B. Tech. Civil Engineering
Semester-V

L-3 T-0 P-0 C-3

CVE-320: Advance Surveying and Remote Sensing

Course Objectives

- Understand various advanced instruments, their concepts and terminology involved in civil Engineering.
- Understand the aerial and terrestrial photogrammetric surveying.
- Use the applications of remote sensing in civil construction alteration works, detecting land use and land cover, creating base maps for visual reference.
- Find the modern surveying techniques for addressing the field problems in real time.
- Develop proficiency in conducting survey using advanced instruments and methods.
- Acquire the necessary skills to work with advanced instruments and methods.

Course Outcomes (COs)

After completion of course, students will be able to: -

CO 1 Understand various types of digital instruments used in surveying for accurate measurement and data record keeping.

CO 2 Understand various methods of surveying astronomy in tracing alignment and path at suitable locations.

CO 3 Analyze the GPS and GIS surveying

CO 4 Apply the methods of terrestrial photogrammetric, flight planning and Stereoscopy for preparing 3D geographical maps.

CO 5 Apply the remote sensing & GIS data in various filed like in disaster management, agriculture etc.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	2	2	2	-	-	1	-	-	1	1	2	1	1	2	2	-
CO2	3	2	2	2	2	2	-	-	1	-	-	1	-	-	-	-	-	2	-
CO3	3	2	2	2	2	2	-	-	1	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	2	2	2	-	-	1	-	-	1	-	-	3	-	-	2	2
CO5	3	2	2	2	2	2	-	-	1	-	-	1	-	-	-	2	3	2	3

High-3 Medium-2 Low-1

COURSE CONTENT:

Unit - I Modern Equipment's for Surveying   7 Hours

Digital levels and Theodolite, Electronic Distance measurement (EDM), Total Station and Global Positioning Systems (GPS), Digital Planimeter, Geographic Information System (GIS), Components and Advantages, Electronic Theodolite.

Unit – II Surveying Astronomy   7 Hours

Definitions of astronomical terms, coordinate systems for locating heavenly bodies, Zones of earth coordinates for earth resources mapping, convergence of meridian parallel of latitude, latitude and longitude, Spherical triangles.

Unit - III GPS & GIS Surveying   10 Hours

Introduction & components of GPS, Space segment, control segment and user segment, Elements of Satellite based surveys Map datum, GPS receivers, GPS observation methods and their advantages Digital Terrain Model (DTM): Topographic representation of the terrain and generation of DTM on computers using spot heights and contour maps Multiphase Error to the satellite Signal. Introduction to GIS – definition, concept and history of developments, Computer fundamentals for GIS, Hardware and software requirements for GIS.

Unit - IV Advance Method of Reconnaissance   8 Hours

Photogrammetry: Principle, definitions and classifications of terrestrial and aerial photogrammetry, flight planning for aerial photography, scale and relief displacements of vertical aerial photographs, stereoscopic vision on vertical photographs, computation of position, length and elevations of objects using photographs and photo mosaic Photographic Maps. Drone Survey, Applications of Unmanned Aerial Vehicle (UAV) based Remote Sensing- Mapping of Landslide Affected Area, Infested Crop Damage Assessment and Large-Scale Mapping.

Unit - V REMOTE SENSING   8 Hours

Introduction, Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing. Application of Remote Sensing.

Total: 40 Hours

Text Books:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson India, 2nd Edition, 2006.

2. Manoj, K. Arora and Badjatia, "Geomatics Engineering", Nem Chand & Bros, 2011.

3. Bhavikatti, S.S., "Surveying and Levelling", I.K. International, Vol. I and II, 2010.

4. Punmia B. C. Higher Surveying, Laxmi Publications, New Delhi.

Reference Books:
1 Chandra, A.M., "Higher Surveying", New Age International (P) Limited, 3rd Edition, 2002.
2 Anji Reddy, M., "Remote sensing and Geographical information system", B. S. Publications, 2001.
3 Arora, K.R., "Surveying", Standard Book House, Vol-I, II and III, 2015.
4 A.M. Chandra, S.K. Ghosh, "Remote Sensing and Geographical Information System", 1 st Edition, Narosa Publishing house, 2007.

