

## Civil and Infrastructure Engineering

Semester IV						
S.No	Course Code	Course Name	L	T	P	C
1	CE202T	<u>Surveying and Geomatics</u>	2	1	0	6
2	CE202L	<u>Surveying and Geomatics Laboratory</u>	0	0	3	3
3	CE203T	<u>Structural Analysis</u>	2	1	0	6
4	ME204L	<u>Solid Mechanics Lab</u>	0	0	3	3
5	ME202L	<u>Fluid Mechanics Lab</u>	0	0	3	3
6	CE301T	<u>Environmental studies</u>	3	0	0	6
7	CE204T	<u>Water Resources Engineering</u>	3	0	0	6
		Institute Elective-I	2	1	0	6
		Total Credits				39

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1	<b>Title of the course (L-T-P-C)</b>	<b>Surveying and Geomatics 2-1-0-6</b>
2	<b>Pre-requisite courses(s)</b>	
3	<b>Course content</b>	<ol style="list-style-type: none"> <li>1. Introduction to Plane &amp; Geodetic Surveying, Fundamental Principles, Traversing, Leveling, Instrumentation</li> <li>2. Digital Levels, Total Station- Basics, Different types of surveying methods, Different sources of errors, Error adjustments</li> <li>3. GNSS- Basic concepts, Different types of GPS errors, Different types of GNSS based surveying techniques</li> <li>4. Ground Penetrating RADAR- Basics, Survey techniques, GPR Radargram Interpretation</li> <li>5. LiDAR concepts- Terrestrial LiDAR, Airborne LiDAR overview</li> <li>6. Unmanned Aerial System (UAS) Photogrammetry &amp; Remote Sensing overview</li> </ol>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>1. B.C. Punmia, A.K. Jain and A.K. Jain, Surveying, Vol. 1 and II, 5th or later editions, Laxmi Publications, New Delhi, 2015.</li> <li>2. Chandra A. M., Higher Surveying, New Age International Publishers, 2007</li> <li>3. Chandra A. M., Plane Surveying, New Age International Publ., 2007</li> <li>4. James, M Anderson &amp; Edward M Mikhail., Surveying Theory and Practice, Tata Mc Graw Hill, 2012</li> <li>5. Charles D Ghilani, Paul R Wolf., Elementary Surveying, Prentice Hall, 2012</li> <li>6. Satheesh Gopi, R. Sathikumar, and N. Madhu. Advanced Surveying: Total Station, GIS and Remote Sensing 1st Edition, 2007, Pearson India</li> <li>7. Charles D. Ghilani, Elementary Surveying: An Introduction to Geomatics (15th Edition) Pearson Publishers. 2017</li> <li>8. Pinliang Dong, Qi Chen. LiDAR Remote Sensing and Applications, 1st Edition, CRC Press</li> <li>9. Harry M. Jol. Ground Penetrating Radar Theory and Applications, 1st Edition, 2009, Elsevier publications.</li> <li>10. Journal articles as informed by the instructor</li> </ol>

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1	<b>Title of the course (L-T-P-C)</b>	<b>Surveying and Geomatics Laboratory 0-0-3-3</b>
2	<b>Pre-requisite courses(s)</b>	
3	<b>Course content</b>	<ol style="list-style-type: none"><li>1. Introduction to Survey Instruments</li><li>2. Compass Traverse</li><li>3. Theodolite Traverse</li><li>4. Differential Levelling</li><li>5. Profile and Cross Section Survey</li><li>6. Trigonometric Levelling</li><li>7. Tacheometric Surveying</li><li>8. Total Station Surveying</li><li>9. GPS Surveying</li><li>10. Surveying &amp; Mapping using Global Navigation Satellite System (GNSS)</li></ol>
4	<b>Texts/References</b>	<ol style="list-style-type: none"><li>1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I &amp; II, Laxmi Publications, 2015</li><li>2. James, M Anderson &amp; Edward M Mikhail., Surveying Theory and Practice, Tata Mc Graw Hill, 2012</li><li>3. Charles D. Ghilani, Elementary Surveying: An Introduction to Geomatics (15th Edition) Pearson Publishers. 2017</li></ol>

