

CV Scheme and Syllabus 2020-21

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous College under VTU)
(NAAC Accredited with 'A' Grade, NBA Accredited)



Syllabus - V to VIII Semester B.E.
Outcome Based Education Curriculum

2020-2021

Department of Civil Engineering
NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
Mudugurki Village, Venkatagiri Kote Post,
Devanahalli taluk,
Bangalore district - 562 164

Fifth Semester B.E. - Scheme

| Sl. No | Course Code | Course | Teaching Department | L-T-P-S (Hrs/week) | Total Credits | Marks |
|--------|-------------|---------------------------------|---------------------|--------------------|---------------|-------|
| 1 | 18CVI51 | Transportation Engineering (IC) | CE | 3-0-2-0 | 4 | 100 |
| 2 | 18CVI52 | Fluid Mechanics (IC) | CE | 3-0-2-0 | 4 | 100 |
| 3 | 18CVT53X | Foundation Elective – IV | CE | 4-0-0-0 | 4 | 100 |
| 4 | 18EET54X | Engineering Elective – V | CE | 4-0-0-0 | 4 | 100 |
| 5 | 18CVT55 | Structural Analysis-II | CE | 3-0-0-0 | 3 | 100 |
| 6 | 18CVL56 | Cad Lab. | CE | 1-0-2-0 | 2 | 100 |
| 7 | 18CVH57 | General Aptitude | CE | 2-0-0-0 | 2 | 100 |
| 8 | 18CVT58 | Environment Science | CE | 1-0-0-0 | 1 | 100 |
| Total | | | | 21-0-6-0 | 24 | 800 |

| Foundation Elective – IV | | |
|--------------------------|-------------|---|
| Sl. No | Course Code | Course |
| 1 | 18CVT531 | Railways, Harbours & Tunnels |
| 2 | 18CVT532 | Hydrology and Irrigation Engineering |
| 3 | 18CVT533 | Natural Disaster Mitigation and Management |
| 4 | 18CVT534 | Construction Management and Engineering Economics |
| 5 | 18CVT535 | Design of Masonry Structures |
| 6 | 18CVT536 | Rural Water Supply and Sanitation |

| Engineering Elective – V | | |
|--------------------------|-------------|--|
| Sl. No | Course Code | Course |
| 1 | 18 EET 541 | Solid Waste Management(CV) |
| 2 | 18 EET 542 | Modeling of Residential Building using AI(CSE) |
| 3 | 18 EET 543 | Metal Forming Process (ME) |
| 4 | 18 EET 544 | C ⁺⁺ (EC) |
| 5 | | |

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|-------------------------------|--------------------|----------------------|----------------------|-----------------------|
| IC – Integrated Course | L - Lecture | T - Tutorials | P - Practical | S - Self Study |
|-------------------------------|--------------------|----------------------|----------------------|-----------------------|

Sixth Semester B.E. - Scheme

| Sl. No | Course Code | Course | Teaching Department | L-T-P-S (Hrs/week) | Total Credits | Marks |
|--------|-------------|---|---------------------|--------------------|---------------|-------|
| 1 | 18CVI61 | Limit State Design of Reinforced Concrete & Steel Structures (IC) | CE | 3-0-2-0 | 4 | 100 |
| 2 | 18CVT62 | Geotechnical Engineering | CE | 4-0-0-0 | 4 | 100 |
| 3 | 18CVI63 | Environmental Engineering (IC) | CE | 3-0-2-0 | 4 | 100 |
| 4 | 18CVT64X | Foundation Elective -VI | CE | 3-0-0-0 | 3 | 100 |
| 5 | 18EET65X | Engineering Elective –VII | CE | 4-0-0-0 | 4 | 100 |
| 6 | 18HOE66X | Open Electives-VIII | CE | 2-0-0-0 | 2 | 100 |
| 7 | 18CVL67 | Extensive Survey Camp | CE | 1-0-2-0 | 2 | 100 |
| 8 | 18CVH68 | Technical Aptitude and GD | CE | 1-0-0-0 | 1 | 100 |
| Total | | | | 21-0-6-0 | 24 | 800 |

| Foundation Elective -VI | | |
|--------------------------------|--------------|---|
| Sl. No | Courses Code | Course |
| 1. | 18CVT641 | Pavements Materials & construction |
| 2. | 18CVT642 | Traffic Engineering |
| 3. | 18CVT643 | Hydraulics & Hydraulics Machineries |
| 4. | 18CVT644 | Industrial Waste Water Treatment |
| 5. | 18CVT645 | Repair and Rehabilitation of Structures |
| 6. | | |

| Engineering Elective –VII | | |
|----------------------------------|-------------|--|
| Sl. No | Course Code | Course |
| 1 | 18 EET 651 | Remote sensing & GIS (CV) |
| 2 | 18 EET 652 | Data-Driven Models for Early Prediction of Construction Time (CSE) |
| 3 | 18 EET 653 | Non Destructive Testing (ME) |
| 4 | 18 EET 654 | Python (EC) |

| Open Elective – VIII | | |
|-----------------------------|---------------------|---------------------------------------|
| Sl. No | Courses Code | Course Name |
| 1 | 18 HOE661 | Lab View – Level 1 |
| 2 | 18 HOE 662 | Yoga Meditation |
| 3 | 18 HOE 663 | Martial Arts |
| 4 | 18 HOE 664 | Music (Carnatic / Instrumental) |
| 5 | 18 HOE 665 | Dance |
| 6 | 18 HOE 666 | Sports |
| 8 | 18 HOE 668 | Basics of Photography |
| 9 | 18 HOE 669 | Online Certificate courses from NPTEL |

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|-------------------------------|--------------------|----------------------|----------------------|-----------------------|
| IC – Integrated Course | L - Lecture | T - Tutorials | P - Practical | S - Self Study |
|-------------------------------|--------------------|----------------------|----------------------|-----------------------|

Seventh Semester B E Scheme

| Sl. No | Subject Code | Subject | Teaching Department | L-T-P-S (Hrs/week) | Total Credits | Marks |
|--------|--------------|-------------------------------|---------------------|--------------------|---------------|-------|
| 1 | 18 CVT71 | Estimation and Valuation | CE | 3-0-0-0 | 3 | 100 |
| 2 | 18 CVT72X | Foundation Elective- IX | CE | 3-0-0-0 | 3 | 100 |
| 3 | 18EET73X | Engineering Elective – X | CE | 3-0-0-0 | 3 | 100 |
| 4 | 18 HOE74X | Open Electives- XI | CE | 3-0-0-0 | 3 | 100 |
| 5 | 18 HOE75X | Open Electives- XII | CE | 3-0-0-0 | 3 | 100 |
| 6 | 18 CVL76 | Concrete Laboratory | CE | 1-0-2-0 | 2 | 100 |
| 7 | 18 CVL77 | Geo Technical Engineering Lab | CE | 1-0-2-0 | 2 | 100 |
| 8 | 18 CVP78 | Project Phase I | CE | 3-0-2-0 | 4 | 100 |
| Total | | | | 20-0-6-0 | 23 | 800 |

| Foundation Elective - IX | | |
|--------------------------|-------------|--|
| Sl. No | Course Code | Course |
| 1 | 18CVT721 | Water Resources Engineering |
| 2 | 18CVT722 | Pavement and Highway Geometric Design |
| 3 | 18CVT723 | Pre Stressed Concrete Structures |
| 4 | 18CVT724 | Design and Detailing of RC and Steel Structures |
| 5 | 18CVT725 | Sub Surface Exploration and Ground Improvement Techniques. |
| 6 | 18CVT726 | Basics of Earthquake Engineering. |

| Engineering Elective - X | | |
|--------------------------|--------------|---|
| Sl. No | Courses Code | Course |
| 1 | 18 EET 731 | Smart Cities and Application of IOT.(CV) |
| 2 | 18 EET 732 | Software and Computer Applications for Civil Engineering(CSE) |
| 3 | 18 EET 733 | Biomass Energy Systems(ME) |
| 4 | 18 EET 734 | AI&ML(EC) |
| | | |

| Open Elective - XI | | |
|---------------------------|---------------------|---|
| Sl. No | Courses Code | Course |
| 1 | 18HOE741 | Tax Management |
| 2 | 18HOE 742 | Assessment of Building Energy Performance (Offered by ASHRAE) |
| 3 | 18 HOE 743 | Ground Water Hydrology |
| 4 | 18 HOE 744 | Online Certificate courses from IITs/IISc/SWAYAM |
| 5 | 18HOE 745 | Online Certificate courses from NPTEL |

| Open Elective - XII | | |
|----------------------------|---------------------|--------------------------------------|
| Sl. No | Courses Code | Course |
| 1 | 18HOE 751 | Small & Medium Enterprise Management |
| 2 | 18 HOE 752 | Animation & Multimedia Engineering |
| 3 | 18 HOE 753 | Basics of RS,GIS & GNSS |
| | | |

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|-------------------------------|--------------------|----------------------|----------------------|-----------------------|
| IC – Integrated Course | L - Lecture | T - Tutorials | P - Practical | S - Self Study |
|-------------------------------|--------------------|----------------------|----------------------|-----------------------|

Eighth Semester B E Scheme

| Sl. No | Subject Code | Subject | Teaching Department | L-T-P-S (Hrs/week) | Total Credits | Marks |
|---------------|---------------------|-------------------------------------|----------------------------|---------------------------|----------------------|--------------|
| 1 | 18CVI81 | Professional Practice / Internship | CE | 2-0-2-0 | 3 | 100 |
| 2 | 18CVP82 | Project Phase – II & III | CE | 5-0-2-0 | 6 | 200 |
| 3 | 18CVP83 | Evaluation and Viva Voce (External) | CE | 3-0-2-0 | 4 | 100 |
| 4 | 18CVS84 | Technical Seminar | CE | 1-0-0-0 | 1 | 100 |
| | | Total | | 11-0-6-0 | 14 | 500 |

| | | | | |
|-------------------------------|--------------------|----------------------|----------------------|-----------------------|
| IC – Integrated Course | L - Lecture | T - Tutorials | P - Practical | S - Self Study |
|-------------------------------|--------------------|----------------------|----------------------|-----------------------|

| Transportation Engineering (IC) | | | | | |
|--|----------------|----------------|-------------------|----------------------|--------------------|
| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Code |
| 18CVI51 | 3:0:2:0 | 4 | 50:50 | 3 Hours | FC |
| <p>Course Objectives: This course will enable students to :</p> <ul style="list-style-type: none"> • Study the importance and characteristics of road transport and various committee. • Understand the recommendations, various road patterns and road development programs in India. • Analyze requirements of Ideal alignment and various geometrical design factors. • Gain knowledge on Pavement materials and its properties. • Identify the importance of Highway Drainage system and Highway Economics. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport, Jayakar committee recommendations and implementation – Central Road Fund, Indian Roads Congress.</p> <p>Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, Present scenario of road development in India (NHDP and PMGSY) and in Karnataka (KSHIP), Road development plan - vision 2021. 10Hours</p> | | | | | |
| Module – II | | | | | |
| <p>Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys- Map study, Reconnaissance, Preliminary and Final location and detailed survey, Reports and drawings for new and re-aligned projects.</p> <p>Highway Geometric Design-I: Importance, Terrain classification, Design speed, Factors affecting geometric design, Cross sectional elements; Camber- width of pavement-Shoulders, Width of formation- Right of way, Typical cross-sections. 10Hours</p> | | | | | |
| Module – III | | | | | |
| <p>Highway Geometric Design-II: Sight Distance-Restrictions to sight distance- Stopping sight distance- Overtaking sight distance- overtaking zones- Examples on SSD and OSD- Sight distance at intersections, Horizontal alignment-Radius of Curve- Super elevation Examples, Vertical alignment, summit and valley curves with examples. 10 Hours</p> | | | | | |
| Module – IV | | | | | |
| <p>Pavement Materials and Design Sub grade soil: Desirable properties - HRB soil classification- determination of CBR and modulus of sub grade reaction - Examples on CBR.</p> <p>Aggregates- Desirable properties and list of tests, Bituminous materials- Explanation on Tar, bitumen, List of tests on bituminous materials. Pavement types, component parts of flexible and rigid pavements and their functions, Rigid pavement- Westergaard's equations for load and temperature stresses, Examples. 10 Hours</p> | | | | | |
| Module – V | | | | | |
| <p>Highway Drainage: Significance and requirements, Surface drainage system and design Examples sub surface drainage system.</p> <p>Highway Economics: Highway user benefits, Economic analysis - annual cost method- Benefit Cost Ratio method-NPV-IRR methods- Examples. 10 Hours</p> | | | | | |

List of Highway Material Testing Lab Experiments

| Sl No. | Name of the Experiment |
|---|---|
| Test on Aggregates | |
| 1 | Aggregate crushing value |
| 2 | Aggregate abrasion value (Los Angels Abrasion Test) |
| 3 | Aggregate Impact value |
| 4 | Shape tests on aggregates (Flaky, elongation) |
| Test on bituminous materials and mixes | |
| 5 | Specific gravity of bitumen |
| 6 | Penetration test on bitumen |
| 7 | Ductility test on bitumen |
| 8 | Viscosity test on bitumen |
| 9 | Softening point test on bitumen |
| 10 | Flash and fire point test on bitumen |
| 11 | Marshall Stability tests on bituminous |

Course Outcomes: After successful completion of the course, students will be able to,

- Compare the different modes and characteristics of road transport that includes various features and committees.
- Recognize different road patterns and road development programs in India.
- Analyze factors influencing road alignment, different types of road surveys and factors influencing geometric design.
- Develop the knowledge of horizontal and vertical alignment, Pavement materials and its properties.
- Design drainage for roads and prepare the total estimation of the project.