List of e-Learning Resources:
1. https://nptel.ac.in/
2. https://www.coursera.org/

B.Tech Civil Engineering
Semester-V

L-2 T-1 P-0 C-3

CVE340: Repair, Rehabilitation & Retrofitting of Structures

Course Objectives
- Explain different types of deterioration of structures, distress in structures and damage mechanism.
- Understand the aspects of repair and rehabilitation and facets of maintenance.
- Apply the various techniques of repair for corrosion protection in structures.
- Illustrate different methods for strengthening the existing structures and methods of demolition of structures using engineered and non-engineered techniques.

Course Outcomes (COs)
1. Understand the various causes of deterioration in structures and classify them according to their type and mechanism of damage.
2. Apply appropriate materials and techniques for repairing structures, such as special concrete and mortar, epoxy injection, and fiber reinforced concrete
3. Analyze the different distress patterns that can occur in structures under accidental and cyclic loads, and evaluate their severity
4. Evaluate the durability aspects of structures and assess their potential for long-term sustainability
5. Evaluate the performance requirements of different repair systems and select the most suitable method for the specific structure being repaired

Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	-	1	1	-	-	-	-	-
CO2	2	1	1	-	-	1	2	-	-	-	-	-
CO3	1	2	2	1	-	-	-	-	-	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-
CO5	2	1	1	1	-	-	-	-	-	-	-	-

High-3 Medium-2 Low-1

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	1	2	2	1	-	-
CO2	1	-	1	3	2	1	-
CO3	2	-	1	-	2	1	-
CO4	1	-	2	2	1	1	-
CO5	-	-	1	2	2	1	-

High-3 Medium-2 Low-1

Unit - I Introduction   8 Hours
Deterioration of structures; distress in structures; causes and prevention, mechanism of damage; types of damage; damage under accidental and cyclic loads, cracking in structures, evaluation of damage.

Unit - II Cause of Deterioration and Durability Aspects   8 Hours
Holistic model of Deterioration of RCC, Permeability of Concrete (Capillary Porosity, Air Voids, Micro Cracks, Macro Cracks), Aggressive Deterioration chemical agents (Corrosion of Reinforcing bars, Sulphate attack, Alkali Silica Reaction), Durability Aspects.

Unit - III Condition Survey and Non-Destructive Evaluation   **8 Hours**
Preliminary Inspection, Planning Stage, Visual Inspection, Testing of samples, Considerations for repair strategies, Concrete Strength Assessment, Chemical Test, Corrosion Potential Assessment, Structural integrity.

Unit - IV Materials and Techniques of Repair   **8 Hours**
Special concrete and mortar, concrete chemicals, expansive cement, polymer concrete sulphur infiltrated concrete, ferro cement, fiber reinforced concrete, methods of repair in concrete, steel, masonry and timber structures. Gunite and shotcrete, epoxy injection.

Unit - V Rehabilitation and Retrofitting Methods   **8 Hours**
Repair options, Performance Requirement of Repair Systems, Selection of Repair Method, Stages of Repairing, Repair Methods, Repair/Rehabilitation strategies.

Total: 40 Hours

Reference(s)
1. Shetty .M.S., "Concrete, Technology", Theory and Practice, S.Chand and Company, New Delhi 2010
2. Allen .R.T. and Edwards .S.C., "Repair of Concrete Structures" Blakie and Sons, UK 1987.
3. Raiker .R.N. "Learning from Failures, Deficiencies in Design, Construction and Service", R&D Centre (SDCPL), Raikar Bhavan, Bombay 1987.
4. "Repair & Rehabilitation" "Compilation from The Indian Concrete Journal", - ACC - RCD Publication 2001.
5. Revision compbell, Allen and Itarold Roper, "Concrete Structures Materials Maintenance and Repair" Longman Scientific and Technical UK 1991.
6. cpwd.gov.in/Units/handbook.pdf

List of e-Learning Resources:
1. https://nptel.ac.in/
2. https://www.coursera.org/

B. Tech (Civil Engineering)
Semester-V

L-2 T-1 P-0 C-3

CVE340: Structural Analysis - II

Course Objectives
- This course introduces students to theory of structures, types of structures, various methods for analysis of indeterminate structure.
- To apply these methods for analyzing the indeterminate structures to evaluate the response of such structures in the form of bending moment, shear force, axial force etc.

