2016-17

Course Title: Environmental Engineering		**Course Code: 15ECVC204**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs/ week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50 Hrs	**Examination Duration: 3 Hrs**	

Unit I

1.Introduction

Impact of human activities on environment, Water pollution causes, need for protected water supply. **02 hrs**

2. Demand and conveyance of water

Human activities and environmental pollution need for protected water supply. Types of water demands, population forecasting- arithmetical, geometrical, incremental increase and simple graphical method. Surface and subsurface sources Intake structures. Design of the economical diameter of the rising main. **04 hrs**

3. Quality of Water

Concept of safe wholesome and palatability of water, Sampling of water, Examination of Water–Physical, chemical and Biological Examinations. Drinking water standards BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. **04hrs**

4.Water Treatment

Treatment flow-charts. Aeration- Principles, types of Aerators. Sedimentation aided Coagulant, design, jar test, Theory of filtration, slow sand, rapid sand and pressure filters, design – excluding under drainage system .Theory of disinfection, types of disinfection. **10 hrs**

Unit II

5.Miscellaneous Treatment and Distribution of Water

Softening methods of removal of hardness by lime soda process and zeolite process. Adsorption technique, reverse osmosis technique, fluoridation and defluoridation. **05 hrs**

System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems.

6. Sewerage systems

Types of sewerage systems. DWF, estimation of storm flow, design of storm water drain. Design of sewers - self cleansing and non-scouring velocities. Design of hydraulic elements for circular sewers flowing full and flowing partially full. **06 hrs**

7. Sewage characteristics

Physical, Chemical and Biological characteristics, CNS cycle. BOD and COD their significance. **03 hrs**

8. Disposal of Sewage

Self-purification phenomenon, Zones of purification, Oxygen sag curve. Sewage sickness Sewage farming. Numerical Problems on Disposal of Effluents using Streeter Phelps equation. **04 hrs**

9. Sewage Treatment

Flow diagram of municipal waste water treatment plant. Preliminary & Primary treatment: Screening, grit chambers, primary sedimentation tanks – Design. **03 hrs**

Unit III

10.Secondary treatment and sludge disposal

Theory and design of biological unit operation- Trickling filter and Activated sludge process and its modifications. **09 hrs**
Miscellaneous treatment – Oxidation pond, concepts of UASB and RBC.
Digestion of sludge, Sludge drying beds.

Text Books

1. Birdie, G.S., *Water Supply and Sanitary Engineering*, Dhanpath Rai and Son Publishers, New Delhi, 2003
2. Garg, S.K., *Sewage disposal and Air Pollution Engineering*, Khanna Publishers, 2003.
3. Garg, S.K., *Water supply Engineering*, 7ed., Khanna Publishers, New Delhi, 2005.
4. Modi, P.N., *Sewage Treatment and Disposal Engineering*, 15ed., Standard Book House, New Delhi, 2015.
5. Punima, B. C., and Jain Ashok, *Environmental Engineering-I*, 2ed., Laxmi Publications, New Delhi., 2008.
6. Punmia, B. C., Ashok K Jain and Arun Kumar Jain, *Wastewater Engineering*, Laxmi Publications, New Delhi, 2016.

Course C

Course Title: Structural Analysis-II

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

ISA Marks: 50 **ESA Ma**

Teaching Hours: 40 **Examina**

Unit I

1. Slope Deflection Method

Introduction, Sign convention, Development of slope-deflection equations and Analysis of Beams and Orthogonal Rigid jointed plane frames (sway and non sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid) **08 hrs**

2. Consistency Deformation Method

Introduction, static indeterminacy, Analysis of continuous beam and frame by Consistency Deformation Method. **08 hrs**

Unit II

3. Stiffness Matrix Method

Degree of kinematic indeterminacy of one and two dimensional structures, generalised coordinates, Analysis of continuous beams with and without sinking of supports and portal frames kinematic redundancy ≤ 3. **08 hrs**

4. Flexibility Matrix Method

Development of element flexibility matrices, Development of global flexibility matrix, Analysis of continuous beams, and rigid plane frames to determine for internal forces and displacements. **08 hrs**

Unit III

5. Plastic Analysis

Introduction, plastic hinge and plastic moment capacity, Assumptions, Shape factor for general sections, Collapse load, Basic theorems for finding collapse loads, Methods of plastic analysis, Beam mechanism for continuous beam. **08 hrs**

Text Books

1. Bhavikatti S.S, *Structural Analysis II,* 4ed., Vikas Publishing House India Pvt. Ltd, Bangalore, 2016.
2. Pandit G.S. and Gupta S.P, *Matrix Method of Analysis* , 2ed., McGraw Hill Education India Pvt. Ltd, New Delhi, 2008.
3. Reddy C.S., *Basic Structural Analysis*, 3ed., Tata McGraw Hill Education India Pvt. Ltd New Delhi, 2017.