Text Books:

- Dr. S.K. Khanna, Dr. C.E.G Justo, A. Veraraghvan, “Highway Engineering” Revised 10th Edition, Nem Chand & Sons (2017)
- L.R. Kadiyali, “Principles And Practices Of Highway Engineering”(Including Expressways And Airport Engineering), Khanna Publishers(2005)
- Transportation Engineering, K P Subramaniam, ISBN:978-8174092205 2nd edition, 2011, Scitech Publications, Chennai
- Introduction to Transportation Engineering, James H Banks, ISBN-13: 978-0070702462 2nd edition, 2004, Mc. Graw. Hill Pub. New Delhi
- Construction Equipment and its Management- S.C. Sharma, (Chapters 1,2,3,4,6,7) SBN:9788174092281 8174092285 xvi+893 Yr. of Pub.2013 Paper Back English Khanna Publishers, Delhi.

Reference Books:

- IRC Codes, Indian Road Congress Publications
- “Specifications for Roads and Bridges”-MoRT&H Specifications, Indian Road Congress

Publications(2013)

- C. Jotin Khisty, B. Kent Lal, “Transportation Engineering, PHI Learning Pvt. Ltd”, 3rd Edition(2002)
- E.J. Yoder, M.W. Witzak, “Road materials & Pavement Design”, Wiley India Pvt Ltd; 2nd edition (2011)
- James H Banks, “Introduction to Transportation Engineering”, McGraw. Hill Publications(2010)

E-Resources:

- <https://www.fhwa.dot.gov/environment/publications/flexibility/ch01.cfm>
- <https://www.railelectrica.com/traction-mechanics/train-grade-curve-and-acceleration-resistance-2/>
- <http://nptel.ac.in/courses/105104098/TransportationII/lecture6/7slide.htm/>
- <http://www.aboutcivil.org/highway-drainage-design-guidelines-structures.html>
- <http://nptel.ac.in/courses/105104098/45>
- <https://www.youtube.com/watch?v=qbO7ZMfCDWI>

| Fluid Mechanics (IC) | | | | | |
|---|-----------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVI52 | 3-0-2 | 4 | 50:50 | 3 hours | FC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Understand fluid properties, fluid statics and fluid pressure. • Analyse the system in terms of kinematic concepts related to fluid flow. • Compute the discharge through pipes, notches and weir • Design of uniform open channels of different cross sections including most economical sections • Compute force exerted by jet on different type of vanes and to design impulse turbine and to know operation characteristics under different operating conditions | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Fluids & Their Properties: Introduction to fluids, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Viscosity, Cohesion, Adhesion, Surface tension & Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems). Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems. | | | | | |
| Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Measurement of pressure using simple, differential & inclined manometers (theory & problems). 10 Hrs | | | | | |
| Module – II | | | | | |
| Hydrostatic Pressure on Surfaces: Introduction, Definitions Total pressure and Centre of pressure, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged plane surfaces-Problems. Practical applications of Total pressure and centre of pressure. | | | | | |
| Kinematics and Dynamics of Fluid Flow: Introductions, methods of describing fluid motion, types of fluid flow, streamline, path line. Three dimensional continuity equations in Cartesian Coordinates (derivation and problems), Bernoulli's equation using Euler's equation of motion with assumptions and limitations (Problems). 10 Hrs | | | | | |
| Module – III | | | | | |
| Flow through pipes | | | | | |
| Head losses - Major loss & Minor loss, Darcy - Weisbach Equation, Hydraulic Gradient line, Total Energy Line, Series and Parallel Network of pipes, Numerical Problems. | | | | | |
| Orifice and mouth piece: Hydraulic coefficients, Concept of Orifice and Mouthpiece (No Numerical Problems). | | | | | |
| Notches and Weirs: Definition of Notch and Weir, Flow through V-notch, Rectangular weir, Cippoletti weir, Corrections for Velocity of Approach, End Contractions, Numerical Problems. 10 Hrs | | | | | |
| Module – IV | | | | | |
| Open Channels Flow: | | | | | |
| Calculation of Velocity using Chezy's and Manning's equations, Hydraulic Efficient Channels: Rectangular and Trapezoidal channel, Numerical Problems. Specific Energy, Critical Depth, Froude's Number, Specific Energy Diagram, Subcritical and Supercritical flows, Alternative Depths, Hydraulic Jump, Numerical Problems. 10 Hrs | | | | | |
| Module – V | | | | | |
| Impact of Jet on Vanes: Impact of jet on vanes, Force exerted by the jet on a straight & curved vane (Stationary & Moving). Velocity triangles, Numerical Problems. | | | | | |
| Pelton wheel: Components and working principle. Maximum power, Efficiency, working proportions-problems. | | | | | |
| Francis Turbines: Components and working principle. Draft Tube: Types, Efficiency of | | | | | |

Draft tube and problems.

10Hrs**Laboratory Experiments****List of Experiments****Cycle 1**

1. Calibration of V- Notch
2. Calibration of Rectangular Notch
3. Calibration of Broad Crested Weir and Ogee Weir

Cycle 2

4. Orifice/mouth piece
5. Calibration of Venturimeter
7. Pipe losses

Cycle 3

8. Impact of jet on vanes
9. Centrifugal pump
11. Pelton wheel turbine
12. Kaplan Turbine

Course Outcomes:

Students will be able to

- Solve problems on fluid properties, fluid statics and fluid pressure.
- Analyse the system in terms of kinematic concepts related to fluid flow
- Compute the discharge through pipes, notches and weir
- Design of uniform open channels of different cross sections including most economical sections
- Compute force exerted by jet on different type of vanes and to design impulse turbine and to know operation characteristics under different operating conditions

Text Books:

- P.N. Modi & S.M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House
- Madan Mohan Das, "Fluid Mechanics and Turbo Machines", PHI Learning Pvt. Ltd. 2011
- R.K. Bansal: "A Text book of Fluid Mechanics and Hydraulic Machines", 9th Edition, 2014, Laxmi Publications, New Delhi, ISBN: 978-81-318-0815-3.

Reference Books:

- K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
- K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.

E-Resources:

- <https://nptel.ac.in/courses/105/103/105103095/>
- <https://nptel.ac.in/courses/105/105/105105203/#>
- <https://nptel.ac.in/courses/105/103/105103096/>

| Railways, Airport, Harbor and Tunnels | | | | | |
|---|----------------|----------------|-------------------|----------------------|--------------------|
| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT531 | 3:0:0:0 | 3 | 50:50 | 3 hours | PEC |
| <p>Course Objectives: This course will enable students to :</p> <ul style="list-style-type: none"> • Understand the importance of Railways and various components of railway track. • Know about the Tractive resistances & super elevation involved for movement of train & geometric elements of a track. • Know about the layout of an airport, site selection, aircraft characteristics and runway design. • Gain the knowledge on types of Tunnels & methods of tunneling. • Know the importance of Harbors and Docks. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Railway Engineering: Advantages of railways as transportation mode, Typical cross sections, suitability of different gauges, Coning of wheels, components of the permanent way - Rails, Sleepers, Ballast and Fixtures - functions, types, requirements. Functions, requirements, Track fitting and fasteners-Fish plates-bearing plates, Calculation of quantity of materials required for laying a track-Examples. 10 Hours</p> | | | | | |
| Module – II | | | | | |
| <p>Traction and Tractive Resistance: Traction and Tractive resistance, Gradients, super elevation, cant deficiency, Negative super elevation, Points and crossings, Salient features of Metro transport. Geometric Design of Railways: Necessity, Safe speed on curves, Cant-cant deficiency- negative cant-safe speed based on various criteria, (both for normal and high speed tracks) Transition curve, Gradient and types, grade compensation, Examples on above. 10 Hours</p> | | | | | |
| Module – III | | | | | |
| <p>Airport Engineering: Features and Role of Airways in transportation, Aircraft characteristics, Air transportation planning, wind rose diagram, site selection, Airport components and diagram, basic length and corrected length of runway length, Taxiway - Turning radius, exit taxiway, design factors and elements. 10 Hours</p> | | | | | |
| Module – IV | | | | | |
| <p>Tunnel Engineering And Harbours: Advantages and disadvantages, Different shapes of tunnels, Surveying-Transferring centre line, and gradient from surface to inside the tunnel working face, Tunneling in rocks-Drift method, Heading and benching method, Tunneling methods in soils-Needle beam, Liner plate, Tunnel lining, Tunnel ventilation, Pilot tunneling. 10 Hours</p> | | | | | |
| Module – V | | | | | |
| <p>Harbours and Docks: Types, components, Natural phenomenon affecting the design of harbours. Wind, wave and tides. Currents, Breakwaters - types, wharf and quays, Jetties and piers. Spillways. Docks: Dry dock and wet docks, Slipways, Navigational aids, warehouse and transit-shed. 10 Hours</p> | | | | | |
| <p>Course Outcomes: After successful completion of the course, students will be able to,</p> <ul style="list-style-type: none"> • Identify the importance of Railway Engineering in transportation sector. • Design the various Geometrics of railways.. • Analyze the components of Airport design. | | | | | |

- Demonstrate the different types of tunnels and methods of tunneling.
- Identify the importance of Harbour and dock construction.

Text Books:

- S.C. Saxena and S.P Arora: “Railway Engineering”, (Chapters 1-11, 15), 7th Edition, Dhanpat Rai Publications, New Delhi, ISBN: 9788189928834.
- S.K Khanna, M.G Arora, S.S Jain - Airport Planning and Design, (Chapters 1,3,5-8), 6th Edition, Nem Chand Bros - Roorkee, ISBN: 81-85240-68-10.
- R. Srinivasan: “Harbour, Dock and Tunnel Engineering”, (Chapters 1-3), Charaotar Publishing House, 28th Edition, 2016, ISBN: 9789385039195.

Reference Books:

- J S Mundery: “Railway Track Engineering”, (Chapters 1-5), Tata McGraw-Hill Education, 4th Edition, 2009.
- Hasmukh P. Oza, Gautam H. Oza “Dock and Harbour Engineering”, (Chapters 8-12,17,21), 7th Edition, Charotar Publishing house Pvt. Ltd., Gujarat, India, ISBN: 9789380358789.

E-Resources:

- <http://nptel.ac.in/courses/105107123/>
- <https://www.railelectrica.com/traction-mechanics/train-grade-curve-and-acceleration-resistance-2/>
- <http://www.faa.gov/airports/engineering/>
- <https://sites.google.com/a/venusict.org/dha/material>

| Water Resources Engineering | | | | | |
|---|-----------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT532 | 3-0-2 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| <p>The students will be able to:</p> <ul style="list-style-type: none"> • Prepare the students for a successful career as hydrologist and water resources engineers. • Develop the ability among students to synthesis data and technical concepts for application in hydrology and water resources engineering. • Provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, analyze, solve engineering problems and to prepare them for their career. • Provide students with advanced tools of data collection and the analysis of the same with respect to water resources. • Promote student awareness for the lifelong learning and to introduce them professional ethics and codes of professional practice in water resources management. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Basics of Hydrometeorology: Hydrologic cycle, Global water budget, Practical applications – Hydrometeorology, Air front, cyclones, Formation of precipitation, Types and forms of precipitation, Climate and Weather Meteorological Observations.</p> <p>Precipitation: Measurement of rainfall, Radar Measurement of rainfall, Rainfall Hyetograph, Intensity Duration and Frequency analysis, Consistency, Missing data, Average depth of rainfall analysis (Theory and Problems). 08 Hrs</p> | | | | | |
| Module – II | | | | | |
| <p>Surface Runoff: Concept of catchment, Linear, Areal and Relief Aspects, Detailed study of Runoff process, Factors affecting Runoff, Runoff estimation, Strange and SCS methods, yield estimation. 08 Hrs</p> | | | | | |
| Module – III | | | | | |
| <p>Ground Water: Groundwater in Hydrologic Cycle, Origin of groundwater, Rock properties affecting groundwater, Types of aquifer, Darcy’s law, coefficient of permeability, groundwater flow rates, permeability formulae, laboratory and field measurement of permeability, Ground water movement. 08 Hrs</p> | | | | | |
| Module – IV | | | | | |
| <p>Water Harvesting And Conservation: Water Harvesting Techniques, Micro Catchments, Design of Small Water Harvesting Structures – Farm Ponds, Percolation Tanks, Yield from a Catchment, Site selection for artificial recharge, Rain water and Runoff Harvesting in Rural and Urban Areas, Reservoir Sedimentation 08 Hrs</p> | | | | | |
| Module – V | | | | | |
| <p>Watershed Management: Project Proposal Formulation, Watershed Development Plan, Entry Point Activities, Estimation Watershed Economics, Agroforestry, Grassland Management, Wasteland Management, Watershed Approach in Government Programmes, Developing Collaborative know how People’s Participation, Evaluation of Watershed Management. 08Hrs</p> | | | | | |
| Course Outcomes: | | | | | |
| <p>Students will be able to</p> <ul style="list-style-type: none"> • Explain hydrologic cycle and hydro meteorological measurements with a know how about various methods of field measurements and estimation of precipitation. • Recognize the process of abstraction and runoff which they apply to carry out the assessment of water balance and runoff potential. | | | | | |

- Gain knowledge about basic aquifer parameters and groundwater resources for different hydro-geological boundary conditions.
- Recognize the need of water harvesting and conservation.
- Develop the water shed management concepts in accordance with importance to society.

