

UNIVERSITY OF LUCKNOW
FACULTY OF ENGINEERING & TECHNOLOGY

Evaluation Scheme for B. Tech.

Branch : CIVIL ENGINEERING

SEMESTER – V

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
Theory									
01.	CE - 501	Design of Concrete Structures -I	3--1--0	20	10	30	70	100	4
02.	CE – 502	Environmental Engineering-I	3--1--0	20	10	30	70	100	4
03.	CE – 503	Transportation Engineering - I	3--0--0	20	10	30	70	100	3
04.	CE – 504	Geotechnical Engineering	3--0--0	20	10	30	70	100	3
05.	CE - 505	Structural Analysis-II	3--1--0	20	10	30	70	100	4
Practical									
06.	CE - 551	Concrete Technology Lab	0--0--3	-	40	40	60	100	2
07.	CE – 552	Environmental Engineering Lab	0--0--2	-	20	20	30	50	1
08.	CE – 553	Transportation Engineering Lab	0--0--3	-	40	40	60	100	2
09.	CE - 554	Geotechnical Engineering Lab	0--0--2	-	20	20	30	50	1
10.	GP - 501	General Proficiency				50		50	
Total			15-3-10					800	24

Abbreviations : CT - Class Test
ESE - End Semester Examination

TA - Teacher's Assessment

UNIVERSITY OF LUCKNOW
FACULTY OF ENGINEERING & TECHNOLOGY

Evaluation Scheme for B. Tech.

Branch : CIVIL ENGINEERING

SEMESTER - VI

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
Theory									
01.	CE - 601	Environmental Engineering-II	3--1--0	20	10	30	70	100	4
02.	CE – 602	Transportation Engineering - II	3--0--0	20	10	30	70	100	3
03.	CE – 603	Advanced Foundation Engg.	3--1--0	20	10	30	70	100	4
04.	CE – 604	Design of Concrete Structures - II	3--1--0	20	10	30	70	100	4
05.	CE – 605	Any one from the list (DE – 1)	3--0--0	20	10	30	70	100	3
Practical									
06.	CE - 651	Structural Detailing Lab.	0--0--2	-	20	20	30	50	1
07.	CE – 652	Computer Aided Design Lab	0--0--2	-	20	20	30	50	1
08.	CE – 653	Triangulation Camp*	0--0--3	-	40	40	60	100	2
09.	CE - 654	Mini Project	0--0--3	-	40	40	60	100	2
10.	GP - 601	General Proficiency				50		50	
Total			15-3-10					800	24

Abbreviations : CT - Class Test
ESE - End Semester Examination

TA - Teacher's Assessment
DE - Departmental Elective

* This will be done during winter break for one week with the help of total station and differential GPS.

Note: Students have to undergo Industrial Training for a period of six weeks during summer vacation. The report of Industrial Training will be submitted to the Head of the Department in the beginning of seventh semester.

Departmental Elective – 1 :-

- CE - 6051 Remote Sensing & GIS Application
- CE - 6052 Integrated Waste Management
- CE - 6053 Geosynthesis and Reinforced Soil Structures
- CE - 6054 Modern Construction Materials
- CE - 6055 Geo-Environmental Engineering

CE - 501

DESIGN OF CONCRETE STRUCTURE - I

L	T	P
3	1	0

UNIT-1

Concrete Making materials , Properties of concrete and reinforcements , Testing of concrete, Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. 8

UNIT-2

Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method. 8

UNIT-3

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, Design of beam in shear, Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments. 8

UNIT-4

Design of one way and two way solid slabs by Limit State Design Method, Serviceability Limit States, Control of deflection, cracking and vibrations. 8

UNIT-5

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, Requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts. 8

Note : All designs shall be conforming to IS : 456 – 2000.

Text Books :

1. Gambhir, M L ,”Fundamentals of Reinforced Concrete”, Prentice Hall of India.
2. Unnikrishna Pillai, S. & D. Menon, “ Reinforced Concrete Design”, Tata Mc-Graw Hill Company Limited.
3. Park, R. and T. Pauley,” Reinforced Concrete Structures”, John Wiley & Sons.

References Books :

1. IS : 456 – 2000, “ Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.
2. Jain, A.K., “Reinforced Concrete : Limit State Design”, Nem Chand & Bros., Roorkee.
3. Jain, O. P. & Jai Krishna, “ Plain and Reinforced Concrete”, Vol. I & II, Nem Chand & Bros., Rookee.
4. Dayaratnam, P, ”Reinforced Concrete Design”, Oxford & IBH.