Ram chandra, *Design of steel structures-Vol II*, 12ed, Standard book house, New Delhi 2015

Reference Books:

1. Jain A.K., *Advanced Structural Analysis*, 3ed., Nemchand and Brothers, Roorkee, India, 2015.
2. Leet,, Uang, and Anne M., *Fundamentals of Structural Analysis*, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2017.
3. Noris, C.H. and Wilbur, J., *Elementary Structural Analysis*, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2005.
4. Bhavikatti S.S, *Matrix Methods of Structural Analysis*, 1ed., I K International Publishing House Pvt. Ltd., 2011.
5. Timoshenko, S.P., and Young, D.H., *Theory of Structures*, McGraw Hill Company, New York, 1965.
6. B. G. Neal, The Plastic Methods of Structural Analysis, Chapman and Hall, 1977

Course Title: Transportation Engineering **Course Code: 15ECVC304**

L-T-P: 4-0-0 **Credits: 4** **Contact Hours: 4 Hrs/ week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 50 **Examination Duration: 3 Hrs**

Unit I

1. Development of Highway Engineering

Importance of transportation, Different modes of transportation, Characteristics of road transport, Jayakar committee recommendations and implementation, Types of Roads, Road patterns, planning surveys, master plan-saturation system of road planning, Phasing of road development in India and problems, Salient features of 3rd and 4th 20year road development plans and problems, Highway development authorities – NHAI, MoRTH, KSHIP, KRDCL, Present scenario of road development nationally and at state level – Bharatmala Project, NGHM, NHDP, PMGSY, Vision 2021. **08 hrs**

2. Highway Alignment Selection Criteria

Guidelines for selection of Ideal alignment, factors affecting the alignment, Engineering surveys, Steps involved in Preparation of Detailed Project Report (DPR) for new highway alignment and realignment of highway. **04 hrs**

3. Geometric Design of Highways

Functional design of highways, Cross Section Elements of highways, Sight Distance, Design of Horizontal and Vertical Curves, Features involved in highway safety and traffic efficiency. **12 hrs**

Unit II

4. Traffic Engineering

Sampling in Traffic Studies, Objectives, methods of traffic study, equipment used for traffic studies, data collection, analysis and interpretation of (i) Spot speed (ii) Speed and delay (iii) Volume (iv) Origin - Destination (v) Parking (vi) Accident studies, problems on above — **06 hrs**

5. Pavement Materials

Materials used in Highway construction – Soil, Stone aggregates, bituminous binders, bituminous paving mixes, Portland cement and cement concrete : Desirable properties, tests, requirements for different types of pavement. Innovative materials used in road construction. — **06 hrs**

6. Fundamentals of Pavement Engineering

Introduction of pavement design - Types of pavements, Desirable characteristics of pavement, components of flexible and rigid pavement and function of each component layer, Factors affecting pavement design, ESWL and its determination. Types of joints in rigid pavement and function of each type. — **04 hrs**

Unit III

7.Pavement Construction Technology

Specification and construction procedure of **:** Earthwork, Preparation of Embankment / Subgrade, Granular sub base course, Granular base course, Prime Coat, Cementaceous Subbase/Base course, Bituminous base course, Tack Coat, Bituminous surface course, Dry Lean Concrete base course, Pavement Quality Concrete surface course, Highway drainage system. — **06 hrs**

8. Highway Economics

Concept and principle of Engineering economics, Identification and measurement of Highway Benefits, Highway Transportation costs, Road User costs and Benefits. — **04 hrs**

Economic analysis by benefit cost ratio method- BCR, NPV-IRR. Highway Financing- BOO, BOT, BOOT Concepts, eProcurement system.

Text Books

1. Khanna S.K., and C.E.G. Justo, & A. Veeraragavan, *Highway Engineering*, 10ed., Nem Chand and Bros. Publishers, Roorkee, 2016.
2. Kadiyali L.R., *Traffic Engineering and Transportation Planning*, 7ed., Khanna Publishers, New Delhi, 2011.
3. Kadiyali L.R.., *Principles and Practices* of *Highway Engineering*, Khanna Publishers, New Delhi, 2005.
4. Papacostas C.S. and Prevedourous, P.D., *Transportation Engineering and Planning*, 3 ed., Prentice-Hall India, New Delhi, 2002.

Reference Books:

1. T. Fwa, *The Handbook of Highway Engineering*', Taylor & Francis Group, Newyork, 2006.
2. C. Jotin Khisty, B.Kent lal, *Transportation Engineering*, PHI Learning Pvt. Ltd. New Delhi, 2014.

3. Ministry of Road Transport and Highways, *Specification for Road and Bridge Works* (Fifth revision 2014), Indian Road Congress, New Delhi.
4. IRC: 73-1980-*Geometric Design Standards for Rural (Non Urban) Highways*, Indian Road Congress, New Delhi.
5. IRC: 37-2012 –*Guidelines for the Design of Flexible Pavements* (Third Revision), Indian Roads Congress, New Delhi.
6. IRC: 58-2015- *Guidelines for the Design of Plain jointed Rigid pavements for highway*, Indian Roads Congress, New Delhi.

Course Title: Traffic Engineering **Course Code: 15ECVE302**

L-T-P: 3-0-0 **Credits: 3** **Contact Hours: 3 Hrs/ week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 40 **Examination Duration: 3 Hrs**

Unit I

1. Traffic and Road user characteristics

Objectives and scope of traffic engineering, Components of road traffic- vehicle, driver and road, vehicle performance characteristics, road user characteristics: human characteristics, factors affecting road traffic, concept of classified traffic, methods of measurements, and concepts of passenger car units (PUC) for mixed traffic flow. **04 hrs**

2. Traffic Engineering studies and analysis

Sampling in traffic studies, adequacy of sample size, sampling techniques, application of sampling methods for traffic studies, equipment, concept Data collection, analysis and interpretation of results of classified traffic volume, spot speed, speed and delay, origin and destination, parking studies and accident studies. Problems on above. **08 hrs**

3. Traffic flow characteristics, traffic flow variables, speed

Flow –density relationship, PCU values, level of service, factors influencing roadway capacity, capacity of roads at various levels of service, capacity of intersections. **06 hrs**

Unit II

5. Traffic Regulation and control

General regulations, regulation on vehicles, drivers and flow regulation and traffic control devices – Types & objectives of marking, signs, signals and islands, delineators, traffic and environment hazard- noise and air pollution due to road traffic and method of control. **06 hrs**

4. Traffic features Design

Design of intersection – Channelization and rotary, Design of signalized intersections including signal timings as per IRC guidelines, problems on above Design of on street and off street parking facilities. **10 hrs**

Unit III

6. Traffic Management system

Traffic System Management (TSM) with IRC standards, Traffic regulatory measures, Travel Demand Model (TDM), Direct and Indirect methods, Congestion and parking pricing, all segregation methods-coordination among different agencies, ITS for traffic management system. **06 hrs**

Text Books

1. L.R. Kadiyali, *Traffic Engineering and Transport Planning*, Khanna Publications, Delhi, 2013.
2. S. K.Khanna, CEG Justo and A.Veeraragavan, *Highway Engineering*, Nem Chand Bros, Roorkee,2016.

