawing of spillways and energy dissipators.

**Books:**

- Subramanya, K., Engineering Hydrology, Tata McGraw-Hill
- Garg, S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers
- Chow, V.T., Maidment, D.R. and Mays, L.W., Applied Hydrology, Tata McGraw-Hill

<b>Subject Code: CE3P001</b>	<b>Name: Structural Engineering Laboratory</b>	<b>L-T-P: 0-0-3</b>	<b>Credit: 2</b>
<p><b>Prerequisite: None</b></p> <p>Casting and load-deformation test of reinforced concrete and post tensioned beams; Cement test: Standard consistency, setting times, compressive strength, fineness and soundness; Aggregate Tests: Sieve analysis, Bulking of sand, Aggregate crushing value, Absorption, Unit weights; Tension test of MS, HYSD, HT bars: Yield/Proof stress, Ultimate Strength, Young's modulus, percentage elongation; Compressive strength of bricks and Pre-conditioning; Load deformation testing of steel beam; Concrete mix design and slump test; Demonstration of flow table, compacting factor and V.B. tests; Compressive strength of cubes by Non-Destructive Testing; Dynamics of SDOF, MDOF systems; Indirect tensile strength of cylinders.</p>			
<b>Subject Code: CE3P002</b>	<b>Name: Soil Mechanics Laboratory</b>	<b>L-T-P: 0-0-3</b>	<b>Credit: 2</b>
<p><b>Prerequisite: None</b></p> <p>Specific gravity test, sieve analysis, hydrometer analysis, Atterberg's limits tests, Proctor compaction test, relative density of sand, in-situ density test, permeability tests, direct shear test, unconfined compression test, vane shear test, triaxial tests, consolidation test.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Lambe, T.W., Soil Testing for Engineers John Wiley &amp; Sons Inc.</li> <li>• Murthy, V.N.S., Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, Marcel Dekkar, Inc., USA.</li> <li>• Robert W.D., Soil Testing Manual: Procedures, Classification Data, and Sampling Practices, McGraw-Hill Professional.</li> </ul>			
<b>Subject Code: CE3P003</b>	<b>Name: Water Resources Engineering Laboratory</b>	<b>L-T-P: 0-0-3</b>	<b>Credit: 2</b>
<p><b>Prerequisite: CE2L005: Hydraulics</b></p> <p>Experiments on flow measurements in open channels and pipes; verification of momentum and energy equations; hydraulic jump; measurement of hydrostatic and hydrodynamic forces; flow in open channels; specific energy</p>			
<b>Subject Code: CE3L004</b>	<b>Name: Design of Steel Structures</b>	<b>L-T-P: 3-0-0</b>	<b>Credit: 3</b>
<p><b>Prerequisite: None</b></p> <p>Introduction to Steel Structure Design: Structural Systems, Design Loads and Load Combinations, Rolled Sections and Built-up sections; Working Stress Design; Plastic Design; Limit State Design Methods; Design of structural fasteners: rivets, bolts and welds. Simple and Eccentric Connections; Design of tension members; Design of compression members; Design of Built-up column using lacing and battening; Design of flexure members; Design of Beam-Column; Design of Column Bases; Design of Plate Girder and Gantry Girder.</p> <p><b>Books:</b></p> <ul style="list-style-type: none"> <li>• Subramanian, N., Design of Steel Structures, Oxford University Press</li> <li>• Duggal, S.K., Limit State Design of Steel Structures, McGraw Hill</li> <li>• Ram, K S, Design of Steel Structures, Pearson Education</li> </ul>			



<b>Subject Code: CE3L005</b>	<b>Name: Foundation Engineering</b>	<b>L-T-P: 3-0-0</b>	<b>Credit: 3</b>
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**Prerequisite: None**

Introduction, examples of foundation problems, site characterization, soil exploration, site investigation methods, in-situ tests, Bearing capacity: general, local and punching shear failure, effect of size, shape, depth and water table, Settlement of foundations: elastic, consolidation and total settlement, Types of foundation: shallow and deep foundations, isolated, combined, mat etc., contact pressure distribution, basics of design of shallow foundation, deep foundation type, load transfer mechanism in piles, pile capacity, laterally loaded pile, test pile and pile load test, efficiency of pile group, settlement of pile, earth pressure theories: Rankine's theory, Coulomb's theory, Stability analysis of earth retaining structures - gravity, cantilever, counterfort, Slope stability: finite slopes and infinite slopes, Bishop's simplified method, method of slices.

**Books:**

- Bowles, E., Foundation Analysis and Design by Joseph, McGraw Hill Higher, USA.
- Das, B. M., Principles of Foundation Engineering, Cengage Learning.
- Das, B. M., Principles of Geotechnical Engineering, Cengage Learning.
- Budhu, M., Soil mechanics and foundations, Wiley Publishers, New Delhi.
- Murthy, V. N. S., Principles of Soil Mechanics and Foundation Engg, UBSPD.
- Khan, I.H., A text book of Geotechnical Engg, Prentice Hall India.
- Gopal Ranjan & Rao, A. S. R. Basic and Applied Soil Mechanics, Wiley Eastern Ltd.

Bowles, Joseph E. Foundation analysis and design, McGraw-Hill Publishers

<b>Subject Code: CE3L006</b>	<b>Name: Water and Wastewater Engineering</b>	<b>L-T-P: 3-1-0</b>	<b>Credit: 4</b>
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**Prerequisite: None**

General requirement for water supply, population forecasting and water demand, sources, intake, pumping and transportation of water; Physical, chemical and biological characteristics of water and their significance, Water quality criteria, Water borne diseases, Natural purification of water sources. Engineered systems for water treatment: aeration, sedimentation, softening, coagulation, filtration, adsorption, ion exchange, and disinfection. Generation and collection of wastewater, quantities of sanitary wastes and storm water. Design of sewerage system Primary, secondary and tertiary treatment of wastewater; Wastewater disposal standards. Basics of microbiology. Biological wastewater treatment systems: Aerobic processes - activated sludge process and its modifications, trickling filter, RBC, Anaerobic Processes- conventional anaerobic digester, High rate and hybrid anaerobic reactors. Sludge digestion and handling. Disposal of effluent and sludge Design problems on water and wastewater treatment units and sludge digestion.

**Books:**

- Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., Environmental Engineering, McGraw-Hill International Ed.
- McGhee, T. J, Water Supply and Sewerage, McGraw-Hill Inc.
- Davis, M. L and Cornwell, D. A, Introduction to Environmental Engineering, McGraw-Hill, Inc.
- Metcalf & Eddy, Wastewater Engineering- Treatment and Reuse (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill.
- Sawyer, C. N, McCarty, P. L and Parkin, G. F., Chemistry for Environmental Engineers, McGraw- Hill.
- APHA, Standard Methods Examination of Water and Wastewater, American Public Health













































