CE – 502
ENVIRONMENTAL ENGINEERING – I

L T P
3 1 0

UNIT-1

Public Water supply: Hydrosphere, Hydrological cycle and Natural water. Beneficial uses of water, water demands, variations in demands; population forecasting; basic needs and factors affecting consumption; design period.

Sources of water: Surface and underground sources, relation and development of source in r/o quality and quantity of water, Development of wells, Storage reservoir-balancing and service storage, capacity determination by mass curve method. Intake systems. 8

UNIT-2

Quality and Examination of Water: Necessity for examination of impurities in water, sampling of water, physical, chemical and bacteriological quality for domestic water supply. Drinking water quality standards and criteria.

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures. 8

UNIT-3

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, general design guidelines for distribution systems, Hardy - Cross, Newton – Raphson and equivalent pipe methods of pipe network analysis.

Water supply and plumbing systems in buildings and houses. 8

UNIT-4

Wastewater collection: Systems of sanitation and wastewater collection; choice of sewerage system and suitability to Indian conditions.

Estimation of wastewater flows and variations in wastewater flows. Storm water: Collection and estimation of storm water by different methods. 8

UNIT-5

Wastewater Transmission: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems. Planning of sewerage systems. 8

Text Books :

1. Peavy, Howard S., Rowe, Donald R and Tchobanoglous, George, "Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc-Graw Hill.
3. Davis, M.L. & Cornwell, D.A.: Introduction to Environmental Engineering, Mc-Graw Hill.

References Books :

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Davis Mackenzie L., Cornwell, David A., "Introduction to Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., New Delhi.
4. A.K. Jain, Environmental Engineering, Khanna Publishing House
5. O P Gupta, Elements of Environmental Pollution Control, Khanna Publication
6. M. P. Poonia and SC Sharma: Environmental Engineering, Khanna publishing house
7. Keshav Kant, "Air Pollution Control Engineering", Khanna Publishing House

CE - 503
TRANSPORTATION ENGINEERING - I

L T P
3 0 0

UNIT – 1

Introduction: Role of Transportation, Modes of Transportation, History of road development, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan, Road types and pattern.

Geometric Design: Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. 8

UNIT – 2

Traffic Engineering: Traffic characteristic, volume studies, speed studies, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection. 8

UNIT – 3

Design of Highway Pavement: Types of Pavements, Design factors, Design of Flexible Pavement by CBR method (IRC: 37-2001), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC : 58 – 2002). 8

UNIT – 4

Road Construction Methods: WBM, Surface dressing, Bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete road construction. 8

UNIT – 5

Traffic and Parking Studies: Traffic and Parking Problems, Ill effects of Parking, Design Standards for on Street Parking Facilities, Traffic Regulatory Measures for On Street Parking Facilities, Peripheral Parking Schemes, Truck Terminals, Long Distance Bus Terminals 8

Text Book:

1. Khanna S. K., Justo C.E.G, & Veeraragavan, A. “Highway Engineering”, Nem Chand and Bros., Roorkee- 247 667.
2. Khanna S. K., Justo C.E.G, & Veeraragavan A., “Highway Materials and Pavement Testing”, Nem Chand and Bros., Roorkee- 247 667.
3. LR Kadiyali, Transportation Engineering, Khanna Publication.
4. Chakraborty Partha & Das Animesh., “Principles of Transportation Engineering”, Prentice Hall (India), New Delhi,

Reference Books:

1. L.R. Kadiyali, Transportation Engineering, Khanna Publishing House
2. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributers, New Delhi
3. Kumar, R Srinivasa, “A Text book of Highway Engineering”, Universities Press, Hyderabad.
4. Kumar, R Srinivasa, “Pavement Design”, Universities Press, Hyderabad.

5. IRC : 37- Latest revision, “Tentative Guidelines for the design of Flexible Pavements” Indian Roads Congress, New Delhi
6. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (with CD)
7. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (First Revision)
8. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban) Highways
9. IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas
10. IRC:93-1985 Guidelines on Design and Installation of Road Traffic Signals.
11. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (First Revision)
12. IRC: SP: 68-2005, “Guidelines for Construction of Roller Compacted Concrete Pavements”, Indian Roads Congress, New Delhi.
13. IRC: 15-2002, “Standard Specifications and Code of Practice for construction of Concrete Roads” Indian Roads Congress, New Delhi.
14. MORTH, “Specifications for Road and Bridge Works”, Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, New Delhi.