Reference Books:

1. Matson T.M., Smith W.S., Hurd, H.W. *Traffic Engineering*, McGraw Hill Publishing Co. Inc., New York,2005.
2. Drew D.R., *Traffic Flow Theory and Control*, McGraw Hill Publishing Co. . Inc., New York, 2002.
3. Wiiliam R. McShane and Roger P, Roess, *Traffic Engineering*, Prentice Hall, New Jersey, 2000.
4. Papacostas, C.A., *Fundamentals of Transportation Engineering*, Prentice-Hall of India Pvt. Ltd., New Delhi, 2000.

Course Title: Construction Engineering & Management Laboratory		**Course Code: 15ECVP306**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2 Hrs/ week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 30	**Examination Duration: 3 Hrs**	

1. Introduction to project management software such as Primavera P6, MS Project, etc.
2. Develop a Work Break-down Structure (WBS) for a residential building of 3 storey.
3. Create and add activities to the WBS and assign relationships as per the logic of the precedence diagram for the residential building. Determine the duration of the project.
4. Apply constraints and filters to the developed activities to develop two-week, one-month and three-month look-ahead schedule.
5. Develop different roles and resources in the resource library and assign to the various activities along with their unit rates.
6. Develop the cost-loaded schedule and create baseline of the project.

7. Perform earned value analysis to track and monitor the project.
8. Building a 3D model of a typical building in AutoCAD Revit 2018 and Synchro (Architectural, Structural and Construction Details)
9. Conduct simulations in Microsoft Visio process simulator to determine most efficient excavation cycles on large scale projects.
10. Conduct Monte-Carlo simulation in Microsoft Excel to perform risk analysis for the project.

Reference Books:

1. Kim Heldman & William Heldman, *Microsoft Excel for Project managers 2007*.
2. P. Harris, *Planning and Scheduling Using Primavera P6 2010.*

2017-18

Course Title: Building Technology and Services		**Course Code: 15ECVC201**
L-T-P: 3-0-0	**Credits: 3**	**Contact Hours: 3 Hrs/ week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40	**Examination Duration: 3 Hrs**	

Unit I

1. Components of a Building

Introduction, types of building as per NBC, Components of a building – Foundations, RCC components like columns, beams, slabs. Floor structures, roof structures, doors, windows and other openings, building finishes. **05 hrs**

2. Building Materials

Introduction. Properties of concrete and its ingredients, building stones, Clay products, Bricks and tiles; Timber, Plywood, Allied products, Plastics and glass, Paints, Steel, Gypsum and Allied products, Adhesives. **07 hrs**

3. Types of Foundations

Preliminary investigations of soil, Presumptive bearing capacity of soils, Masonry footings, Isolated footings, Grillage footings, Strap footings, Raft foundations, Pile foundations. **05 hrs**

Unit II

4. Stone and Brick Masonry

Rubble masonry, Ashlar masonry, Bonds in brick work (English and Flemish bond). Load bearing and partition walls. Damp proof construction. **05 hrs**

5. Floors and Roofs

Types of flooring (Materials and method of laying), Granolithic, Mosaic, Ceramic, Marble, Polished Granite, Industrial flooring, Flat Roof (R.C.C.), Sloped roof (R.C.C. and Tile roof), Lean to roof, Steel trusses, Water and Weather proof course. **03 hrs**

6. Stairs, Doors and Windows

Types (Classifications) and Technical terms in stairs, Requirements of a good stair. Geometric Design of RCC Dog Legged and open well stairs. (Plan and sectional elevation of stairs) Paneled doors, Glazed doors, Flush doors, Collapsible and rolling shutters, Louvered doors, Revolving, sliding and swing doors, Windows, Types, Paneled, Glazed, Bat window, Dormer window, Louvered and corner window, Ventilators **06 hrs**

Unit III

7. Plastering and Painting

Purpose of Plastering, Materials of plastering, Lime mortar, Cement Mortar, Methods of plastering, Stucco plastering, Lath plastering, Purpose of Painting, Distemper, Plastic emulsion, Enamel, Powder coated painting to walls and iron and steel surfaces, Polishing of wood surface. **05 hrs**

8. Introduction to cost effective construction and services

Necessity, Advantages, Pre fabrication techniques, Pre cast doors and windows (Pre cast frames and shutters), Alternative Building Materials, Hollow concrete blocks, Stabilized mud blocks, Micro concrete tiles, Precast roofing elements. Water supply and sanitation. Electricity illuminated. Modern services & Air condition, fire detection and protection. **04 hrs**

Text Books

4. Bhavikatti.S.S, *Building Materials*, Vikas Publishing House Pvt Ltd, 2012.
5. Punmia, B.C., Jain A.K., *Building Construction*, 10ed., Lakshmi Publications, New Delhi, 2008.
6. Rai, M. and Jai Sing, *Advanced Building Materials and Construction*, CBRI Publications, Roorkee, 2014.
7. Sushilkumar, *Building Construction*, 20ed., Standard Publisher and Distributors, Delhi, 2014.