Text Books:

- Subramanya K: “Hydrology”, Tata McGraw Hill Co., New Delhi, ISBN: 9781259029974.
- Jeya Rami Reddy P: “Hydrology”, Laxmi Publications, New Delhi, ISBN: 9788170080992.
- Vir Singh: “Watershed Planning and Management”, Raj Yash Publishing House, Bikaner, ISBN: 9788186882405.

Reference Books:

- Ven Te chow: “Handbook of applied hydrology”, McGraw Hill Book company. ISBN: 978-0070107748.
- S. K. Garg: “Irrigation Engineering and Hydraulic structures”, Khanna Publication, New Delhi, ISBN: 978-8174090478.
- P.N.Modi: “Irrigation, water Resources and water power Engineering”, Standard book house, New Delhi, ISBN: 978-8189401290.

E-Resources:

- <https://nptel.ac.in/courses/105/101/105101002/>
- <https://nptel.ac.in/courses/105/101/105101010/>

| Natural Disaster Mitigation and Management | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT533 | 4-0-0 | 4 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Understand about types of Natural Disasters and Disaster Management Cycle. • Develop skills in various stages of preparedness, mitigation and Management of Natural Hazards. • Obtain Complete Knowledge on the Water and Weather related Disaster Management. • Demonstrate the knowledge of Various Organization and Stakeholders Working on Disaster Management. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Natural Disasters – Overview: Introduction- Natural Disasters around the world-Natural Disaster Risk Assessment- Earth and its characteristics Human Dimensions of Global environment Change – Disaster mitigation, preparedness, response and recovery comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food & Nutrition and Shelter -Role of UN Red cross and NGOs. | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| Natural Hazards: Introduction and Review - Natural Disasters - Principles, Elements, and Systems-Geological-Geomorphological aspects, Earthquake- Geology, Seismology, Characteristics and dimensions – Landslides - Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc.- Tsunami -Nature and characteristics. | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| Climate system aspects and Processes: Oceanic, Atmospheric and Hydrologic cycles - Severe Weather and Tornadoes , Cyclones, Floods and Droughts - Global Patterns - Mitigation and Preparation – Drought –Famine- nature and dimensions – Drought Assessment and Monitoring. | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| Natural Disaster Communication: Mapping - Modeling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination, mobile communication Etc. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| Administrative mechanisms: Community and Social organizations – Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self-education. | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to <ul style="list-style-type: none"> • Understand types of natural disasters and its management. • Develop organizational and Administrative strategies for managing Natural Hazards. | | | | | |

- Learn methodologies for disaster risk assessment w.r.t Water and Climate related disasters.
- Apply tools like GPS, GIS, Remote sensing, information technologies, etc. for managing the disasters.
- Specify key roles of capacity building to face disaster among government bodies, institutions, NGO's, etc.

Text Books:

- Kovach, Robert L.: "Earth's Fury: An Introduction to Natural Hazards and Disasters", Englewood Cliffs, N.J., Prentice Hall, 1995.
- B.Narayan: "Disaster Management", S.B.Nangia, A P H publishing corporation, Delhi-2014
- Siddhartha Gautam, K Leelakrishna Rao: "Natural disaster Management", 3rd Edition, 2012, ISBN: 9381604320.

Reference Books:

- Arul Jothi, D L Balaji: "Safety and Disaster Management Education In Schools", 1st Edition, Anmol Publications, 2009, ISBN: 9380252609.

E-Resources:

- <https://www.ndma.gov.in/en/>
- www.nrdms.gov.in/natural_disaster.asp
- <https://www.ksndmc.org/Default.aspx>

| Construction Management and Engineering Economics | | | | | |
|---|-----------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT534 | 4-0-0 | 4 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Understand the fundamentals of construction and project management. • Learn the fundamentals of Resource management. • Study the concepts of Construction Economics and Finance. • Learn financial management and construction accounting. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Introduction: Construction Team and functions of a construction manager. Project Organization, Types, structure and practices. Stages of construction project, Delays. Job layout, Construction schedules - Preparation, uses and types of construction schedule. | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| Project management: Project Planning, Scheduling, Monitoring and Updating. Work Breakdown Structure, Introduction to CPM and its applications, Network fundamentals, Numerical on Fulkerson's rule. Introduction to PERT and its uses and importance, Numerical on Time estimates. | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| Resources management: Equipment-Selection, planning and financing. Equipment management and maintenance, Owning and operation costs. Materials management-Importance, objectives and uses. Functions of materials management department and stores management. | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| Engineering economics: Basic principles, Time value of money, Nominal and Effective Interest, Discounted cash flow, Cash flow diagrams Equivalence – Single payment Compound amount factor, Uniform annual series payments – Derivations and problems. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| Financial management –Working capital management, Sources of finance, Long term and short term Finance Construction accounting – Basic concepts and principles, Income statement, Financial statements – Profit and Loss, balance sheets Taxation Inflation and Depreciation – methods of depreciation. | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to <ul style="list-style-type: none"> • Recognise the nature of construction industry and the importance of management. • Formulate project management principles to solve problems on construction network and time estimates. • Manage the resources efficiently in construction. • Apply the concepts of economics and finance in constructions. • Manage finance and accounts in construction. | | | | | |
| Text Books: | | | | | |
| <ul style="list-style-type: none"> • Chitkara K K: "Construction Project Management", 10th Reprint, Tata McGraw Hill, 2006, ISBN-13: 978-9339205447. | | | | | |

- Srinath L.S: “PERT and CPM”, 3rd Edition, East West Press Pvt. Ltd., New Delhi, 2001, ISBN-13: 978-8185336206.
- Courtland A. Collier and William B. Ledbetter, “Engineering Economics and Cost Analysis”, Harper and Row, 2005, ISBN-13: 9780673983947.

Reference Books:

- Peurifoy. R L: “Construction Planning, Equipment and Methods”, 6th Edition, (Chapters 1,2), McGraw Hill, 2001, ISBN 13: 9780072321760.
- Harris F and McCaffer R.: “Modern Construction Management”, 7th Edition, (Chapters 4,6,7), BSP Professional Books, 2013, ISBN-13: 978-0470672174.

E-Resources:

- nptel.ac.in/courses/105103023/
- <http://www2.aku.edu.tr/~icaga/kitaplar/fundamentals-of-construction-management.pdf>
- https://iimtstudies.files.wordpress.com/2014/03/finance_and_eco.pdf
- https://www.openstaxcollege.org/files/textbook_version/low_res_pdf/21/ principles-of-economics-LR.pdf

| Design of Masonry Structures | | | | | |
|---|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT535 | 3-0-0-0 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| <p>The students will be able to:</p> <ul style="list-style-type: none"> • Understand the concept of masonry construction. • Recognize the strength and stability aspects along with defects in masonry. • Study the behaviour of masonry under compression. • Compute flexural and shear bond strengths. • Design the load bearing masonry building as per BIS codal provisions. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Masonry Units, Materials, Types and Masonry Construction: Brick, stone and block masonry units – strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars, selection of mortars. 10 Hrs</p> | | | | | |
| Module – II | | | | | |
| <p>Strength, Stability and Defects: Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks. 10 Hrs</p> | | | | | |
| Module – III | | | | | |
| <p>Strength of Masonry in Compression: Behaviour of Masonry under compression, strength and Young's modulus, influence of mortar and masonry unit, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context. Effects of slenderness and eccentricity on compressive strength. 10 Hrs</p> | | | | | |
| Module – IV | | | | | |
| <p>Flexural and shear bond: Bond between mortar and masonry unit, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. 10 Hrs</p> | | | | | |
| Module – V | | | | | |
| <p>Permissible Stresses, Design Considerations and Load Considerations for Masonry: Permissible stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses. Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels. Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, freestanding wall.</p> <p>Design of Load Bearing Masonry Buildings: Design of load bearing masonry for building up to 3 storeys using IS : 1905 and SP : 20 procedure. 10 Hrs</p> | | | | | |
| Course Outcomes: | | | | | |
| <p>Students will be able to</p> <ul style="list-style-type: none"> • Classify and describe the characteristics of brick, stone, clay block, concrete block. • Comprehend the factors affecting the strength and stability of masonry. • Describe the behavior of masonry under compression, strength and elastic properties. | | | | | |

- Calculate masonry flexural, shear bond strength of and permissible compressive stress.
- Analyze and design the load bearing masonry building.

Text Books:

- Hendry A.W , “Structural masonry”, Macmillan Education Ltd., 2nd edition, ISBN-13: 978-0333733097
- Sinha B.P & Davis S.R. “Design of Masonry structures”, E. & F. N. Spon, 2004.
- Jagadish K. S, Venkatarama Reddy B. V and Nanjunda Rao K. S, “Alternative building materials & technologies”, New age International, New Delhi & Bangalore, 2007.

Reference Books:

- Dayaratnam P, “Brick & Reinforced Brick structures”, Oxford & IHB. ISBN-13: 978-8120402492, 2017.
- Sven Sahlin, “Structural Masonry”, Prentice Hall, ISBN-13: 978-0138539375, 1971.
- IS 4326: Code of practice for earthquake resistant design and construction of buildings.
- IS 1905: Code Of Practice for Structural Use of Unreinforced Masonry.
- SP 20: Handbook on Masonry Design and Construction.

E-Resources:

- <https://nptel.ac.in/courses/105/106/105106197/>

| CONSTRUCTION QUALITY MANAGEMENT SYSTEM (QA/QC) | | | | |
|--|----------------|----------------|-------------------|--------------------|
| Course Code | L:T:P:S | Credits | Exam marks | Course Type |
| 18EET541 | 4-0-0-0 | 4 | 50:50 | PEC |
| Course Objectives: | | | | |
| The students will be able to: <ul style="list-style-type: none"> ● Learn the importance of quality assurance and control ● Know the ISO standards for construction and QC/QA plan ● Provide the performance monitoring requirements for QC/QA ● Study the construction deficiencies, documentation, field changes and reporting ● Apply the above concepts for life project. | | | | |
| Syllabus | | | | |
| Module – I | | | | |
| Introduction: Construction Quality, Definition of quality as given by Deming, Juran, Crosby, Inspection and Testing, Quality aspects in every phase in the life cycle of Construction project, Quality control, Quality Assurance, difference between Quality control, Quality Assurance (QA/QC). PDCA Cycle. 10 hrs | | | | |
| Module – II | | | | |
| Quality Systems: Study of ISO 9000 - Quality System Standards, Purpose of ISO Standards - project setting construction QC/QA plan - contracts description - objectives of this construction quality assurance plan (CQAP) - organization Project QC/QA organization - responsibilities and authorities of organizations- environmental protection agency - structure of QC/QA organization - responsibilities and authorities of key personnel - contractor's quality control personnel - QC systems manager 10 Hrs | | | | |
| Module – III | | | | |
| Performance monitoring requirements - quality of life performance standards - pollution prevention - reporting Inspection and verification activities - general construction inspection and verification requirements - control, verification and acceptance testing plan – inspections - preparatory inspection - initial inspection - follow-up inspection - completion inspection - QC testing - QA testing - construction acceptance criteria - construction audits - compliance with handling, storage, packaging, - preservation, and delivery requirements - material identification and traceability . 10 Hrs | | | | |
| Module – IV | | | | |
| Construction deficiencies - deficiency identification - contractor qc deficiency identification and control - non-conformance report - contractor QC deficiency correction - preventive actions Documentation - daily record keeping - daily construction report - inspection and testing report forms - record drawings - control of quality records Environmental requirement approvals (environmental protection agency) - required submittals – CQAP - work completion report - EPA approval Field changes - CQAP changes - QC changes Final reporting: As-built drawings and specification – QA/QC report 10 Hrs | | | | |
| Module – V | | | | |
| Project Base Learning Quality plan for a small residential building including documentation using templates. 10 Hrs | | | | |

Course Outcomes:

On completion of this course, students will be able to:

- Gain the knowledge of different aspects of quality
- Implementation of ISO standards and QC/QA plan
- Perform monitoring requirements for QC/QA
- Identify construction deficiencies, documentation, field changes and reporting for site
- Evaluate the QA/QC plan for life project.

Text Books:

- 1 N. Logothetis, "Management for Total Quality", 8th Edition, Prentice Hall New Delhi, 2003.
- 2 D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book House, Bangalore. 2000
- 3 James O Brien, P.E. (1989) "Construction Inspection Handbook: Quality Assurance/Quality Control" Springer US, SBN: 978-1-4757-1193-6 (Print) 978-1-4757-1191-2 (Online)

References:

1. Robert (QMP) "Bench Marking", "The search for industry Best Practices that led to superior performance" American Society of Quality 1995.
2. Parsons (2007) "Construction Quality Control/Quality Assurance Plan Phase 1 Facility Site Work Construction Hudson River PCBs Superfund Site" GE Company – Parsons Project Office 381 Broadway, Bldg 40-2, Fort Edward, NY 12828
3. Break Joseph and Susan Joseph "Total Quality Management", Excel Books , New Delhi, 1995.
4. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.
5. Ishikawa, K. (2006). Introduction to quality control. Productivity Press, Chennai.
6. Mathur, P. (2003). Implementing ISO 9001:2000. Vikas Publishing House, New Delhi.
7. Mitra, A. (2001). Fundamentals of quality control and improvement. Pearson Education Asia, New Delhi.
8. Mohanty R., Lakhe R. (2002). Total quality management. Jaico Publication House, Mumbai.

