

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

1. **Subject Code:** CEC-102                      **Course Title:** Geospatial Engineering – I
2. **Contact Hours:**    **L:** 2                      **T:** 0                      **P:** 2
3. **Examination Duration (Hrs.):**    **Theory:** 3                      **Practical:** 0
4. **Relative Weightage:**    **CWS:** 10-25    **PRS:** 25    **MTE:** 15-25    **ETE:** 30-40    **PRE:** 0
5. **Credits:** 3                                      **6. Semester:** Spring                      **7. Subject Area:** PCC
8. **Pre-requisite:** NIL
9. **Objective:** To impart knowledge of basic principles on field surveying procedures and practices for civil engineering applications.

**10. Details of Course:**

S.No.	Contents	Contact Hours
1.	Geospatial Engineering - Definition, Importance and its relevance to engineering projects, basic principles. Classification of surveys based on instruments and survey work.	2
2.	Types of maps, scales and uses, plotting accuracy, map sheet numbering, map projections.	2
3.	Levelling: Different Levels, Temporary and Permanent Adjustments in Levels. Determination of elevation, spirit leveling. Contouring	5
4.	Linear and Angular measurements: Tapes, EDM, Compass, Theodolites, Tacheometer, Temporary and permanent adjustment in equipment. Measurement of angles, directions and distances.	5
5.	Methods of control establishment, traversing, triangulation, trilateration, adjustment of survey measurements, computation of coordinates. Adjustment in traversing	5
6.	GPS surveying – principles and methods, applications, DGPS, error in observations and corrections.	5
7.	Curves: horizontal, Vertical, Transition, Layout of curves	4
<b>Total</b>		<b>28</b>

## **List of Practical**

1. Demonstration and study of different types of maps, atlases, conventional symbols and SOI map numbering system.
2. Determine elevations of at least five points from a given BM/TBM using IOP level.
3. (i) Carry out fly leveling to transfer R.L. from a given BM/TBM using Auto Level  
(ii) Carry out leveling work using Digital levels.
4. Study the different parts of a Vernier Theodolite and measure of horizontal angles between two lines by method of repetition.
5. Using a Vernier Theodolite, measure of horizontal angles between two lines by among four given lines by method of reiteration and vertical angle to find out the height of a building.
6. Demonstration and hands-on-experience of Total Station for collection, download and reduction of sample data.
7. Demonstration of different types of GPS receivers for collection, download and processing of sample data.
8. Establish Control points using single frequency GPS receiver. Carry out post- processing using GNSS solutions software. Plot these points.
9. Demonstration of Digital Level and Smart Station.
10. Layout a traverse of five/six sides using Total Station. Carry out detail computations and adjust the traverse using Gale's Table. Plot the traverse at suitable scale for mapping the area.
11. Prepare a map using data collected by Total Station using methods of radiation, intersection and resection. Use SOI standard symbols and colors to depict the features.

## **11. Suggested Books:**

<b>S.No.</b>	<b>Name of Authors/Books/Publisher</b>	<b>Year of Publication/Reprint</b>
1.	Garg, P.K., Theory and Principles of Geoinformatics, Khanna Book Publishing Co., Delhi, 1 <sup>st</sup> Edition	2019
2.	Ghosh, J.K. Elementary Engineering Surveying, Studium Press, New Delhi, 1 <sup>st</sup> Edition	2010
3.	Ghosh, J.K. A Text Book on GPS Surveying, CRC Press, US, 1 <sup>st</sup> Edition	2016
4.	Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill, 7 <sup>th</sup> Edition	1998
5.	Arora, K.R., "Surveying", Vol. I, II and III, Standard Book House, 17 <sup>th</sup> Edition	1995
6.	Chandra, A.M., "Plane Surveying", New Age Publishers. 3 <sup>rd</sup> Edition	2002
7.	Schofield, W. and Breach M., "Engineering Surveying", 6 <sup>th</sup> Ed., Butterworth-Heineman.	2007
8.	Sateesh, Gopi, Sathikumar, R. and Madhu, N., Advanced Surveying: Total Station, GPS, GIS & Remote Sensing, Pearson.	2017