CE – 504
GEOTECHNICAL ENGINEERING

L T P
3 0 0

UNIT – 1

Preview of Geotechnical field problems in Civil Engineering, soil formation, transport and deposit, soil composition, basic definitions, clay minerals, index properties, particle size analysis and soil classification. 8

UNIT – 2

Soil-water systems, capillarity-flow, Darcy's law, permeability, field and lab tests, piping, quick sand condition, seepage, flow nets, flow through dams, filters. Soil compaction, water content – dry unit weight relationships, OMC, field compaction control, Proctor needle method. 8

UNIT – 3

Effective stress principle, stresses due to applied loads, Boussinesq and Westergaard equations. Compressibility and consolidation characteristics, rate of consolidation, Terzaghi's one dimensional theory of consolidation and its applications, over consolidation ratio, determination of coefficient of consolidation and secondary consolidation (creep), consolidation under construction loading. 8

UNIT – 4

Shear strength - direct & triaxial shear tests, Mohr – Coulomb strength criterion, drained, consolidated, undrained and unconsolidated tests, strength of loose and dense sands, normally consolidated and over consolidated soils, dilation, pore pressure, Skempton's coefficient. Earth pressure theories, Coulomb and Rankine approaches for $c-\phi$ soils, smooth and rough walls, inclined backfill 8

UNIT – 5

Characterization of ground, site investigations, groundwater level, methods of drilling, sampling, in situ test, SPT, CPT, DCPT. Types of foundations – shallow / deep, isolated, combined, mat, etc., definitions, bearing capacity of shallow foundations (Terzaghi analysis), general, local and punching shear failures, corrections for size, shape, depth, water table, bearing capacity by consolidation method, insitu bearing capacity determination, Provisions of IS code of practice, selection of depth of footing, eccentrically loaded footings. 8

Text Books:

1. Narasinga Rao, B.N.D, "Soil Mechanics & Foundation Engineering", John Wiley & Sons, Wiley India Pvt. Ltd.
2. Khan I H, Textbook of Geotechnical Engineering, Prentice Hall India
3. Brij Mohan Das Geotechnical engineering CENGAGE Learning
4. Gulati, S.K, Geotechnical Engineering, Tata Mc. Graw Hill

References Books :

1. Murthy VNS, Geotechnical Engineering, Soil Mechanics and foundation engineering, Marcel Dekken Inc.
2. Rowe R.K, Geotechnical and Geotechnical Engineering Handbook, Kluwer Academic Publication London
3. Arora KR, Geotechnical Engineering: Soil Mechanics and foundation engineering, Standard Publisher Distributor
4. Venkataramaiah C, Geotechnical Engineering, New Age Pvt. Ltd.

CE - 505
STRUCTURAL ANALYSIS - II

L T P
3 1 0

UNIT – 1

Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint, Method of Consistent Deformation, Slope-Deflection method, Moment Distribution method, Strain Energy method. 8

UNIT – 2

Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged arches, Influence line diagrams for maximum bending moment, Shear force and thrust. 8

UNIT – 3

Suspension Bridges, Analysis of cables with concentrated and continuous loadings, Basics of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders. 8

UNIT – 4

Basics of Force and Displacement Matrix methods for beams, frames and trusses. 8

UNIT – 5

Basics of Plastic Analysis, Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Frames. 8

Text Books :

1. H. C. Martin, Introduction to Matrix Methods of Structural Analysis, Mc-Graw Hill Book Publishing Company Ltd.
2. C. S. Reddy, Structural Analysis, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Gupta & Gupta, Theory of Structures, Vol 1 & 2, TMH
4. P. Dayaratnam, Analysis of Statically Indeterminate Structures, Affiliated East-West Press.