Reference Books:

1. Arora, S.P. and Bindra, S.P., *A Text Book of Building Construction Technology*, Dhanapat Rai Publications (P) Ltd., New Delhi, 2014.
2. Jagadeesh, K.S., Venkatarama Reddy B.V. and Nanjunda Rao K.S., *Alternative Building Materials and Technologies*, New Age International (P) Ltd., New Delhi, 2007.
3. National Building Code of India 2016, Bureau of Indian Standards

Course Title: Survey Practice - I		**Course Code: 17ECVP201**
L-T-P: 0-0-1	**Credits: 1**	**Contact Hours: 2 Hrs / Week**
ISA Marks: 80	**ESA Marks: 20**	**Total Marks: 100**
Teaching Hours: 30	**Examination Duration: 3 Hrs**	

Demonstrations

1. Study of chain, tape, Ranging rod, Direct Ranging, Dumpy level, Compass and EDM device.
2. Use of planimeter and demonstration of minor instruments like clinometer, hand level, box sextant.
3. To locate contour by direct and indirect method.

4. To locate points using radiation & intersection method of plane tabling.

Experiments

1. Plot the boundary layout of a building by using direct ranging and set out the perpendiculars using chain, tape and cross staff.
2. To mark the center line for different types of civil engineering structures (using closed traverse methods) having different shapes.
3. To locate the various positions of objects (trees, electric pole, drainage) along the center line of a road.
4. To setup the temporary bench marks for a given topography using Auto level.
5. To determine difference in elevation between two points using reciprocal leveling and determine the collimation error.
6. To conduct profile leveling for water supply / sewage line / road alignment and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.

Open Ended Experiments:

- Determine and plot the contour map for a sloping terrain and locate the plinth level for the proposed building on sloping terrain.

Reference Books:

1. Bhavikatti S.S., *Surveying and Leveling Vol-I & II,* I.K., International Publishers, New Delhi, 2008.
2. Punmia, B.C., Ashok.K Jain, Arun.K., *Surveying Vol. l & 2*, 15ed., Laxmi Publishers, New Delhi- 2005.
3. SP:7, *National Building Code of India*, Bureau of Indian Standards, 2016

Course Title: Building Engineering Drawing **Course Code: 17ECVP202**

L-T-P: 0-0-2 **Credits: 2** **Contact Hours: 4 Hrs/ week**

ISA Marks: 80 **ESA Marks: 20** **Total Marks: 100**

Teaching Hours: 40 Hrs **Examination Duration: 4 Hrs**

1. Introduction to NBC, Building Bye Laws, Model space and paper space, Bubble diagram.

2. Bubble diagram with circulation for a residential building

3. Draw plan, front elevation, section, site plan and write schedule of openings, as per Bye Laws, using AutoCAD, for a given site dimensions for different types of buildings and calculate FAR, Plinth area and Carpet area;

i. Residential Building
ii. Office Building
iii. School Building
iv. Hospital Building
v. College Building

4. Select any one of the building plans from above and draw water supply, sanitary system and rainwater recharging and harvesting system using ByLayer command in AutoCAD.
5. Select any one of the building plans from above and draw bubble diagram with circulation suing AutoCAD.

Open Ended Experiment

- Obtain contour details from the open ended experiment from survey practice-I. Propose a residential building on the sloping ground for the given site dimension as per NBC.
- Draw plan, front elevation, sectional elevation and site plan in AutoCAD with necessary details.

References

1. Bethune, J. D., *Engineering Graphics with AutoCAD*, Pearson Education Publishers, 2017.
2. Chandra, A.M and Chandra, S., *Engineering Graphics with AutoCAD*, 2ed., Pearson Education Publishers, 2004.
3. Gurcharan Singh., *Civil Engineering Drawing*, 7ed., Standard Publishers Distributors, 2014.
4. N. Kumara Swamy, A. Kameswara Rao, *Building Planning and Drawing*, Charator Publishing House Pvt. Ltd., 2007.
5. Shah, M.H and Kale, C.M, *Building Drawing*, Tata Mc Graw Hill Publishing Co. Ltd., 2012.
6. Malik R S and Meo G S, *Civil Engineering Drawing*, 2ed, Asian Publishers/Computech Publications Pvt Ltd, 2010.
7. SP:7, *National Building Code of India*, Bureau of Indian Standards, 2016

Course Title: Survey Practice - II **Course Code: 15ECVP204**

L-T-P: 0-0-1 **Credits: 1** **Contact Hours: 2 hr / week**

ISA Marks: 80 **ESA Marks: 20** **Total Marks: 100**

Teaching Hours: 30 **Examination Duration: 3Hrs**

List of Experiments

Demonstrations

1. Measurement of horizontal angles with method of repetition and reiteration using theodolite and Total Station, Measurement of vertical angles using theodolite and Total Station.
2. To determine height of a remote object, horizontal distance and coordinates of points using Total Station.
3. Introduction to GPS.

Experiments

1. To determine the elevation of an object using single plane method when base is accessible and inaccessible using theodolite and Total station.
2. To determine the distance and difference in elevation between two inaccessible points using double plane method using theodolite and Total station.
3. To set out simple curves using linear methods perpendicular offsets from long chord.

4. To set out simple curves using linear methods by offsets from chords produced.
5. To set out simple curves using Rankine's deflection angles method.
6. To set out compound curve with angular methods.
7. To set out reverse curve between two parallel line with angular methods.

Structured Enquiry

- To set out the center line of columns for different buildings using Total Station.

Open Ended

1. To collect various surveying data and build model using AutoCAD / Civil 3D software.
2. Plot the longitudinal and cross sections of a road and determine the volume of Earthwork.

