**NBKR INSTITUTE OF SCIENCE & TECHNOLOGY :: VIDYANAGAR**

*(AUTONOMOUS)*

**CIVIL ENGINEERING**

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2013-2014)

**III YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – I SEMESTER**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| S.  No. | Course  Code | Course Title | Contact  Hours/  Week | | | Credits | Evaluation | | | | | | | | | | | | |
| Sessional  Test-I | | | Sessional  Test-II | | | | Total Sessional Marks (Max. 40) | Semester  End Examination | | | Max.  Total Marks | |
| **THEORY** | L | P | T |  | Duration  in Hours | | Max.  Marks | Duration  in Hours | Max.  Marks | | 0.8(Better of two sessional tests)  +  0.2(Other) | | Duration  in Hours | Max.  Marks | |  | |
| 1 | 13CE3101 | Structural Analysis - I | 3 | - | 1 | 4 | 2 | | 40 | 2 | 40 | | 3 | | 60 | 100 | |
| 2 | 13CE3102 | R.C.C. Structural Design – I | 3 | - | 1 | 4 | 2 | | 40 | 2 | 40 | | 3 | | 60 | 100 | |
| 3 | 13CE3103 | Steel Structural Design | 3 | - | 1 | 4 | 2 | | 40 | 2 | 40 | | 3 | | 60 | 100 | |
| 4 | 13CE3104 | Foundation Engineering | 3 | - | 1 | 4 | 2 | | 40 | 2 | 40 | | 3 | | 60 | 100 | |
| 5 | 13CE3105 | Transportation Engineering - II | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | | 3 | | 60 | 100 | |
| 6 | 13CE3106 | Advanced Hydraulics | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | | 3 | | 60 | 100 | |
|  | | **PRACTICALS** |  |  | | | | | | | |  | | |  | | | | |
| 1 | 13CE31P1 | Soil Mechanics Laboratory | - | 3 |  | 2 | | - | - | - | - | | Day-to-day Evaluation and a test | | 3 | | 60 | | 100 |
| 2 | 13CE31P2 | Material Testing Laboratory | - | 3 |  | 2 | | - | - | - | - | | 3 | | 60 | | 100 |
|  |  | **TOTAL** | **20** | **06** | **04** | **28** | |  |  |  |  | |  | |  | | **800** |

**13CE3102 – R.C.C. STRUCTURAL DESIGN – I**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Strength of materials** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Understand the design principles, characteristics strength and loads, stress block concept and various limit states. Be able to design singly and doubly reinforced rectangular and flanged beams. |
| CO2 | Be able to carry out and present complete design and detailing of beams for shear, torsion and bond. Be able to carry out and present complete design and detailing of different types of slabs. |
| CO3 | Be able to carry out and present complete design and detailing of columns for various loading conditions. |
| CO4 | Be able to carry out and present complete design and detailing of different types of footing with axial load. |
| CO5 | Be able to carry out and present complete design and detailing of different types of stair cases. Be able to calculate the deflections and crack widths of beams**.** |
| **Course content** | **UNIT – I**  **DESIGN PRINCIPLES:** Basic Design Principles – Stress Strain curves of concrete and steel – Characteristic strengths and loads – Partial safety factors – Stress block – Various limit states.  **DESIGN FOR FLEXURE:** Limit state of collapse in flexure – Ultimate flexural strength – Balanced, Under and Over - reinforced sections – Design of singly and doubly reinforced rectangular beams – Design of flanged beams.  **UNIT – II**  **DESIGN FOR SHEAR, TORSION AND BOND**:Shear – Truss analogy – Design of beams for shear and torsion – Anchorage and development length.  **DESIGN OF SLABS AND BEAMS:** Design of one way and two way slabs- Design of stair cases – Design of continuous beams and slabs.  **UNIT – III**  **DESIGN OF COMPRESSION MEMBERS:** Columns – Reduction factors – Axially loaded, Eccentrically loaded columns – Uniaxial moment – Biaxial moment (Biaxial moment for practice only and not for University Examination).  **UNIT – IV**  **DESIGN OF FOUNDATIONS:** Types of footings- Design of Isolated (Square, Rectangular and Circular) footings subjected to axial load.  **UNIT – V**  **DESIGN OF STAIR CASE:** Types of staircase – specifications - design of doglegged stair case.  **LIMIT STATES OF SERVICEABILITY:** Deflection (short and long term) – Cracking. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Comprehensive RCC Designs by Dr. B. C. Punmia, A. K. Jain &Arun Kumar Jain. 2. Limit State Design (IS 456: 2000) by N. Krishna Raju& R. N. Pranesh.   **REFERENCE BOOKS**:   1. Reinforced Concrete Design by SN Sinha. 2. LSD of Reinforced concrete Structures by Ramchandra. 3. Reinforced concrete Design by Unni Krishna Pillai and DevdasMenon. 4. Limit State Theory and Design of Reinforced Concrete by S. R. Karve& V. L. Shah. | |

**13CE3103 - STEEL STRUCTURAL DESIGN**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Structural Analysis I,Engineering mechanics, Engineering Mathematics-I&II. | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to design riveted and welded connections. |
| CO2 | Be able to design tension and compression members. |
| CO3 | Be able to design laterally supported beams. |
| CO4 | Be able to design laterally unsupported beams like gantry girders. |
| CO5 | Be able to design slab bases, gusseted bases and grillage foundations. |
| **Course Content** | **UNIT – I**  **INTRODUCTION:** Properties of sections – Types of loads – Permissible stresses in tension, compression and shear as per IS code.  **RIVETED CONNECTIONS:** Types of Riveted Joints – modes of failure of riveted joints – Strength and efficiency of rivet – Strength of lap and butt joints – Design of riveted joints – Design of bracket connections (Beam to column and Beam to beam connections).  **WELDED JOINTS:** Types of welded joints – Strength of fillet and butt welds – Design of welded joints – Design of bracket connections (Beam to column and beam to beam connections).  **UNIT – II**  **DESIGN OF TENSION AND COMPRESSION MEMBERS:** Design of tension members – Lug angles – Tension splice. Design of compression members – Single and built – up columns – Design of lacing and battens – Design of eccentrically loaded columns – Column splicing.  **UNIT – III**  **LATERALLY SUPPORTED BEAMS:** Design of simple beams – Design of built up beams- Curtailment of flange plates – Connection of flange plate with flange of beam.  **UNIT – IV**  **LATERALLY UNSUPPORTED BEAMS:** Permissible bending compressive stress – Effective length of compression flange – Design of simple beams – Design of Gantry Girders.  **UNIT – V**  **DESIGN OF COLUMN BASES:** Slab base – Gusseted base – Bases subjected to moment – Grillage foundation. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Design of Steel Structures by S.K. Duggel. 2. Design of Steel Structures by S.S. Bhavikatti.   **REFERENCE BOOKS:**   1. Design of Steel Structures Vol. I & II by Dr. Rama Chandra. 2. Limit State design Structural steel by M.R. Shiyekar. 3. Design of Steel Structures by N. Subramaniyan. | |

**13CE3104 - FOUNDATION ENGINEERING**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Soil Mechanics** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to analyse finite and infinite slopes |
| CO2 | Be able to calculate earth pressure in various soils under different types of loadings and able to analyse stability of retaining walls. |
| CO3 | Be able to calculate bearing capacity of shallow foundations |
| CO4 | Be able to design pile foundation and able to understand the deign characteristics of well foundation |
| CO5 | Understand the various methods of site exploration and be able to write investigation reports. |
| **Course Content** | **UNIT – I**  **STABILITY OF SLOPES:** Stability analysis of infinite slopes – Stability analysis of finite slopes – Swedish circle method – Friction circle method – Tailor’s stability number and use of charts – Improving stability of slopes.  **UNIT – II**  **EARTH PRESSURES:** Earth pressure theories of lateral earth pressure – Active and passive earth pressures in cohesionless and cohesive soils (with and without surcharge) – Rankine’s and Coulumb’s earth pressure theories – Graphical methods due to Rebhann and Culmann.  **EARTH RETAINING STRUCTURES:** Types of Retaining Structures – Stability Consideration of Gravity and Cantilever Retaining Walls – Drainage in retaining walls – Joints in retaining walls.  **UNIT – III**  **BEARING CAPACITY OF SHALLOW FOUNDATIONS :** Types of foundations – Depth of foundation – Terzaghi’s bearing capacity equation – Bearing capacity of square, circular, rectangular and continuous footings – Meyerhof’s theory – Skempton’s method – Brinch Hansen’s method – Effect of ground water table on bearing capacity – Bearing capacity from building codes – Tolerable settlements – Settlement analysis.  **UNIT – IV**  **PILE FOUNDATIONS:** Classification of piles – Pile driving – Load carrying capacity of piles – Dynamic formulae – Static formulae – pile load tests – Insitu penetration Tests – Group action of piles – Negative skin friction.  **WELL FOUNDATIONS:** Types – Different shapes of wells – Components of wells – functions and Design Criteria – Sinking of wells – Tilts and shifts.  **UNIT – V**  **SITE INVESTIGATIONS AND SUB-SOIL EXPLORATION:** Site reconnaissance – Depth of exploration – Lateral extent of exploration – Test pits – Auger borings – Wash borings – Soil sampling – Split – spoon sampler – Penetration tests – Geophysical methods – Seismic refraction and electrical resistivity methods – Sub soil investigation reports. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Soil Mechanics and Foundation Engineering by K.R.Arora. 2. Geotechnical Engineering by C. Venkatramaiah. 3. Soil Mechanics and foundation Engineering by P.N. Modi 4. Soil Mechanics & Foundation Engineeering by B.C.Punmia   **REFERENCE BOOKS:**   1. Analysis and design of foundations and retaining structures by Shamsher Prakash, Gopal Ranjan & Swamisaran. 2. Soil Mechanics & Foundation Engg. by V.N.S.Murthy. 3. Foundation Engineering by Teng 4. Foundation Engineeing by P.C Varghese. | |

**13CE3105 - TRANSPORTATION ENGINEERING – II**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Transportation Engineering – I(2-2) | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Understand the basics of traffic engineering. |
| CO2 | Understand the components of permanent way. |
| CO3 | Understand types of stations, yards, crossing and turnouts. |
| CO4 | Understand the elements of airport engineering. |
| CO5 | Understand the elements of harbour engineering. |
| **Course Content** | **Unit - I**  **TRAFFIC ENGINEERING:** Road user and vehicular characteristics, Traffic studies (uses, field methods and presentation of data only) – Volume, speed, origin & destination, parking; Traffic control devices – signs and signals, Highway capacity  **Unit - II**  **RAILWAY ENGINEERING I:** Comparison of railway and Highway transportation, classification of Indian railways, permanent way – components, gauges, coning of wheels, ballast types and functions.  **Unit - III**  **RAILWAY ENGINEERING II:** Classification and layout of different types of stations, station yards, types of crossings, Type of switches, Turnouts – factors affecting speed at turnouts.  **Unit - IV**  **AIRPORT ENGINEERING:** Airport planning – Master plan, Regional plan, data for site selection Air craft characteristics  **AIRPORT LAYOUT AND TERMINAL AREA:** Terminal area, Building area, parking area, Blast considerations, Typical airport layouts and their features.  **Unit - V**  **DOCKS AND HARBOUR ENGINEERING:** Tides–winds–waves–currents–classification of harbours–site selection classification of ports–Docks – types of docks–Breakwaters–types of Break waters–quays jetties–wharves–dolphins–fender aprons–transit sheds and ware houses–dredging. | |
| **Text Books and reference Books:** | **TEXT BOOKS**:   1. Traffic Engineering and Transport Planning by L.R. Kadiyali. 2. A text book of Railway Engineering by Saxena S.C. and Arora S.P. 3. Airport Planning and Design by Khanna S.K., Arora M.G. and Jain S.S.   4. Docks and Harbour Engineering by R. Srinivasan.  **REFERENCE BOOKS**:   1. Traffic Engineering Vol. I & II by Hobbs F.D. and Richardson P.R. 2. A text book of Railway Engineering by Rangwala. 3. Airport Engineering by Norman J, Ashford, Saleh A. Mumayiz and Paul H Wright. 4. A Course in Docks and Harbour Engineering by S.P.Bindra. 5. Railway Engineering by [Satish Chandra](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Satish+Chandra%22&source=gbs_metadata_r&cad=4), [M. M. Agarwal](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22M.+M.+Agarwal%22&source=gbs_metadata_r&cad=4). | |

