Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Civil Engineering**   Semester: **V**
Subject: **Structural Engineering Design – I**   Code: **C020511(020)**
Class Tests: **Two (Minimum)**   Assignments: **Two (Minimum)**
ESE Duration: **Three Hours**   Maximum Marks: **100**
                                                               Minimum Marks: **35**

UNIT-1: Objectives of structural design, Steps in RCC Structural Design Process, Role of structural designer.
Design philosophies: Working stress design and limit state design method. Advantages of Limit State Method over other methods.

Introduction: Properties of Concrete and reinforcing steel, stress-strain curves, permissible stresses, modular ratio, loads on structure, shrinkage, creep, Type of Loads on Structures and Load combinations. Introduction to IS 456:2000 and IS 875.
Introduction to working stress method: Basis for design of rectangular beam using working stress method. Analysis and design of singly reinforced and doubly reinforced sections by working stress method, shear in beams.

UNIT-2: Limit State Method – Rectangular Beams: Introduction to limit state method, characteristic loads, partial safety factor, safety and serviceability considerations

Limit state of Collapse (Flexure): Assumptions, stress block parameters, neutral axis, analysis and design of singly and doubly reinforced section. Effective span to effective depth ratio, modification factors for singly reinforced, doubly reinforcement and flanged beams.
Limit State of Collapse (Shear, bond and torsion): shear in beams, Torsion in beams, bond and development length, design of lintels.
Limit State of Serviceability: Deflection.

UNIT-3: Limit State Method – L, T-Beams, Slab and Stairs: Properties of L and T-section, moment of resistance and design of singly reinforced T-beam, L beam. Dead loads, imposed loads, thickness of slabs, modification factors, effective span, reinforcement in slab, design of one-way slab and two-way slabs. Design of stairs – dog legged stair, open newel stair.

UNIT-4: Limit State of Collapse (Compression): Columns: Axially loaded short columns, minimum eccentricity, longitudinal and transverse reinforcement, effective length of column, safe load on columns, circular columns, Pu – Mu interaction curves, combined axial load and uni-axial bending, combined axial load and bi-axial bending.

UNIT-5: Limit State Method – Column Footings- Isolated and Combined Rectangular Footing: General principle of design of reinforced concrete footing, proportioning of footings, edge thickness, depth of footing, design of isolated column footings – square and rectangular footings. Limit State Design of Combined Rectangular footing.

Text Books:

1. Limit State Design of Reinforced Concrete – B. C. Punmia, A. K. Jain and A. K. Jain (Laxmi Publications).
2. Limit State Theory and Design of Reinforced Concrete (IS:456-2000) – V. L. Shah and S. R. Karve (Structures Publications, Pune).
3. Reinforced Concrete Design – S. U. Pillai and D. Menon (Tata McGraw Hill).

Reference Books:

1. Relevant IS codes IS: 456:2000, IS 875, Part 1, 2
2. Reinforced Concrete Structures – Dayaratam P. (Oxford and IBH Publishing Co.)
3. Reinforced Concrete Limit State Design – Jain, A.K. (Nem Chand and Bros. Roorkee)
4. Fundamentals of Reinforced Concrete Design – M. L. Gambhir (PHI Learning)
5. Design of Reinforced Concrete Structures – M. L. Gambhir (PHI Learning)
6. Design Aids for Reinforced Concrete to I.S.-456-1978 – SP-16, 1980 (Bureau of Indian Standards, New Delhi)

COURSE OUTCOME:
1. Leaner is able to understand the importance of reinforced cement concrete.
2. Learner has clarity about the various design philosophies used in structure engineering design
3. Learner is able analyze and design singly and doubly reinforced section using working stress method.
4. Leaner is able to analyze and design rectangular beams using limit state method.
5. Leaner is able to design elements such as slabs, columns, footings and staircases.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch: Civil Engineering   **Semester: V**
Subject: Hydrology and Water Resources Engineering   **Code: C020512(020)**
Class Tests: Two (Minimum)   **Assignments: Two (Minimum)**
ESE Duration: Three Hours   **Maximum Marks: 100**
                                                                 Minimum Marks: 35

UNIT-1: Introduction - Hydrologic cycle, water-budget equation, world water balance, applications in engineering.
Precipitation - Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP).