Reference Books:

1. Bhavikatti S.S., *Surveying and Leveling Vol-I & II*, I.K. International Publishers, 2008.
2. Punmia B.C., Jain, Ashok K. J., and Arun.K. J., *Surveying Vol. l & 2*, 15ed., Laxmi Publications (P) ltd, New Delhi, 2005.
3. Duggal S. K., *Surveying Vol-II*, 4e, McGraw Hill Education Pvt. Ltd.,New Delhi, 2013.

IS Codes:

1. IS 11134:1984(R2000), *Code of practice for Setting out of Buildings.*
2. SP:7, *National Building Code of India, Bureau of Indian Standards*, 2016
3. IRC: 73-1980-*Geometric Design Standards for Rural (Non Urban) Highways, Indian Road Congress*, New Delhi.
4. IRC: 86-1983-*Geometric Design Standards for Urban Roads in Plains, India Road Congress*, New Delhi.

Course Title: Advanced Project Management **Course Code: 15ECVC305**

L-T-P: 3-0-0 **Credits: 3** **Contact Hours: 3 Hrs/ week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 40 **Examination Duration: 3 Hrs**

Unit I

1. Introduction to Advanced Project Management

Introduction, Importance of advanced project management, the project management institute and PMBOK, the role of a project manager, project management in India. **05 hrs**

2. Work Breakdown Structure

Concept of WBS, Common usage of terms, Preparing a WBS, Factors to be considered, WBS measurement considerations, Challenges to be considered, WBS level of Detail, WBS life-cycle considerations, Project risk and the WBS, Resource planning and management with WBS, Problems – Detailed WBS of residential, commercial, industrial and Highway Road etc. CPM and PERT. **12 hrs**

Unit II

3. Cost Loaded Scheduling and Project Controls

Determination of unit costs and total cost of a typical construction project. Project Controls - Introduction, Project life cycle, Overview of project life cycle, earned value management, Cost performance Index, Schedule performance index, forecasting methods and problems, resource utilization and cumulative curves, Cost loaded Schedules. **08 hrs**

4. Resource Allocation

Introduction, Objectives of resource allocation, Methods of resource allocation, Resource smoothing, Steps in resource smoothing, Resource levelling, Steps in resource levelling. **04 hrs**

5. Contractor's Estimation of cost and Bidding Strategy

Pre-qualification process, study of tender documents, preparation of construction schedule, determination of bid price. **04 hrs**

Bidding and Estimation practices in Indian Construction Industry.

Unit III

6. Risk analysis and Project Close out

Risks involved in projects – determination and mitigation. Closing out of project, Lessons learnt, historical data - creation and uses. **03 hrs**

7. Quality Control

Need for inspection and Quality Control, principles of inspection, Stages of inspection and quality control. Status of construction labour, wages of construction workers, different labour acts. **04 hrs**

Text Books

1. James Lewis, *Project Planning, Scheduling, and Control*, 3ed., 2009.

Reference Books:

1. P. Harris, *Planning and Scheduling Using MS Project* 2010.
2. Ursula Kuehn, *Integrated Cost and Schedule Control in Project Management,* 2ed.,2011.

Course Title: Construction Simulation Practice **Course Code: 17ECVP301**

L-T-P: 0-0-1 **Credits: 1** **Contact Hours: 2 Hrs/ week**

ISA Marks: 80 **ESA Marks: 20** **Total Marks: 100**

Teaching Hours: 30 **Examination Duration: 3 Hrs**

Preamble:

Through the courses in the preceding semesters (3rd, 4th and 5th), the students are studying the basics of many courses in the fields of construction engineering and management, structural engineering, geotechnical

engineering, environmental engineering and transportation engineering. This course aims to bridge the gaps between theoretical concepts learned in classroom and their practical applications in the industry.

Course will be delivered through a series of site visits and guest lectures from industry experts.

Deliverables:

Student group will be given a hypothetical site where in their job profile will be of a project manager. Guest lectures from project managers and site engineers will provide the necessary tools and work cultures on the site, which the students have to apply to their project.

The students will learn the following concepts as practiced in the field:

1. Roles and responsibilities of various stakeholders involved like the owner, architect, structural consultant and the general contractor.
2. The material procurement process – quality and cost negotiation process. Costs involved in using RMC or procurement of raw materials to produce concrete on site etc.
3. Labour cost negotiations, roles and responsibilities, basic amenities to be provided and person-hour tracking.
4. Safety protocol followed in the jobsite.
5. Process of material delivery on the job site and coordination with the accounts department.
6. Technical problems encountered during execution – For example, deep well located during excavation – design changes to be made, concrete strength failure after 28 days – what measures to be taken, errors during surveying of the building, honeycombing or bulging of concrete etc.
7. Tracking of the progress – both time and cost. Creating of monthly progress reports.
8. Equipment management – renting vs owning, maintenance.
9. Roles and responsibilities on the project manager, site engineers, supervisors, safety officers.
10. Store management.
11. On site testing and third party testing – advantages and disadvantages.
12. Site layout for optimum utilization of construction space.
13. Reconciliation of materials like formwork, steel etc.

The student team will submit a comprehensive report about the management of a construction site and the difficulties and solutions employed to their sites and present their case.

References books:

1. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, 2ed., Edition, Pearson Publications, 2015.
2. Robert. L Peurifoy and William B. Ledbetter, *Construction planning and Equipment& methods*, Tata McGraw Hill Pvt. Ltd, New Delhi, 3ed., 2010.
3. Ursula Kuehn, *Integrated Cost and Schedule Control in Project Management*, 2ed.,2011.