**13CE3106 – ADVANCED HYDRAULICS**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Fluid Mechanics | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to analyze the flow characteristics in channels. |
| CO2 | Be able to design channels for uniform flow. |
| CO3 | Be able to compute specific energy and critical depth. |
| CO4 | Be able to analyze GVF and make GVF computations. |
| CO5 | Be able to analyze RVF and make RVF computations. |
| **Course Content** | **UNIT – I**  **INTRODUCTION TO CHANNEL FLOW :** Differences between pipe flow and channel flow – classification of flows – Geometric elements of channel section – velocity and pressure distributions – Velocity distribution coefficients – Parallel and curvilinear flows – Pressure correction coefficient.  **UNIT – II**  **UNIFORM FLOW:** Uniform flow – Chezy and Manning formulate – Hydraulically efficient channel sections (rectangular, triangular, trapezoidal and circular sections) – Uniform flow computations.  **UNIT – III**  **SPECIFIC ENERGY AND CRITICAL DEPTH:** Specific energy and critical depth – Critical flow computations – Applications – Transitions.  **UNIT – IV**  **GRADUALLY VARIED FLOW :** Dynamic equation of gradually varied flow – classification of flow profiles – Features of flow profiles – Control sections – Analysis of flow profiles – Gradually varied flow computations – Direct step method.  **UNIT – V**  **RAPIDLY VARIED FLOW:** Hydraulic jump – Momentum equation – Characteristics of jump in a horizontal rectangular channel – Rapidly varied unsteady flow – Surges in rectangular channels. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Open Channel Hydraulics by Ven Te Chow. 2. Flow in Open Channels by Subramanya K.   **3.** Open channel flow by Madan Mohan Das.  **REFERENCE BOOKS:**   1. Flow through Open Channels by K.G.Rangaraju. 2. Hydrology by H.M. Raghunath. 3. Hand Book of Applied hydrology by Ven Te Chow | |

**13CE31P1 - SOIL MECHANICS LABORATORY**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** | Soil Mechanics | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to determine index properties of soils and classify them. |
| CO2 | Be able to determine the compaction characteristics |
| CO3 | Be able to determine the permeability of soils. |
| CO4 | Be able to determine the California Bearing Ratio value. |
| CO5 | Be able to determine the shear parameters of the soil. |
| **Course Content** | **List of experiments:**   1. (a) Specific Gravity   (b) Grain Size Distribution by Sieve Analysis   1. (a) Liquid Limit & Plastic Limit   (b) Shrinkage Limit  3. (a)In-Situ density by core cutter method  (b) In-Situ density by Sand replacement method   1. I.S. light Compaction Test 2. California Bearing Ratio Test 3. North Dakota Cone Test 4. (a) Free Swell Index Test   (b) Direct Shear Test   1. Unconfined Compression Test 2. Coefficient of Permeability by constant Head method 3. Coefficient of Permeability by Falling Head method   **Demonstration**   1. Hydrometer Analysis 2. Triaxial Shear Test 3. Consolidation Test | |

**13CE31P2 - MATERIAL TESTING LABORATORY**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** | **Strength of materials** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Mild steel for tension, direct shear, hardness and impact load |
| CO2 | HYSD bar for tension, hardness, torsion and Wood for compression test |
| CO3 | Springs, and rolled steel joist for bending. |
| CO4 | Beams for deflection and elastic modulus. |
| CO5 | Close-coiled helical springs for deflection |
| **Course Content** | **LIST OF EXPERIMENTS**   1. Tension test on Mild Steel bar. 2. Tension test on HYSD bar. 3. Compression test on wood. 4. Direct shear test on Mild Steel. 5. Rockwell and Brinell Hardness tests. 6. Charpy and Izod Impact tests. 7. Bending test on Rolled Steel Joist. 8. Bending test on carriage springs. 9. Torsion test-Determination of Rigidity modulus (G). 10. Deflection test on simply supported beam-Determination of Elastic modulus (E). 11. Deflection test on fixed beam- Determination of Elastic modulus (E). 12. Deflection test on close-coiled helical springs. 13. Deflection test on over hanging beam - Determination of Elastic modulus (E). | |

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**CIVIL ENGINEERING**

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2013-2014)

**III YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – II SEMESTER**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| S.No. | Course  Code | Course Title | Contact  Hours/  Week | | | Credits | Evaluation | | | | | | | | | |
| Sessional  Test-I | | Sessional  Test-II | | | Total Sessional Marks (Max. 40) | Semester  End Examination | | Max.  Total Marks | |
| **THEORY** | L | P | T |  | Duration  in Hours | Max.  Marks | Duration  in Hours | | Max.  Marks | 0.8(Better of two sessional tests)  +  0.2(Other) | Duration  in Hours | Max.  Marks |  | |
| 1 | 13CE3201 | R.C.C. Structural Design - II | 3 | - | 1 | 4 | 2 | 40 | 2 | | 40 | 3 | 60 | 100 | |
| 2 | 13CE3202 | Hydrology | 4 | - | - | 4 | 2 | 40 | 2 | | 40 | 3 | 60 | 100 | |
| 3 | 13CE3203 | Structural Analysis -II | 3 | - | 1 | 4 | 2 | 40 | 2 | | 40 | 3 | 60 | 100 | |
| 4 | 13CE3204 | Concrete Technology | 4 | - | - | 4 | 2 | 40 | 2 | | 40 | 3 | 60 | 100 | |
| 5 | 13CE3205 | Environmental Engineering - I | 4 | - | - | 4 | 2 | 40 | 2 | | 40 | 3 | 60 | 100 | |
| 6 | 13CE32EX | Elective –I | 4 | - | - | 4 | 2 | 40 | 2 | | 40 | 3 | 60 | 100 | |
|  | | **PRACTICALS** |  |  | | | | | | | |  |  | | | |
| 1 | 13SH32P1 | Advanced Communication Skills Laboratory | - | 3 | - | 2 | - | - | | - | - | Day-to-day Evaluation and a test | 3 | 60 | | 100 |
| 2 | 13CE32P1 | Highway Materials Laboratory | - | 3 | - | 2 | - | - | | - | - | 3 | 60 | | 100 |
|  |  | **TOTAL** | **22** | **06** | **02** | **28** |  |  | |  |  |  |  | | **800** |

**Elective I:**

13CE32E1 Industrial Steel Structural Design

13CE32E2 Advanced Foundation Engineering

13CE32E3 Transportation Planning

13CE32E4 Industrial Waste and Waste Water Management

13CE32E5 Ground Water Hydrology

**13CE3201 – R.C.C. STRUCTURAL DESIGN – II**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **R.C.C.Structural Design, Foundation Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to design rectangular and trapezoidal combined footings. |
| CO2 | Be able to design cantilever and counterfort retaining walls. |
| CO3 | Be able to design water tanks, spherical and conical domes. |
| CO4 | Be able to design circular slabs using yield line theory. |
| CO5 | Be able to calculate stresses for prestressed rectangular sections |
| **Course Content** | **UNIT – I**  **DESIGN OF FOUNDATIONS:** Design of combined footings (Rectangular and Trapezoidal).  **UNIT – II**  **DESIGN OF RETAINING WALLS:** Design of retaining walls – Cantilever and Counterfort types for different loadings.  **UNIT – III**  **DESIGN OF WATER TANKS:** Review of working stress design method – Circular and Rectangular tanks resting on ground – Circular tanks with IS code method and Rectangular tanks with Approximate method – Spherical and Conical domes – Design of Intze tanks.  **UNIT – IV**  **YIELD LINE THEORY:** Introduction – behavior of slab up to failure – assumptions – guidelines for predicting yield line pattern – yield criterion – methods of analysis and basic principles – virtual work – Equilibrium method – corner levers – circular slabs.  **UNIT – V**  **PRESTRESSED CONCRETE:** Principles of prestressing – Materials used – Methods and Systems of prestressing – Losses of prestress – Analysis of rectangular sections for stresses. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Comprehensive RCC Designs by Dr. B. C. Punmia, A. K. Jain & Arun Kumar Jain. 2. Limit State Design (IS 456: 2000) by N. Krishna Raju & R. N. Pranesh. 3. Prestressed Concrete by N. Krishna Raju.   **REFERENCE BOOKS:**   1. Limit State Theory and Design of Reinforced Concrete by S. R. Karve & V. L. Shah. 2. Reinforced Concrete – Limit State Design by A.K.Jain. 3. RC Design by SN Sinha. | |

**13CE3202 - HYDROLOGY**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | None | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to measure, analyze and estimate rainfall data. |
| CO2 | Be able to measure and calculate evaporation, transpiration, evapotranspiration and infiltration indices. |
| CO3 | Be able to determine runoff volume. |
| CO4 | Be able to analyze unit hydrograph method. |
| CO5 | Be able to perform flood routing by Pul’s and Muskingum methods. Be able to calculate the yield of aquifers |
| **Course Content** | **UNIT – I**  **INTRODUCTION:** Hydrologic cycle – Hydrologic data – Sources of Data.  **PRECIPITATION :** Precipitation – forms and types of precipitation – Measurement of precipitation – Mean precipitation over an area – Rain gauge network – Estimation of missing data – Double mass curve – Intensity – duration – frequency (IDF) curves.  **UNIT – II**  **ABSTRACTIONS:** Evaporation, Transpiration, Evapotranspiration – Factors affecting – Measurement – Methods for reduction – Infiltration – Measurement – Infiltration indices.  **UNIT – III**  **RUNOFF:** Runoff process – Factors affecting runoff – Drainage basin characteristics – Determination of run off – Run off formulae, tables – Stream gauging Yield – Flow duration curve – Flow mass curve.  **UNIT – IV**  **FLOODS:** Importance of flood studies – Methods of estimating flood peak – Empirical formulae – Rational method – Components of a Hydrograph – Base flow separation – Unit hydrograph – Derivation of unit hydrograph of different durations – Gumbel’s method of flood frequency analysis.  **UNIT – V**  **FLOOD ROUTING:** Basic equation – Types – Routing by Pul’s and Muskingum methods.  **GROUNDWATER:** Groundwater occurrence – Darcy’s law – Types of aquifers – Dupuit’s equation – wells – yield – recuperation test. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Engineering Hydrology by Subramanya, K. 2. A Text Book of Hydrology by P. Jayarami Reddy.   **REFERENCE BOOKS:**   1. Hydrology by H.M. Raghunath. 2. Hydrology by Madan Mohan Das. 3. Hand Book of Applied hydrology by Ven Te Chow. | |

**13CE3203 - STRUCTURAL ANALYSIS –II**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Structural Analysis –I (III –I) | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to draw influence line diagram for determinate structures under various loadings. |
| CO2 | Be able to understand the static and kinematic indeterminacies of structures and apply Castigliano’s theorem-II |
| CO3 | Be able to draw SFD and BMD of indeterminate structures using slope deflection and moment distribution methods. |
| CO4 | Be able to draw SFD and BMD using Kani’s method.. |
| CO5 | Understand the concept of plastic analysis and be analyse indeterminate structures |
| **Course Content** | **UNIT – I**  **INFLUENCE LINES :** Influence lines for reactions SF and BM for determinate structures – Maximum BM and SF for single, two and multipoint loads – UDL longer and shorter than span and EUDL.  **UNIT – II**  **INDETERMINATE STRUCTURES:** Determination of static and kinematic indeterminacies – Solution of trusses having up to two degree of internal and external indeterminacies – Castigliano’s theorem – II.  **UNIT – III**  **STATICALLY INDETERMINATE BEAMS AND FRAMES:**   1. **Slope – Deflection method** with degree of indeterminacy not exceeding three – Effect of sinking 2. **Moment Distribution method** including frames with sway limited to single bay single storey – effect of sinking of supports.   **UNIT – IV**  **KANI’S METHOD:** Continuous beams – settlement of supports – single bay portal frames with side sway.  **MULTISTOREYED FRAMES:** Analysis of multi-storeyed frames using, portal and cantilever methods.  **UNIT – V**  **PLASTIC ANALYSIS:** Idealized stress – strain diagram – Shape factors – Moment-Curvature relationships – Plastic hinges – Collapse Mechanism – Analysis of fixed and continuous beams and portal frames. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Structural Analysis Vol. I & II by S. S. Bhavikatti. 2. Comprehensive structural Analysis Vol. I & II by R. Vaidanathan & P. Perumal. 3. Analysis of Structures Vol. I & II by V.N. Vazirani & M.N. Ratwani.   **REFERENCE BOOKS:**   1. Theory of Structures Vol.I by S. P.Gupta, G.S. Pandit & R. Gupta. 2. Mechanics of Structures Vol.II by S.B. Junnarkar. 3. Structural Analysis by L.S. Negi & R.S.Jangid. 4. Steel Structures Vol. II by Ramchandra. | |