UNIT-2: Abstractions from precipitation - Evaporation process, evaporimeters, analytical methods of evaporation estimation,interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

Runoff - Runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph.

UNIT-3: Water withdrawals and uses - Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone, soil water, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT-4: Distribution systems - Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Water logging: causes, effects and remedial measures. Lining of canals, types of lining, design of lined canal.

UNIT-5: Reservoir Planning - Introduction, Type of reservoirs, storage zones of a reservoir, mass curve and demand curve, determination of reservoir capacity, safe field.

FloodRouting: Graphical method, trial and error method, reservoir losses, reservoir sedimentation, and life of reservoir.

Text Books:

1. Engineering Hydrology – K. Subramanya (Tata McGraw Hill)
2. A Text Book of Hydrology – Dr. P. Jaya Rami Reddy (Laxmi Publications)
3. Irrigation Engineering and Hydraulic Structures – S.K. Garg (Khanna Publications)
4. Irrigation Engineering – B.C. Punmia (Laxmi Publications)

Reference Books:

1. Applied Hydrology – VenTe Chow, David R. Maidment, Larry W. Mays (McGraw Hill)
2. Applied Hydrology – Linsely R.K. Kohler, M.A. and J.L.H. Paulhus (McGraw Hill)
3. Irrigation, Water Resources and Water Power Engineering – Dr. P.N. Modi (Standard Book House)
4. Theory and Design of Irrigation Structures (Volume – I & II) – Varshney (Nem Chand & Bros.)

Course Outcomes: The students will be able to:

1. Explain the hydrologic cycle and precipitation.
2. Compute runoff by different method.
3. Estimate the water requirement of different crops.
4. Design Canal.
5. Compute the reservoir capacity.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch: Civil Engineering   **Semester: V**
Subject: Geotechnical Engineering   **Code: C020513(020)**
Class Tests: Two (Minimum)   **Assignments: Two (Minimum)**
ESE Duration: Three Hours   **Maximum Marks: 100**
     Minimum Marks: 35

UNIT-1: Introduction and soil classification:Definitions: Soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation moisture content, moisture content- specific gravity etc. Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: textural classification, Indian standard soil classification system.

UNIT-2: Permeability, Compaction and effective stress: Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Compaction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field. Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, quick sand condition.

UNIT-3: Consolidation of Soil and Shear Strength: Introduction, comparison between compaction and consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits. Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore pressure measurement, computation of effective shear strength parameters. unconfined compression test.

UNIT-4: Stability of Slopes - Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

UNIT-5: Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer test, analysis of borehole logs, geophysical and advance soil exploration methods.

Text Books:

1. Soil Mechanics and Foundation Engineering – Garg S.K. (Khanna Publishers)
2. Soil Mechanics and Foundations – B.C. Punmia, A. K. Jain, A. K. Jain (Laxmi Publication)
3. Geotechnical Engineering-Shashi K Gulhati,ManojDatta(McGraw Hil Education)

Reference Books:

1. Soil Mechanics and Foundation Engineering – S.N. Murthy (Dhanpat Rai Publications)
2. Basic and Applied Soil Mechanics – Gopal Ranjan and Rao A.S.R. (New Age International)
3. Soil Mechanics and Foundation Engineering –K.R. Arora (Standard Publisher Dist.)
4. Soil Mechanics and Foundation Engineering – Purushothama Raj (Pearson Education)
5. Text Book of Geotechnical Engineering – I. H. Khan (PHI Learning)

COURSE OUTCOME:

1. Students should be able to define different properties of soil
2. Students should be able to analyze permeability, compaction and effective stress
3. Students should be able to analyze consolidation ofsoil and shear strength
4. Students should be able to evaluate the stability of slope of different types of soil
5. Students should be able to explore soil infield