Course Title: Horizontal and Vertical Construction Methods **Course Code: 15ECVE405**

L-T-P: 3-0-0 **Credits: 3** **Contact Hours: 3 Hrs/ week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 40 **Examination Duration: 3 Hrs**

Unit I

1. Planning for earthwork construction

Planning, Graphical presentation of Earthwork, Earthwork quantities, Mass diagram and its applications, Pricing of earthwork operations. **04 hrs**

2. Compaction and Stabilization Equipment

Compaction of soil and rock, Types of compaction equipment, roller production estimating, Dynamic compaction, Soil stabilization, stabilizing soils with lime, Cement-soil stabilization. **05 hrs**

3. Excavators and loaders **06 hrs**

Hydraulic Excavators, selection of front shovels, calculating shovel production, height of cut effect on shovel production, angle of swing effect on shovel production, Loaders – introduction, Loader buckets/attachments, operating specifications, Loader production rates, calculating wheel loader production, Calculating track loader production, Loader safety.

Unit II

4. Drilled Shaft Foundations

Introduction, Construction of drilled shafts – dry method of construction, casing method of construction, wet construction method, Installation of casings, Steel cages, Placement of concrete, Dewatering, open dewatering systems, deep well systems, well point systems – Types, techniques, Basement waterproofing systems. **05 hrs**

5. Formwork Systems **06 hrs**

Introduction, formwork materials, shores and scaffolding, Vertical formwork systems – Conventional wall/columns forming systems, Modular panel column form, adjustable wraparound column forms, circular steel forms for round columns, wall panel system, single sided wall formwork, formwork ties,

Horizontal formwork systems – conventional wood form and metal systems, cup-lock type scaffolding system, slab flex system, tunnel form, flying formwork system, crane-jumped formwork, automatic climbing formwork, self-rising core system.

6. Concrete and Conveying Systems **06 hrs**

Introduction, Concrete – Mixers, Concrete plants, Pre-tensioning and Post tensioning, Transporting and handling – Concrete chute, concrete mixer with lift, concrete skip, truck mixer concrete pumps, concrete belt conveyors, concrete pump truck, trailer pump and pipeline with tower-mounted boom, trailer mounted pumps, pipeline system, mobile concrete placing booms, finishing.

Unit III

7. Cranes

Major cranes types, Mobile cranes, Crawler cranes, Telescoping-boom truck-mounted cranes, Lattice-boom truck-mounted cranes, Rough-terrain cranes, modified cranes for heavy lifting, crane booms, lifting capacities of cranes, Rated loads for lattice and telescopic boom cranes, Tower cranes – classifications, operation, Tower crane selection, Rated loads for tower cranes, rigging, slings, safety. **05 hrs**

8. Modular Construction Practices: **03 hrs**

Introduction to Modular Construction, Modular coordination, Modular Standardization, Modular System Building, Limitation and Advantages of Modular Construction

Text Books

1. Peurifoy, *Construction Planning, Equipment & Method*, 7ed., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
2. Basem M, *Construction Technology for High-rise Buildings-Handbook*, 2014.

Reference Books:

1. Stephens W. Nunnally, *Managing Construction Equipment*, 2ed, Pearson Publications, USA, 2000.
2. Gupta B. L., Amit Gupta, *Construction Management and Machinary*, 5ed, Standard Publications, New Delhi, 2015.

Course Title: Finite Element Methods **Course Code: 15ECVE403**

L-T-P: 3-0-0 **Credits: 3** **Contact Hours: 3 Hrs/ week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 40 **Examination Duration: 3 Hrs**

Unit I

1. Introduction to Finite Element method.

Introduction, Basic concepts on finite element analysis, Introduction to nodes, elements, and shape functions, Steps in Finite Element Analysis, Key concepts and Terminologies. **05 hrs**

2. Element Properties.

Natural Coordinates, Triangular Elements, Rectangular Elements, Introduction to Weighted integrals, Integration by parts-Review, Gradient and Divergence Theorems, Functionals. **05 hrs**

3. Finite Element Formulation Technique. **05 hrs**

Virtual Work and Variational Principle (Rayleigh-Ritz Method), Weighted Integrals and Weak Formulation, Different types of weighted integral methods such as Galerkin Method, Petrov-Galerkin Method, Collocation Method and Method of Least-squares.

Unit II

4. Second Order Boundary Value Problem.

FEA formulation of 2^{nd} order boundary value problem, Development of element level equations, Assembly of element level equations and implementation of boundary conditions, Assembly process and Connectivity matrix. **08 hrs**

5 Applications of Second Order Boundary Value Problem. **10 hrs**

Radially symmetric problems, One-dimensional heat transfer problem, Euler-Bernoulli beam, Shear deformable beam, Eigen value problems, Introduction to time dependant problems.

Unit III

6. FEM Program

Structure of FEM program for FEM Analysis, Description of different modules in FEM software (ABAQUS), Introduction to different types of analysis, Pre and post processing. Comparison of manually solved problems with software results. **07 hrs**

Text Books

1. Reddy J.N., *An Introduction to Finite Element Method*, 3ed., McGraw- Hill Publishing Company Inc, New York, 2017.
2. Krishnamoorthy C. S., *Finite Element Analysis*, Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2004.

Reference Books:

Rajasekaran, S., *Finite Element Analysis in Engineering Design*, S. Chand Group, 2006.