**13CE3204 –CONCRETE TECHNOLOGY**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Building Technology (2-1) | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Understand the behavior and characteristics of various types of cements and additives. |
| CO2 | Understand the characteristics and behavior of various types of aggregates. Determine the properties of fresh and hardened concrete. Understand the different types of mixing, storage, transportation and placement of concrete. |
| CO3 | Understand the various methods of curing concrete. Understand the various tests to be conducted on hardened concrete. |
| CO4 | Understand the long term behavior of elasticity, shrinkage and creep. Understand the durability of concrete. |
| CO5 | Be able to design concrete mix for various grades using different methods |
| **Course Content** | **UNIT – I**  **PORTLAND CEMENT :** Composition – Physical properties – Rapid hardening Portland cement –Portland Blast Furnace cement – Low heat Portland cement – Sulphate resisting Portland cement – White Portland Cement – Coloured Portland cement – High alumina cement – Super sulphate cement – Masonry cement – Expansive cements – Oil well cements.  **ADDITIVES:** Classifications – Accelerators – Retarders – Water Proofers – Pigments – Air entraining agents – Pozzolana.  **UNIT – II**  **CONCRETE AGGREGATES :** Classifications – Heavy aggregates – Normal weight aggregates – Strength and other mechanical properties – Moisture content and its effects – Deleterious substances – Alkali–Aggregate reaction – Thermal properties – Grading curves and Grading requirements – Gap–graded aggregate – Maximum aggregate size – Use of ‘Plums’ – Handling of aggregates.  **FRESH CONCRETE:** Workability – Factors affecting workability – Measurements of workability – Comparison of tests – Effect of time and temperature – Segregation – Bleeding – Mixing of concrete – Concrete mixers – vibration of concrete – Types of vibrators – Ready mixed concrete – Pumped concrete. Prepacked concrete and vacuum processed concrete  **UNIT – III**  **CURING OF CONCRETE:** Methods of curing − Maturity – Influence of temperature – Steam curing at atmospheric pressure – High pressure steam curing.  **HARDENED CONCRETE:** Compression tests – Effect of capping – Flexure test – Splitting test – Rebound Hammer test – Ultrasonic pulse test – Abrasion of Concrete.  **UNIT – IV**  **ELASTICITY, SHRINKAGE AND CREEP:** Modulus of elasticity – Dynamic modulus – Poisson’s ratio – Shrinkage and its effects – Creep of concrete – Factors affecting creep.  **DURABILITY:** Permeability – Chemical attack of Concrete – Efflorescence – Air entrained concrete – measurements – effects – Thermal properties – Resistance of concrete to fire.  **UNIT – V**  **CONCRETE MIX DESIGN AND QUALITY CONTROL:** Basic consideration – Factors in the choice of properties – Method of calculation by absolute volume method – Simple example of mix design – Design of high strength mixes– ACI & IS methods of mix design. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Concrete Technology by M.S. Shetty.  2. Concrete Technology by G Gambhir  3. Concrete Practice by R.H. Elvery.  **REFERENCE BOOKS:**  1. Properties of Concrete by A.M. Neville  2. Concrete Technology Vol. I & II by D.F. Orchard.  3. Concrete Technology & Practice by W.H.Taylor.  4. I.S. 10262–2009 Guidelines for Concrete Mix Design. | |

**13CE3205 - ENVIRONMENTAL ENGINEERING – I**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Fluid mechanics – I** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Identify the sources of water and intake works for collection. Be able to forecast and calculate water demand. |
| CO2 | Be able to determine the water quality and understand the conventional methods of water treatment. |
| CO3 | Understand the concepts of filtration and disinfection. |
| CO4 | Apply the advanced water treatment methods. |
| CO5 | Understand the various methods of conveyance and distribution of water. Be able to design pipe-networks by hardy-cross method. Understand various joints, valves and house service connections. |
| **Course Content** | **UNIT – I**  **SOURCES, DEMAND AND COLLECTION OF WATER:** Sources of water-Source selection Water demand-Types-Factors affecting water demand-Fluctuations in water demand-Design period-Population forecasting methods and their suitability-Intake works for collection of water.  **UNIT – II**  **WATER QUALITY:** Need for protected water supply-Water quality- Characterization-Water quality standards-Water-borne diseases  **CONVENTIONAL TREATMENT OF WATER:** General outline of conventional water treatment units and their functions-Theory of aeration-Aeration methods-Principles and design of sedimentation-coagulation, flocculation and clarification  **UNIT – III**  **FILTRATION AND DISINFECTION:** Theory of filtration-Types of filters- Working and design of slow and rapid sand filters-Operational troubles in filters-Disinfection-Types of disinfectants-Theory of chlorination-Break point chlorination.  **UNIT – IV**  **ADVANCED TREATMENT METHODS:** Membrane process- Removal of salinity-Adsorption technique-Removal of arsenic-Ion exchange process-Removal of hardness-Chemical oxidation and precipitation-Removal of Iron &, manganese, fluorides.  **UNIT – V**  **CONVEYANCE SYSTEM:** Intake structures-Systems of conveyance of water-Pipe materials Hydraulics of flow in pipes  **WATER DISTRIBUTION:** Requirements of water distribution-Components-Service reservoirs Layout of distribution networks-Design of pipe networks-Hardy cross and equivalent pipe method-Pipe joints-Valves-House service connections. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Water Supply Engineering by S.K. Garg. 2. Water Supply Engineering by B.C.Punmia.   **REFERENCE BOOKS:**   1. Water Treatment Principles and Design by James M. Montgomery. 2. Water and waste water Technology by E.W. Steel. 3. Environmental Engineering by H.S. Peavy et al., | |

**13CE32E1 – INDUSTRIAL STEEL STRUCTURAL DESIGN**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Steel Structural design | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to design plate girders |
| CO2 | Be able to design water tanks |
| CO3 | Be able to design roof frames |
| CO4 | Be able to design chimneys |
| CO5 | Be able to analyse and design light gauge steel structures |
| **Course Content** | **UNIT – I**  **DESIGN OF PLATE GIRDERS:** Riveted and welded plate girders – Design of cross section- Curtailment of flange plates – Vertical and horizontal stiffeners – Splicing of web – Splicing of flange.  **UNIT – II**  **DESIGN OF WATER TANKS:** Design of cylindrical steel tanks, pressed steel tanks and rectangular steel tanks including staging.  **UNIT – III**  **DESIGN OF ROOF TRUSSES :** Loading on roof trusses – Design of purlins – Design of members of roof truss – Angular and tubular members – Design of connection of members.  **UNIT – IV**  **CHIMNEYS:** Introduction - lining for masonry chimneys – various forces acting on masonry chimneys - stability of masonry chimneys – architectural treatment of masonry chimneys - specifications for design of masonry chimneys - Design of chimneys.  **UNIT – V**  **LIGHT GAUGE STEEL STRUCTURES:** Light gauge steel types of sections – Specifications – Basic allowable design stresses – Compression members – Local buckling of elements, Stiffened and unstiffened compression elements – Computation of permissible stresses – Design of columns – Flexural Members – Bending – Deflection - Local bucking of compression elements – Laterally supported and unsupported beams- computation of permissible stresses – Design of beams. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Design of Steel Structures – Ramchandra Vol. I&II  2. Steel Structures Vol. III – Vazirani and Ratwani  3. Design of Steel Structures – Arya and Ajmani | |

**13CE32E2 - ADVANCED FOUNDATION ENGINEERING**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Foundation Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to foundation design considerations |
| CO2 | Be able to design of footing |
| CO3 | Be able to design of mat foundation by conventional method |
| CO4 | Be able to analyze pile load in group of piles |
| CO5 | Be able to predict the settlements in shallow and deep foundations |
| **Course Content** | **UNIT – I**  **FOUNDATION DESIGN CONSIDERATION:** Depth and spacing of footings – Displaced soil effects – Water table fluctuation – Foundations in sands and clays – Environmental considerations.  **UNIT – II**  **FOOTINGS:** Classification and purpose – Contact pressure under footings – proportioning of footings – Principles of footing design.  **UNIT – III**  **MAT FOUNDATIONS:** Allowable bearing pressure for mat foundations – conventional design of mat foundations – Modulus of sub-grade reaction.  **UNIT – IV**  **DEEP FOUNDATIONS:** Single piles versus pile groups – pile spacing – pile caps – Analysis of pile load in a group of piles.  **UNIT – V**  **SETTLEMENT ANALYSIS:** Prediction of settlement in cohesive and cohesion less soil deposits (Shallow & Deep foundations). | |
| **Text Books and reference Books:** | **REFERENCE AND TEXT BOOKS:**   1. Soil mechanics and foundation engineering by V.N.S. Murthy. 2. Modern geotechnical engineering by Alam Singh. 3. Foundation analysis and design by Bowles, J.E. 4. Foundation engineering by Brahma, S.P. 5. Foundation engineering by Teng, W.C. 6. Analysis and Design of foundation and Retaining structures by Shamsher Prakash, Gopal Ranjan and Swami Saran. 7. Foundation Engineering by Peck, Honson, Thornburn. 8. Basic and Applied Soil Mechanics by Gopal Ranjan & A.S.R. Rao. 9. Geotechnical Engineering by C. Venkatramaiah. 10. Numerical Problems, Examples and Objective Questions in Geotechnical Engineering A.V. Narasimha Rao and C. Venkatramaiah. | |

**13CE32E3 - TRANSPORTATION PLANNING**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Transportation Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | To understand the necessity of a planning process, its implementation and components. |
| CO2 | To summarize data collection techniques and in depth analysis of ways data is collected, assimilated and processed. |
| CO3 | To discuss the earlier two stages of the four stage planning model so as to familiarize students to model and forecasting techniques. |
| CO4 | To discuss the earlier two stages of the four stage planning model that will help students understand the planning process from a point of a planner. |
| CO5 | To analyze and execute plans and ideas required for a planning process along with a brief introduction to planning for a city of small or medium size. |
| **Course Content** | **UNIT – I**  **TRANSPORT PLANNING PROCESS** –Scope of the Subject, Interdependence of the Land Use and Traffic, Systems Approach to Transport Planning. Stages in Transport Planning, Survey and Analysis of Existing Conditions, Forecast Analysis of Future Conditions and Plan Synthesis, Evaluation, Programme Adoption and Implementation, Continuing Study, Citizen Participation, Difficulties in the Transport Planning Process.    **UNIT – II**  **TRANSPORTATION SURVEY:** Introduction, Definition of the Study Area, Zoning , Type of Surveys, Home Interview Surveys, Commercial Vehicles Surveys, Taxi Surveys, Road Side Interview Surveys, Post Card Questionnaire, Registration Number Plate Surveys, Tags on Vehicles, Public Transport Surveys, Inventory of Transport Facilities, Inventory of Land Use and Economic Activities, Expansion of Data From Samples.  **UNIT – III**  **TRIP GENERATION** – Introduction and Definitions, Trip Purpose, Factors Governing Trip Generation and Attraction Rates, Multiple Linear Regression Analysis, Category Analysis.  **TRIP DISTRIBUTION** – What is Trip Distribution, Methods of Trip Distribution, Uniform (Constant) Factor Method, Average Factor Method.  **UNIT – IV**  **TRAFFIC ASSIGNMENT** – Purpose of Traffic Assignment, General Principles, Assignment Techniques - All-or-Nothing Assignment, Multiple Route Assignment, Capacity Restraint Assignment, Diversion Curves.  **MODAL SPLIT** – General Considerations, Factors Affecting Modal Split, Modal Split in the Transport Planning Process.  **UNIT – V**  **EVALUATION** – Need for Evaluation, Several Plans to be Formulated, Testing, Considerations in Evaluation, Economic Evaluation.  **TRANSPORT PLANNING FOR SMALL AND MEDIUM SIZED CITIES** – Introduction, Difficulties in Transport Planning for Small and Medium Cities, Quick response Techniques. | |
| **Text Books and reference Books:** | **TEXT BOOKS**   1. Traffic Engineering and Transport Planning by L.R. Kadiyali.   **REFERENCE BOOKS:**   1. A course in Highway Engineering by S.P. Bindra, Dhanpat Rai & Sons, Delhi 1988. 2. Transpiration Engineering, Vol I by Vazirani and Chandola, 2000 | |