References Books :

1. A K Jain, Advanced Structural Analysis, Nem Chand & Bros., Roorkee
2. O. P. Jain & A. K. Jain, Theory and Analysis of Structures, Vol. I & II, Nem Chand Bros., Roorkee.
3. S. P. Timoshenko and D. Young, Theory of Structures, Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
4. Indeterminate Structural Analysis by C. K. Wang. Mc-Graw Hill Book Publishing Company Ltd.
5. S S Bhavikkati, Structural Analysis II, Vikash Publishing House.
6. B C Punamia and A K Jain, Theory of Structures, Laxmi Publication

CE-551
CONCRETE TECHNOLOGY LAB

L T P
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Note :- At least **ten** experiments are to be conducted from the following list.

1. Determination of Normal Consistency, Initial & Final Setting time of cement.
2. Determination of Compressive strength of cement.
3. Determination of Fineness of cement by air permeability and Le-chatalier's apparatus.
4. Determination of Soundness of cement.
5. Determination of Tensile strength.
6. Determination of Crushing value & Impact value of aggregate
7. Determination of water absorption of aggregate
8. Sieve Analysis of Aggregate and determination of Specific gravity & bulk density
9. Sieve analysis of sand and determination of Silt content in sand
10. Determination of bulking of sand
11. Demonstration of Non-destructive testing of concrete

CE - 552
ENVIRONMENTAL ENGINEERING LAB

L T P
0 0 2

Note :- At least **ten** experiments are to be conducted from the following list.

1. Determination of turbidity, colour and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of most probable number of coliforms.
6. Measurement of air pollutants with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total, suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.

CE – 553
TRANSPORTATION ENGINEERING LAB

L T P
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Note :- At least **ten** experiments are to be conducted from the following list.

1. Crushing Value Test of Aggregate
2. Impact Value Test of Aggregate
3. Los Angeles Abrasion Value of Aggregate
4. Shape Test (Flakiness Index, Elongation Index) of Aggregate
5. Penetration Test of Bituminous Sample
6. Softening Point Test of Bituminous Sample
7. Stripping Test of Bituminous Sample
8. Ductility Test of Bituminous Sample
9. Flash & Fire Point Test of Bituminous Sample
10. Classified both directional Traffic Volume Study
11. Traffic Speed Study (Using Radar Speedometer or Enoscope)

CE – 554
GEOTECHNICAL ENGINEERING LAB

L T P
0 0 2

Note :- At least **ten** experiments are to be conducted from the following list.

1. Sieve Analysis
2. Hydrometer Analysis
3. Liquid & Plastic Limit Tests
4. Shrinkage Limit Test
5. Proctor Compaction Test
6. Relative Density
7. In Situ Density – Core cutter & Sand Replacement
8. Permeability Test
9. Direct Shear Test
10. Auger Boring
11. Static Cone Penetration Test
12. Standard / Dynamic Cone Penetration Test

CE - 601
ENVIRONMENTAL ENGINEERING – II

L T P
3 1 0

UNIT-1

Pollutants of Water, their origin and effects; Oxygen demanding wastes, pathogens, 3 nutrients, salts, thermal applications, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution. Effects of oxygen demanding wastes on surface waters. Waste water quality and characteristics. Water borne diseases and their control. Objectives of treatment: Water and waste water treatment, unit operations and processes and flow sheets. 8

UNIT-2

Sedimentation: Determination of settling velocity, efficiency of ideal sedimentation tank, short circuiting; different classes of settling; design of primary and secondary settling tanks; removal efficiency for discrete and flocculent settling. Coagulation: Mechanisms of coagulation, coagulants and their reactions, coagulant aids; design of flocculators and clariflocculators. 8

UNIT-3

Filtration: Theory of filtration; Hydraulics of filtration; Carmen - Kozeny and other equations; slow sand, rapid sand and pressure filters, backwashing; brief introduction to other filters; design of filters. Disinfection: Requirements of an ideal disinfectant; kinetics of disinfection, various disinfectants, chlorination and practices of chlorination. Water softening and ion exchange: calculation of dose of chemicals. Adsorption. 8

UNIT-4

Waste water Treatment: Preliminary, primary, secondary and tertiary treatment processes. Primary Treatment: Screens, grit chamber and their design, sedimentation and chemical treatment to be given. Secondary Treatment: Theory of organic matter removal; activated sludge process, design of different units and modifications, extended aeration systems; trickling filters, R.B.C. Community and Low Cost Treatment Systems: aerated lagoons, waste stabilization ponds, oxidation ditches. 8

UNIT-5

Anaerobic digestion of sludge: Design of low and high rate anaerobic digesters and septic tanks. Basic concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor. Disposal of waste water on land and in water bodies. Introduction to Duckweed pond, vermiculture and root zone technologies and other emerging technologies for wastewater treatment. 8

Text Books :

1. Peavy, Rowe and Tchobanoglous, Environmental Engineering, Tata Mc Graw Hill.
2. Metcalf and Eddy, Wastewater Engineering: Treatment & Reuse, Tata Mc Graw Hill.
3. Garg: Water Supply Engineering (Environmental Engg- I), Khanna Publishing House.
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engg.Vol.-II), Khanna Publishing House.