1. Pandit G.S. and Gupta, S.P., *Structural Analysis, A Matrix Approach*, 2ed., Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2008.
2. Cook R.D., Malkus D.S., Plesha M.E. and Witt R.J. *Concepts And Applications Of Finite Element Analysis*, 4ed., John Wiley and Jous, Inc., 2013.
3. Bathe K.J., *Finite Element Procedures*, Klaus-Jürgen Bathe; 2ed., 2014.
4. Bhavikatti S.S., *Finite Element Analysis*, New Age International Publication Pvt. Ltd., New Delhi, 2010.
5. Daryl L. Logan., *A first course in the Finite Element Method*, 5ed, Cengage Learning, 2010.
6. Tirupathi R. Chandrupatla and Ashok D. Belegundu, *Introduction to Finite Elements in Engineering*, 4ed, Pearson, 2011

2018-19

Course Title: Surveying		**Course Code: 15ECVC202**
L-T-P: 4-0-0	**Credits: 4**	**Contact Hours: 4 Hrs / week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 50	**Examination Duration: 3 Hrs**	

UNIT-I

1. Overview and Measurement of directions **05 hrs**

Basic principle of surveying, classification of surveying, Measurement of distance: chain surveying. chain and their types, tapes and their types. Errors in chain surveying and tape corrections.

Compass surveying, prismatic and surveyor's compass, bearings and their types. Calculation of included angles from bearings. Corrections to measured bearings – local attraction. Plotting a traverse, closing error and its adjustment by Bowditch's rule. Traverse computations – Latitude and departure (omitted measurements).

2. Measurement of elevations and contouring **07 hrs**

Levelling - Terminologies, Types of levelling instruments viz Dumpy level, Auto level, electronic or digital level and their temporary adjustments, taking observations.

Methods of calculating reduced levels – HI method and rise and fall method.

Types of leveling curvature and refraction correction, sensitiveness of bubble tube.

Contours and contouring, characteristics of contours, contour interval, Contouring methods – Direct and indirect. Interpolation of contours. Preparation of contour maps. Uses of contour maps.

3. Theodolite surveying and Trigonometric levelling **04 hrs**

Theodolite surveying, terminologies used in theodolite, parts of a vernier theodolite, temporary adjustments. Measurement of horizontal angle, vertical angle and other theodolite applications. Theodolite traversing, locating landscape details.

Basic principles, calculation of heights and distances using single plane method and double plane method

4. Tacheometric Surveying **04 hrs**

Basic principle of stadia tacheometry; tacheometric equations for horizontal line of sight, inclined line of sight (LOS), when staff vertical to LOS and when staff normal to LOS; Anallactic lens, tangential method of tacheometry, subtense bar, and Beaman's stadia arc; determination of tacheometric constants.

Unit II

5. Curve surveying **06 hrs**

Types of curves, circular curve-terminologies, elements of a simple curve, methods of setting out simple curve- linear method, angular method; compound curves- elements of a compound curve, setting out of compound curve; Reverse curve-element of elements of a reverse curve, setting out of reverse curve; Transition curve- requirements of a transition curve, elements of transition curve, setting out of transition curve;

6. Modern Surveying Instruments: Theodolite, EDM and Total Station **08 hrs**

Modern theodolites- Micro-optic theodolites, electronic theodolites, digital theodolite Electromagnetic spectrum radar, electromagnetic distance measurement (EDM), EDM equipment- Geodimeter, tellurometer, mekenometer, distomat. Corrections to measurements; Total station- principles and working, temporary adjustments, application- angle measurement, distance measurement (horizontal, vertical and slope)

7. Areas and Volumes **06 hrs**

Computation of areas: Area from co-ordinates, latitude and departures, Mid-ordinate method, average ordinate method, Trapezodial rule, Simpson's rule, Computation of volumes: Volumes from cross sections, Prismoidal formula, and Trapezoidal formula capacity of reservoirs volume of borrow pits, Construction surveying / setting out works: Prerequisites, instruments and methods.

Laying out buildings, Setting-out of culverts, Setting-out bridges – locating the center line – locating bridge piers, Setting-out tunnels – Transferring alignment, Transferring bench marks or levels, Setting out Sewer lines

Unit III

8. Introduction to Photogrammetry and Remote Sensing: Terrestrial and Aerial photographs, Photo interpretation, Stereoscopy. **05 hrs**
Remote Sensing: Principle, Idealized remote sensing system, Types, applications. Introduction and applications of LIDAR.

9. Modern methods of Surveying **05 hrs**

Area from digital planimeter**,** Satellite based positioning system, Global Positioning System (GPS), basic principles, Satellite configuration, positioning using satellite signals, receivers; Functions - determining position, navigation, tracking, mapping, precise time determination; Application in surveying.
Introduction to GIS (Geographic Information System): Components, software, data, users, features, subsystems, data acquisition, data processing and analysis, communication, management, capabilities, operations, Applications of GIS in civil engineering.

Text Books

1. Alak, D., *Plane Surveying*, S. Chand & Co., 2000.
2. Bhavikatti S.S., *Surveying and Leveling Vol-I & II*, I.K. International Publishers, 2008.
3. Chandra, A.M., *Higher Surveying*, 3ed. New Age India Ltd. 2015.
4. Chandra, A.M., *Plane Surveying*, 3ed. New Age India Ltd. 2015.
5. Punmia, B.C., Ashok.K. Jain, Arun.K. *Surveying Vol. 1*, *Vol. 2* and *Vol. 3*., Lakshmi Publishers, 2015.

Reference Books:

1. Anderson, J. M. and Mikhail E. M., *Introduction to Surveying*, TMH, New York, 1985
2. Roy, S.K., *Fundamentals of Surveying*, Prentice Hall of India, 2010.