Eresources:

<https://nptel.ac.in/courses/110/104/110104080/>

| Structural Analysis-II | | | | | |
|---|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT55 | 3-0-0-0 | 3 | 50:50 | 3 hours | FC |
| Course Objectives: | | | | | |
| <p>The students will be able to:</p> <ul style="list-style-type: none"> • Evaluate the beams by influence line diagram and rolling loads. • Understand the concepts of indeterminate structures by deflection method. • Analyze the beams and frames by moment distribution method. • Determine the unknown moments by kani's method. • Develop the matrix for static indeterminate structures. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Rolling Load and Influence Lines: Rolling load analysis for simply supported beams for several point loads and UDL, Influence line diagram for reaction, SF and BM at a given section for the cases mentioned above.</p> <p>Slope Deflection Method: Introduction, Sign convention, Development of slope- deflection equations and Analysis of Beams, Analysis of Orthogonal Rigid jointed plane frames including sway with kinematic redundancy less than/equal to three.</p> | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| <p>Moment Distribution Method: Introduction, Definition of terms- Distribution factor, Carry over factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames including sway with kinematic redundancy less than/equal to three.</p> | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| <p>Kani's Methods: Introduction, Basic Concept, Analysis of Continuous beams and Analysis of rigid jointed plane frames with and without sway.</p> | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| <p>Stiffness Matrix Method of Analysis: Introduction, Development of stiffness matrix for continuous beams, plane truss element and axially rigid plane framed structural elements with kinematic indeterminacy ≤ 3.</p> | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| <p>Matrix Method of Analysis (Flexibility Method) : Introduction, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤ 3.</p> | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| <p>Students will be able to</p> <ul style="list-style-type: none"> • Illustrate the concepts of ILD and moving loads on determinate structures. • Apply the knowledge of structural analysis in engineering problems. • Identify the suitable method to solve complex problems. • Analyze determinate and indeterminate structures by different methods. • Formulate the matrix for structural elements. | | | | | |
| Text Books: | | | | | |

- S S Bhavikatti: “Structural Analysis - Vol. II”, (Chapters 1, 3-6), Vikas Publishing House, 4th Edition, 2009, ISBN: 9789325968806, 9325968800.
- S Ramamrutham and R Narayan: “Theory of Structures”, (Chapters 9-12,14), Dhanpat Rai Publishing Company Private Limited, New Delhi, 9th Edition, 2014, ISBN: 978-9384378103.

Reference Books:

- Reddy C. S: “Basic Structural Analysis”, (Chapters 11-13,18), Tata McGraw Hill, New Delhi, 3rd Edition, 2010, ISBN: 9780070702769.
- G.S. Pandit and R. Gupta: “Theory of Structures” Vol. 2, (Chapters 1-5), Tata McGraw Hill Publication Company Ltd., 1st Edition, ISBN: 9780074634981, 0074634984

E-Resources:

- <http://elearning.vtu.ac.in/elcmys/13/ENotes/ECEEM/GR.pdf>
- http://elearning.vtu.ac.in/elcmys/e-con/Stru_Ana/ch5/html/0004.htm
- http://elearning.vtu.ac.in/elcmys/P2/CV42/Chapter_05/html/0004.htm
- <http://elearning.vtu.ac.in/elcmys/StruAna.htm>

| General Aptitude | | | | | |
|---|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVH57 | 3-0-0-0 | 1 | 50:50 | 3 hours | |
| Course Objectives: | | | | | |
| The students will be learning: <ul style="list-style-type: none"> • Understand different types of Numerical / Arithmetical problems. • Understand the different Data interpretation problems. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Numerical Ability-I: Numbers, HCF and LCM of numbers, Decimal Fractions, Average, Problems on Numbers, Problems on Ages. | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| Numerical Ability-II: Percentage, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule, Time and Work. | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| Numerical Ability-III: Pipes and Cistern, Time and Distance, Problems on Trains, Alligation or Mixture, Simple Interest, Compound Interest. | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| Numerical Ability-IV: Races and Games of Skill, Calender, Clocks, Permutations and Combinations, Probability, Odd man out and Series. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graphs. | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to <ul style="list-style-type: none"> • Solve and analyze different types of Numerical / Arithmetical problems. • Solve and analyze different Data interpretation problems. | | | | | |
| Text Books: | | | | | |
| <ul style="list-style-type: none"> • R S Aggarwal, “Quantitative Aptitude for competitive examinations”, (Chapters 1-3,6-8,10-18,20-22,26-28,30,31,35-39), S. Chand Publishing, New Delhi, 2014, ISBN-13: 978-81-219-2498-6. | | | | | |

Reference Books:

- GKP, “General Aptitude: Quantitative Aptitude & Reasoning” ISBN-13: 9788183559591 G.K. Publications Private Limited

E-Resources:

- <https://nptel.ac.in/>

| Limit State Design of RC and Steel Structure | | | | | |
|--|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVI61 | 4:0:0:0 | 4 | CIE:50 SEE:50 | 4 hours | FC |
| Course Objectives: | | | | | |
| This course will enable students to: | | | | | |
| <ul style="list-style-type: none"> • Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading. • Follow a procedural knowledge in designing various structural RC elements. • Impart the culture of following the codes for strength, serviceability and durability as an ethics. • Provide knowledge in analysis and design of RC elements for the success in competitive examinations. • Analyse the behaviour of different connections used in steel structures. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications – Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC – Stress strain behaviour of Concrete and Reinforcing Steel – Analysis and Design of Singly reinforced Rectangular beams by working stress method – Limit State philosophy as detailed in IS code – Advantages of Limit State Method over other methods – Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method. 8 Hours | | | | | |
| Module – II | | | | | |
| Design Of Slabs: Types of slabs - Analysis and design of one way simply supported and continuous slabs and supporting beams-Two-way slab. | | | | | |
| Design of Columns: Effective length of column, Slenderness ratio for columns, Minimum eccentricity, Design of short axially loaded columns, Design of column subject to combined axial load and uni-axial and bi-axial moment using SP – 16 charts. 8 Hours | | | | | |
| Module – III | | | | | |
| Design of Stair cases: General features; types of stair case, Design of Dog legged and Open well staircases. | | | | | |
| Design of Footings: Introduction, Types of footings – selection - Design of isolated rectangular footing for axial load – Design of combined and raft footings. 8 Hours | | | | | |
| Module – IV | | | | | |
| Introduction: Advantages and Disadvantages of Steel structures, loads, load combination, Failure criteria for steel, Codes, Specifications and section classification. | | | | | |
| Bolted Connections: Advantages and Limitations of bolted joints, Design strength of ordinary Black=Bolts and High Strength Friction Grip bolts (HSFG), Design of Simple Connections, Moment resistant Connections. 8 Hours | | | | | |

Module – V

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages of Bolted and Welded Connections. **8 Hours**

List of Experiments using Auto Cadd Software

| Sl. No. | Name of the Experiment |
|---------|---|
| 1 | Drawing of Singly and Doubly reinforced beams. |
| 2 | Drawing of one way, one way continuous and two way Slabs. |
| 3 | Drawing of columns. |
| 4 | Drawing of dog legged and open Well stair case. |
| 5 | Drawing of footings. |
| 6 | Bolted and welded connections. |

Course Outcomes:

- Understand the design philosophy and principles.
- Solve engineering problems of RC elements subjected to flexure, shear.
- Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
- Prepare Reinforcement drawings of structural elements.
- Apply the concept of Limit State Design of steel structures.
- Capable of design various steel components using bolted and welded connections.

TEXT BOOKS :

1. Pillai and Menon, Reinforced Concrete Design-, McGraw Hill Education, 3rd edition (2017)
2. N Krishnaraju, Design of Reinforced Concrete Structures: IS:456-2000, CBS Publishers & Distributors, 4th Edition (2016)
3. S. S. Bhavikatti: “Design of RCC Structural Elements Vol-I”, New Age International Publications, New Delhi, ISBN: 978-8122416930.
4. N Subramanian: “Design of Steel structures”, Oxford University Press, 11th Edition, 2013, ISBN:9780195676815.
5. K S Duggal: “Limit State Design of Steel Structures”, Tata Mcgraw Hill, Edition, 2010, ISBN: 9781259083785.
6. S. Ramamrutham: “Design of Steel structures”, Dhanpat Rai Publishing Company, Edition, 2018, ISBN-10: 8187433361; ISBN-13: 978-8187433361.

Reference Books:

1. Neelam Sharma, “R.C.C.Design & Drawing”, S.K. Kataria & Sons, Reprint edition (2013)
2. P.C. Varghese, “Limit State Design of Reinforced Concrete”, PHI Learning Private Limited, 2nd Edition (2008)
3. V. L. Karve & Late S. R. Shaha, “Limit State Theory & Design of Reinforced Concrete (I.S456 - 2000)”, Structures Publications (2014)
4. S.N.Shinha: “Reinforced concrete Design” TMH Education Private Limited, ISBN: 978-9351342472.
5. S.S Bhavikatti: “Design of Steel Structures”, IK International Pvt. Ltd.,2009, ISBN: 9789380026619.
6. Dr. B C Punmia, Dr. A K Jain: “Comprehensive Design of Steel Structures”, Firewall Media, 1998, ISBN: 9788170080930.

| Geotechnical Engineering | | | | | |
|--|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT62 | 4:0:0:0 | 4 | CIE:50 SEE:50 | 4 hours | FC |
| Course Objectives: | | | | | |
| This course will enable students to: <ul style="list-style-type: none"> • Understand the basic concepts of soil mechanics to identify and classify the soil • Know the role of water in soil and determine the rate of settlement through laboratory test • Assess the shear strength of soil and improvement in mechanical behaviour by densification of soil • Compute the distribution of stresses below footing and understand the forces acting on the retaining walls • Conceptually learn various theories related to bearing capacity of soil | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| INTRODUCTION: Introduction, origin and formation of soil, Phase Diagram, Basic definitions and their inter relationships. Index properties of soils, Consistency of soils: Atterberg limits and indices. Liquid Limit by Casagrande's method, Plastic limit and shrinkage limit determination. STRUCTURE & CLASSIFICATION OF SOILS: Clay minerals, Soil structure and fabric. Purpose of soil classification, The Unified Soil Classification System, and IS classification system. 10 Hrs | | | | | |
| Module – II | | | | | |
| PERMEABILITY and COMPRESSIBILITY OF SOIL: Introduction, Darcy's law, Coefficient of permeability and its determination in laboratory, Factors affecting permeability, Hydraulic Conductivity in Stratified Layers of Soil, Seepage Velocity and Superficial Velocity. Numerical Problems. CONSOLIDATION: Definition, Mass-spring analogy, Normally, under and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (C_c , a_v , m_v and C_v). 10 Hrs | | | | | |
| Module –III | | | | | |
| SHEAR STRENGTH OF SOILS: Introduction, Concept of shear strength, Mohr-coulomb Failure Criteria, Total and effective shear strength parameters, Concept of pore pressure, Measurement of shear parameters - Direct shear test and Triaxial compression test, Drainage Conditions and Strength Parameters. SOIL COMPACTION: Laboratory Tests: Standard and Modified proctor's compaction tests, factors affecting compaction, problems. 10 Hrs | | | | | |
| Module-IV | | | | | |
| STRESSES IN SOILS: Boussinesq's and Westergard's theories assumptions and Equations for point loads, Pressure Isobars, Numerical problems. LATERAL EARTH PRESSURE: Active and Passive earth pressures, Rankine's Earth pressure Theory, Coulomb's Earth Pressure Theory, Culman's and Rebhan's graphical methods. 10 Hrs | | | | | |
| Module – V | | | | | |
| BEARING CAPACITY OF SHALLOW FOUNDATIONS: Introduction, Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's bearing capacity equations-assumptions and limitations, IS Code's bearing capacity equations, Bearing capacity of footings subjected to eccentric loading. Effect of ground water table on bearing capacity. Standard penetration test - Bearing capacity based on corrected SPT value and Cone penetration test. Foundation settlement: Calculation of settlement - immediate, consolidation and secondary | | | | | |

settlements. Numerical problems.

10 Hrs

Course Outcomes:

Students will be able to

- Identify and Classify the soil
- Understand the role of water in soil and capable of estimating consolidation characteristics of soil.
- Determine the shear strength parameters of soil through laboratory test
- Compute the lateral pressure distribution behind retaining walls and stress distribution below footing
- Estimate the load bearing capacity under footings and cause of settlement due to applied loads.

TEXT BOOKS :

- Punmia B.C. (2005), “Soil Mechanics and Foundation Engg.”, 16th Edition Laxmi Publications Co., New Delhi.
- Gopal Ranjan and Rao A.S.R. (2000), “ Basic and Applied Soil Mechanics”, New Age International (P) Ltd., New Delhi.
- Venkatramiah C., Geotechnical Engineering, New Age International (P) Ltd , Publishers, New Delhi, 2006.

Reference Books:

- Ramamurthy T.N. & Sitharam T.G.(2010), “Geotechnical Engineering”, S.Chand & Company, New Delhi.
- Murthy V.N.S. (1996), “Soil Mechanics and Foundation Engineering”, 4th Edition, UBS Publishers and Distributors Ltd, New Delhi.
- Braja M. Das (2002), Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India.