References Books :

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi.
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee, Water Supply and Sewerage, Mc Graw Hill.
4. Fair and Geyer, Water Supply and Wastewater Disposal, Jhon Wiley & Sons.
5. Ramalho, Introduction to Wastewater Treatment Processes, Academic Press.
6. Parker, Wastewater Systems Engineering Prentice Hall.

CE - 602
TRANSPORTATION ENGINEERING – II

L T P
3 0 0

UNIT – 1

Indian railways: Development and organization of Indian Railways. Permanent way : Sub-grade, formation, embankment and cutting, track drainage. Rails : Rail gauges, types of rails, defects in rails, rail failure, creep of rail. Rail Fastenings : Fish plates, spikes, chairs, keys, bearing plates. Sleepers : Timber, steel, cast iron, concrete and prestressed concrete sleepers, manufacturing of concrete sleepers, sleeper density. Ballast : Ballast materials, size of ballast, screening of ballast, specification of ballast, tests on ballast. 10

UNIT – 2

Railway Track Geometry : Gradients, horizontal curves, super-elevation, safe speed on curves, cant deficiency, negative super elevation, compensation for curvature on gradients, track resistance and tractive power. Points & Crossings : Elements of a simple turn-out, details of switch, details of crossings, number & angle of crossings, design of turn-out. 8

UNIT – 3

Stations & Yards : Site selection for a railway station, layout of different types of stations, classification of stations, types of railway yard, functions of marshalling yards. Signalling & interlocking : Classification of signals, method of train working, absolute block system, mechanical interlocking of a two line railway station. 7

UNIT – 4

Airport Engineering : Air craft characteristics affecting airport design; Runway operation; Runway pavement design, design of overlay; Runway lighting and marking heliport. 8

UNIT – 5

Water Transport - Harbors: Layout and port facilities; Inland waterways; Inland water operation. 7

Text Books :

1. S. P. Arora & S. C. Saxena, A Text Book of Railway Engineering, Dhanpat Rai Publications.
2. L R Kadiyali, Transport Engineering, Nem Chand & Bros.
3. N J Ashford, Airport Engineering : Planning, Design and Development of 21st Century Airports, Wiley.

Reference Books :

1. M. M. Aggrawal, Railway Engineering, Oxford Higher Education.
2. James H, Water Transport : Origin and Early Evolution, Cambridge University Press.
3. Robert H, Planning and Design of Airports, Mc Graw Hill Education.

CE - 603
ADVANCED FOUNDATION ENGINEERING

L T P
3 1 0

Unit -1

Vertical pressures under surface loads, elastic solution, Boussinesq and New Mark charts, Westergaard's equation and approximate solution. 8

Unit -2

Bearing capacity and settlement analysis of shallow foundations: Meyerhof and Hansen's bearing capacity equations, BIS bearing capacity equation, immediate and consolidation settlements in cohesive soil, De-Beer and Schmertman's methods of settlement prediction in non cohesive soil. 8

Unit -3

Classification of piles, load carrying capacity of single pile in clay, silt and sand by dynamic and static methods, pile load test, pile group, negative skin friction and settlement of pile group. 8

Unit - 4

Foundation on expansive soil, construction on expansive soil, alteration of soil condition, under-reamed piles. Elements of well foundation, shape, depth of scour, well sinking, tilt, shift and their prevention. 8

Unit -5

Stability of slopes, limit equilibrium method, method of slices, simplified Bishop method, Stability charts.

Machine foundation: Classification, definitions, design principle in brief, Barken's method.

8

Text Books:

1. K. R. Arora – Soil Mechanics & Foundation Engineering, Standard Publisher.
2. Alam Singh – Modern Geotechnical Engineering, CBS Publisher.
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics, New Age Int. Publisher.