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**1. Subject Code:** CEE-103

**Course Title:** Theory of Structures

**2. Contact Hours:**

**L:** 3

**T:** 1

**P:** 0

**3. Examination Duration (Hrs):**

**Theory:** 3

**Practical:** 0

**4. Relative Weight: CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0

**5. Credits:** 4

**6. Semester:** Autumn

**7. Subject Area:** ESC

**8. Pre-requisite:** NIL

**9. Objective:** Introduction to different types of structures and their analyses under various loading conditions.

**10. Details of Course:**

S. No.	Contents	Contact Hours
1.	Types of Engineering Materials, Introduction to Structural Elements, Types of supports, Stresses and Strains: Elastic Constants and their mutual relationships	6
2.	Analysis of Statically determinate Trusses: Method of Joints and Method of Sections	4
3.	Bending Moment and Shear Force Diagrams for Determinate Beams under Simple Types of Loads, Method of Super Position	6
4.	Members Subjected to Flexural Loads: Statically determinate beams, support reactions, relationship between load, shear force and bending moment, shear force and bending moment diagrams; Theory of flexure for initially straight beams, distribution of bending stresses across the beam cross-section, principal stresses in beams; flexure.	6
5.	Slope and Deflection of Beam: Equation of elastic curve for loaded beam, relationship between bending moment, slope and deflection; Calculation of deflection by Integration Method, Moment area Method, S.E. in flexure, Conjugate Beam Method	7
6.	Unit Load Method for Determination of Slopes and Deflections in Beams and Frames and Deflection of Trusses	4
7.	Redundant Structures: Static and Kinematic Indeterminacy	3
8.	Moment Distribution Method for Analysis of Continuous Beams, Portal Frames and Multistoried Structures	6
<b>Total</b>		<b>42</b>

**11. Suggested Books:**

<b>S. No.</b>	<b>Name of Authors/Books/Publisher</b>	<b>Year of Publication/Reprint</b>
1	Hibbeler R.C., "Structural Analysis:", Pearson Press, 10 <sup>th</sup> Edition	2007
2	Leet K.M., Uang C.M., and Gilbert A.M., "Fundamentals of Structural Analysis", McGraw Hill, 3 <sup>rd</sup> Edition	2007
3	Gere J.M. and Goodno J.M., "Mechanics of Materials", Cengage Learning, 9 <sup>th</sup> Edition	2009
4	E.P. Popov, "Engineering Mechanics of Solids", Pearson Press, 2 <sup>nd</sup> Edition	2005

**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEL-203

**Course Title:** Intelligent Transportation System

**L-T-P:** 2-1-0

**Credits:** 03

**Subject Area:** PEC

**Course Outlines:** Introduction to Intelligent Transportation System, ITS Architecture, Data Collection Techniques, Traffic Management Centers, Applications of Intelligent Transportation System.

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEC-104

**Course Title:** Fluid Mechanics

**L-T-P:** 3-0-2/2

**Credits:** 03

**Subject Area:** PCC

**Course Outlines:** Fundamentals of Stagnant, Hydrostatic Forces, Manometers, Kinematics of flow, Bernoulli's equation and its Applications, Flow Measuring Devices, Laminar, and Turbulent flow through Pipes, Flow through different Conduits, Hardy-Cross Method, Pipe Networks, the Concept of Boundary Layer Theory and Drag and Lift forces.

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEE-102

**Course Title:** Mechanics of Solids

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

**Credits:** 4

**Subject Area:** ESC

**Course Outlines:** Mechanical properties of deformable solids, the concepts of equilibrium, stress-strains and deformations in mechanical components and structures under various loadings for Engineering analysis and design.

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEE-106

**Course Title:** Geospatial Techniques and Programming

**L-T-P:** 3-0-2

**Credits:** 4

**Subject Area:** ESC

**Course Outlines:** Introduction to Geospatial Engineering, Surveying Measurements and Techniques, GPS Surveying, Photogrammetry, Remote Sensing, Geospatial Programming, Geographic Information System and Practical.