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1	<b>Title of the course (L-T-P-C)</b>	<b>Structural Analysis 2-1-0-6</b>
2	<b>Pre-requisite courses(s)</b>	NIL
3	<b>Course content</b>	<ol style="list-style-type: none"> <li>1. <b>Method of consistent deformation:</b> Indeterminate beams - Propped cantilever, Fixed and Continuous beams - Analysis for shear force and bending moment - Clapeyron's theorem of three moments - Slope and deflection - effect of sinking of supports.</li> <li>2. <b>Slope - Deflection Method:</b> Analysis and application to continuous beams - portal frames (single bay - Single storey).</li> <li>3. <b>Moment-Distribution Method:</b> Analysis of continuous beams and portal frames (single storey single bay).</li> <li>4. <b>Analysis of pin jointed frames</b> (one degree redundancy); Forces in indeterminate pin jointed frames due to temperature variation and lack of fit;</li> <li>5. <b>Influence lines and Moving Loads for beams:</b> Maximum bending moment and shear force diagrams for simply supported spans traversed by single point load - two concentrated loads - Uniformly distributed load, shorter and longer than the span - enveloping parabola and equivalent uniformly distributed load, determination of maximum bending moment and shear force for a system of concentrated loads on simply supported girders - focal length of a girder - counter bracing.</li> <li>6. <b>Influence lines and Moving Loads for trusses:</b> Influence lines for simple trusses, Muller - Breslau Principle, Influence lines for reactions, shear force at a point and bending moment at a section of beams with fixed ends and two span continuous beams.</li> </ol>
4	<b>Texts/References</b>	<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. R.C. Hibbeler, Structural Analysis, 8th Edition, Pearson Education.</li> <li>2. Junarkar. S. B and Shah H.J- Mechanics of Structures Vol 1 &amp; Vol.2 – 27th Edition, Charotar Publishers, 2008.</li> <li>3. Wang C.K. - Intermediate Structural Analysis – Tata McGraw Hill Publishers, 2010.</li> <li>4. L.S. Negi, Theory and Problems in Structural Analysis, Tata McGraw Hill Pub, 1997.</li> <li>5. Reddy C.S.- Basic Structural Analysis - Tata McGraw- Hill Publishing Company Ltd.</li> </ol>

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1	<b>Title of the course (L-T-P-C)</b>	<b>Solid Mechanics Lab (0-0-3-3)</b>
2	<b>Pre-requisite courses(s)</b>	Nil
3	<b>Course content</b>	<p><b>List of Experiments:</b></p> <ul style="list-style-type: none"> <li>● Calibration of photoelastic material using a disk under diametral compression, a beam under four-point bending and an uni-axial tensile specimen; and SCF evaluation in a circular ring, crane hook and a plate with hole.</li> <li>● Stresses in thin pressure vessels using strain gauges;</li> <li>● Deflection of curved beams – a ring, a semi-circular ring, a quadrant and an angular davit</li> <li>● Stability of columns – To evaluate the buckling load for different materials (Steel, Copper, Aluminium and Brass) under different end conditions (Hinge-Hinge and Hinge- fixed condition)</li> <li>● Hardness test – Rockwell, Vickers and Brinell Hardness test</li> <li>● Impact testing machine: Izod and Charpy test</li> <li>● Torsion testing machine</li> </ul> <p>Tests of UTM: Tension (Ductile and Brittle), compression (brittle and ductile), bending of beam, leaf spring characteristics</p>
4	<b>Texts/References</b>	<p>S. Crandall, N. Dahl, S. Lardner, An Introduction to Mechanics of Solids, Tata MG Hill, 2012.</p> <p>E.P. Popov, Engineering Mechanics of Solids, Prentice Hall, 2012.</p> <p>Gere and Goodno, Mechanics of Materials, 7th ed., Cengage Learning India, 2012. Gere and Timoshenko, Mechanical of Materials, CBS Publishers, 1986.</p>