E-Resources:

- http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil_mech/index.htm
- <http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html>
- <http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf>

| INDUSTRIAL WASTEWATER TREATMENT | | | | | |
|--|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT 642 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 4 hours | FE |
| Course Objectives: | | | | | |
| This course will enable students to: | | | | | |
| <ul style="list-style-type: none"> Identify, formulate, and solve various types of industrial pollution. Function on multi-disciplinary teams in the areas of different types of industries to reduce, recycle and reuse the waste from industries. Apply knowledge of mathematics, science, and engineering in industrial wastewater treatment, like planning, analysis and designing of treatment units including details of statutory rules and regulations. Design a system, components, or processes to meet desired needs in industrial wastewater treatment. Identify, various types of industrial wastes and suitable treatment techniques. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Industrial Scenario in India - Industrial activity and Environment - Uses of Water by industry - Difference between domestic and industrial wastewater- Parameters of pollution and their effects receiving streams- Classification of streams based on the mixing of effluents-Self-purification of streams - Oxygen sag curve- Derivation of Streeter – Phelps equation – Numerical problems. | | | | | |
| 8 Hours | | | | | |
| Module – II | | | | | |
| Environmental Standards for Industrial Effluents - Effluent sampling – grab and composite sampling, Treatment methods of industrial effluent – pre-treatment of waste - Equalization – Neutralization-Flotation-Volume reduction and strength reduction. | | | | | |
| 8 Hours | | | | | |
| Module – III | | | | | |
| Introduction to Secondary Treatment of Industrial Effluents – Design of an aeration unit – design of a trickling filter – design of an oxidation pond - Introduction and feasibility of combined treatment municipal waste and industrial waste -volume ratio-Rental charges and economics. | | | | | |
| 8 Hours | | | | | |
| Module – IV | | | | | |
| Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Cotton textile Industry, Dairy industry and sugar mill. | | | | | |
| 8 Hours | | | | | |
| Module – V | | | | | |
| Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Paper and pulp Industry, Distillery industry, Food Processing industry. Processing industry. | | | | | |
| 8 Hours | | | | | |
| Course Outcomes: | | | | | |
| <ul style="list-style-type: none"> Characterize the different types of industrial effluents. Advise the regulating authority about the possible danger from specific industries. Develop planning skill in designing water pollution control systems in industries. Differentiate red category industries from green category industries. | | | | | |

TEXT BOOKS :

- Nelson L Nemerow: “Liquid Waste of industry, Theories, Practices and Treatment”, Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: “Waste water treatment”, 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.

Reference Books:

- Nelson L Nemerow: “Liquid Waste of industry, Theories, Practices and Treatment”, Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: “Waste water treatment”, 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.
- Mahajan S P.: “Pollution control in Process Industries”, Tata McGraw Hill Company, New Delhi, 1985, ISBN: 9780074517727, 0074517724.
- Eckenfelder: “Industrial Water pollution Control”, McGraw Hill Company, New Delhi American Chemical Society, Washington D.C., USA, 2000, ISBN: 9789339220433.

E-Resources:

- www.neerienviis.nic.in/pdf/
 - www.fao.org/
- www.gewater.com/applications, www.waterleau.com/en

| PAVEMENT MATERIALS AND CONSTRUCTION | | | | | |
|---|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT641 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 hours | FE |
| Course Objectives: | | | | | |
| <ul style="list-style-type: none"> ● To learn the types, source, functions and properties of soil and its stabilization methods. ● Understand the origin, classification, requirements, properties and tests on road aggregates and its gradation for road construction. ● To know the various tests and specifications of different types of bituminous materials for use in various components of road. ● To know appropriate equipment's required for construction depending upon the requirement. ● Prepare quality assurance and quality control plans in an attempt to construct better performing pavements | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>SOIL: Types, source, functions, properties. Preparation of subgrade, quality control tests. Construction of embankments for roads, compaction studies in laboratory and field, properties of compacted soils.</p> <p>SOIL STABILIZATION – principle, methods and tests, proportioning of materials. Stabilizers and waste materials in road construction, their properties and scope in road construction.</p> <p style="text-align: right;">08 Hours</p> | | | | | |
| Module – II | | | | | |
| <p>AGGREGATES: Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation, maximum aggregate size, Importance of aggregate gradation Rotchfutch method.</p> <p style="text-align: right;">08 Hours</p> | | | | | |
| Module – III | | | | | |
| <p>BITUMEN AND TAR: Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.</p> <p>BITUMINOUS EMULSIONS AND CUTBACKS: Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.</p> <p style="text-align: right;">08 Hours</p> | | | | | |
| Module – IV | | | | | |
| <p>EQUIPMENT IN HIGHWAY CONSTRUCTION: Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavements</p> <p style="text-align: right;">08 Hours</p> | | | | | |
| Module – V | | | | | |
| <p>CONSTRUCTION OF FLEXIBLE AND CEMENT CONCRETE PAVEMENTS: Specifications of materials, construction methods and field control checks for various types of flexible and rigid pavements layers. (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.</p> <p style="text-align: right;">08 Hours</p> | | | | | |

Course Outcomes:

- Characterize the response characteristics of soil, aggregate, asphalt, and asphalt mixes
- Analyze flexible pavements and rigid pavements.
- Identify the need of various equipment required for construction of highways.
- Construction of flexible pavement and rigid pavement.
- Prepare quality assurance and quality control plans in an attempt to construct better performing pavements

Text Books:

- Highway Engineering- Khanna, S.K., and Justo, C.E.G.(Chapters,6,7,8,9): Nem Chand and Bros. Roorkee ISBN:9788185240800.
- Construction Equipment and its Management- S.C. Sharma, (Chapters 1,2,3,4,6,7) SBN:9788174092281 8174092285 xvi+893 Yr. of Pub.2013 Paper Back English Khanna Publishers, Delhi.
- Hot Mix Asphalt Materials, Mixture Design and Construction- (Chapters 1 and 2) Freddy L. Roberts, Kandhal, P.S. : University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland. ISBN 10: 0914313010 - ISBN 13: 9780914313014

Reference Books:

- Freddy L Roberts, Prithvi S Kandhal et al, “**Hot Mix Asphalt Materials, mixture design and construction**”- (2ndEdition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA. ISBN-10: 0914313010; ISBN-13: 978-0914313014
- RRL, DSIR, ‘**Bituminous Materials in Road Construction**’, HMSO Publication. ISBN9781138893764 -
- RRL, DSIR, ‘**Soil Mechanics for Road Engineers**’, HMSO Publication. ISBN: 0115502785 9780115502781
- Relevant IRC codes and MoRT & H specifications

e-Resources:

- <http://www.fhwa.dot.gov/pavement/pavemat.cfm>
- <http://library.iitbbs.ac.in/book-info.php?id=53c3bce66e43be4f209556518c2fcb54>
- <http://www.pppcatalog.com/store/pavement-maintenance-and-construction/>
- <http://cce.oregonstate.edu/ptm>
- <http://www.fhwa.dot.gov/pavement/asphalt/>

| INDUSTRIAL WASTEWATER TREATMENT | | | | | |
|--|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT 642 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 4 hours | FE |
| Course Objectives: | | | | | |
| This course will enable students to: | | | | | |
| <ul style="list-style-type: none"> Identify, formulate, and solve various types of industrial pollution. Function on multi-disciplinary teams in the areas of different types of industries to reduce, recycle and reuse the waste from industries. Apply knowledge of mathematics, science, and engineering in industrial wastewater treatment, like planning, analysis and designing of treatment units including details of statutory rules and regulations. Design a system, components, or processes to meet desired needs in industrial wastewater treatment. Identify, various types of industrial wastes and suitable treatment techniques. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Industrial Scenario in India - Industrial activity and Environment - Uses of Water by industry - Difference between domestic and industrial wastewater- Parameters of pollution and their effects receiving streams- Classification of streams based on the mixing of effluents-Self-purification of streams - Oxygen sag curve- Derivation of Streeter – Phelps equation – Numerical problems. 8 Hours | | | | | |
| Module – II | | | | | |
| Environmental Standards for Industrial Effluents - Effluent sampling – grab and composite sampling, Treatment methods of industrial effluent – pre-treatment of waste - Equalization – Neutralization-Flotation-Volume reduction and strength reduction. 8 Hours | | | | | |
| Module – III | | | | | |
| Introduction to Secondary Treatment of Industrial Effluents – Design of an aeration unit – design of a trickling filter – design of an oxidation pond - Introduction and feasibility of combined treatment municipal waste and industrial waste -volume ratio-Rental charges and economics. 8 Hours | | | | | |
| Module – IV | | | | | |
| Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Cotton textile Industry, Dairy industry and sugar mill. 8 Hours | | | | | |
| Module – V | | | | | |
| Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Paper and pulp Industry, Distillery industry, Food Processing industry. Processing industry. 8 Hours | | | | | |
| Course Outcomes: | | | | | |
| <ul style="list-style-type: none"> Characterize the different types of industrial effluents. Advise the regulating authority about the possible danger from specific industries. Develop planning skill in designing water pollution control systems in industries. Differentiate red category industries from green category industries. | | | | | |

TEXT BOOKS :

- Nelson L Nemerow: “Liquid Waste of industry, Theories, Practices and Treatment”, Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: “Waste water treatment”, 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.

Reference Books:

- Nelson L Nemerow: “Liquid Waste of industry, Theories, Practices and Treatment”, Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: “Waste water treatment”, 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.
- Mahajan S P.: “Pollution control in Process Industries”, Tata McGraw Hill Company, New Delhi, 1985, ISBN: 9780074517727, 0074517724.
- Eckenfelder: “Industrial Water pollution Control”, McGraw Hill Company, New Delhi American Chemical Society, Washington D.C., USA, 2000, ISBN: 9789339220433.

E-Resources:

- www.neerienvi.nic.in/pdf/
 - www.fao.org/
- www.gewater.com/applications, www.waterleau.com/en

| REPAIR AND REHABILITATION OF STRUCTURES | | | | | |
|--|----------------|----------------|----------------------|----------------------|--------------------|
| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT643 | 3-0-0-0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |
| Course Objectives: | | | | | |
| The objective of this course is to make students | | | | | |
| <ul style="list-style-type: none"> • To investigate the cause of deterioration of concrete structures. • To strategize different repair and rehabilitation of structures. • To analyze the behavior of deteriorated structure. • To evaluate the performance of the materials for repair. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods, Quality assurance for concrete construction, as built concrete properties strength, permeability, thermal properties and cracking. | | | | | |
| 08 Hours | | | | | |
| Module – II | | | | | |
| Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection. | | | | | |
| 08 Hours | | | | | |
| Module – III | | | | | |
| Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, testing techniques | | | | | |
| 08 Hours | | | | | |
| Module – IV | | | | | |
| Materials for Repair: Special concretes and mortars ,concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning. | | | | | |
| 08 Hours | | | | | |
| Module – V | | | | | |
| Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies | | | | | |
| 08 Hours | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to | | | | | |
| <ul style="list-style-type: none"> • Achieve Knowledge of design and development of problem solving skills. • Understand the cause of deterioration of concrete structures. • Design and develop analytical skills. • Summarize the principles of repair and rehabilitation of structures • Understands the concept of Serviceability and Durability. | | | | | |

Reference Books:

- Sidney, M. Johnson “Deterioration, Maintenance and Repair of Structures”.
- Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”- Longman Scientific and Technical
- R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”- Blakie and Sons
- Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL)

E-Resources:

- <http://linlpringer.com>
- <http://crcnetbase.com>

| REMOTE SENSING AND GIS | | | | | |
|---|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:S | Credits | Exam marks | Exam Duration | Course Type |
| 18EET651 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 hours | EET |
| Course Objectives: | | | | | |
| This course will enable students to: <ul style="list-style-type: none"> • Know about the principles of remote sensing and spectral signatures. • Know about satellites, types of remote sensing and digital image processing • Remote sensing and GIS advantages in mapping. • Application in the field of Civil engineering. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Principles of Remote Sensing: Introduction to remote sensing, Remote sensing system. Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Active remote sensing. Passive Microwave Remote Sensing: Basics–physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, passive microwave scanners and sensors. 8 Hours | | | | | |
| Module – II | | | | | |
| Platforms, Sensors and Data Products: Ground aircraft, space aircraft platforms- photographic sensors, scanners, radiometers, and Mission planning. Data types and format, Scale and Legend. Introduction, platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) Basic elements in Image interpretation. 8 Hours | | | | | |
| Module – III | | | | | |
| Geographic Information System: Introduction, history of GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data- spatial and non spatial, data models with advantages and disadvantages. Drone survey and its application. 8 Hours | | | | | |
| Module – IV | | | | | |
| Hyper-spectral Remote Sensing: Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, N dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyper- spectral sensors, applications. High-resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications. GNSS, IRNSS, GPS and its application. 8 Hours | | | | | |
| Module – V | | | | | |
| Civil Engineering Applications of RS and GIS, water resource management using GIS and RS, Ground water studies using GIS and RS, Urban Development Planning using RS and GIS, Flood monitoring, Draught monitoring, Transportation engineering, RS and GIS site selection for Dams, Bridges, Reservoirs. 8 Hours | | | | | |
| Course Outcomes: | | | | | |
| <ul style="list-style-type: none"> • Demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves. • Apply the concepts of satellite and sensor parameters and characteristics of different | | | | | |

platforms.

- Prepare spatial Maps in GIS and able to Interpret GIS Maps.
- Explain the Hyper spectral remote sensing systems.
- Apply RS and GIS techniques to solve complex Civil engineering Problems.

TEXT BOOKS :

- Lilles and T.M and R.W. Kiefer: “Remote sensing and image interpretation”, (Chapters 1-8), 4th Edition, John Wiley and Sons, 2000, ISBN: 9780470052457.
- Jensen J.R: “Introductory digital image processing, a remote sensing perspective”, (Chapters 1-4), 2nd Edition Prentice Hall, 1996, ISBN: 9780132058407.
- Richards J.A., and X. Jia: “Remote sensing digital image analysis: an introduction”, (Chapters 1-3), 3rd Edition, Springer, 2006, ISBN: 9783540297116.
- Mikhail E., J. Bethel, and J.C. McGlone: “Introduction to modern photogrammetry”, (Chapters 5-9), Wiley, 2001, ISBN: 9780471309246.