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology

Branch: Civil Engineering   **Semester: V**

Subject: Transportation Engineering   **Code: C020514(020)**

Class Tests: Two (Minimum)   **Assignments: Two (Minimum)**

ESE Duration: Three Hours   **Maximum Marks: 100**

                                             Minimum Marks: 35

UNIT-1: Highway development and planning: Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

Geometric Design: Typical Cross Sections in Urban and Rural roads, Various Cross Sections Elements, Width of Carriage-way, Shoulders, Medians, Width of Roadways, Right of Way, Camber, Design Speed, Sight Distance, Stopping Sight Distance, Passing Sight Distance, Sight Distance at Inter-Section, Passing Zones, Super Elevations, Set Back, Extra Widening on Horizontal Curve, Transition Curve, Design of Horizontal and Vertical Alignment, Combinations of Horizontal and Vertical Alignment.

UNIT-2: Traffic engineering and control: Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems.

UNIT-3: Pavement materials: Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems.

Design of pavements: Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC;rigid pavements- components and functions; factors affecting design and performance of CCpavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems.

UNIT-4: Railway Engineering: Permanent way, gauges, coning of wheels and tilting of rails. Rail types, wear and failure, Sleepers, rail Fixtures and fastening, ballast cushion.

UNIT-5: Geometric design of railway track: Gauge, Gradients speed, super elevation, cant deficiency, Negative super elevation, curves, length of transition curves, grade compensations.

Points and crossings: Left and right hand turnout, design calculations for turnout & Crossover, railway track functions. Station and Yards: Types, functions facilities & equipment.

Name of Text Books:

1. Highway Engineering – S. K. Khanna& C.E.G. Justo (Khanna Publishers, Delhi)
2. Highway Engineering –L.R. Kadiyalai,' Traffic Engineering and Transport Planning', Khanna Publishers.
3. Railway Engineering – S.C. Saxena& Arora, "A Text Book of Railway Engineering", Dhanpat Rai & Sons Publications.
4. Railway Engineering – S.C. Rangwala, "Railway Engineering"(Charotar Publishing House Pvt. Ltd.)

Name of Reference Books:

1. Partha Chakraborty, Principles of Transportation Engineering, PHI Learning.
2. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley StudentEdition, 2009.
3. Railway Tracks Engineering: J.S. Mundrey, Tata Mc. Graw-Hill Publishing.

COURSE OUTCOME: Upon completion of this course, the students:

1. Will conversant with various terminologies of Highway Engineering and design geometric elements of highways and expressways.
2. Will carry out traffic studies and implement traffic regulation and control measures.
3. Will evaluate highway construction material and design rigid and flexible pavements as per IRC.
4. Will conversant with various terminologies of Railway Engineering.
5. Will design turnouts in Railway.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch: Civil Engineering   **Semester: V**
Subject: Structural Analysis – II(Professional Elective –I)   **Code: C020531(020)**
Class Tests: Two (Minimum)   **Assignments: Two (Minimum)**
ESE Duration: Three Hours   **Maximum Marks: 100**
                                                                 Minimum Marks: 35

UNIT-1: Analysis by Classical Methods: Introduction- What makes a structure and roles of a structural engineer.

Review of solid mechanics: Stability of structures, Indeterminate Structures, Static and kinematic indeterminacies, Boundary conditions, Redundancy, Flexural Rigidity, Elastic Curve, Degree of freedom, Force and Displacement methods of structure analysis, Principle of superposition.

Analysis of indeterminate beams using by Classical Methods: Consistent deformation method, Theorem of three moments (Clapeyorn's theorem of three moments).Application to problems of beams and frames to determine the support reactions, plot shear force and bending moment diagrams, considering sinking of support.

UNIT-2: Analysis by Energy Method: Introduction - Concepts of energy principles, Strain energy of linear elastic systems due to axial load, bending moment and torsion. Minimum strain energy and Castigliano's second theorem, Principle of virtual displacement and virtual forces - Castigliano's first theorem - Maxwell's reciprocal theorem,Betti's law. Resilience, lack of fit, Thermal stresses, Settlement of supports,

Application to problems of indeterminate beams, 2D pin jointed frames (trusses), 2 hinged arches and 2D rigid frames to determine the support reactions, plot shear force and bending moment diagrams.