Reference:

1. J. E. Bowles – Analysis and Design of Foundation, Mc Graw Hill.
2. V. N. S. Murthy – Soil Mechanics and Foundation Engineering, CBS.
3. B. M. Das – Foundation Engineering , CENGAGE Learning

CE - 604
DESIGN OF CONCRETE STRUCTURE - II

L T P
3 1 0

UNIT-1

Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs. (IS Code Method). 8

UNIT-2

Analysis and design of beam curved in plan. Structural behaviour of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings, and design of strap footing. 8

UNIT-3

Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, design of T-shaped retaining wall, Concept of Counter fort retaining wall. Loads, forces and I.R.C. bridge loadings and design of R.C. slab culvert. 10

UNIT-4

Design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground / underground, design of overhead tanks. 8

UNIT-5

Advantages of prestressing, methods of prestressing, losses in prestress, analysis of simple pre-stressed rectangular and T-section. 6

Text Books :

1. Jain, A.K., "Reinforced Concrete : Limit State Design", Nem Chand & Bros., Roorkee.
2. Gambhir, M L ,"Fundamentals of Reinforced Concrete", Prentice Hall of India.
3. Unnikrishna Pillai, S. & D. Menon, " Reinforced Concrete Design", Tata Mc-Graw Hill Company Limited.

Reference Books :

1. IS : 456 – 2000, " Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi.
2. Park, R. and T. Pauley," Reinforced Concrete Structures", John Wiley & Sons.
3. Dayaratnam, P,"Reinforced Concrete Design", Oxford & IBH.
4. Jain, O. P. & Jai Krishna, " Plain and Reinforced Concrete", Vol. I & II, Nem Chand & Bros., Roorkee.

CE-651
STRUCTURAL DETAILING LAB

L T P
0 0 2

Preparation of working drawings for the following using any drafting software.

1. RC Beams- Simply supported, Continuous, Cantilever
2. T – beam / L-beam floor
3. Slabs – Simply supported, Continuous, One way and two way slabs.
4. Columns – Tied Columns and Spirally reinforced columns.
5. Isolated footings for RC Columns.
6. Combined rectangular and trapezoidal footings.
7. Detailing of Buildings with respect to Earthquake Resistant Design.

CE –652
COMPUTER AIDED DESIGN LAB

L T P
0 0 2

1. Working on analysis softwares like ANSYS , ADINA , NISA
2. Working on Design Softwares LIKE STAAD PRO / STRUDS / SAP / ETAB / STRAP
3. Working ON Geotechnical Softwares like GEO-5 / Plaxis
4. Working on Environmental Engineering softwares for Analysis and Design of water & wastewater treatment and distribution systems (Water Cad / Sewer Cad / Water Gem / Sewer Gem /Loop)
5. Working on Transportation Enggsoftwares / Surveying Softwares
6. Working on GIS softwares (Arc GIS / Envi / GePSy)
7. Working on Project Management softwares (Primaveera / MS Project)

CE – 6051
REMOTE SENSING AND GIS APPLICATION

L T P
3 0 0

Unit I

Remote Sensing: Introduction, sources of energy for remote sensing, active and passive sources, electromagnetic radiation, and their characteristics, thermal emission, Interaction of EMR with atmosphere, spectral reflection curves. 8

Unit II

Multi concept of remote sensing, sensors and orbital characteristics, various sensing platforms for remote sensing, characteristics of various satellite, remote sensing data products and their uses. Data capture for simulation of land surface, geomorphology, landuse classification, flood plain mapping, application to snow cover studies, 8

Unit III

Geographic Information system: Introduction, concept and terminology, components of GIS, Raster and Vector formats, scanners and digitizers, methods of digitization, data Preprocessing, form conversion, data reduction, and generalization. Data bases and DBMS, Spatial databases, co-ordinate systems and geo-referencing. 8

Unit IV

Data merging, edge matching, registration and re-sampling, data manipulation and analysis representation of real-world problems, problem solving and spatial modeling, classification, aggregation, overlay, buffers and digital elevation models. 8

Unit V

Applications in planning of utility lines, flood studies, ground water recharge, erosion modeling, case studies on use of GIS related to land use, water, environment and transportation. Integrated use of remote sensing and GIS, introduction to arc view, arc info, map info and MODFLOW software. 8

Text Books :

1. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman., Remote Sensing and Image Interpretation. Wiley
2. B. Bhatta, Remote Sensing and GIS, Oxford University Press
3. Lillesand and Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons Ltd.
4. Ian Haywood, Dorling, An Introduction to GIS, Kindersley Pvt. Ltd
5. Satheesh, G., Sathikumar, R., and Madhu, N., Advanced Surveying, Pearsons Educations.