Reference Books:

- Ravi P Gupta: “Remote sensing Geology”, (Chapters 1-8), Springer Verilag, New York, ISBN: 9783662052839
- Mather P.M.: “Computer processing of remotely-sensed images, an introduction”, ISBN: 9781119956419.

E-Resources:

- <http://www.set.ait.ac.th/page.php?fol=rsgisandpage=rsgis>
- http://geology.wlu.edu/harbor/geol260/lecture_notes/notes.html
- <http://www.rejinpaul.com/2014/10/vtu-civil-notes-vtu-civil-enigneering-1st-2nd-3rd-4th-5th-6th-7th-8th-semester-lecture-notes-download-load.html>
- <http://www.rejinpaul.com/2013/12/civil-2nd-4th-6th-8th-semester-notes-an-na-university-civil-notes.html>

| EXTENSIVE SURVEY CAMP | | | | | |
|---|----------------|----------------|--------------------------|----------------------|--------------------|
| Course Code | L:T:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVL67 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 hours | FC |
| Course Objectives: | | | | | |
| This course will enable students to: <ul style="list-style-type: none"> • Understand the practical applications of Surveying. • Use of Total station in different projects. • Develop communication skills, team work and use modern tool usage in the field of civil engineering. | | | | | |
| Syllabus | | | | | |
| <p>An extensive survey training involving investigation and design of the following projects is to be conducted for 10 days.</p> <p>The student shall submit a project report consisting of designs and drawings.</p> <p>General instructions: Reconnaissance of the sites and fly leveling to establish bench marks.</p> <ol style="list-style-type: none"> 1. New Tank Projects: The work shall consist of <ol style="list-style-type: none"> a. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line. b. Capacity surveys. c. Details at Waste weir and sluice points. d. Canal alignment. 2. Restoration of an Existing Tank: The work shall consist of: <ol style="list-style-type: none"> a. Alignment of centre line of the existing bund, Longitudinal and Cross sections along the centre line. b. Capacity surveys, Details at sluice and waste weir. 3. Water Supply and Sanitary Project: Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers. 4. Highway Project: Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road. (Drawing should be preferably done using AutoCAD). | | | | | |
| Course Outcomes: | | | | | |
| On completion of this course, students will be able to: <ul style="list-style-type: none"> • Understand of the principles and operation of the Global Positioning System for locating salient features by Total Station. • Able to measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork for civil engineering projects. | | | | | |

- Appreciate the need for licensed surveyors to establish positioning information for property and structures.
- Prepare layout plans as per the specifications of the local bodies.
- Develop communication skills and team work in any project.

TEXT BOOKS :

- Dr. B C Punmia: “Surveying Volume I”, (Chapters 1-4, 6, 7, 9-13, 16, 18, 22), Lakshmi Publications Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.
- Dr. B C Punmia: “Surveying Volume II”, (Chapters 1-4, 6, 7, and 15), Lakshmi Publications Pvt Ltd, 6th Edition, 2005, ISBN: 978-81-700-8853-0.

Reference Books:

- Chandra, A.M.: “Higher Surveying”, New Age International Publishers, 2002, ISBN: 9788122438123.
- Punmia P.C.: “Surveying”, Volume 3, 15th Edition, Laxmi publications, 2004, ISBN: 81-7008-825-9.
- Lab manual provided by Dept. of Civil Engg., NCET.

E-Resources:

- http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790
- <http://ascelibrary.org/journal/jsued2>
- www.survivorlibrary.com/engineers_surveying_instruments_1892.pdf
- www.asicivilsurvey.com/
- [https://www.slideshare.net/suryaom/advance-surveying-equipments.](https://www.slideshare.net/suryaom/advance-surveying-equipments)

| Estimation and Valuation | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT71 | 3-2-0-0 | 3 | 50:50 | 3 hours | PCC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Gain the knowledge of estimating the different types of buildings. • Estimate the quantities of work and develop the bill of quantities and arrive at the Cost of Civil Engineering Project. • Identify the specifications of different items of works • Analyse the rates of different building components of works according to standard schedule of rates. • Understand, Apply and Create the Tender and Contract document. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Introduction: Unit of measurements, Method of taking quantities - Study of various drawings. Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential, building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc. | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| Estimation of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimation of retaining walls – culverts – estimation of irrigation works, estimation of road works | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| SPECIFICATION AND TENDERS | | | | | |
| Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts –M-Book Measurement - Preparation of bills – Preparation of BOQ (Bill of Quantity). | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| VALUATION | | | | | |
| Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease Arbitration and legal requirements. Current rate of construction materials. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| Contract Management: Types of contract- essentials of contract agreement- legal aspects, penal provisions on breach of contract. | | | | | |
| Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture. | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to | | | | | |

- Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.
- Estimate the cost of different sanitary works.
- Prepare the specifications as per standard schedule of rates.
- Analyze the rates for various items of work.
- Assess contract and tender documents for various construction works.

Text Books:

- B. N. Dutta: “Estimating and costing”, UBS publishers Distributors Ltd., India, 27th Edition, ISBN-13: 978-8174767295.
- P.L. Basin: “Quantity Surveying”, 3rd Revised Edition, S. Chand and company, New Delhi, ISBN-10: 8121900859.
- S.C. Rangwala: “Estimating and Specification”, 16th Edition, Charotar publishing house, 2014, ISBN: 978-93-80358-97-0.

Reference Books:

- G.S. Birde: “Text book of Estimating and Costing”, 6th Edition, Dhanpath Rai and sons, New Delhi, ISBN: 9789384378134.
- D.D. Kohli, R.C. Kohli: “A text book on Estimating, Costing and Accounts”, 2nd Edition, S. Chand, New Delhi, ISBN-10: 8121903327.
- Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.

E-Resources:

- <https://www.schandpublishing.com/books/...textbook-estimating-costing>.
- nfra.eresourceerp.com/estimation.html
- nfra.eresourceerp.com/Project-estimation.html
- <https://www.mynewsdesk.com/in/view/pressrelease/job-costing-estimation>.

| Hydrology and Irrigation Engineering | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT721 | 3-2-0-0 | 3 | 50:50 | 3 hours | PCC |
| Course Objectives: | | | | | |
| This course will enable students to; | | | | | |
| <ul style="list-style-type: none"> • Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration. • Quantify runoff and use concept of unit hydrograph. • Demonstrate different methods of irrigation, methods of application of water and irrigation procedure. • Design canals and canal network based on the water requirement of various crops. • Determine the reservoir capacity. | | | | | |
| Syllabus | | | | | |
| Module 1 | | | | | |
| Hydrology: | | | | | |
| Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation. | | | | | |
| Precipitation: | | | | | |
| Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs 10Hrs | | | | | |
| Module – II | | | | | |
| Losses: Evaporation: | | | | | |
| Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control | | | | | |
| Evapo-transpiration: | | | | | |
| Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation, | | | | | |
| Infiltration: | | | | | |
| Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices. 10Hrs | | | | | |
| Module – III | | | | | |
| Runoff: | | | | | |
| Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. | | | | | |
| Hydrographs: | | | | | |
| Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations 10Hrs | | | | | |
| Module – IV | | | | | |
| Irrigation: | | | | | |
| Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation. | | | | | |
| Water Requirements of Crops: | | | | | |
| Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation design criteria. Rational method design. Hydraulic analysis of design, storm sewer appurtenances. Storm detention: effects of urbanization, | | | | | |

types of surface detention, subsurface disposal of storm water.

10Hrs

Module – V

Canals:

Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.

Reservoirs:

Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam. **10Hrs**

Course Outcomes:

After studying this course, students will be able to:

- Understand the importance of hydrology and its components.
- Measure precipitation and analyze the data and analyze the losses in precipitation.
- Estimate runoff and develop unit hydrographs.
- Find the benefits and ill-effects of irrigation.
- Find the quantity of irrigation water and frequency of irrigation for various crops.
- Find the canal capacity, design the canal and compute the reservoir capacity.

Text Books:

- K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
- Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
- Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

Reference Books:

- H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
- Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
- VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
- Modi P.N "Water Resources and Water Power Engineering". Standard book house, Delhi.
- Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

E-Resources:

- <https://guides.lib.vt.edu/subject-guides/cee/environmental-water-engineering>
- <https://ascelibrary.org/doi/book/10.1061/9780784406748>

| Traffic Engineering | | | | | |
|---|----------------|----------------|----------------------|----------------------|--------------------|
| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT722 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |
| Course Objectives: | | | | | |
| Students will be able to study the | | | | | |
| <ul style="list-style-type: none"> ● Scope of traffic engineering and traffic characteristics. ● Various traffic engineering studies. ● Interpretation of the traffic study and traffic flow theory. ● Intersection design and Rotary intersection. ● Traffic regulation and control and ITS. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Introduction to Traffic Engineering: Definition, objectives of Traffic Engineering and scope of Traffic Engineering. | | | | | |
| Traffic Characteristics: Road user characteristics, vehicular characteristics – static and dynamic characteristics, power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Problems on above. 08Hours | | | | | |
| Module – II | | | | | |
| Traffic Studies and Interpretation – Types, Objectives, Data collection, analysis and interpretation of results of classified traffic studies. Spot speed, speed and delay, origin and destination, Parking studies, Accident- causes, analysis of individual accidents, measures to reduce accident. Problems on above. 08Hours | | | | | |
| Module – III | | | | | |
| Traffic Flow Characteristics: Traffic flow variables, speed – flow – density relationship, PCU values, correlation and regression analysis (linear only) – Queuing theory, Poisson's distribution and Normal Distribution application to traffic engineering and relevant problems on above. Traffic Forecast and Simulation technique. 08Hours | | | | | |
| Module – IV | | | | | |
| Intersection Design: Principle At grade and Grade separated junctions – Types – channelization – Features of channelizing Island – median opening – Gap in median at junction. | | | | | |
| Rotary Intersection: Elements – Advantages – Disadvantages – Design guide lines – Three legged inter section – Diamond inter change – Half clover leaf – clover leaf- Advantages- Disadvantages only. 08Hours | | | | | |
| Module – V | | | | | |
| Traffic Regulation and Control: Driver, vehicle and road controls – Traffic regulations – Traffic markings, Traffic signs, Traffic signals – Vehicle actuated and synchronized signals – Signals co-ordination. Webster's method of signal design, IRC method – Street lighting, Road side furniture's. Relevant problems on above. | | | | | |
| Intelligent Transport System: Definition, Necessities, Application in the present traffic scenario. 08Hours | | | | | |
| Course Outcomes: | | | | | |
| On completion of this course, Students will be able to | | | | | |
| <ul style="list-style-type: none"> ● Know the objective and scope of traffic engineering and traffic characteristics. ● Interpret the traffic study and traffic flow theory. ● Conduct traffic studies and analyze traffic data | | | | | |

- Design traffic signal systems.
- Recognize traffic regulation and control and ITS.

Text Books:

1. L.R. Kadiyali, Traffic Engineering & Transport Planning ,Khanna Publishers, (Chapters, 1-6,8-11,13-17) ISBN-10: 817409220X; ISBN-13: 978-8174092205.
2. Khanna & Justo, Highway Engineering , Nemchand & Bros,Roorkee, (Chapter 5) ISBN: 978-81-85240-80-0.

Reference Books:

1. Salter RJ and Hounsell NB, “Highway, Traffic Analysis and Design”- Macmillan Press Ltd., London, (Chapter 1-4), ISBN: 9780333609033.
2. Matson T M, Smith W S, Hurd F W, “Traffic Engineering, Mc Graw Hill Book Co, NY, USA. ISBN 10: 0071761136 ISBN 13: 9780071761130
3. Drew D R,” Traffic Flow Theory and Control”, McGraw Hill Book Co, NY, USA. .. ISBN: 978-3-642-02604-1
4. Wohl and Martin, “Traffic System Analysis of Engineers and Planners”-Mcgraw Hill Book Co, New York, USA. ISBN 10: 0070712743 ISBN 13: 9780070712744.
5. Pignataro, “ Traffic Engineering”, John wiley & sons. ISBN: 978-1-118-76230-1
6. Nicholas J Garber, Lester A Hoel, “Traffic & Highway Engineering”- Third edition, Bill Stenquist. ISBN 0-534-38743-8. 1
7. IRC: SP:41-1994, IRC SP:31-1992, IRC 43-1994, Indian Roads Congress
8. MoRTH “Type Designs for Intersections on National Highways”-Indian Roads Congress.
9. MORTH “Manual for Road Safety in Road Design”-Indian Roads Congress.

e-Resources:

1. [https://en.wikipedia.org/wiki/Traffic_engineering\(transportation\)](https://en.wikipedia.org/wiki/Traffic_engineering(transportation))
2. <http://www.faadooengineers.com/threads/7094-Traffic-Engineering-Ebooks-notes-pdf-ppt-download>
3. <http://nptel.ac.in/downloads/105101008/>
4. <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4114883>

| Pre-Stressed Concrete Structures | | | | | |
|---|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 19CVT723 | 3-2-0-0 | 3 | 50:50 | 3 hours | PCC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Understand the concept of pre-stressing, devices for pre and post-tensioning. • Identify different stress distribution due to pre stress and the imposed load. • Calculate loss of pre stress and deflection in PSC members. • Study the limit state of PSC beams in flexure and shear, anchorage zone (End block) stress. • Design of pre-tensioned, post tensioned simple PSC beams, continues and cantilever beam. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Introduction: Definition and scope of pre stressed concrete, its applications, Types of pre-stressing system, High strength concrete and steel, Stress-Strain characteristics and properties.</p> <p>Basic Principles of Pre-stressing: Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning devices, tensioning methods and end anchorages. Ram pressure, extension and proof stress calculation during stressing operation.</p> <p>Analysis of Sections for Flexure: Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles.</p> | | | | | |
| 10Hrs | | | | | |
| Module – II | | | | | |
| <p>Losses of Pre-Stressing: Various losses encountered in pre-tensioning and post-tensioning methods, determination of jacking force.</p> <p>Deflections: Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer of loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep and deflection, load verses deflection curve, methods of reducing deflection.</p> | | | | | |
| 10Hrs | | | | | |
| Module – III | | | | | |
| <p>Design of beam: Flexure -IS Code recommendations –Ultimate flexural strength of sections Shear, shear resistance of sections, shear reinforcement. Limit state of serviceability control of deflections and cracking. Design of pre-tensioned and post-tensioned sections. Design of post tensioned slabs (PT Slab).</p> | | | | | |
| 10Hrs | | | | | |
| Module – IV | | | | | |
| <p>Design of End Block: Transmission of pre-stress in pre-tensioned member, transmission length, anchorage stress in post-tensioned members. Bearing stress and bursting tensile force, stresses in end block, IS code method, design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.</p> | | | | | |
| 10Hrs | | | | | |
| Module – V | | | | | |
| <p>Cantilever Beams and Continuous Beams: Analysis and design of cantilever beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.</p> | | | | | |
| 10Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to | | | | | |

- Identify different pre-stressing techniques and apply principles of pre-stressing to field problem.
- Evaluate the nature of stresses in the flexural member and calculate different losses in PSC members.
- Compute the deflection of PSC members.
- Design the pre-tensioned and post-tensioned beams.
- Analyze composite and continuous beam.