UNIT-3: Method of Moment distribution: Framed structure, sway and non-sway framed structure, causes of sway in framed structure, deformation in sway and non-sway framed structure, Stiffness, Fixed end moments due to various loads and settlement, Bending stiffness, Distribution factors, Carryover factors, Sign convention.

Application of Method of Moment Distribution to problems of indeterminate beams (also with cases of sinking of supports) and rigid frames (single/ multiple bay, single/ multi storey portals) without and with sway problem to determine the support reactions, plot shear force, bending moment diagrams and elastic curve.

UNIT-4: Method of Slope deflection: Joint equilibrium equations, compatibility and Boundary conditions

Application of Method of Slope deflection to problems of indeterminate beams (also with cases of sinking of supports) and rigid frames (single/ multiple bay, single/ multi storey portals) without and with sway problem to determine the support reactions, slope, deflections, plot shear force, bending moment diagrams and elastic curve.

Basics of Column analogy method and its application for fixed beams.

UNIT-5: Influence lines by Muller Breslau Principle: Review of Influence line, rolling load, Difference between ILD, SFD, BMD, Joint equilibrium equations, compatibility, Boundary conditions, Maxwell Betti's theorem. Muller Breslau Principle.

Application of Muller Breslau principle: Qualitative and quantitative influence lines for Support Reactions, Shear Force Diagram and Bending Moment.Diagram of indeterminate beams - propped Cantilevers and continuous beams.

Basics of Influence lines for Arches and stiffening girders.

Text Books:

1. SMTS – II Theory of Structures – Punmia B.C., A. K. Jain, A. K. Jain (Laxmi Publications)
2. Fundamentals of Structural Analysis (with Computer Analysis and Applications) – Sujit Kumar Roy and SubrataChakrabarty (S. Chand)
3. Basic Structural Analysis – C.S. Reddy (Tata McGraw Hill)

Reference Books:

1. Intermediate Structural Analysis – Wang. C.K. (Tata McGraw Hill)
2. Fundamentals of Structural Analysis – Harry H. West and Louis F. Geschwindner (Wiley India)
3. Theory of Structures (Vol. I & Vol. II) – G. Pandit, S. Gupta & R. Gupta (Tata McGraw Hill)
4. Structural Analysis – Hibbeler (Pearson Education)
5. Fundamentals of Structural Mechanics and Analysis – M. L. Gambhir (PHI Learning)

COURSE OUTCOME:

1. Leaner is able to differentiate and analyze the different kinds of structures- determinate and indeterminate.
2. Learner is able to apply suitable method for given structure - rigid jointed or pin-jointed plane frames.
3. Leaner is able to analyze indeterminate beams and frame (sway and non-sway) using Moment distribution method.
4. Leaner is able to analyze indeterminate beams and frame (sway and non-sway) using slope deflection method.
5. Learner is able to draw influence line diagram for determinate and indeterminate beams using Muller Breslau principle and is able to apply it for finding out maximum values of stress function.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch: Civil Engineering   **Semester: V**
Subject: Repair & Rehabilitation of Structures (Professional Elective –I)   Code: C020532(020)
Class Tests: Two (Minimum)   **Assignments: Two (Minimum)**
ESE Duration: Three Hours   **Maximum Marks: 100**
                                                        Minimum Marks: 35

UNIT I: QUALITY ASSURANCE
Quality assurance for Concrete and Steel construction, Properties such as strength, permeability, thermal properties and cracking. Corrosion prevention.

UNIT II: INFLUENCE ON SERVICEBILITY AND DURABILITY
Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III: MAINTENANCE AND REPAIR STRATEGIES
Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV: MATERIALS FOR REPAIR
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, ferro-cement, Fiber reinforced concrete.