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1	<b>Title of the course (L-T-P-C)</b>	<b>Fluid Mechanics Lab (0-0-3-3)</b>
2	<b>Pre-requisite courses(s)</b>	Exposure to Fluid Mechanics
3	<b>Course content</b>	<p><b>List of Experiments:</b></p> <ul style="list-style-type: none"> <li>● Stability of floating bodies for determining the metacentre and buoyancy</li> <li>● Reynolds experiment for laminar/turbulent flow visualisation</li> <li>● Measurement of discharge coefficient for different shaped orifices with varying head</li> <li>● Demonstration of Bernoulli's principle</li> <li>● Visualisation of Free and Forced vortices</li> <li>● Demonstration of linear momentum and impact forces of Jet for different deflection angles</li> <li>● Pressure loss in pipe friction for laminar/turbulent flow</li> <li>● Minor losses in Pipe system (fittings: bend, elbow, contraction/expansion)</li> <li>● Major losses in Pipe system: Effect of pipe material, dimensions</li> <li>● Fluidized Granular Bed</li> <li>● Submerged Jet</li> <li>● Flow Measurement by Venturi-meter, Orifice-meter &amp; Rota-meter</li> <li>● Heleshaw Apparatus</li> <li>● Hydraulic Jump</li> <li>● Course project set-up</li> </ul>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>1. Yunus A. Cengel, John M. Cimbala, Fluid Mechanics, Tata McGraw Hill Education, 2011.</li> <li>2. F.M.White, Fluid Mechanics, Seventh Edition, Tata McGraw Hill Education, 2011.</li> <li>3. Philip J.Pritchard, Alan T.Mcdonald,RobertW.Fox, Introduction to Fluid Mechanics, Wiley, 2009.</li> <li>4. John F. Douglas, J. M. Gasoriek, Lynne Jack and John Swaffield, Fluid Mechanics, Pearson, 2008.</li> </ol>

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<b>1</b>	<b>Title of the course (L-T-P-C)</b>	<b>Environmental studies (3-0-0-6)</b>
<b>2</b>	<b>Pre-requisite courses(s)</b>	<b>Nil</b>
<b>3</b>	<b>Course content</b>	<p>Module A: Introduction to Environment Studies – Need for the study of the environment in technical education, Human Population, sustainability, Global perspective, Urban Transformation, people and nature, Science and values, Climate change and its possible causes. Water Treatment Discussion of water quality constituents and introduction to wastewater treatment and processes, Solid Waste Management, and Different aspects of solid and hazardous waste management (CIE) (9 Hr)</p> <p>Module B: Natural Resources, Ecosystems, Biodiversity and its conservation: Natural resources and ecosystems, Forest, grassland, desert and aquatic ecosystems, biodiversity at global, national and local levels, conservation of biodiversity. (BSBE) (9 Hr)</p> <p>Module C: Air Pollution- Introduction, classification, and source (natural, vehicular, and industrial) of air pollutants, the effect of air pollution (human health, plant pathology, and global impact), greenhouse effect and global warming, aerosols, smog, acid rain, analytical methods for monitoring air pollution, prevention and control of air pollution. (Chemistry) (9 Hr)</p> <p>Module D: Environment- Perspective from Social Sciences, Sociological Perspective of Environmentalism, Political Economy in Environmental Studies, Basic Environmental Economics, Economic development and environment, Philosophy of Environmental ethics and moralities (HEART) (9 Hr)</p> <p>Module E: Field work and project: visit to a local area to document environmental assets, case studies of a simple ecosystem, and group discussions on current environmental issues. (All) (6 Hr)</p>
<b>4</b>	<b>Texts/References</b>	<ul style="list-style-type: none"> <li>• Botkin and Keller “Environmental Science. John Wiley &amp; Sons, 2012</li> <li>• Hannigan, John. Environmental sociology. Routledge, 2022.</li> <li>• Saravanan, Velayutham. Political Economy of Development and Environment in Modern India. Routledge India, 2023.</li> <li>• Attfield, R. (2018). Environmental philosophy and environmental ethics for sustainability. The Sage handbook of nature, 1, 38-58.</li> <li>• Muthukrishnan, Subhshini, . Introduction to Environmental Economics. PHI Learning. 2024.</li> <li>• Worrel A W and P A Vesilind, Solid Waste Engineering, Cengage Learning, 2012</li> <li>• William Cunningham and Mary Cunningham, Environmental Science: A Global Concern, McGraw Hill 2022</li> <li>• Gilbert M. Masters, Wendell P. Ela-Introduction to Environmental Engineering and Science- Pearson, 2022</li> </ul>