**13CE32E4 - INDUSTRIAL WASTE AND WASTE WATER MANAGEMENT**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Environmental Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | To understand the water quality requirements for different industries. |
| CO2 | To reduce the concentration or strength of waste and to reduce the volume of waste also. |
| CO3 | Understanding the methods for disposing waste into streams, oceans and lakes. |
| CO4 | The re-use of the industrial waste as well as municipal wastewater. |
| CO5 | Identifying the sources and characteristics of liquid waste from different industries and treatment methods for those wastes. |
| CO6 | Understanding the limitations, advantages and suitability of effluent treatment plants and disposal methods. |
| **Course Content** | **UNIT – I**  Quality requirements of boiler and cooling waters – Quality requirements of process water for Textiles – Food processing, and Brewery Industries – Boiler and Cooling water treatment methods.  **UNIT – II**  Basic Theories of Industrial Waste water Management – Volume reduction – Strength reduction – Neutralization – Equalization and proportioning. Joint treatment of industrial wastes and domestic sewage – consequent problems.  **UNIT – III**  Industrial waste water discharges into streams. Lakes and oceans and problems. Recirculation of Industrial Wastes – Use of Municipal Waste Water in Industries.  **UNIT – IV**  Manufacturing Process and design origin of liquid waste from Textiles, Paper and Pulp industries, Thermal Power Plants, Fertilizers, Steel Plants, Oil Refineries, and Distillers, Special Characteristics, Effects and treatment methods.  **UNIT – V**  Common Effluent Treatment Plants – Advantages and Suitability, Limitations, Effluent Disposal Methods. | |
| **Text Books and reference Books:** | TEXT BOOK:  1. Waste Water Treatment by M.N. Rao and Dutta, Oxford & IBH, New Delhi.  REFERENCES:  1. Liquid waste of Industry by Newmerow.  2. Water and Waste Water technology by Mark J. Hammer and Mark J. Hammer (Jr). | |

**13CE32E5-GROUND WATER HYDROLOGY**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Hydrology** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Identify the ground water flow & prediction and well hydraulics. |
| CO2 | Explain the method to identify groundwater sources. |
| CO3 | Demonstrate the saline water intrusion. |
| CO4 | Identify the sources of groundwater contamination. |
| CO5 | Apply the process for sustainable groundwater management |
| **Course Content** | UNIT – I  **WATER WELLS:** Shallow Well – Deep well – Well Construction – Well Completion – Well development – Testing of wells for yield – Protection of wells – Well rehabilitation.  UNIT – II  **SUBSURFACE INVESTIGATIONS AND ARTIFICIAL RECHARGE:** Test drilling – Geophysical, resistivity and spontaneous potential logging – Concept of artificial recharge.  UNIT – III  **SALINE WATER INTRUSION:** Occurrence – Ghyben – Herzberg relation between fresh and saline waters – Shape of interface – Control of saline water intrusion.  UNIT – IV  **POLLUTION OF GROUND WATER:** Municipal, Industrial and Agricultural sources of pollution – Attenuation, distribution and evaluation of ground water pollution – Monitoring ground water quality.  UNIT – V  **GROUND WATER MANAGEMENT:** Concept of basin management – Equation of hydrologic equilibrium – Ground water basin investigation – Data Collection – Alternative basin yields – Evaluation of perennial yield – Basin management by conjunctive use. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Ground water hydrology by D.K.Todd.  2. Ground water by H.M.Raghunath.  **REFERENCES BOOKS:**  1. Liquid waste of Industry by Newmerow.  2. Water and Waste Water technology by Mark J. Hammer and Mark J. Hammer (Jr). | |

**13CE32P1 – HIGWAY MATERIALS LABORATORY**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** | **TRANSPORTATION ENGG – I** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to determine various properties of highway materials. |
| CO2 | Be able to conduct various test for highway materials. |
| CO3 | Be able to assess the quality of highway materials. |
| CO4 | Be able to choose the required material based on field conditions. |
| CO5 | Be able to evaluate the quality of the highway materials. |
| **Course Content** | **CYCLE – I: TESTS ON AGGREGATES**   1. Specific Gravity and Water Absorption Test. 2. Aggregate Impact Test 3. Elongation Index Test 4. Flakiness Index Test 5. Angularity Number Test 6. Los Angles Abrasion Test 7. Aggregate Crushing Test   **CYCLE – II: TESTS ON BITUMEN**   1. Flash & Fire Point Test 2. Softening Point Test 3. Specific Gravity Test 4. Penetration Test 5. Ductility Test 6. Stripping Value Test | |

**13HS32P1 – ADVANCED COMMUNICATION SKILLS LABORATORY**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 – 3 |
| **Prerequisite:** | **English, English Language Lab** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Attend interview with ease and confidence |
| CO2 | Understand the importance of the various skills involved in developing enriching interpersonal relationships. |
| CO3 | Able to reach the corporate expectations |
| CO4 | Gain proficiency in usage of vocabulary for both professional and personal life |
| CO5 | Empower in writing skills in order to prepare a persuasive resume and letters |
| **Course Content** | **LIST OF EXPERIMENTS**   1. **Vocabulary Building** – Synonyms and Antonyms, Word roots, One-word Substitutes, Prefixes and Suffixes, Study of word origin, Analogy, Idioms and Phrases. 2. **Group Discussion** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of voice, Body Language, Relevance, Fluency and Coherence. 3. **Intrapersonal & Interpersonal Relationship Skills** - Intrapersonal & Interpersonal Relationship Skills - To be an Effective Team Player 4. **Resume’ Writing** – Structure and Presentation, Planning, Defining the career Objective, Projecting ones strengths and Skill-Sets, Summary, Formats and Styles, Letter-Writing. 5. **Interview Skills** – Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Interview through Tele and Video-Conferencing. 6. **Corporate Etiquettes**- Dressing Etiquettes- Dining Etiquettes- Nonverbal Communication- Proximity of Place | |
| **Text Books and reference Books:** | **Books Recommended:**   1. Effective Technical Communication, M. Ashraf Rizivi, Tata Mc. Graw-Hill Publishing Company Ltd. 2. A Course in English commucation. Madhavi Apte, Prentice-Hall of India,2007. 3. Communication Skills. Leena Sen, Prentice-Hall of India,2005. 4. Academic Writing-A Practical guide for students by Stephen Bailey,Rontledge Falmer, London & New York,2004. 5. English Language Communication: A Reader cum Lab Manual., Dr A Ramakrishna Rao, Dr G Natanam &Prof SA Sankaranarayanan, Anuradha Publications, Chennai. 6. Body Language- Your Success Mantra. Dr. Shalini Verma, S. Chand, 2006. 7. Soft Skills, Dr K. Alex, S. Chand Publications, New Delhi. | |

**NBKR INSTITUTE OF SCIENCE & TECHNOLOGY :: VIDYANAGAR**

*(AUTONOMOUS)*

**CIVIL ENGINEERING**

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2013-2014)

**IV YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – I SEMESTER**

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| S.No. | Course  Code | Course Title | Contact  Hours/  Week | | | Credits | Evaluation | | | | | | | | | |
| Sessional  Test-I | | | Sessional  Test-II | | Total Sessional Marks (Max. 40) | Semester  End Examination | | Max.  Total Marks | |
| **THEORY** | L | P | T |  | Duration  in Hours | | Max.  Marks | Duration  in Hours | Max.  Marks | 0.8(Better of two sessional tests)  +  0.2(Other) | Duration  in Hours | Max.  Marks |  | |
| 1 | 13CE4101 | Environmental Engineering – II | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 2 | 13CE4102 | Irrigation & Hydraulic Stru.. | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 3 | 13CE4103 | Quantity Surveying & Valuation | 3 | - | 1 | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 4 | 13CE4104 | Construction Planning & Management | 3 | - | 1 | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 5 | 13SH4101 | Economics & Accountancy | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 6 | 13CE41EX | Elective – II | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
|  | | **PRACTICALS** |  |  | | | | | | | |  |  | | | |
| 1 | 10CE41P1 | Concrete Technology Laboratory | - | 3 | - | 2 | | - | - | - | - | Day-to-day Evaluation and a test | 3 | 60 | | 100 |
| 2 | 10CE41P2 | Environmental Engineering Laboratory | - | 3 | - | 2 | | - | - | - | - | 3 | 60 | | 100 |
|  |  | **TOTAL** | **22** | **06** | **02** | **28** | | **12** | **320** | **12** | **320** | **24** | **480** | | **800** |

**Elective – II:**

13CE41E1 Prestressed concrete structures

13CE41E2 Advanced structural design

13CE41E3 Solid waste management

13CE41E4 Traffic engineering

13CE41E5 Applied soil mechanics

13CE41E6 Bridge engineering

**VISION AND MISSION OF INSTITUTE**

**Vision**:

* To emerge as a comprehensive Institute that provides quality technical education and research thereby building up precious human resource for the industry and society.

**Mission**:

* To provide a learner-centered environment that challenges individuals to actively participate in the education process.
* To empower the faculty to excel in teaching while engaging in research, creativity and public service.
* To develop effective skills enabling learners to pick up critical thinking thus crafting them to be professionally fit and ethically strong.
* To reach out industries, schools and public agencies to partner and share human and academic resources.

**VISION AND MISSION OF CIVIL ENGINEERING DEPARTMENT**

**Vision:**

* To promote excellence in civil engineering education, enrich research and provide quality professional service to the society in all areas of civil engineering.

**Mission:**

* To provide a learner-centered environment for students to gain comprehensive knowledge in civil engineering.
* To provide a learning experience that fosters an aptitude for research.
* To provide graduates with contemporary skills and tools required to excel in civil engineering profession or alternate fields. To produce graduates to serve within the constraints of complex needs of the society with high integrity.

**PROGRAMME EDUCATIONAL OBJECTIVES OF THE DEPARTMENT**

**PEO 1:** Graduates will be proficient in the fundamental knowledge of basic science, engineering science including mathematical and computational skills appropriate for civil engineering.

**PEO 2:** Graduates will be successful practicing engineers in civil engineering and allied fields or alternate careers using their technical knowledge, teamwork, communication skills and leadership qualities.