UNIT V: TECHNIQUES FOR REPAIR
Rust eliminators and polymers coating for rebar's during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Text Books:
1. Denison Campbell, Allen and Harold Roper, "Concrete Structures", Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.

Reference Books:
1. M.S.Shetty, "Concrete Technology - Theory and Practice", S.Chand and Company, New Delhi, 1992.
2. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R & D Centre (SDCPL), RaikarBhavan, Bombay, 1987.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch: Civil Engineering **Semester: V**
Subject: Groundwater Engineering (Professional Elective –I) **Code: C020533(020)**
Class Tests: Two (Minimum) **Assignments: Two (Minimum)**
ESE Duration: Three Hours **Maximum Marks: 100**
Minimum Marks: 35

Unit 1 Introduction

Definition and scope, Hydrology & Hydrologic Cycle and components, The necessity for hydrologic data. Presence of water on earth and its distribution, ground water resources.

Unit 2 Groundwater hydrology

Occurrence of groundwater, well hydraulics and well construction, geo-physical explorations, groundwater quality and management of groundwater resources; Problems and perspectives regarding groundwater in India.

Unit 3 Hydrogeology:

Darcy's Equation; flow characteristics; general flow equations; unsaturated flow; Well Hydraulics: Steady and unsteady radial flows in aquifers; partially penetrating wells; multiple well systems; characteristic well losses , specific capacity.

Unit 4

Surface and Subsurface investigations: Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction.

Unit 5

Water Wells: Construction; completion, development, protection and rehabilitation of wells. Groundwater quality, Groundwater Management: Basin management, investigations, conjunctive use, modeling, artificial recharge.

Text Books:

1.   Engineering Hydrology – K. Subramanya (Tata McGraw Hill)

2.   A Text Book of Hydrology – Dr. P. Jaya Rami Reddy (Laxmi Publications)

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch:Civil Engineering   **Semester:V**
Subject:Structural Analysis Lab   **Code: C020521(020)**
Maximum Marks:40   **Minimum Marks:20**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To determine the flexural rigidity (EI) for a given beam using various prototype models.
2. To verify the Maxwell's theorem of reciprocal deflection
3. To determine the vertical deflections of a variety of curved bars.
4. To determine the horizontal deflection and deformed shape of portal frames with different end conditions.
5. To determine the strain in an externally loaded beam using digital strain indicator.

Analysis using Standard Structural Analysis Package such as SAP2000:

6. Determinate Beams
7. Determinate pin-jointed frames
8. Determinate rigid frames
9. To draw influence lines for determinate beams

Analysis using Standard Structural Analysis Package such as SAP2000:

10. Indeterminate Beams
11. Indeterminate pin-jointed frames
12. Indeterminate rigid frames
13. To draw influence lines for indeterminate beams

Analysis using MS Excel:

14. Application of MS excel in Structure Analysis for problems in determinate structures.

Finite Element Analysis Package | ANSYS:

15. Introduction to the latest version of a Standard Finite Element Analysis Package such as ANSYS.
16. Analysis of a plate with a hole on the latest version of a Standard Finite Element Analysis Package such asANSYS.

Equipment/Machines/Instruments/Tools/Software Required:

1. Elastic properties of beam apparatus
2. Maxwell's law of reciprocal deflection apparatus
3. Universal frame with variety of curved bars
4. Universal frame with variety of portal frames
5. Digital Strain Indicator
6. Dial gauges for measuring deflections
7. Weights and hangers to apply loads
8. Latest Release of Software Package SAP2000 (Computers & Structures Inc., USA)
9. Latest Release of Software Package ANSYS (ANSYS Inc., USA)

Recommended Books:

1. Reference Manual of Respective Software
2. Verification Manual of Respective Software

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch:Civil Engineering   **Semester:V**
Subject:Transportation Engineering Lab   **Code: C020522(020)**
Maximum Marks:40   **Minimum Marks:20**
List of Experiments: (At least Ten experiments are to be performed by each student)