**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEE-104      **Course Title:** Design of Reinforced Concrete Elements

**L-T-P:** 3-1-2/2

**Credits:** 4

**Subject Area:** ESC

**Course Outlines:** Properties of Concrete and reinforcing steel, concepts of RCC Design: Working stress method and Limit state method, Design for flexure, shear, torsion and axial loads, Design of different structural members such as slabs, beams, columns, foundations, Basic concepts of analysis and design of prestress concrete members.

## **INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEE-105

**Course Title:** Design of Steel Elements

**L-T-P:** 2-1-0

**Credits:** 3

**Subject Area:** ESC

**Course Outlines:** Properties of steel, Different steel sections, Wind and other loads in steel structures, Concepts of limit state design of steel structures, Design of bolted and welded connections, Eccentric connections, Design of tension and compression members, Rolled section beams and Built-up beams.

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTER/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEO-101      **Course Title:** Probability Methods in Engineering Problems

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

**Credits:** 3

**Subject Area:** OEC

**Course Outlines:** Random variables; Probability; Correlation; Conditional probabilities; Bayesian inference; Independence and conditional independence; Probabilistic transformations; Combinations of random variables. Optimum Design Concepts: Optimality Conditions; Optimal Design with MATLAB. Unconstrained Design Optimization; Constrained Design Optimization; Applications of Optimization. Genetic Algorithm for Optimum Design; Multi-objective Optimum Design. Fundamentals of probability theory, General component reliability; First-order second-moment methods; First and Second-order reliability method. Importance measures and parameter uncertainty; Sampling techniques; Surrogate Modelling. Reliability based design codes; System reliability.

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTER/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEO-103

**Course Title:** Water Resources Engineering

**L-T-P:** 3-0-2/2

**Credits:** 3

**Subject Area:** OEC

**Course Outlines:** To impart knowledge of methods of Harnessing available Water Resources Irrigation and Soil-Water Relationships, Consumptive use, Canal irrigation, Planning, Alignment and Capacity of Irrigation, Canal systems, Hydraulics, and design of stable channels including Alluvial, The concepts related to Sediment Transport in Alluvial Channels, Design of Hydraulic Structures, Design of Diversion Head Works and Hydropower

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTER/SCHOOL:** Department of Civil Engineering

**Subject code:** CEC-201

**Course Title:** Geospatial Engineering-II

**L-T-P:** 2-0-6

**Credits:** 5

**Subject Area:** PCC

**Course Outlines:** Photogrammetry, Remote Sensing, Remote Sensing Sensors and its data products, Digital Image Processing, Geographic Information Systems, Introduction to UAV, Applications of Geospatial Engineering in Civil Engineering, Field Survey Camp

## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEC-203

**Course Title:** Structural Analysis-I

**L-T-P:** 3-0-2/2

**Credits:** 3

**Subject Area:** PCC

**Course Outlines:** Introduction to different types of civil structures, Types of loading on structures and responses, Internal forces and concept of determinacy, Internal forces in statically determinate structures: truss, frames, arches, cables, Bending moment and Shear force diagrams, Deformation of determinate structures, Energy methods, Castigliano's theorem, Principle of least work, Principle of virtual work, Analysis of indeterminate structures, Flexibility/Force method, Stiffness/Displacement method.

**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Civil Engineering

**Subject Code:** CEC-205

**Course Title:** Channel Hydraulics

**L-T-P:** 3-0-2/2

**Credits:** 3

**Subject Area:** PCC

**Course Outlines:** Introduction to Channel Hydraulics, Specific energy, Subcritical and Supercritical flows, Uniform Flow, Gradually Varied Flow, Hydraulic Jump, Flow Measurement devices in Channels, Fluvial Hydraulics, and Unsteady Flow used in the Design of inland Waterways for Irrigation and Navigation.