**PEO 3:** Graduates will be innovative problem solvers within the realistic constraints of economic, environmental, social, political, health, safety and sustainability impacts, and serve the society as responsible professionals with integrity

**PEO 4:** Graduates will engage in lifelong learning within the profession or through higher studies.

**PROGRAMME OUTCOMES OF THE DEPARTMENT**

The programme outcomes are the skills and knowledge which the graduates have at the time of graduation:

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design an engineering system, component, or process
4. An ability to identify, formulate, and solve engineering problems
5. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
6. A knowledge of contemporary issues.
7. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
8. An understanding of professional and ethical responsibility
9. An ability to function on multi-disciplinary teams
10. An ability to communicate effectively
11. To embark on a career as an entrepreneur or civil engineering project manager/ consultants thereby playing a very important role in society.
12. A recognition of the need to be successful in competitive examinations, and an ability to engage in lifelong learning

**13CE4101 -ENVIRONMENTAL ENGINEERING – II**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Environmental Engineering – I** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to estimate sewage and design the sewage system. |
| CO2 | (a) Be able to determine the characteristics of domestic wastewater.  (b) Be able to design preliminary sewage treatment plant. |
| CO3 | Be able to design secondary sewage treatment plant. |
| CO4 | Understand the concepts of sludge management and tertiary sewage treatment. |
| CO5 | Understand the methods of effluent disposal. |
| **Course Content** | **UNIT – I**  **WASTEWATER COLLECTION AND ESTIMATION:** Sanitation**-**Systems of sanitation Sewerage-Systems of sewerage-Sources of wastewater-Sewage and storm water estimation Hydraulic design of sewers-Different materials used for sewers-Shapes of sewer-Sewer appurtenances-House drainage & Plumbing systems  **UNIT – II**  **CHARACTERISTICS OF DOMESTIC WASTEWATER:** Characteristics of sewage-physical, chemical, biological-BOD equation-Factors affecting the BOD rate of reaction Population equivalent-Relative stability  **PRELIMINARY AND PRIMARY SEWAGE TREATMENT:** Layout and generaloutline of wastewater treatment plant-Function of each unit-Principles and design of screens-Grit chambers-Primary settling tanks  **UNIT – III**  **SECONDARY SEWAGE TREATMENT:** Principles and nutritional requirement of biological treatment system-Factors affecting biological treatment-Working principles and constructional details of Trickling filter-Activated sludge process-Oxidation/Stabilization pond-Oxidation ditch  **UNIT – IV**  **SLUDGE MANAGEMENT:** Sludge-Characteristics and types-Sludge treatment-Thickening Stabilization-Conditioning-Dewatering-Drying/Incineration-Sludge utilization and disposal  **Tertiary SEWAGE treatment:** Removal of nitrogen-Phosphorus-Refractory organic-Heavy metals-Suspended solids and pathogenic bacteria.  **UNIT – V**  **EFFLUENT DISPOSAL:** Methods-Dilution-Self purification of surface water bodies-Oxygen sag curve-Marine disposal-Land disposal-Sewage farming  Onland disposal and treatment systems-Working principle and design of septic tank- Septic tank effluent disposal system-Disposal standards | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Sewage Disposal and Air Pollution Engineering by S.K. Garg. 2. Wastewater Engineering by B.C.Punmia.   **REFERENCE BOOKS:**   1. Water Supply and Sanitary Engineering by G. S. Birdie & J. S. Birdie. 2. Environmental Engineering by H.S. Peavy et al. 3. Wastewater Engineering, Treatment, Disposal and Reuse by Metcalf and Eddy. | |

**13CE4102 - IRRIGATION & HYDRAULIC STRUCTURES**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Advanced Hydrology** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Understand the basic terminologies of irrigation engineering. |
| CO2 | Be able to design lined channel. |
| CO3 | Be able to design weir on permeable foundation. |
| CO4 | Understand the planning and design methods of dams and reservoirs. |
| CO5 | Understand the hydraulic design principles of spillways. |
| **Course Content** | **UNIT – I**  **IRRIGATION ENGINEERING :** Benefits and ill effects of irrigation – Methods of irrigation – Quality of irrigation water – Duty and Delta – Irrigation efficiencies – Irrigation water requirements – Assessment of Irrigation water - Crop Seasons – Principle crops – Rotation of crops.  **UNIT – II**  **CANALS :** Classification of canals – Canal alignment – Kennedy’s and Lacey’s theories – Design – Balancing depth – Effects, causes and prevention of water logging – Types of lining – Design of lined canals – Canal outlets – Falls – CD works.  **UNIT – III**  **DIVERSION HEAD WORKS:** Location of diversion head works – Components – Causes of failure of weirs and remedial measures – Bligh’s and Khosla’s theories of design of weirs and permeable foundation.  **UNIT – IV**  **STORAGE HEAD WORKS:** Types of dams – Site selection and Reservoir Planning – Forces acting on and causes of failure of a gravity dam – Elementary and practical profiles – Stability analysis – Single and multiple step methods of design – Grouting – Multipurpose projects.  **UNIT – V**  **SPILLWAYS :** Requirements, components and types of spillways – Design principles of ogee spillway – Methods of energy dissipation below spillways – effect of TWC and JHC – Scour protection below spillways Stilling basins and appurtenances – Hydraulic design of energy dissipaters. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Irrigation Engineering and Hydraulic Structure – P.N. Modi. 2. Irrigation Engineering and Hydraulic Structures – S.K. Grag.   **REFERENCE BOOKS:**   1. A text book of Irrigation Engineering and Hydraulic Structures – R.K.Sha. 2. Irrigation and water power Engineering – Dr. B.C. Punmia | |

**13CE4103 -QUANTITY SURVEYING AND VALUATION**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Building technology | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to prepare approximate and detailed estimates of simple buildings. |
| CO2 | Understand the specifications of various components of simple building. |
| CO3 | Be able to carry out rate analysis for various construction works for a simple building. |
| CO4 | Be able to prepare tenders and arbitration of tenders. |
| CO5 | Be able to prepare valuation document. |
| **Course Content** | **UNIT – I**  **INTRODUCTION:** General items of work in buildings – Standard units – Principles of working out quantities for detailed and abstract estimates, approximate and detailed estimates of simple buildings.  **UNIT – II**  **SPECIFICATIONS:** Types - Standard specifications for different items of building construction – Earth work for foundations, Sand, Cement, Kankar, mortars, foundation concrete, Reinforced concrete, Brick work, Stone masonry, Lime, Mosaic Flooring, RCC roof and GI sheet roof, plastering, , pointing , Painting and wood works.  **UNIT – III**  **RATE ANALYSIS:**  Earth work for foundations and basement of buildings.  Mortars : Lime mortar ( 1:1.5), Cement Mortar (1:4)  Foundation Concrete : Lime concrete (1:2:4), Cement Concrete (1:5:10)  Reinforced Concrete : Lintels, Slabs, Beams, Columns (1:2:4)  Brick work : Constructed with first class bricks with L.M. (1:1.5) and C.M.(1:6)  Stone Masonry : C.R.S. – Ist  sort constructed with C.M. (1:2) and R.R.Masonry in mud, lime mortar (1:1.5), C.M.(1:2)  Flooring: a) With Cuddapah or Shahbad slabs.  b) Ellis pattern flooring with 10cm concrete and 20mm cement concrete surface - Mosaic flooring.  Roofing: a) R.C.C. roof 10cm thick, 2 courses of flat tiles to top.  b) A.C. corrugated sheet roofing on steel purlins.  Plastering : a) With L.M. (1:1.5) 2 coats (20mm thick)  b) C.M. (1:4) 12mm thick.  Pointing: a) With C.M.(1:3) flush pointing to R.R. Masonry.  b) C.M. (1:3) for brick masonry.  Painting: a) White washing and colour washing of walls: 2 coats.  b) Painting iron and wood work: 3 coats.  Wood work: a) Panelled doors and windows.  b) W.B.M. road with bituminous carpet 20mm thick.  **UNIT – IV**  **CONTRACTS:** Types of contracts, contract document, conditions of contracts, contract procedure, termination of contracts, specifications, important conditions of contract, arbitration and tenders.  **UNIT – V**  **VALUATION:** Introduction, technique of valuation, elements of valuation and factors affecting valuation, methods of valuation of land property and building property, rate of interest for sale, purchase, mortgage, capital gain, tax, estate duty and death duty.  Types of valuation – Valuation for renewal of lease, extension of lease, standard rent, easement rights, preparation of feasibility reports, valuation of reports, awards. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Text book of estimating and costing – B.N. Dutta. 2. Estimating Consting by G.S.Birdie.   **REFERENCEBOOKS**:   1. Valuation by Rangwala. 2. A.P.D.S.S. Standard data book Vol. II. 3. A.P. Department standard specifications. 4. Professional practice – by Roshan Namvati. | |

**13SH4101 ECONOMICS & ACCOUNTANCY**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | None | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Able to demonstrate an ability to define analyze and identify the appropriate solution to a business problem using sound economic and accounting principles. |
| CO2 | Able to know the role of various cost concepts in managerial decisions and also the managerial uses of production function. |
| CO3 | Able to understand to take price and output decisions under various market structures. |
| CO4 | Able to know in brief formalities to be fulfilled to start a business organisation. |
| CO5 | Able to analyse the firm’s financial position with the techniques of economic aspects as well as financial analysis. |
| **Course Content** | **UNIT – I**  **Demand Analysis:** Definition and basic concepts of Economics – consumer’s equilibrium: Marginal Utility Analysis - the concept of Demand - Law of demand – Elasticity of Demand: Types, determinants and its importance.  **UNIT – II**  **Theory of Production and Cost and Banking :** Production function – Cobb – Douglas production function and its properties – Law of variable proportions – Law of Returns to Scale – Cost concepts – Revenue curves – Break-Even Analysis-Money-functions of Money-Functions of Commercial Banks-Features of Indian Economy.  **UNIT – III**  **Theory of Pricing:** Classification of markets – Pricing under perfect Competition – Pricing under Monopoly – Price discrimination – Monopolistic Competition.  **UNIT – IV**  **Types of Business Organizations:** Sole tradership, partnership and Joint Stock Companies – Formation of companies - Shares and debentures.  **UNIT – V**  **Financial & Management Accounting:** Concepts and principles, Journal and Ledger, Trial Balance, Final Accounts: Trading account, Profit and Loss account and Balance Sheet.  Basic concepts in Capital Budgeting process and Methods – Working Capital: operating cycle, factors and sources | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Management Accounting : S N Maheswari  2. Economic Analysis : K. Sankaran  3. Elementary Book keeping &  Principles of Commerce : K.sanyasaiah  **REFERENCES**:   1. Double entry book keeping : Battlibai 2. Cost Accounting : Jain and Narang 3. Managerial Economics : Maheswari and Varshaney | |

**13CE4104 -CONSTRUCTION PLANNING AND MANAGEMENT**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | Concrete Technology (3-2) | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | .Be able to understandthe basics of construction management. |
| CO2 | Be able to schedule various components of project and apply CPM/ PERT techniques. |
| CO3 | Be able to demonstrate the working of various equipments in construction industries. |
| CO4 | Be able to perform quality control and prepare audit statement. |
| CO5 | Be able to demonstrate the importance of safety and risk in construction. Be able to understand the organizational structures and roles. |
| **Course Content** | **UNIT - I**  **INTRODUCTION:** Significance of construction management, Objectives and functions of construction management. Types of construction, Resources for construction industry. Stages of construction, Construction team. Engineering drawings  **UNIT - II**  **CONSTRUCTION PLANNING:** Stage of planning, Scheduling, Preparation of material, Equipment, labour and finance schedules, Bar charts, Mile stone charts.  Network Techniques In Construction Management: Critical Path Method (CPM), Programe Evaluation and Review Technique (PERT) – Network techniques breakdown structures. Classification of activities, Rules, for developing net works. Network development. Network analysis. Critical activities and critical path - Cost optimization  **UNIT – III**  **CONSTRUCTION AND EQUIPMENT MANAGEMENT** Equipment requirement in construction industry, heavy earth moving equipment Bulldozer Scrapers, loaders Excavator, shovels and Cranes; Compaction equipment; Grading equipment. Aggregate production equipment; Asphalt mixing plant; Asphalt laying equipment; Hauling equipment, Concrete mixing equipment; Material handling devices; Pneumatic equipment; Bridge construction equipment; Drilling and blasting equipment; Pumping and dewatering equipment.  **UNIT – IV**  **INSPECTION AND QUALITY CONTROL:** Need for inspection and quality control Principals of inspection. Enforcement of specifications Stages of inspection and quality control  Ethical Audit: Introduction - Aspects of project realization - Ethical audit procedures - The decision makers - Variety of interests - Formulation of briefs - The audit statement- the audit reviews  **UNIT – V**  **SAFETY AND RISK:** Introduction – Safety and risk - Concept and importance of safety - Types of risk - Safety and engineers - Safety measures in construction works - Design for safety - Risk benefit analysis – Accidents.  **ORGANISING CONSTRUCTION:** Principals of organization. Communication Leadership and human relations. Types of organization. Organization for a construction firm. Temporary services. Job layout**.** | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Construction Planning and Management by P.S. Gahlot and B.M Dhir.  2. Construction Equipment and its Management by S.C.  3. Construction Management and Accounts by J.L. Sharma  **REFERENCE BOOKS:**  1. Engineering Ethics by M. Govinda Rajan.  2. Construction Engineering and Management by S. Seetharaman.  3. Construction Management and Accounts by Haripal Singh. | |