1. Determination of crushing value of aggregates.
2. To determine 10 percent finer value.
3. Determination of abrasion value by Los Angle's Machine.
4. Determination of abrasion value by Deval's Abrasion Machine.
5. Determination of Impact Value of aggregates.
6. Determination of Specific Gravity and Water Absorption of aggregate.
7. Determination of Softening Point of Bitumen.
8. Determination of Ductility Value of Bitumen.
9. Determination of Viscosity Value of Bitumen.
10. Determination of Elongation Index of Aggregate.
11. Determination of Flakiness Index of aggregate.
12. Determination of Penetration Value of Bitumen.
13. Flash and Fire Point Test.
14. Study of Marshal Stability Test.
15. Study of Benkelman Beam.

Equipment/Machines/Instruments/Tools/Software Required:

1. Ring and Ball Apparatus
2. Standard Penetrometer
3. Los Angles Abrasion Machine
4. Deval's Abrasion Machine
5. Ductility Testing Machine
6. Tar Viscometer
7. Sieve Shaker
8. Standard I.S. Sieves for Fine and Coarse Aggregate
9. Length Gauge
10. Thickness Gauge
11. Crushing Value Cylinder and Mould with Plunger
12. Aggregate Impact Testing Machine
13. Flash and Fine Point Apparatus
14. Benkelman Beam
15. Hot Air Oven
16. Water Bath
17. Marshall Stability Machine and with Mould
18. Proving Ring and Dial Gauge
19. Weighing Balance up to 10 kg capacity

Text Books:

1. Highway Engineering – Justo & Khanna (Khanna Publishers)
2. Highway Engineering Manual – Justo & Khanna (Khanna Publishers)

COURSE OUTCOME: On completion of this course, the student:
1. Will determine the crushing strength value of aggregate.
2. Will determine abrasion value of aggregate.
3. Will list physical properties of bitumen for road construction
4. Will list index properties of aggregate.
5. Will determine flash and fire point of bitumen.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology
Branch:Civil Engineering   **Semester:V**
Subject:Geotechnical Engineering Lab   **Code: C020523(020)**
Maximum Marks:40   **Minimum Marks:20**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
4. Field identification of Fine Grained soils.
5. Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
10. Consistency limits by Shrinkage limit.
11. Permeability test using Constant-head test method.
12. Permeability test using Falling-head method.
13. Compaction test: Standard Proctor test.
14. Compaction test: Modified Proctor test.
15. Relative density.
16. Consolidation Test.
17. Triaxial Test (UU)
18. Vane shear test
19. Direct Shear Test
20. Unconfined Compression Strength Test.

==**Equipment/Machines/Instruments/Tools/Software Required:**==

1. Core Cutter Mould
2. Pycnometer of capacity 500 ml and 1000 ml
3. Small and Big Soil Container
4. Hydrometer Apparatus
5. Oven
6. Liquid Limit Apparatus
7. Shrinkage Limit Apparatus
8. Constant Head Permeability Test Apparatus
9. Following Head Permeability Test Apparatus
10. Mechanical Sieve Analysis (Complete Sets of Sieves)
11. Static Cone Penetrometer Test Apparatus
12. Skempton's Core Pressure Apparatus
13. Soil Sampling Tube, Piston Tube
14. Rammer for Compaction
15. Soil Extractor
16. Measuring Jar Cylinder (1000 CC)
17. Light Compaction Mould
18. Heavy Compaction Mould
19. Direct Shear Test Apparatus with full accessories
20. Triaxial Compression Test Apparatus with full accessories
21. Consolidometer Apparatus
22. Unconfined Compression Test Apparatus

Recommended Books:

1. Soil Mechanics and Foundation Engineering – B.C. Punmia (Laxmi Publication)
2. Soil Engineering in Theory and Practice (Vol-II) –Alam Singh (Asia Publishing House, New Delhi)

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of the Program: B.Tech　　　　　　　　　**Semester: V**
Subject: Environmental Studies　　　　　　　　**Code: C000506(020)**
Period per week (L-T-P): (0-0-2) / Week　　　　**Non-Credit**
Total Contact Hours: 40　　　　　　　**No. of assignments to be submitted: 05**

PREREQUISITE: Knowledge of basic Chemistry, Physics and Mathematics.