Text Books:

- Krishna Raju N.: “Pre-stressed Concrete”, 5th Edition, Tata McGraw Hill, New Delhi, 2007. ISBN:978-9387886209.
- Dayaratnam P.: “Pre-stressed Concrete Structures”, 7th edition, Oxford and IBH Publications, New Delhi, 1996. ISBN:978-9386479778.
- Lin T.Y., Ned. Burns H.: “Design of Pre-stressed Concrete Structures”, 3rd edition, John Wiley and Sons, New York, 1982. ISBN:978-9812531179.

Reference Books:

- Mallick S.K., Gupta A.P.: “Pre-stressed Concrete”, Oxford and IBH, New Delhi, 1983. ISBN: 978-9324527831.
- Natarajan V.: “Fundamentals of Pre-Stressed Concrete”, 1976, B.I Publications, Bombay. ISBN: 978-9367312602.
- Libby J.R.: “Modern Pre-stressed Concrete”, CBS Publishers, New Delhi, 1986. ISBN: 978-9376239543.
- IS: 1343-1980, Code of Practice For Prestressed Concrete, Bureau of Indian Standards, New Delhi, 1981.

E-Resources:

- <http://www.vtuupdates.com>>vtunotes
- <http://www.vidhayarthiplus.com>
- <http://www.iitg.ernet.in>>qip>cd_cell>chapters

| Design and Detailing of RC & Steel Structures | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT724 | 3:2:0:0 | 4 | 50:50 | 3 hours | PCC |
| Course Objectives: | | | | | |
| The students will be able to: | | | | | |
| <ul style="list-style-type: none"> • Identify, formulate and solve engineering problems of RC elements subjected to different kinds of Loading. • Follow a procedural knowledge in designing and detailing various structural RC elements. • Impart the usage of codes for strength, serviceability and durability. • Provide knowledge in analysis , design and detailing of RC elements. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Layout Drawing: General layout of building showing, position of columns, footings, beams and slabs with standard notations. Detailing of Beam and Slab floor system, continuous beams. | | | | | |
| Detailing of Staircases: Dog legged and Open well. | | | | | 10 Hrs |
| Module – II | | | | | |
| Detailing of Column footings: Column and footing (Square and Rectangle) Design and detailing of Rectangular Combined footing slab and beam type. | | | | | |
| | | | | | 10 Hrs |
| Module – III | | | | | |
| Design and detailing of Retaining walls (Cantilever and counter fort type). Design and detailing of Circular and Rectangular water tanks resting on ground and free at top(Flexible base and Rigid base), using IS: 3370 (Part IV) only | | | | | |
| | | | | | 10 Hrs |
| Module – IV | | | | | |
| CONNECTIONS: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened. COLUMNS: Splices, Column-column of same and different sections. Lacing and battens. COLUMN BASES: Slab base and gusseted base. | | | | | |
| | | | | | 10 Hrs |
| Module – V | | | | | |
| Design and drawing of | | | | | |
| i) Bolted or welded plate girder | | | | | |
| ii) Roof Truss (Forces in the members to be given) Gantry girder | | | | | |
| | | | | | 10 Hrs |
| Course Outcomes: | | | | | |
| Students will be able to | | | | | |
| <ul style="list-style-type: none"> • Understand the design philosophy and principles. • Solve engineering problems of RC elements subjected to flexure, shear. • Demonstrate the procedural knowledge in design and detailing of RC structural elements and Steel structural elements • Prepare Reinforcement drawings of structural elements | | | | | |
| Text Books: | | | | | |
| <ul style="list-style-type: none"> • Pillai and Menon, Reinforced Concrete Design-, McGraw Hill Education, 3rd edition (2017) • N Krishnaraju, Design of Reinforced Concrete Structures: IS:456-2000, CBS Publishers & Distributors, 4th Edition (2016) | | | | | |

- S. S. Bhavikatti: “Design of RCC Structural Elements Vol-I”, New Age International Publications, New Delhi, ISBN: 978-8122416930.

Reference Books:

- Neelam Sharma, “R.C.C.Design & Drawing”, S.K. Kataria & Sons, Reprint edition (2013)
- P.C. Varghese, “Limit State Design of Reinforced Concrete”, PHI Learning Private Limited, 2nd Edition (2008)
- V. L. Karve & Late S. R. Shaha, “Limit State Theory & Design of Reinforced Concrete (I.S. 456 - 2000)”, Structures Publications (2014)
- S.N.Shinha: “Reinforced concrete Design” TMH Education Private Limited, ISBN: 978-9351342472.

E-Resources:

- <http://nptel.ac.in/courses/105105105/14>
- https://youtu.be/pIdaC_I6H_M
- <https://youtu.be/zVKf6hZfrhA>
- <https://youtu.be/DjT5G6Klf1M>
- <https://youtu.be/0fTvE8aSsiE>
- <https://youtu.be/JwiHgkC-6Ic>
- <https://youtu.be/WaAWYM6HDWs>
- <https://youtu.be/AyRgeA65oI0>
- <https://youtu.be/aTGeCoGkh3M>
- <https://youtu.be/AfHmpWlcqq4>
- <https://youtu.be/PDJPcQq3PZE>
- <https://youtu.be/wJWt0dcgafs>
- <https://youtu.be/8ATp13mOhvg>
- <https://youtu.be/hxakW1miEcM>

| Subsurface Exploration and Ground Improvement Techniques | | | | | |
|---|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT725 | 3-2-0-0 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Access ground condition through multidisciplinary sources and Implement various exploration methods to determine soil properties which helps in design • Understand the dewatering techniques based on environmental context • Select and apply appropriate techniques for ground improvement • Suggest/propose suitable chemical stabilizers for ground improvement, through engineering practice and environmental context • Apply the contextual knowledge to choose suitable type of geosynthetics for ground improvement and filtration. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| SUBSURFACE EXPLORATION: Introduction, Importance of exploration, Methods of exploration: Boring, sounding tests. Soil samples-undisturbed, disturbed and representative samples, Soil samplers and sampling, Number and disposition of trial pits and boring, Depth of exploration, Field tests: SPT, SCPT, DCPT, plate load test, Geo-physical methods, Borehole logs, Site investigation report. | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| GROUND IMPROVEMENT: Introduction, Need and objectives for ground improvement, Classification of improvement techniques, suitability and feasibility. Engineering properties of weak and compressible deposits. | | | | | |
| HYDRAULIC MODIFICATIONS: Objectives, Techniques, Dewatering methods. Drains, different types of drains. Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading. | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| MECHANICAL MODIFICATION: Introduction, Principles of densification, Compaction- Shallow and deep compaction, compaction quality control. Effect of compaction on engineering properties - compressibility, permeability, and liquefaction potential. | | | | | |
| DYNAMIC MODIFICATIONS: Introduction, Need and objectives, Dynamic Consolidation, Compaction by blasting, vibratory probe, Vibroflotation. | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| CHEMICAL MODIFICATION: Introduction, Methods of Chemical stabilization, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization, Stabilization using Fly ash. Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Bitumen, tar or asphalt in stabilization. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| GROUTING: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting. | | | | | |
| GEOSYNTHETICS: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fiber properties, Hydraulic properties, Durability; Applications of Geosynthetics – Reinforcement, Separation, Filtration and Fluid Transmission. | | | | | |
| 10 Hrs | | | | | |

Course Outcomes:

Students will be able to,

- Apply the knowledge of exploration methods to interpret field and laboratory data.
- Identify dewatering techniques based on field conditions
- Conduct investigations on problems and suitable techniques in stabilization
- Suggest/propose suitable chemical stabilizers based on site condition
- Choose suitable type of geosynthetics for ground improvement and filtration process.

Text Books:

1. Peter.G.Nicholson,“Soil improvement and ground modification methods”,Butterworth-Heinemann Ltd, 1st Edition-22 Aug 2014 ,ISBN: 978-0-12-408076-8
2. Dr. P.Purushotham Raju ,“Ground Improvement techniques”, Laxmi Publications,2000, ISBN: 978-8131808573
3. Manfred R. Hausmann,“ Engineering principles of ground modification”, McGraw-Hill Publishing Co.1990, ISBN: 978-0071007405
4. Nihar Ranjan Patra,“Ground Improvement techniques”,S.Chand (G/L) & Company Ltd,2012,ISBN:978-9325960015.

Reference Books:

- Jie Han,“Principles and Practice of Ground Improvement”,John Wiley & Sons,edition-28 july 2015, ISBN: 978-1118259917
- Ingles. O.G and Metcalf J.B.,’Soil stabilisation –Principles and Practice”,Butterworths. London 1972, ISBN: 978-0409482157
- M.C.Alfaro,“Improvement Techniques of Soft Ground in Subsiding & Lowland”,CRC Press,1994,ISBN: 978-9054101536
- J.M.Galvin,“Groung Engineering “, Springer,2016 ,ISBN: 978-3319250038

E-Resources:

- www.sciencedirect.com/science/book/9780124080768
- https://www.bauer.de/bma/info_80_e
- thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/
- [https:// www.nptel.ac.in/courses/105104034](https://www.nptel.ac.in/courses/105104034)

| Basics of Earthquake Engineering | | | | | |
|---|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVT726 | 3-2-0-0 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to learn: | | | | | |
| <ul style="list-style-type: none"> • Fundamentals of engineering seismology • Fundamental of structural dynamics • Irregularities in building which are detrimental to its earthquake performance • Different methods of computation seismic lateral forces for framed and masonry structures • Earthquake resistant design requirements for RCC and Masonry structures • Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| <p>Engineering Seismology: Terminologies (Focus, Focal depth, Epicentre, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicentre, Magnitude of earthquake).</p> | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| <p>Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.</p> | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| <p>Seismic Performance of Buildings and Over View of IS-1893: Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modelling; Code based seismic design methods.</p> | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| <p>Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).</p> | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| <p>Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings.</p> <p>Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.</p> | | | | | |
| 10 Hrs | | | | | |

Course Outcomes:

Students will be able to:

- Acquire basic knowledge of engineering seismology.
- Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
- Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
- Analyse multi-storied structures modelled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
- Comprehend planning and design requirements of earthquake resistant features of RCC structures through exposure to different IS-codes of practices.

Text Books:

- Pankaj Agarwal and Manish Shrikande, “Earthquake resistant design of structures”, PHI India.
- S.K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press
- Anil K. Chopra, “Dynamics of Structures: Theory and Applications to Earthquake Engineering”, Pearson Education, Inc.
- T. K. Datta, “Seismic Analysis of Structures”, John Wiley & Sons (Asia) Ltd.