**13CE41E1-PRESTRESSED CONCRETE STRUCTURES**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Design of Reinforced Cement Concrete Structures** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | To calculate resultant stresses in rectangular sections. |
| CO2 | To design prestresses concrete sections. |
| CO3 | To design pre-tensioned and post tensioned members. |
| CO4 | To analyse and design composite prestressed concrete members. |
| CO5 | To design prestressed concrete slabs. |
| **Course Content** | **UNIT – I**  **INTRODUCTION:** Basic concepts of prestressing, historical development, advantages of prestressed concrete, high strength concrete, high tensile steel.  **PRESTRESSING SYSTEM:** Introduction, tensioning devices ,pretensioning and post tensioning systems, thermo-electric and chemical prestressing.  **ANALYSIS OF PRESTRESSED CONCRETE SECTIONS:** Basic assumption, analysis of prestress, resultant stress at a section, pressure line, concept of load balancing, stress in tendons and cracking moment.  **UNIT – II**  **LOSSES OF PRESTRESS**: Nature of losses of prestress, loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip. Total losses allowed for in design.  **DESIGN OF PRESTRESSED CONCRETE SECTIONS:** Design of sections for Flexure, Axial tension, compression bending and for shear. Design of members for bond and the sections for bearing.  **UNIT – III**  **DESIGN OF PRE- TENSIONED AND POST-TENSIONED MEMBERS:** Dimensioning of flexural members, Estimation of self weight of beams, Design of pretensioned and post-tensioned beams. Design of partially prestressed members.  **UNIT – IV**  **COMPOSITE CONSTRUCTION OF PRESTRESSED AND IN SITU CONCRETE:** Composite structural members, types of composite construction, analysis of stress, differential shrinkage, deflection of composite members, flexural strength of composite sections and design of composite sections.  **UNIT – V**  **PRESTRESSED CONCRETE SLABS**: Types of prestressed concrete floor slabs, design of prestressed concrete one way slabs, two way slabs & simple flat slabs | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Prestressed concrete by N.Krishna Raju.  2. Prestressed concrete structures by P. Dayaratham.  **REFERENCE BOOKS:**  1. Fundamentals of Prestressed Concrete by N.C.Sinha and S.K.Roy.  2. Modern Prestressed Concrete by James R.Libby. | |

**13CE41E2- ADVANCED STRUCTURAL DESIGN**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Design of Reinforced Cement Concrete Structures, Steel Structures Design** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to design the long columns, deep beams and concrete walls. |
| CO2 | Be able to design multistory frames, grid slabs and flat slabs. |
| CO3 | Be able to design simply supported and continuous beams, columns using plastic design philosophy. |
| CO4 | Be able to design pre-stressed beams for limit state of collapse and limit state of serviceability. |
| CO5 | Be able to design slabs, pressure pipes and Railway sleepers using pre-stressed concrete concepts. |
| **Course Content** | **UNIT – I**  **REINFORCED CONCRETE:** Design of Slender Columns – Deep Beams – Concrete walls under vertical loads.  **UNIT – II**  **REINFORCED CONCRETE:** Design of Multistorey Building Frames – Grid Floors – Flat Slabs.  **UNIT – III**  **STRUCTURAL STEEL:**  Plastic Design of simply supported and continuous beams and columns – single bay rectangular frames.  **UNIT – IV**  **PRESTRESSED CONCRETE:** Design of beams for strength in limit state in flexure and shear – Limit state strength at transfer conditions – Limit state of deflection and cracking.  **UNIT – V**  **PRESTRESSED CONCRETE:** Design of reinforcement in anchor zones – Design of rectangular slabs – Design of pressure pipes – Design of Railway sleepers. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Limit State Design of Reinforced Concrete by P.C. Varghese.  2. Advanced Reinforced Concrete Design by N. Krishna Raju.  3. Prestressed Concrete by N. Krishna Raju.  4. Prestressed Concrete by G.S.Pandit & S.P.Gupta.  5. Design of Steel Structures by Ramachandra. | |

**13CE41E3 -SOLID WASTE MANAGEMENT**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Environmental Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to understand the importance, sources, classification and characterization of solid waste. |
| CO2 | Be able to understand collection, handling, storage and processing of solid waste. |
| CO3 | Be able to understand the process of recovery of products and energy. |
| CO4 | Be able to understand the various methods for disposing solid waste and application of GIS in land fill. |
| CO5 | Be able to find the properties of hazardous waste. |
| **Course Content** | **UNIT – I**  **INTRODUCTION:**  Goals and objectives of solid waste management, impacts of solid waste generation in a technological society. Quantities of solid wastes, challenges and opportunities.  **GENERATION OF SOLD WASTES:**  Sold waste generation sources, classification of solid waste, data on Indian city wastes, factors influencing generation of solid wastes, characterization and analysis of solid wastes.  **UNIT – II**  **ONSITE HANDLING, STORAGE AND PROCESSING:**  Public health and aesthetics, onsite handling, methods used at residential and commercial sources, onsite storage dust bins, community containers container locations onsite processing methods.  **COLLECTION:**  Frequency of collection equipment and labour requirements, collection routes, transport means and location of transfer stations.  **UNIT – III**  **PROCESSING TECHNIQUES AND EQUIPMENT:**  Purpose of processing paling shredding, and incineration.  **RECOVERY OF RESOURCE CONVERSION PRODUCTS AND ENERGY:**  Material processing and recovery systems, recovery of chemical conversion products, recovery of biological conversion products recovery of energy from conversion products.  **UNIT – IV**    **DISPOSAL OF SOLID WASTES:**  Sanitary landfills – General considerations, site selection – operational management systems in land fill – gas and  leachate control – construction ocean disposal of solid wastes combustion – incineration and types of incinerators – Application of GIS in Land Fill.  **UNIT – V**  **HAZARDOUS WASTES:**  Special wastes hazardous wastes, hospital wastes, sewage sludges, industrial solid wastes methods of disposal. | |
| **Text Books and reference Books:** | **REFERENCE BOOKS:**  1. Bhide, A.D. and sundaresam B.B. (1983) solid waste management in developing countries INSDOC, New Delhi.  2. Solid waste engineering principles and management issues – Technobanglous, G. Theise, H.and Ehasisn, R. (1996). McGraw Hill, Tokyo. | |

**13CE41E4 - TRAFFIC ENGINEERING**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Transportation Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Understand the necessity of traffic management and its organizational structure in a civil body. |
| CO2 | To compare and analyze detailed parking techniques applicable in the view of street management techniques. |
| CO3 | To inspect various technical aspects of vehicle control and different types of methods used in to ensure a smooth transit. |
| CO4 | To understand and debate various rules and regulations laid upon by the civic administration to provide an environment that provides for a hassle free commute. |
| CO5 | To analyze the effects vehicle use has on the environment and to familiarize with justice issues. |
| **Course Content** | **UNIT – I**  Traffic Engineering Administration – Functions of traffic engineering, Organisational structure in state departments and for a city. Need for Traffic Forecasting.  **UNIT – II**  Parking – Parking surveys, Ill effects of parking, methods of parking – On street and off street, regulations for on street parking, parking metres, peripheral parking schemes, loading and unloading facilities.  **UNIT – III**  Traffic signals – Advantages and disadvantages, Signal indications, signal face, Type of traffic signals systems, warrents for traffic control signal installation.  Miscellaneous traffic control aids and street furniture – Road delineators, hazard markers, object markers, speed breakers, rumble strips, guard rails.  **UNIT – IV**    Traffic regulations – Basic principles of regulation, regulation of speed, vehicles, driver, mixed traffic, parking regulations, enforcement of regulations.  Traffic management – Traffic management measures, restrictions of turning movements, one way streets, tidal flow operation, closing side streets, exclusive bus lanes.  **UNIT – V**  Traffic and environment – Effects of traffic on environment, noise pollution, air pollution, vibration, visual intrusion and degrading the aesthetics.  Fuel crisis and transportataion – factors affecting fuel consumption of motor vehicles – Effect of road condition on fuel consumption of vehicles | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Traffic Engineering and Transport Planning by L.R.Kadiyali.  2. Highway Engineering by Justo and Khanna.  **REFERENCE BOOKS**  1. Transportation Engineering by S.P.Bindra.  2. Transportation Engineering by Ahuja. | |

**13CE41E5 - APPLIED SOIL MECHANICS**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 – 0 |
| **Prerequisite:** | **Foundation Engineering, Soil Mechanics** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to apply the knowledge of ground improvement techniques for shallow layers |
| CO2 | Be able to apply the knowledge of ground improvement techniques for deep layers |
| CO3 | Be able to estimate the pressure distribution for bulk heads |
| CO4 | Be able to design anchored bulk heads by various methods |
| CO5 | Be able to design various components of bracing. |
| **Course Content** | **UNIT – I**  **SOIL IMPROVEMENT TECHNIQUES FOR SHALLOW LAYERS:**  Soil improvement – Mechanical treatment – Lime stabilization – Cement Stabilization – Bituminous stabilization – Chemical Stabilization – Freezing and heating – Geotextiles.  **UNIT – II**  **SOIL IMPROVEMENT FOR DEEP LAYERS :**  Dynamic compaction and consolidation – Preloading – Sand drains – Electro – osmosis – Lime columns – Stone columns – Grouting.  **UNIT – III**  **BULKHEADS:**  Uses of sheet piling walls – Common types of sheet piling walls – Common sheet pile sections – Cantilever sheet piling walls in cohesionless soils – cantilever sheet piling walls in cohesive soils (Approximate analysis only).  **UNIT – IV**  **ANCHORED BULKHEADS:**  Anchored bulkhead design by free earth support method – Anchored bulkhead design by fixed earth support method – Methods of reducing lateral pressure – Tyes of anchorage.  **UNIT – V**  **BRACED EXCAVATIONS:**  Braced cut – Apparent pressure diagrams for cuts in both sands and clays – Types of bracing systems – Design of various components of bracing – Bottom heave of cuts in soft clays – Piping failure of cuts in sands. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Alam Singh “Modern Geotechnical Engineering”  2. Gopal Ranjen & A.S.R.Rao, “Basic and Applied Soil Mechanics.  3. K.R.Arora – “Soil Mechanicas and Foundation Engg”.  4. C.Venkatramaiah – Geotechnical Engineering.  5. A.V.Narasimha Rao and C.Venkatramaiah – Numerical Problems, Examples and Objective  Questions in Geotechnical Engg. | |

**13CE41E6 - BRIDGE ENGINEERING**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 – 0 |
| **Prerequisite:** | **D.R.C.C.S., S.S.D** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be familiar with site investigation principles and various loading conditions and be able to design box culverts and bridge bearings. |
| CO2 | Be able to design bridge deck slab using effective width method of analysis for different loading conditions. |
| CO3 | Be able to design T-beam bridge by pigeauds method. |
| CO4 | Be able to design plate girder and composite bridges. |
| CO5 | Be able to analyze stability of piers and abutments. |
| **Course Content** | **UNIT - I**  **INTRODUCTION:**  Importance of site investigation in Bridge design. Highway Bridge loading standards. Impact factor. Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.  **BOX CULVERT:** General aspects. Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only.  **BRIDGE BEARINGS :**  General features – Types of Bearings – Design principles of steel Rocker & Roller Bearings – Design of a steel Rocker Bearing – Design of Elastometric pad Bearing.  **UNIT - II**  **DECK SLAB BRIDGE :**  Introduction – Effective width method of Analysis Design of deck slab bridge (Simply supported) subjected to class AA Tracked Vehicle only.  **UNIT - III**  **BEAM & SLAB BRIDGE (T-BEAM BRIDGE)**  General features – Design of interior panel of slab – Pigeauds method – Design of a T-beam bridge subjected to class AA tracked vehicle only.  **UNIT – IV**  **PLATE GIRDER BRIDGE :**  Introduction – elements of a plate girder and their design. Design of a Deck type welded plate girder – Bridge of single line B.G.  **COMPOSITE BRIDGES :**  Introduction – Advantages – Design of Composite Bridges consisting of RCC slabs over steel girders’ including shear connectors  **UNIT V**  **PIERS & ABUTMENTS:**  General features – Bed Block – Materials piers & Abutments Types of piers – Forces acting on piers – Stability analysis of piers – General features of Abutments – forces acting on abutments – Stability analysis of abutments – Types of wing walls – Approaches – Types of Bridge foundations (excluding Design). | |
| **Text Books and reference Books:** | **TEXT BOOKS :**   1. Bridge Engineering by Ponnu Swamy, TATA Mcgraw Hill Company, New Delhi. 2. Design of Bridges by N.Krishnam Raju, Oxford & IBH, Publishing Company Pvt.ltd., Delhi. 3. Relevant – IRC & Railway bridge Codes.   **REFERENCE :-**   1. Design of Steel structures, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain. 2. Design of Bridges Structure by D.J.Victor. 3. Design of Steel structures by Ramachandra. 4. Design of R.C.C. structures B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain.   5. Design of Bridges Structure by T.R.Jagadish & M.A.Jayaram Prentice Hall of India Pvt., Delhi. | |