Course Title: Construction Project Management **Course Code: 15ECVC206**

L-T-P: 3-0-0 **Credits: 3** **Contact Hours: 3Hrs / Week**

ISA Marks: 50 **ESA Marks: 50** **Total Marks: 100**

Teaching Hours: 40 Hrs **Examination Duration: 3 Hrs**

Unit I

1. Introduction to Construction Project Management

Phases of construction project, importance of construction and construction industry, Indian construction Industry, Construction project management and its relevance, stakeholders of a construction project. **04 hrs**

2. Drawings and Specifications

Types of Drawings-Architectural and Structural, Study of Scales Used, sequence of dimensioning, dimension lines and figures, Importance of Specifications, General specifications detailed specifications of a typical building. Scope definition using drawings and specifications. **05 hrs**

3. Work Breakdown Structure

Concept of WBS, Common usage of terms, Preparing a WBS, Factors to be considered, WBS measurement considerations, Challenges to be considered, WBS level of Detail, WBS life-cycle considerations, Project risk and the WBS, Resource planning and management with WBS, Problems – Detailed WBS of a residential building. **06 hrs**

Unit II

4. Project Management through Networks

Introduction, project feasibility, planning methods of projects– Objectives, planning stages. Scheduling, Bar charts and mile stone charts. Introduction, Terms & definitions, Elements of network, types of network, drawing the network. CPM – Event times, Activity times, floats, critical activity and critical path. Problems. PERT – Introduction, time estimates, expected time, earliest expected time, latest allowable occurrence time, slack, critical path. **08 hrs**

Probability of completing the project. Problems. Updating of network. Problems. Contraction of network. Problems.

5. Construction Safety Management

Introduction, evolution of safety, Accident causation theories, unsafe conditions and acts, health and safety act and regulations, role of safety personal, causes of accidents, principles of safety, safety and health management system. **05 hrs**

6. Inspection and Quality Control

Introduction, Objectives, principles and function, Inspector's role, Technical services required for field inspection, Laboratories required, Quality control, Factors affecting the quality of conformance, Quality control methods. **04 hrs**

Unit III

6. Construction Equipment

Introduction, standard and special equipment, factor for selecting equipment, cost of owning and operating, economic life of an equipment. Earth moving equipment (Bulldozers, Scrapers, Loaders and Excavators). Hoisting equipment, concrete mixer and plants, conveyors and rollers, trenching machines, equipment for highway construction. Live projects for course project. **08 hrs**

Text Books

1. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, 2ed., Edition, Pearson Publications, 2015.

Reference Books:

1. Robert. L Peurifoy and William B. Ledbetter, *Construction planning and Equipment& methods*, Tata McGraw Hill Pvt. Ltd, New Delhi, 3ed., 2010.
2. Verma Mahesh, *Construction planning and Management*, Metropolitan Book Co. Delhi, 1982.

2019-20

Course Title: Structural Analysis-I		**Course Code: 15ECVC203**
L-T-P: 4-0-0	**Credits: 3**	**Contact Hours: 4 Hrs/ week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hours: 40 Hrs	**Examination Duration: 3 Hrs**	

Unit I

1. Structural Systems

Forms of structures, Conditions of equilibrium, Degree of freedom, Linear and Nonlinear structures, one, two, three dimensional structural systems, Static and Kinematics determinacy of structures. Theorem of minimum potential energy Law of conservation of energy Principle of virtual work. **6 HRS**

2. Deflection of Beams

Slope and deflection of simply supported and cantilever beams by Moment area method and Conjugate beam method. **6 HRS**

3. Strain Energy

Strain energy and complimentary strain energy, Strain energy due to axial load, bending and shear, Principle of virtual work, Unit load method, The first & second theorem of Castigliano, Betti's law, Clarke - Maxwell's theorem of reciprocal deflection, Problems on beams frames and trusses. **7 HRS**

Unit II

4 Analysis of beams and trusses

Analysis of beams (Propped cantilever and trusses) by strain energy and unit load method. **8 HRS**

5. Arches and cables

Three hinged circular and parabolic arches with supports at same levels and at different levels. Determination of thrust, shear and bending moment, Analysis of cables under point loads and UDL, length of cables - Supports at same level and at different levels. **6 HRS**

6. **Consistent deformation method**

Propped cantilever and fixed beams **6 HRS**

Unit III

7. Influence Line Diagrams

Influence line diagrams for simply supported, cantilever and over hanging beams, Influence line diagrams for girders supporting floor beams, Use of Influence line diagrams, Maximum S.F. and B.M. values due to moving loads	**6 HRS**

8. Two hinged arches:

Parabolic and circular arches	**6 HRS**

Text Books

1. Bhavikatti S.S, *Structural Analysis I*, 4ed., Vikas Publishing House Pvt. Ltd, Bangalore, 2011
2. Punmia, B. C. Ashok Kumar Jain and Arun Kumar Jain, *Mechanics of Materials*, Laxmi Publications Pvt. Ltd Ltd, New Delhi, 2005.

Reference Books:

1. Reddy C.S., *Basic Structural Analysis*, 3ed., Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2017.
2. A.K. Jain, *Advanced Structural Analysis*, 3ed., Nemchand and Brothers, Roorkee, India, 2015.
3. Leet,, Uang, and Anne M., *Fundamentals of Structural Analysis*, 3ed., Tata McGraw Hill Publishing Company Inc., New York, 2017.
4. Pandit G. S. and Gupta S. P, *Theory of Structures*, Vol I & II, Tata McGraw- Hill Publishing Company, New Delhi, 2017.
5. Ramamruthum, S. and Narayan, R., *Theory of Structures*, Dhanpat Rai Publishing Company, New Delhi, 2017.
6. Prakash Rao D. S., *Structural Analysis, A unified approach*, 1ed., University Press Limited, Hyderabad, 1996.
7. Timoshenko, S. P. and Young, D. H., *Theory of Structures*, Tata McGraw Hill Book Company, New York, 1965.