Reference books :

1. Curran, Paul J., Principles of Remote sensing Longman
2. Campbell, J.B., Introduction of Remote Sensing Taylor and Francis,
3. Sabins, F.F., Remote Sensing: Principles and Interpretations Worth Publishers
4. Reddy, M. Anji, Remote sensing and Geographic Information System BS Publications
5. Elachi, Introduction to the physics and techniques of Remote Sensing, John Wiley & Sons Ltd.
6. Longley, Geographical Information System Vol. I and II, John Wiley & Sons Ltd.

CE – 6052
INTEGRATED WASTE MANAGEMENT

L T P
3 0 0

Unit-1

Introduction: Solid Waste Management- Definition, concept of 4 Rs (reduce, reuse, recycle and recover) of waste management, elements of a waste management system.

Current Issues in Solid Waste Management: Integrated waste management hierarchy, source reduction, recycling, waste-to-energy and land filling. Review of waste management under Swachh Bharat Mission and Smart Cities Program. 8

Unit-2

Municipal Solid Waste: Waste composition and quantities, collection, transportation, segregation, and processing. 8

Unit-3

Disposal of Municipal Solid Waste: Landfill, biochemical processes and composting, energy recovery from municipal solid waste. Municipal Solid Waste (MSW) Rules 2016. 8

Unit-4

Construction and Demolition (C&D) Waste Management: Overview, components, C&D Waste Management Rules 2016, beneficial reuse of C & D waste materials. 8

Unit-5

Electronic Waste (E-Waste) Management – Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges. Hazardous Wastes: Definition, classification, risk assessment, transportation of hazardous waste, current management practices. Environmental audit, containment, remedial alternatives. 8

Text Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGraw Hill
2. Ramachandra T.V., Management of Municipal Solid Waste, 2009; by The Energy and Resource Institute, TERI
3. Sasikumar, K, Gopi Krishna, Sanoop, Solid Waste Management; 2009, PHI.

Reference Books:

1. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India
2. MSW Management Rules 2016, Govt. of India, available online at CPCB website.
3. Construction and Demolition Waste Management Rules, 2016, MoEF&CC
4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
5. P Gupta, " Element of Solid waste hazardous management, Khanna Publishing house.
6. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York.
7. <http://swachhbharatmission.gov.in/sbmcms/index.htm>
8. <http://swachhbharaturban.gov.in/>

GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

L T P
3 0 0

UNIT 1

Introduction to Geosynthetics, types of geosynthetics, artificial and natural geosynthetics and their applications, manufacture of geosynthetics, strength of reinforced soils, testing of geosynthetics. 8

UNIT-2

Drainage application of geosynthetics , filtration applications of geosynthetics, erosion control using geosynthetics geosynthetics in flexible pavement, introduction to geosynthetics in landfills, geosynthetics for construction of landfills. 8

UNIT-3

Sustainable infrastructure development, different types of soil retaining structures, design codes for reinforced soil retaining walls, construction aspects of geosynthetics reinforced soil retaining wall, testing requirements for reinforced soil retaining walls, geosynthetic reinforced soil embankments. 8

UNIT-4

Design of reinforced soil retaining walls – simple geometry, design of reinforced soil retaining walls – sloped backfill soil, soil embankments supported on geocell mattresses, geosynthetic reinforced pile systems for high embankments 8

UNIT-5

Reinforced soil for supporting shallow foundations, response of footings resting on reinforced foundation soils, bearing capacity analysis of footings resting on reinforced foundation soils, carbon footprint analysis 8

Text Books :

1. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 4th edition, 1999.
2. Sanjay Kumar Shukla, Erol Guler "Advances in Reinforced Soil Structures," Ppringer International Pub.

Reference Books :

1. Jewell, R.A., "Soil Reinforcement with Geotextiles", Special Publication No. 123, CIRIA, Thomas Telford. London, UK, 1996.
2. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.
3. Hoe I. Ling, Guido Gottardi , Daniele Cazzuffi , Jie Han , Fumio Tatsuoka "Design and Practice of Geosynthetic-Reinforced Soil Structures", DES Tech Publication, Inc. USA.