**13CE41P2 -ENVIRONMENTAL ENGINEERING LABORATORY**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** | **Environmental Engineering – I** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Physical characteristics of water |
| CO2 | Chemical characteristics of water |
| CO3 | Amount of solids in water |
| CO4 | Biological characteristics of water |
| CO5 | Chlorine demand of water |
| **Course Content** | **LIST OF EXPERIMENTS**  1. Determination of Colour  2. Determination of Turbidity  3. Determination of Total and dissolved solids  4. Determination of Settleable solids  5. Determination of pH  6. Determination of Acidity  7. Determination of Alkalinity  8. Determination of Hardness  9. Determination of Chlorides  10. Determination of Sulphates  11. Determination of BOD  12. Determination of Chlorine demand  13. Determination of Optimum Coagulant Dose | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Environmental Laboratory Manual by Dr. Kotaiah and Dr. N. Kumara Swamy 2. Standards Methods for Analysis of water and Wastewater-APHA   **REFERENCE BOOKS:**   1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999 2. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993. | |

**13CE41P1 -CONCRETE TECHNOLOGY LABORATORY**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** | **Concrete Technology, Building Technology** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Characteristic properties of cement |
| CO2 | Evaluate the quality of aggregates for civil engineering works |
| CO3 | Workability of fresh concrete and compressive strength of hardened concrete |
| CO4 | Compressive strength of bricks. |
| CO5 | Water absorption and Efflorescence test of brick |
| **Course Content** | **LIST OF EXPERIMENTS**  **CEMENT**   1. Fineness by dry sieving 2. Normal consistency, initial & final setting times 3. Specific gravity 4. Compressive Strength   **AGGREGATES**   1. Specific gravity and water absorption of coarse and fine aggregates 2. Sieve analysis of coarse and fine aggregates 3. Bulking of sand by volume method 4. Bulking of sand by weight method 5. Bulk density   **CONCRETE**   1. Workability of fresh concrete by slump test 2. Workability of fresh concrete by compaction factor test 3. Workability of fresh concrete by vee-bee test 4. Workability of fresh mortar by flow table test 5. Compressive strength   **BRICKS**   1. Compressive strength 2. Water absorption 3. Efflorescence | |

**NBKR INSTITUTE OF SCIENCE & TECHNOLOGY :: VIDYANAGAR**

*(AUTONOMOUS)*

**CIVIL ENGINEERING**

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the batch admitted in the academic year 2013-2014)

**IV YEAR OF FOUR YEAR B.TECH. DEGREE COURSE – II SEMESTER**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| S.No. | Course  Code | Course Title | Contact  Hours/  Week | | | Credits | Evaluation | | | | | | | | | |
| Sessional  Test-I | | | Sessional  Test-II | | Total Sessional Marks (Max. 40) | Semester  End Examination | | Max.  Total Marks | |
| **THEORY** | L | P | T |  | Duration  in Hours | | Max.  Marks | Duration  in Hours | Max.  Marks | 0.8(Better of two sessional tests)  +  0.2(Other) | Duration  in Hours | Max.  Marks |  | |
| 1 | 13CE4201 | Design & Drawing Of Irrigation Structures | 1 | 3 | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 2 | 13CE4202 | Environmental Studies | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
| 3 | 13CE42EX | Elective - III | 4 | - | - | 4 | 2 | | 40 | 2 | 40 | 3 | 60 | 100 | |
|  | | **PRACTICALS** |  |  | | | | | | | |  |  | | | |
| 1 | 13CE42P1 | CAAD Laboratory | - | 3 | - | 2 | | - | - | - | - | Day to day evaluation and a test  (100 Marks) |  | - | | 100 |
| 2 | 13CE42PR | Project Work | - | 3 | - | 6 | | - | - | - | - | Continuous Assessment and seminar  (80 Marks) |  | 120 | | 200 |
|  |  | **TOTAL** | **09** | **09** |  | **20** | | **6** | **-** | **6** | **-** | **300** | **9** | **300** | | **600** |

**Elective – III:**

13CE42E1 Remote Sensing & GIS 13CE42E2 Finite Element Analysis

13CE42E3 Advanced Highway Engineering 13CE42E4 Ground Improvement Techniques

13CE42E5 Environmental Pollution and Control

**13CE4201 - DESIGN AND DRAWING OF IRRIGATION STRUCTURES**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Irrigation Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to design surplus weir |
| CO2 | Be able to design tank sluice with tower head |
| CO3 | Be able to design canal drop and canal regulator |
| CO4 | Be able to design syphon well drop |
| CO5 | Be able to design syphon aqueduct. |
| **Course Content** | **Design and Drawing of**   1. Surplus weir 2. Tank sluice with a tower head 3. Canal drop-notch type 4. Syphon well drop 5. Canal regulator 6. Syphon Aqueduct ( Type – II)   ( Under tunnel) | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. “Water Resources Engineering Principles and Practice” by C.S. Murthy.   **REFERENCE BOOKS:**  1. “Irrigation Engineering Structures” by Elhis.  2. “Irrigation Engineering and Hydraulic Structures” by Sharma R.K. | |

**13CE4202 - ENVIRONMENTAL STUDIES**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | None | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to understand the features of ecosystem and bio-diversity. |
| CO2 | Understand the management of major natural resources. |
| CO3 | Be able to understand the causes, effects and remedial measures of environmental pollution. |
| CO4 | Be able understand effectives of elements on environment and disaster management. |
| CO5 | Be able to familiar with environmental acts and must be able to apply the knowledge of environmental studies to certain case studies. |
| **Course Content** | **UNIT – I**  **INTRODUCTION:** Definition-Scope and Importance of Environmental studies- Environmental components.  **ECOSYSTEM:** Introduction- types, characteristics- features- structure and functions of Ecosystems  Bio-diversity and its conservation - Value of bio-diversity consumptive and productive use, social, ethical, aesthetic and option values. Threats to biodiversity- Conservation of bio diversity.  **UNIT – II**  **ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT**:   1. Land Resources and its importance, Land degradation, Soil erosion and desertification, Effects of modern agriculture, fertilizer and pesticide problems. 2. Forest Resources: Use and over- exploitation - Mining and dams- their effects on forest and tribal people. 3. Water Resources: Use and over- utilization of surface and ground water, Floods and droughts, Water logging and salinity, Conflicts over water sharing, Rain water harvesting, clouds seeding and watershed management. 4. Energy resources Energy needs: Renewable and non-renewable energy needs use of alternate energy sources, Impact of energy use of environment   **UNIT – III**  **ENVIRONMENTAL POLLUTION**:  Causes- Effects and control measures of Air pollution- Water Pollution-Soil pollution-Marine Pollution-Noise pollution. Nature of Thermal pollution and nuclear hazards-Global warming, Acid rain-Ozone depletion.  Solid waste management: Composting – Vermiculture - Urban and industrial Wastes - recycling and reuse.  **UNIT – IV**  **ENVIRONMENTAL PROBLEMS IN INDIA**:  Drinking water - Sanitation and public health- Effects of urbanization - transportation, Industrialization on the quality of environment, Green revolution.  **ECONOMY AND ENVIRONMENT:** The economy and environment interaction - Sustainability, Environment Impact Assessment - Social Issues.  **DISASTER MANAGEMENT:** Floods- Earth quakes – Cyclones – Tsunamis.  **UNIT – V**  **ENVIRONMENTAL ACTS:**  Water (Prevention and control of pollution) Act- Air (Prevention and control of pollution) Act - Environment protection Act, Wildlife protection Act, Forest conservation Act, Coastal Zone Regulations  **Case Studies:** Silent Valley Project, Madhura Refinery and Taj Mahal, Tehri Dam, Kolleru Lake Aquaculture, Fluorosis in Andhra Pradesh  **Field Work**: Visit to Local Area having river/ Forest/grass land/hill/mountain to document and environmental assets.  Study of local environment- common plants, insects, birds. Study of simple ecosystems- pond, visits to Industries, water treatment plants, effluent treatment plants. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Environmental science by Anubha Kaushik and C.P. Kaushik. 2. Environmental science and Engineering by P. Anandan and R.Kumaravelan .   REFERENCES BOOKS:   1. Introduction of Envioromental Science by Y. Anjaneyulu. 2. Environmental studies by Dr.B.S. Chauhan. 3. Environmental Science by M Chandra Sekhar. | |

**13CE42E1 - REMOTE SENSING & GIS**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | None | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | To know the workings of a remote sensing system along with the terms and concepts of the physical applications of such a system. |
| CO2 | To focus on different technical aspects of a remote sensing network with specific detail on India. |
| CO3 | To compare different types of data obtained from a remote sensing network with tools specifically designed for the purpose. |
| CO4 | To understand about various methods of corrections applied to data to ensure maximum credibility and accountability to the data collected. |
| CO5 | To identify concepts of GIS and its applications in various fields of planning and policy. |
| **Course Content** | **UNIT – I**  **FUNDAMENTALS :** Definition – History – Physics of Remote Sensing – Electromagnetic Radiation – Interaction of Electromagnetic Radiation with Atmosphere, Earth Surface Features – Vegetation, Soils, Water – Spectral Signature – Atmospheric Windows.  **UNIT – II**  **REMOTE SENSING SYSTEM:** Introduction - Platforms – Types – Satellites – Indian Remote Sensing Satellites.  **SENSORS :** Introduction – Types – Characteristics of Sensors – IFOV – Indian Remote Sensing Sensors – LISS-WIFS-PAN.  **UNIT – III**  **VISUAL DATA ANALYSIS:** Introduction – Types of Data Products – Image interpretation Techniques – Detection, Recognition, Analysis, Classification, Deduction, Idealization – Elements of Image Interpretation – Keys.  **UNIT – IV**  **IMAGE PROCESSING :** Introduction – Overview – Preprocessing \_ Radiometric Correction – Geometric correction – Rectification. Enhancement Techniques – Contrast Stretch – Edge enhancement – Filtering Techniques – Classification Techniques – Supervised and unsupervised classification.  **UNIT – V**  **GEOGRAPHICAL INFORMATION SYSTEM:** Basic Principles – Definition – Components – Data Structures – Raster and Vector formats – Functioning of GIS - Data Input – Data Manipulation – Data Retrieval – Data Analysis – Data Display – Data Base Management Systems. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Remote sensing and GIS by Prof. Anji Reddy. 2. Principles of Remote Sensing & GIS by Dr. PH Anand & V. Raj Kumar   **REFERENCE BOOKS:**   1. F.F.Sabins Jr. Remote Sensing Principles and Interpretation. 2. P.J.Curran, Principles of Remote Sensing. 3. Little and Kiefe, Remote Sensing Principles and Image Interpretation. 4. C.P.I., Principles of Geographic Information Systems. 5. J.R. Jense, Principles of Remote Sensing. 6. Prithvish Nag, M. Kudrat, Digital Remote Sensing. | |