COURSE OBJECTIVES:
1. Basic knowledge of environment, ecology, ecosystems, biodiversity and conservation.
2. Fundamentals of natural resources, control, uses and its impact on environment.
3. Human population, growth, growing needs and its impact on society and environment.
4. Types of environmental pollution, legislations, enactment and management.

COURSE DETAILS:

UNIT I: Introduction to environmental studies, ecology and ecosystems　　　**(06 hours)**
Introduction to environment; Concept and structure of ecology and ecosystem, energy flow; Community ecology; Food chains and webs; Ecological succession; Characteristic features of forest, grassland, desert and aquatic ecosystem; Multidisciplinary nature of environmental studies, scope and importance; Concept of sustainability and sustainable development.

UNIT II: Biodiversity and conservation　　　　　　　　　　　　　　　**(06 hours)**
Introduction to biological diversity and levels of genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots; Threats to biodiversity, habitat loss, conflicts and biological invasions; In-situ and Ex-situ conservation of biodiversity: Ecosystem and biodiversity services.

UNIT III: Natural resources and environment　　　　　　　　　　　　　**(08 hours)**
Concept of Renewable and non-renewable resources; Land resources, land use change, land degradation, soil erosion; Desertification; Deforestation: causes, consequences and remedial measures; Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state); Energy resources: environmental impacts of energy generation, use of alternative and nonconventional energy sources, growing energy needs.

UNIT IV: Human communities, social issues and environment　　　　　　　**(08 hours)**
Basic concept of human population, growth and communities; Impacts on environment, human health, welfare and human rights; Resettlement and rehabilitation; Environmental natural disaster: floods, earthquake, cyclones, tsunami and landslides; Manmade disaster; Environmental movements; Environmental ethics: role of gender and cultures in environmental conservation; Environmental education and public awareness; Human health risks and preventive measurements.

UNIT V: Environmental pollution, policies, legislations, assessment and practices　　　**(12 hours)**
Environmental pollution: Causes, effects and controls of air, water, soil, noise and marine pollution; Concept of hazardous and non-hazardous wastes, biomedical and e-wastes; Solid waste management and control measures; Climate change, global warming, ozone layer depletion, acid rain and their societal impacts; Environment laws: Wildlife Protection Act, Forest Conservation Act, Water (Prevention and control of Pollution) Act, Air (Prevention & Control of Pollution) Act, Environment Protection Act, Biodiversity Act, International agreements negotiations, protocols and practices; EIA, EMP.

On completion of each unit, students have to submit one assignment from each unit.

COURSE OUTCOMES (CO):

On completion of the course, students will able to:

1. Interpret and demonstrate the concept of ecology and ecosystem for environmental sustainability.
2. Define and establish the diversified knowledge of biodiversity and its conservation.
3. Explain the uses of natural resources efficiently and its impact on environment.
4. Illustrate and solve the simple and complex social issues relating to human communities.
5. Exemplify and make useful solution to combat the environmental degradation with the aid of national and international legislations and protocols there under.
6. Demonstrate and elucidate the complicated issues and anthropological problems for societal development.

TEXT BOOKS:

1. De, A.K., (2006).*Environmental Chemistry*, 6th Edition, New Age International, New Delhi.
2. Bharucha, E. (2013). *Textbook of Environmental Studies for Undergraduate Courses*. Universities Press.
3. Asthana, D. K. (2006).*Text Book of Environmental Studies*. S. Chand Publishing.

REFERENCE BOOKS:

1. Odum, E. P., Odum, H. T., & Andrews, J. (1971).*Fundamentals of ecology*. Philadelphia: Saunders.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India.
3. Sharma, P. D., & Sharma, P. D. (2005).*Ecology and Environment*. Rastogi Publications.

OPEN SOURSE LEARNING:

http://nptel.ac.in/