Course Outcomes (COs)
1. Analyse the beam and frames with sway using the moment distribution and Kani's method.
2. Analyse the collapse load and collapse mechanism of statically indeterminate structure using plastic analysis.
3. Analyse the behavior of tall structure frames, including earthquake and wind loads by using portal and cantilever method.
4. Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
5. Analyse the beam and column by apply the concept of influence lines diagram for indeterminate structures.

Articulation Matrix

CO/PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	3	2	-	-	-	-	-	-	-	1	-	-	2	-	-	-	2	2
CO2	2	3	3	2	-	-	-	-	-	-	-	1	-	-	2	-	-	-	2	2
CO3	2	3	3	2	-	-	-	-	-	-	-	1	-	-	2	-	-	-	2	2
CO4	2	3	3	2	-	-	-	-	-	-	-	1	-	-	2	-	-	-	2	2
CO5	2	3	3	2	-	-	-	-	-	-	-	1	-	-	2	-	2	-	2	2

High-3 Medium-2 Low-1

UNIT I: Sway analysis & kani's method   **10 Hours**

Moment distribution method in analysis of frames with sway, analysis of box frames, analysis of portals with inclined members, analysis of beams and frames by Kani's method of rotation contribution.

UNIT II: Plastic analysis   **10 Hours**

Concept of plastic hinge, plastic moment carrying capacity, shape factor, methods of plastic analysis. determination of collapse load for single and multiple span beams. Plastic analysis of beams and frames.

UNIT III: Analysis of tall frames   **10 Hours**

Analysis of tall frames, wind and earthquake loads, code provisions for lateral loads. Approximate analysis of multistory frames for vertical and lateral loads, portal method, cantilever method.

UNIT IV: Matrix method   **08 Hours**

Matrix method of structural analysis: force method and displacement method.

UNIT V: Influence Lines   **10 Hours**

Influence lines for intermediate structures, Muller Breslau principle, Analysis of Beam-Columns.

Total: 48 Hours

Reference(s)
1. Basic Structural Analysis: C.S. Reddy, Tata McGraw Hill Publishing House, New Delhi.
2. Mechanics of Structures (Vol-I and II): S. B. Junnarkar H.J. Shah, Charotar Publishers.
3. Structural Analysis: L.S. Negi and R.S. Jangid, Tata Mc-Graw Hills Publishing House, New Delhi.
4. Analysis of Structures: Vol. I II, Vazirani and Ratwani, Khanna Publishers

5.   Structural Analysis: Bhavikatti, Vikas Publishing House Pvt, ltd.
6.   Structural Analysis: Devdas Menon, Narosa Publishing House.
7.   Basic Structural Analysis: K.U. Muthu, Azmi Ibrahim, M. Vijyan, Maganti Janadharn. I.K. International Publishing House Pvt. Ltd.

Experiments: -

1.   To study two hinged arches for the horizontal displacement of the roller end.
2.   To study the behavior of a portal frame under different end conditions.
3.   To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally.
4.   To study the behavior of a cantilever beam under symmetrical and unsymmetrical bending.
5.   To determine elastic properties of a beam.

List of e-Learning Resources:

1. https://courses.structure.education/courses/structural-analysis-ii
2. https://unacademy.com/course/complete-course-of-structural-analysis-for-gate-ese-98/JCUTKKS8

L-2 T-1 P-2 C-4

SUBJECT: Transportation Engineering-II (Highway &Airport) (CVE350)

Course Objectives

- To introduce the students with the principles and practice of transportation engineer which focuses on Highway Engineering and airport engineering?
- Students would be able to understand the concept of design of flexible and rigid pavement and material used for highway construction.

Course Outcomes (COs)

CO1- Understand the planning, analyzing and management of city traffic.

CO2- Apply principles of physics to estimate stopping, overtaking sight distance.