**13CE42E2 - FINITE ELEMENT ANALYSIS**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Structural Analysis** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Able to apply the fundamental concepts of FEM. |
| CO2 | Able to understand and apply the concepts of one dimensional finite elements. |
| CO3 | Able to apply basic FEM concepts of truss elements. |
| CO4 | Able to apply basic concepts of FEM for beam elements. |
| CO5 | Able to apply isometric concepts in modeling of finite elements. |
| **Course Content** | **UNIT –I**  **INTRODUCTION TO FINITE ELEMENT METHOD:** Introduction, Finite Difference Method, Advantages and disadvantages, basis steps, Limitations, Finite Element Modeling and Discretization, Interpolation and shape functions, Types of elements, nodes and degrees of freedom  **UNIT – II**  **ONE DIMENSIONAL FINITE ELEMENTS:** Introduction, bar element, beam element, bar and beam elements of arbitrary orientation, assembly of elements, stiffness matrices, boundary conditions, loads, applications.  **UNIT – III**  **TRUSSES:** Plane trusses, local and global coordinate systems, direction cosines, element stiffness matrix, assembly of global stiffness matrix, stress calculation.  **UNIT – IV**  **FINITE ELEMENT FORMULATION:** Introduction beam stiffness, assembly of beam stiffness matrix, loading, boundary conditions, plane stress, plane strain analysis  **UNIT – V**  **ISOPARAMETRIC ELEMENTS AND FINITE ELEMENT MODELLING:** Mesh requirements, material properties, loads and reactions, boundary conditions, checking the model, analysis and design software (for practice purpose only) | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. Finite Element Analysis – Govinda Rao. 2. Finite Element Analysis – S. S. BhavaKatti. 3. Introduction to Finite Elements Engineering. - Chandrupatla & Belegundu. 4. Introduction to Finite Elements.- Abel & Desai. 5. Finite Element Analysis in Engineering Design- S. Rajasekaran . 6. Finite Element Analysi, Theory and Programming. - C.S. Krishna Murthy.   **REFERENCE BOOKS:**   1. The Finite Element Method.- Zienkiewicz. 2. Concepts and Applications of Finite Element Analysis.- Robert Cook Davis Mallcus. 3. Theory and Problems of Finite Element Analysis. - George Buchanan. | |

**13CE42E3 - ADVANCED HIGHWAY ENGINEERING**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 – 0 |
| **Prerequisite:** | Transportation Engineering | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | To familiarize with design considerations of highway projects and factors that are involved in everyday work on a project. |
| CO2 | To analyze and study different methods of road maintenance along with failures normally associated with projects involving pavements and sub soils. |
| CO3 | To understand special and complex projects, their maintenance and workings along with factors which influence their efficiency. |
| CO4 | To explain concepts of planning and land use development with respect to highways in particular and the community in general. |
| CO5 | To understand the concepts of safety and economics, important in the economic growth of the community for its social and behavioral consequences. |
| **Course Content** | **UNIT – I**  Highway Lighting – Design factors, design of highway lighting systems.  Machinery and equipment – for earth work, rock excavation, transportation of materials, watering compaction, bituminous and concrete works.  **UNIT – II**  Soil treated roads, Soil stabilized roads – various methods. Maintenance of Highway causes of pavement failures – classification of maintenance works, failures in-flexible pavements, failure in cement concrete pavements, maintenance of bituminous roads and cement concrete roads.    **UNIT – III**  Ghat roads – Alignment, geometry of hill roads, drainage in ghat roads, maintenance problems.  Roads in special areas – Roads in swampy and water logged areas and in block cotton soils.  **UNIT – IV**  Road side development – environmental factors in planning and development of highways, road side development and arboriculture- planning plantation of trees, care of trees.  **UNIT – V**  Highway safety – Road accident situations in India, causes of road accidents. Road and its effects on Road accidents, Safety during construction.  Highway Economics – Introduction – Highway user benefits, highway costs | |
| **Text Books and reference Books:** | **TEXT BOOK**  1. Highway Engineering – S.K.Khanna & C.E.G.Justo.  2. Principles and Practices of Highway Engineering by – L.R.Kadiyali.  **REFERENCE BOOKS:**   1. Principles, Practice and Design of Highway Engg., by S.K. Sharma, S.Chand & Co.Ltd., New Delhi, 1985. 2. A course in Highway Engineering by S.P. Bindra, Dhanpat Rai & Sons, Delhi 1988. | |

**13CE42E4 -GROUND IMPROVEMENT TECHNIQUES**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Soil Mechanics, Foundation Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Be able to understand dewatering methods and grouting techniques. |
| CO2 | Be able to apply in-situ densification methods for soils. |
| CO3 | Be able to understand and apply the various chemicals for stabilization of soils. |
| CO4 | Be able to understand components of reinforced earth and application of geosynthetics. |
| CO5 | Be able to understand the concept of ground improvement for expansive soils. |
| **Course Content** | **UNIT – I**  **Dewatering**: methods of de-watering- sumps and interceptor ditches- single, multi stage well points - vacuum well points. Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains –Electro-osmosis .  **Grouting:** Objectives of grouting- grouts and their properties- grouting methods- ascending, descending and stage groutinghydraulic, fracturing in soils and rocks- post grout test.  **UNIT – II**  **In – situ densification methods in granular Soils:–** Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth.  **In – situ densification methods in Cohesive soils:–** preloading or dewatering, Vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.  **UNIT - III**  **Stabilisation**: Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride, sodium silicate and gypsum  **UNIT – IV**  **Reinforced Earth**: Principles – Components of reinforced earth – factors governing design of reinforced earth walls – design principles of reinforced earth walls.  **Geosynthetics** : Geotextiles- Types, Functions and applications – geogrids and geomembranes – functions and applications.  **UNIT – V**  **Expansive soils**: Problems of expansive soils – tests for identification – methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – under reamed piles. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**  1. Hausmann M.R. (1990), Engineering Principles of Ground Modification, McGraw-Hill International Edition.  2. Purushotham Raj. Ground Improvement Techniques, Laxmi Publications, New Delhi  **REFERENCES:**  1. Moseley M.P. (1993) Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA.  2. Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994) Ground Control and Improvement, John Wiley and Sons,  New York, USA.  3. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall New Jercy, USA | |

**13CE42E5 - ENVIRONMENTAL POLLUTION AND CONTROL**

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| **Course category:** | Program core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 1 - 0 |
| **Prerequisite:** | **Environmental Studies, Environmental Engineering** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | Understanding the nature, significance and effects of pollution. |
| CO2 | Understand the effects of air pollution and various controlling parameters. |
| CO3 | Understanding the effects of water pollution and various controlling parameters |
| CO4 | Understand the various methods for solid and hazardous waste disposal. |
| CO5 | Understand the environmental legislation acts for industrial pollution control. |
| **Course Content** | **UNIT – I**  **THE NATURE OF POLLUTION:**  Air pollution and its effects on living and non-living. Water pollution and its effects, solid wastes and land pollution.  **UNIT – II**  **AIR POLLUTION CONTROL:**  Influence of metereological parameters, physical principles, dry systems, fabric collectors, wet scrubbers, electrostatic precipitations, fume incineration tall sacks. Physical separation systems gravity setting chambers, inertial separators, cyclones, fabric collectors, wet scrubbers, electrostatic precipitators, fume incineration.  **UNIT – III**  **WATER POLLUTION CONTROL:**  Routine methods for removal of suspended and dissolved impurities, advance methods like chemical oxidation, membrane separation process, and biological process for removal of phosphorous and nitrogen. Land treatment, eutrophication control.  **UNIT – IV**  **SOLD WASTE MANAGEMENT:**  Quantities and characterizations of municipal solid wastes, recovery of materials and energy sanitary land filling. Disposal of hazardous wastes.  **UNIT – V**  **ENVIRONMENTAL LEGISLATION AND INDUSTRIAL POLLUTION CONTROL:**  Legislation conserving water pollution air pollution and hazards wastes. Caste studies of pollution control in cement industries, paper, & pulp industries, brewing. | |
| **Text Books and reference Books:** | **TEXT BOOKS:**   1. [Environmental Pollution and Control](https://books.google.co.in/books?id=zxn3TgTOxggC&printsec=frontcover&dq=ENVIRONMENTAL+POLLUTION+AND+CONTROL&hl=en&sa=X&ved=0ahUKEwjrp9Dz8KbNAhUDrI8KHfytD2kQ6AEINTAA) [J. Jeffrey Peirce](https://www.google.co.in/search?sa=X&biw=1366&bih=639&tbm=bks&tbm=bks&q=inauthor:%22J.+Jeffrey+Peirce%22&ved=0ahUKEwjrp9Dz8KbNAhUDrI8KHfytD2kQ9AgINzAA), ‎[P Aarne Vesilind](https://www.google.co.in/search?sa=X&biw=1366&bih=639&tbm=bks&tbm=bks&q=inauthor:%22P+Aarne+Vesilind%22&ved=0ahUKEwjrp9Dz8KbNAhUDrI8KHfytD2kQ9AgIODAA), ‎[Ruth Weiner](https://www.google.co.in/search?sa=X&biw=1366&bih=639&tbm=bks&tbm=bks&q=inauthor:%22Ruth+Weiner%22&ved=0ahUKEwjrp9Dz8KbNAhUDrI8KHfytD2kQ9AgIOTAA) 2. Environmental Pollution Control Engineering by CS Rao 3. [Environmental Pollution and Control](https://books.google.co.in/books?id=NxwNtk3aw54C&printsec=frontcover&dq=ENVIRONMENTAL+POLLUTION+AND+CONTROL&hl=en&sa=X&ved=0ahUKEwjrp9Dz8KbNAhUDrI8KHfytD2kQ6AEISzAD) by [P. R. Trivedi](https://www.google.co.in/search?sa=X&biw=1366&bih=639&tbm=bks&tbm=bks&q=inauthor:%22P.+R.+Trivedi%22&ved=0ahUKEwjrp9Dz8KbNAhUDrI8KHfytD2kQ9AgITTAD)   **REFERENCE BOOKS:**  1. Environmental engineering by peavey and Rowe  2. Environmental pollution and control – P.A Vesilind, J.J. Peirce. | |

**13CE42P1 - COMPUTER AIDED ANALYSIS AND DESIGN**

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| **Course category:** | Program core | **Credits:** | 2 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** | **Structural Analysis, D.R.C.C.S., Building Planning and Drawing** | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | A student will able to know how to apply engineering drawing using computers. |
| CO2 | A student can understand about the scope of Auto CAD software. |
| CO3 | Use STAAD Pro for analysis of simple beams and truss problem. |
| CO4 | Use STRAP Pro for analysis of a pin jointed frame, multi storeyed, multi bay portal frame. |
| CO5 | Execute solution of system of linear simultaneous equations of large system. |
| **Course Content** | 1. Elementary Graphics in Civil Engineering. 2. Elements of Auto CAD and its applications in Civil Engineering. 3. Solution of beam problem by STAAD Pro. 4. Solution of truss problem by STAAD Pro. 5. Analysis of simple Pin jointed frame using **STRAP**. 6. Analysis of multi storeyed, multi bay portal frame by **STRAP**. 7. Solution of system of linear simultaneous equations of large system. | |

**13CE42PR PROJECT WORK**

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| **Course category:** | Program core | **Credits:** | 6 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 0 - 0 - 3 |
| **Prerequisite:** |  | **Sessional Evaluation :**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Outcomes** | CO1 | To develop basic concept and principle of real life problems in Civil engineering. |
| CO2 | Understand the behaviour of simple and complex problems related with Civil Engineering. |
| CO3 | Recognize and be able to apply fundamental principles to check the accuracy , safety and reliability. |
| CO4 | Generate an ability to apply knowledge of Civil Engineering in the design of real life Civil engineering problems. |
| CO5 | Built the necessary theoretical background for planning and estimation of different designed civil engineering structures. |
| **Course Content** | The progress in the project work is to be presented by the middle of IV Year- II Semester before the internal evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The external examiner will evaluate the project work in final project presentation.  **Project report:** To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit separatereports.  The student’s sessional marks for project will be out of 200, in which 80 marks will be based on day to day performance assessed by the guide. Balance 120 marks will be awarded based on the presentation of the project by the students before an external examiner. | |