Reference Books:

- David Dowrick, “Earthquake resistant design and risk reduction”, John Wiley and Sons Ltd.
- C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, “Some Concepts in Earthquake Behaviour of Buildings”, Published by Gujarat State Disaster Management Authority, Government of Gujarat.
- IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
- IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
- IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
- IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
- IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

| Concrete Laboratory | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVL76 | 1-0-2-0 | 2 | 50:50 | 3 hours | PCC |
| Course Objectives: | | | | | |
| The students will be able to: | | | | | |
| <ul style="list-style-type: none"> • Characterize cement properties by conducting various tests on cement. • Design concrete mixes based on properties of material and evaluate the workability of fresh concrete. • Describe mechanical behavior of hardened concrete. • Characterize aggregates based on mechanical properties. • Evaluate bitumen properties for its suitability for various conditions. • Design bituminous mix based on Marshall mix properties. | | | | | |
| Syllabus | | | | | |
| Tests on Cement & Concrete | | | | | |
| <ol style="list-style-type: none"> 1. Test on Specific gravity and fineness of cement 2. Test on Normal consistency and initial and final setting time of cement. 3. Test on Soundness of cement 4. Test on compressive strength of mortar. 5. Mix design of concrete-Fresh concrete: Slump, compaction factor, vee-bee test, flow table test. 6. Properties of hardened concrete-Compressive strength and flexural strength, Split tensile strength, relation between them and codal provision. 7. Non-destructive test on hardened concrete using rebound hammer 8. Non-destructive test on hardened concrete using Ultrasonic pulse velocity. 9. Permeability and water absorption test on concrete. | | | | | |
| Course Outcomes: Students will be able to | | | | | |
| <ul style="list-style-type: none"> • Determine the properties of cement by conducting basic test. • Define the workability of fresh concrete. • Estimate the strength of hardened Concrete by destructive and non destructive test. • Examine the strength of aggregate material as per codal provisions • Measure the physical properties and stability of bituminous materials and mixes by conducting tests. | | | | | |
| Text Books: | | | | | |
| <ul style="list-style-type: none"> • M.S Shetty, “Concrete Technology “, S. Chand & Co. Ltd, New Delhi. • Mehta P.K, “Properties of Concrete”, Tata McGraw Hill Publications, New Delhi. • S.K Khanna, C.E.G.Justo, and A.Veeraragavan, “Highway Material and Pavement Testing | | | | | |
| Reference Books: | | | | | |
| <ul style="list-style-type: none"> • Neville AM, “Properties of Concrete”, ELBS Publications, London. • Relevant BIS codes, Relevant IS Codes and IRC Codes. • IS: 2386 – Methods of tests for aggregate for concrete. • IS: 383 – Specifications for fine & coarse aggregate from natural sources for concrete • IS: 516BxB JWJS– Methods of test for strength of concrete. | | | | | |

E-Resources:

- <http://elearning.vtu.ac.in>
- www.sginstitute.in/downloads/civil.../manual_ConcreteTech

| Geotechnical Engineering Laboratory | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18CVL77 | 1-0-2-0 | 2 | 50:50 | 3 hours | PCC |
| Course Objectives: | | | | | |
| The students will be able to: <ul style="list-style-type: none"> • Carry out laboratory tests and to identify soil as per IS code. • Perform laboratory tests to determine index properties of soil. • Perform tests to determine shear strength and consolidation characteristics of soil. • Prepare the consolidated soil report. | | | | | |
| Syllabus | | | | | |
| LIST OF EXPERIMENTS | | | | | |
| <ol style="list-style-type: none"> 1. Field Identification of soil; gravel type, sand type, silt type and clay types soils. Tests for determination of Specific gravity (for coarse and fine grained soils) and Water content (Oven drying method). 2. Grain size analysis of soil sample (sieve analysis). 3. In situ density by core cutter and sand replacement methods. 4. Consistency Limits – Liquid Limit (Casagrande’s and Cone Penetration Methods), plastic limit and shrinkage limit. 5. Standard Proctor Compaction Test and Modified Proctor Compaction Test. 6. Coefficient of permeability by constant head and variable head methods. 7. Strength Tests. <ol style="list-style-type: none"> a. Unconfined Compression Test. b. Direct Shear Test. c. Triaxial Compression Test (Unconsolidated undrained test). 8. Determination of Consolidation Test. 9. a) Demonstration of miscellaneous equipment’s such as Augers, Samplers, Rapid Moisture meter, Proctor’s needle. <ol style="list-style-type: none"> b) Demonstration of Hydrometer Test and relative density of sands. c) Demonstration of CBR value and Vane shear test. 10. Preparing a consolidated soil report of Index properties and Strength properties of soil. | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to <ul style="list-style-type: none"> • Physical and index properties of the soil. • Classify based on index properties and field identification. • OMC and MDD, plan and assess field compaction program. • Consolidation parameters to assess deformation characteristics. • Strength characteristics and prepare a soil report. | | | | | |
| Text Books: | | | | | |
| <ul style="list-style-type: none"> • Soil Mechanics and Foundation Engg.- Punmia B.C.(2005), 16th Edition Laxmi Publications Co., New Delhi. • Soil Testing for Engineers- Lambe T.W., Wiley Eastern Ltd., New Delhi. • Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol.I, II, III, Princeton Press, London. • Dr. K.R.Arora, “Soil Mechanics & Foundation Engineering”, Standard Publishers & Distributors, New Delhi. | | | | | |

Reference Books:

- Engineering Properties of Soil and Their Measurements- Bowles J.E. (1988), - McGraw Hill Book Co. New York.
- BIS Codes of Practice: IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) –1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) –1966, IS 2720 (Part-60) 1965

E-Resources:

- <http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html>
- <http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf>

| Smart Cities and Applications of IOT | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18EET731 | 3-2-0-0 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to learn: | | | | | |
| <ul style="list-style-type: none"> • Purpose of Smart Cities and their role in nation development. • Modern techniques to enhance the living standards. • Problems faced by traditional cities and solutions. • Different modern techniques to tackle the traditional problems. • Use of IOT in Civil Engineering. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Introduction: Smart City: Concepts, Challenges, Evolution of smart city; Innovation economy (Innovation in industries, clusters, districts of a city; Knowledge workforce: Education and employment; Creation of knowledge -intensive companies). 100 smart city documentation of GOI. | | | | | |
| Urban Infrastructure: Concepts of Sustainable development, Components of Urban Infrastructure, 10 Hrs | | | | | |
| Module – II | | | | | |
| Planning interventions of Urban Infrastructure: Understanding Inclusive Planning: Definition and components; urban consultations; basic principles of urban consultation, process of urban consultations; urban strategic planning, good urban governance, subsidiarity, equity, efficiency, transparency and accountability, civic engagement and citizenship, security; valuing difference and working with diversity; liveable cities. 10 Hrs | | | | | |
| Module – III | | | | | |
| Applications of IoT in Smart Cities: Smart Infrastructure, Air Quality Management, Traffic Management, Smart Parking, Smart Waste Management, Street lighting :Streetlights - into next-generation intelligent lighting platforms, Pervasive wireless connectivity, Open data, Trustable Security, Flexible monetization schemes. | | | | | |
| IoT use cases for smart cities: Road traffic, Public transport, Utilities etc., 10 Hrs | | | | | |
| Module – IV | | | | | |
| Planning interventions: Inclusive zoning, development and building regulations, Slum Improvement; drafting strategic urban development plans – objectives and key actors; planning framework for actions, process of drafting the plan, key considerations. Urban design and decision-making; city transport for all; water supply and sanitation, urban disaster management, management through decentralization | | | | | |
| Key Drivers for IoT Applications in Smart Cities: Cost, Efficiency, Resource reduction, etc., Examples of IoT Applications for Smart Cities 10 Hrs | | | | | |
| Module – V | | | | | |
| Smart urban Infrastructure : Transport, Energy/ Utilities, protection of the environment and safety; Governance (Administration services to citizens, participatory and direct democracy, services to the citizen, quality of life). | | | | | |
| Examples of smart cities : Chhattisgarh City, New York City, Amsterdam Smart City, Copenhagen Smart City 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to: | | | | | |

- Apply the latest technology enabled systems for the management of cities.
- Analyse the dynamic behavior of the urban system in context to physical appearance and by focusing on representations, properties and impact factors.
- Develop the urban infrastructure systems to benefit the citizens, based on smart cities concept as responsive cities.

Text Books:

- Jo Beall (1997); “A city for all: valuing differences and working with diversity”; Zed books limited, London (ISBN: 1-85649-477-2)
- UN-Habitat; “Inclusive and sustainable urban planning: a guide for Municipalities”; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4)
- Arup Mitra; “Insights into inclusive growth, employment and wellbeing in India”; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2)

Reference Books:

- William J. V. Neill (2004); “Urban Planning and cultural identity”; Routledge, London (ISBN: 0- 415-19747-3)
- John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany (ISBN: 0-87395-678-8)
- Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European mediumsized cities". Smart Cities. Vienna: Centre of Regional Science
- "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development (http://indiasmartcities.in/downloads/CONCEPT_NOTE_-3.12.2014__REVISED_AND_LATEST_.pdf)

| GROUND WATER HYDROLOGY | | | | | |
|---|-------------------------------|----------------|-----------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18HOE743 | 3-2-0-0 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to learn: <ul style="list-style-type: none"> To characterize the properties of ground water and aquifers. To quantify the ground water flow. To locate occurrence of ground water and augment ground water resources. To synthesize ground water development methods. | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| INTRODUCTION: Importance. Vertical distribution of sub-surface water. Occurrence in different types of rocks and soils. Definition of aquifer, Aquifuge, Aquitard and Aquiclude. Confined and unconfined aquifers. | | | | | |
| AQUIFER PROPERTIES: Aquifer parameters – Specific yield, Specific retention, Porosity, Storage coefficient, derivation of the expression. Determination of specific yield. Land subsidence due to ground water withdrawals. | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| DARCY’S LAW AND HYDRAULIC CONDUCTIVITY: Introduction. Darcy’s law. Hydraulic conductivity. Coefficient of permeability and Intrinsic permeability, Transmissibility, Permeability in Isotropic, Unisotropic layered soils. Steady one dimensional flow, different cases with recharge. | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| WELL HYDRAULICS – STEADY FLOW: Introduction. Steady radial flow in confined and unconfined aquifers. Pumping tests. | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| WELL HYDRAULICS – UNSTEADY FLOW: Introduction. General equation derivation; This method, Cooper and JaCob method, Chow’s method. Solution of unsteady flow equations. | | | | | |
| GROUND WATER DEVELOPMENT: Types of wells. Methods of constructions. Tube well design. Dug wells. Pumps for lifting water: Working principles, Power requirements. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| GROUND WATER EXPLORATION: Seismic method, Electrical resistivity method, Bore hole geo-physical techniques; Electrical logging, Radio active logging, Induction logging, Sonic logging and Fluid logging. | | | | | |
| GROUND WATER RECHARGE AND RUNOFF: Recharge by vertical leakage. Artificial recharge. Ground water runoff. Ground water budget. | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| After studying this course, students will be able to: <ul style="list-style-type: none"> Find the characteristics of aquifers. Estimate the quantity of ground water by various methods. Locate the zones of ground water resources. Select particular type of well and augment the ground water storage. | | | | | |

Text Books:

- Ground Water- H.M. Raghunath, - Wiley Eastern Limited, New Delhi.
- Ground Water Hydrology- K. Todd, - Wiley and Sons, New Delhi.
- Numerical Ground Water Hydrology- A.K. Rastogi, - Penram, International Publishing (India), Pvt. Ltd., Mumbai.

Reference Books:

- Ground Water Hydrology- Bower H.- McGraw Hill, New Delhi.
- Ground Water and Tube Wells- Garg Satya Prakash, - Oxford and IBH, New Delhi.
- Ground Water Resource Evaluation- W.C. Walton, - McGraw Hill - Kogakusha Ltd., New Delhi.
- Water wells and Pumps – Michel D.M., Khepar. S.D., Sondhi. S.K., McGraw Hill Education – 2nd Edition.

| Small and Medium Enterprises management | | | | | |
|--|-------------------------------|----------------|-------------------|--------------------------|------------------------|
| Course Code | L-T-P-S (Hrs/week) | Credits | Exam marks | Exam Duration | Course Type |
| 18HOE751 | 3-2-0-0 | 3 | 50:50 | 3 hours | PEC |
| Course Objectives: | | | | | |
| The students will be able to learn: | | | | | |
| <ul style="list-style-type: none"> • The basic understanding of the various concepts and factors of Entrepreneurship and MSME. • | | | | | |
| Syllabus | | | | | |
| Module – I | | | | | |
| Basic Aspects: Concept, nature of Entrepreneur & Entrepreneurship, Classification of entrepreneurs, Distinction between Entrepreneur and Manager, Entrepreneurship and Entrepreneurship, Theories of Entrepreneurship: Schumpeter, McLell and and Drucker, Medium, Small and Tiny Business Definition, Role in the economy and significance | | | | | |
| 10 Hrs | | | | | |
| Module – II | | | | | |
| Developing Entrepreneurial Plan: Environment assessment: political, legal, economic, social, Technological, global environment, Developing effective business plan. | | | | | |
| 10 Hrs | | | | | |
| Module – III | | | | | |
| Entrepreneurial Venture Initiation: Assessment of business opportunities, Entrepreneurial Motivation, Government initiatives and private sector opportunity. | | | | | |
| Growth and Development of Entrepreneurial Venture: Strategic planning for emerging venture, Managing entrepreneurial growth, Role of venture capital and their problems. | | | | | |
| 10 Hrs | | | | | |
| Module – IV | | | | | |
| Setting up a Small Business | | | | | |
| Determination of the nature of the business unit : Micro, Small and Medium enterprise, Comparative evaluation of feasibility of buying an existing enterprise , setting up a new venture or starting the business through franchising, Location strategy, Preliminary Registration with State Directorate of Industries | | | | | |
| Assessment of different forms of business organizations: Sole Proprietorship, Partnership, LLP, Joint Stock Companies, HUF. | | | | | |
| 10 Hrs | | | | | |
| Module – V | | | | | |
| Challenges in Entrepreneurship: Business Succession and continuing from family Business perspective, Succession policy, problems of innovation and change. | | | | | |
| 10 Hrs | | | | | |
| Course Outcomes: | | | | | |
| Students will be able to: | | | | | |
| <ul style="list-style-type: none"> • Apply the knowledge in selecting suitable entrepreneur plan. • Analyse the factors involved in assessment of business opportunities. • Able to determine of the nature of the business unit. | | | | | |

Text Books:

- Wickham, Phillip A (1998); Strategic Entrepreneurship, Pitman, UK.
- Shukla, MB, (2011), Entrepreneurship and Small Business Management, Kitab Mahal, Allahabad

Reference Books:

- Hill, Michal A., Inland Durama R et al; Strategic Entrepreneurship: Creating a New Mindset, Blackwell Publishers, Oxford.
- Zenas Block and Ian C Macmillan, Corporate Venturing, Harvard Business School Press, Boston
- Sahay A., V. Sharma (2008), Entrepreneurship and New Venture Creation, Excel Books, New Delhi.
- Lall, Sahai (2006), Entrepreneurship, Excel Books, New Delhi.