CO3 Apply the procedures followed in Indian Road Congress (IRC), American Association of Transportation and AASHO methods for the optimal design of pavements.

CO4- Apply the material characteristics and selection criteria for the use in pavement design.

CO5- Apply the methods of Design the airport pavement and air traffic aids.

Articulation Matrix

CO/ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	1	1	2			1						1	2	1	3		1		2
CO2	3	2	3	1		1						1	2	1	3		2		2
CO3	3	2	3	1		1						1	2	1	3		3		2
CO4	2	1	2	1		1						1	2	2	3	2	2		2
CO5	2	1	2	2		1						1	3	1	3	2	1		2

High-3 Medium-2 Low-1

UNIT I: Highway planning: 10 Hours

Introduction to Highway Engineering: Highway planning and development in India, Rural and urban roads, Road departments in India, Road classification, Road authorities i.e. IRC, CRRI, NHAI, NHDP etc

Highway Alignment & Surveys: Reconnaissance, Aerial surveys, Location surveys, Location of bridges, Problems in rural and urban areas. Highway drawings & reports Highway project preparation

UNIT II: Highway Geometric Design: 10 Hours

Topography and physical features, Cross section elements like carriageway width, formation width, right of way, etc., friction, Light reflecting characteristics, roughness, camber, sight distances, horizontal alignment, design speed, minimum radius, super-elevation, Extra widening transition curve, gradients, design of summit and valley curves.

UNIT III: Pavement Types and their Study 10 Hours

Introduction and types of pavements,

Flexible Pavements: Design of flexible pavements, design of mixes and stability, failures and maintenance, Advantages and disadvantages of flexible pavements

Rigid Pavements: Design of Rigid pavements, Brief study of recent developments in cement concrete pavement design, fatigue and reliability, construction and maintenance. Advantages and disadvantages of rigid pavements, general principles of design, types, construction, maintenance and joints, dowel bars, tie bars.

UNIT IV: Highway Construction Materials And Practice 10 Hours

Highway construction materials, properties, testing methods – CBR Test for sub grade, tests on aggregate & bitumen, Test on Bituminous mixes, Construction practice including modern materials and methods, Inter-facial treatment- seal coat, tack coat, prime coat, wearing coats, grouted macadam, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane, Quality control measures, Highway drainage, Construction machineries.

UNIT V: Airport and its Planning 10 Hours

Runway & Taxiway: Airport site selection. air craft characteristic and their effects on runway alignments, windrose diagrams, basic runway length and corrections, classification of airports. Geometrical elements: taxi ways and runways, pattern of runway capacity.

Obstructions, Lightning & Traffic control: Zoning regulations, approach area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental lending system, precision approach radar

PRACTICAL
LIST OF EXPERIMENTS:

1. Aggregate Crushing Value Test

2. Determination of aggregate impact value.

3. Determination of Los Angeles Abrasion value.

4. Determination of California Bearing Ratio values.

5. Determination of penetration value of Bitumen.

6. Determination of Viscosity of Bituminous Material.

7. Determination of softening point of bituminous material.

8. Determination of ductility of the bitumen.

9. Determination of flash point and fire point of bituminous material.

10. Determination of Bitumen content by centrifuge extractor.

11. Determination of stripping value of road aggregate.

12. Determination of Marshall Stability value for bituminous mix.

13. Determination of shape tests on aggregate.

Total: 60 Hours

REFERENCE BOOKS:
1. Highway Engineering by Gurucharan Singh,
2. Principles of Pavement Design by E.J. Yoder & M.W.Witzech,
3. Highway Engineering by O'Fleherty,
4. Highway Engineering by S.K. Khanna & C.E.G. Justo,
5. Airport Planning & Design by S.K. Khanna & M. G. arora, Foresch,
6. Charles "Airport Planning",
7. Horonjeff Robert "The Planning & Design of Airports",
8. Sharma & Sharma, Principles and Practice of Highway Engg. ,
9. Haung, Analysis and Design of Pavements, Relevant IRC & IS codes,
10. Laboratory Mannual by Dr. S.K. Khanna, Highway Engg. By Hews & Oglesby Highway Material by Walker

LIST OF e-LEARNING RESOURCES:
1) https://onlinecourses.nptel.ac.in/noc22_ce41/preview
2) https://onlinecourses.swayam2.ac.in/nou20_cs14/preview

B. Tech Civil Engineering
Semester-VI

L-2 T-1 P-2 C-4

CVE360: Structural Design-I (RCC)

Course Objectives
- To develop an understanding and appreciation for basic concepts in the behavior and design of reinforced concrete systems and elements.