CE – 6054
MODERN CONSTRUCTION MATERIALS

L T P
3 0 0

Unit – 1

Introduction, properties and uses of modern building materials: Fly ash bricks, soil - cement blocks, calcium silicate bricks, red mud jute fibre polymer composite (RFPC), glass reinforced gypsum. 8

Unit – 2

Introduction , properties and use of geosynthetics, bituminous material, fire resistant materials (chemicals ,paints ,tiles ,bricks, glass),metals, light - weight concrete, mass concrete and waste material based concrete. 8

Unit – 3

Introduction , properties and use of: Ferro cement & fibre reinforced concrete, different types of fibres, high density concrete, nuclear concrete, heat resisting & refractory concretes, pre fabricated systems. 8

Unit – 4

Introduction , properties and use of: Polymers, fibre reinforced polymers, polymer concrete composites (PCCs), sulphur concrete and sulphur - infiltrated concrete. 8

Unit – 5

Introduction , properties and use of: Conventional and modern water proofing materials, conventional and modern insulating materials(thermal, sound and electrical insulating materials).Concept of polymer floor finishes. 8

Text Book:

- 1) Ghambhir M.L."Concrete Technology" Tata McGraw Hill education private Limited.
- 2) A.R. Santhakumar, Concrete Technology, Oxford University Press.
- 3) Building Materials, P.C. Varghese, Prentice-Hall India.
- 4) Shetty, M. S., "Concrete Technology" S. Chand Publication.

Reference Book:

- 1) Krishnaraju .N., Advanced Concrete Technology, CBS Published.
- 2) Materials Science and Engineering: An introduction, W.D. Callister, John Wiley.
- 3) Nevile. A.M., Concrete Technology, Prentice Hall, Newyork.
- 4) Dr. U. K. Shrivastava, Building Materials Technology, Galgotia Publication pvt.ltd.
- 5) Materials Science and Engineering, V. Raghavan, Prentice Hall.
- 6) Properties of Engineering Materials, R.A. Higgins, Industrial Press.
- 7) Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J.Domone, 3rd ed., Spon Press.
- 8) The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall.
- 9) Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann.

CE – 6055
GEO-ENVIRONMENTAL ENGINEERING

L T P
3 0 0

UNIT-1

Fundamentals of Geoenvironmental Engineering : Scope of geoenvironmental engineering - multiphase behaviour of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on geoenvironment - case histories on geoenvironmental problems. 8

UNIT-2

Soil-Water-Contaminant Interaction : Soil mineralogy characterization and its significance in determining soil behaviour – soil-water interaction and concepts of double layer, forces of interaction between soil particles, concepts of unsaturated soil, water flow in saturated and unsaturated zone, soil-water-contaminant interactions and its implications, factors effecting retention and transport of contaminants. 8

UNIT-3

Waste Containment System : Evolution of waste containment facilities and disposal practices, Site selection based on environmental impact assessment ,different role of soil in waste containment, different components of waste containment system and its stability issues, property evaluation for checking soil suitability for waste containment . 8

UNIT-4

Contaminant Site Remediation : Site characterization, risk assessment of contaminated site, remediation methods for soil and groundwater, selection and planning of remediation methods. 8

UNIT-5

Advanced Soil Characterization : Contaminant analysis, water content and permeability measurements, electrical and thermal property evaluation, use of GPR for site evaluation, introduction to geotechnical centrifuge modeling. 8

Text Boos :

1. Yong, R. N., "Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York, 2001.
2. Mitchell, J. K., "Fundamentals of Soil Behaviour" Wiley, 2005.
3. Hillel D., "Introduction to Environmental Soil Physics" Academic Press, New York, 2003.

Reference Books :

1. O.P. Gupta, Elements of Environmental Chemistry, Khanna Publishing House
2. Alvarez-Benedi J. and Munoz-Carpena, R., "Soil-Water-Solute Process Characterization: An Integrated Approach" CRC Press.
3. Berkowitz, B. Dror, I. and Yaron, B., "Contaminant Geochemistry" Springer..
4. Mohamed, A. M. O., "Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, NY.
5. O P Gupta, Elements of land and soil pollution, Khanna Publishing House