- To give an ability to differentiate between working stress design and limit state design.

- To introduce the basic concepts and steps for reinforced concrete sectional design mainly in accordance with ultimate strength design.

- To help the student develop an intuitive feeling about structural and material wise behavior and design of reinforced concrete systems and elements.

Course Outcomes (COs)
1. Illustrate the concepts of Reinforced Cement Concrete, compare various design methodologies, identify grades of concrete and steel, types of loads acting on structures, and Design of beams. (Apply)
2. Design of singly and doubly reinforced beams.
3. Differentiate between one way and two-way slabs, Design one way, one way continuous and two-way slabs.
4. Design of column and column footings economically and suitably recommend the appropriate type according to site conditions.
5. Economical Design of Staircase.

Articulation Matrix

CO/PO/PSO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS 07
CO1	2	2	3	-	3	1	2	2	-	-	-	-	2	-	3	3	-	-	-
CO2	3	2	3	-	3	2	2	2	-	1	-	-	2	-	1	3	-	-	-
CO3	3	2	3	-	3	2	2	2	-	1	-	-	2	-	1	3	-	-	-
CO4	3	2	3	-	3	2	2	2	-	1	-	-	2	-	1	3	-	-	-
CO5	3	2	3	-	3	2	2	2	-	1	-	-	2	-	1	3	-	-	-

High-3 Medium-2 Low-1

UNIT I: Introduction   **12 Hours**
Basic Principles of Structural Design: Assumptions, Mechanism of load transfer, Various properties of concrete and reinforcing steel, Introduction to working stress method and limit state methods of design, partial safety factor for load and material. Calculation of various loads for structural design of singly reinforced beam, Partial load factors.

UNIT II: Design of Beams   **10 Hours**
Doubly reinforced rectangular & Flanged Beams, Lintel, Cantilever, simply supported and continuous beams, Beams with compression reinforcement: Design of beam for shear and bond.

UNIT III: Design of Slabs   **08 Hours**
Slabs spanning in one direction. Cantilever, simply supported and Continuous slabs, Slabs spanning in two directions.

UNIT IV: Columns & Footings   **10 Hours**
Effective length of columns, Design of short and long columns- Square, Rectangular and Circular columns, Design of Column Footing, Columns subjected to axial loads and bending moments.

UNIT V: Staircases   **08 Hours**
General arrangements of staircase, Design of Straight flight stair, Design of Dog Legged and Open

Well Stairs. Design of industrial building frames, multistory frames, bracings for high rise structures.

PRACTICAL

1. Design 01: Design of Simply Supported Beam.
2. Design 02: Design of Cantilever Beam.
3. Design 03: Design of Continuous Beam.
4. Design 04: Design of one-way Slab.
5. Design 05: Design of two-way Slab.
6. Design 06: Design of Column.
7. Design 07: Design of Column Footing.
8. Design 08: Design of Staircase.

Total: 60 Hours

Reference(s)
1. Plain & Reinforced Concrete Vol. I & II – O.P. Jain & Jay Krishna.
2. Limit State Design by P.C. Varghese; Prentice Hall of India, New Delhi.
3. Design of Reinforced Concrete Elements by Purushottam; Tata McGraw Hill, New Delhi.
4. Reinforced Cement Concrete by Gupta & Mallick, Oxford and IBH.
5. Reinforced Cement Concrete by P. Dayaratnam, Oxford and IBH.
6. Plain & reinforced concrete – Ramammutham

List of e-Learning Resources:
1. https://nptel.ac.in/courses/105105105/
2. https://nptel.ac.in/downloads/105105104/