

FIFTH SEMESTER		CIVIL ENGINEERING				Th/Lab Marks		Sessional		Total	Credit
Sl. No.	Subject Code	Subject Name	Department	L-T-P	ESE	CT	TA				
1		MANEGRIAL ECONOMICS	Applied Science	3-0-0	70	20	10	100	3		
2		SOCIOLOGY /CYBER SECURITY	Applied Science	3-0-0	70	20	10	100	3		
3		GEOTECHNICAL ENGINEERING	Core Deptt.	3-0-0	70	20	10	100	3		
4		DESIGN OF STRUCTURE-I	Core Deptt.	3-1-0	70	20	10	100	4		
5		QUANTITY ESTIMATION AND MANAGEMENT	Core Deptt.	3-0-0	70	20	10	100	3		
6		DEPTT ELECTIVE COURSE-1	Core Deptt.	3-1-0	70	20	10	100	4		
7		GEOTECHNICAL ENGINEERING LAB	Core Deptt.	0-0-2	50		50	100	1		
8		CAD LAB-1	Core Deptt.	0-0-2	50		50	100	1		
9		CONCRETE LAB	Core Deptt.	0-0-2	50		50	100	1		
10		CONSTRUCTION MANAGEMENT LAB	Core Deptt.	0-0-2	50		50	100	1		
TOTAL					620	120	260	1000	24		

SIXTH SEMESTER		CIVIL ENGINEERING				Th/Lab Marks		Sessional		Total	Credit
Sl. No.	Subject Code	Subject Name	Department	L-T-P	ESE	CT	TA				
1		INDUSTRIAL MANAGEMENT	Applied Science	3-0-0	70	20	10	100	3		
2		CYBER SECURITY/SOCIOLOGY	Applied Science	3-0-0	70	20	10	100	3		
3		DESIGN OF STRUCTURE-II	Core Deptt.	3-0-0	70	20	10	100	3		
4		ENVIRONMENTAL ENGINEERING	Core Deptt.	3-1-0	70	20	10	100	4		
5		TRANSPORTATION ENGINEERING	Core Deptt.	3-0-0	70	20	10	100	3		
6		DEPTT ELECTIVE COURSE-2	Core Deptt.	3-1-0	70	20	10	100	4		
7		ENVIRONMENTAL ENGINEERING LAB	Core Deptt.	0-0-2	50		50	100	1		
8		CAD LAB-2	Core Deptt.	0-0-2	50		50	100	1		
9		STRUCTURAL DETAILING LAB	Core Deptt.	0-0-2	50		50	100	1		
10		TRANSPORTATION ENGINEERING LAB	Core Deptt.	0-0-2	50		50	100	1		
TOTAL					620	120	260	1000	24		

DEPTT ELECTIVE COURSE-1

- MODERN CONSTRUCTION MATERIALS
- CONCRETE TECHNOLOGY
- GEOENVIRONMENTAL ENGINEERING

DEPTT ELECTIVE COURSE-2

- FOUNDATION DESIGN
- INTEGRATED WASTE MANAGEMENT FOR A SMART CITY
- GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

SEVENTH SEMESTER

CIVIL ENGINEERING

Sl. No.	Subject Code	Subject Name	Department	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		OPEN ELECTIVE COURSE -1	Other Dept	3-0-0	70	20	10	100	3
2		DEPTT ELECTIVE COURSE-3	Core Deptt	3-0-0	70	20	10	100	3
3		DEPTT ELECTIVE COURSE-4	Core Deptt	3-1-0	70	20	10	100	4
4		DESIGN OF STRUCTURE-III	Core Deptt	3-1-0	70	20	10	100	4
5		WATER RESOURCES	Core Deptt	3-0-0	70	20	10	100	3
6		NON DESTRUCTIVE TESTING LABORATORY	Core Deptt	0-0-2	50		50	100	1
7		MINI PROJECT	Core Deptt	0-0-2	50		50	100	1
8		INDUSTRIAL TRAINING	Core Deptt	0-0-3			100	100	2
9		PROJECT-1	Core Deptt	0-0-6			200	200	3
TOTAL					450	100		1000	24

EIGHTH SEMESTER

CIVIL ENGINEERING

Sl. No.	Subject Code	Subject Name	Department	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		OPEN ELECTIVE COURSE-2	Other Dept	3-0-0	70	20	10	100	3
2		DEPTT ELECTIVE COURSE-5	Core Deptt	3-1-0	70	20	10	100	4
3		DEPTT ELECTIVE COURSE-6	Core Deptt	3-0-0	70	20	10	100	3
4		SEMINAR	Core Deptt	0-0-3			100	100	2
5		PROJECT-2	Core Deptt	0-0-12	350		250	600	12
TOTAL					560	60	380	1000	24

OPEN ELECTIVE COURSE-1

ENVIRONMENTAL ENGINEERING

REMOTE SENSING

GREEN BUILDING

OPEN ELECTIVE COURSE-2

BASICS OF CIVIL ENGINEERING

SMART CITIES

DISASTER MANAGEMENT

DEPTT ELECTIVE COURSE-3

COMPUTATIONAL FLUID DYNAMICS

GEOLOGY AND SOIL MECHANICS

DEPTT ELECTIVE COURSE-4

RAILWAY, AIRPORT AND WATERWAYS

AIR AND NOISE POLLUTION

RURAL DEVELOPMENT ENGINEERING

EARTHA RETAINING STRUCTURES

DEPTT ELECTIVE COURSE-5

PROBABILITY METHODS IN CIVIL ENGINEERING

STRUCTURAL DYNAMICS

DEPTT ELECTIVE COURSE-6

PRESTRESSED CONCRETE DESIGN

ENGINEERING HYDROLOGY AND GROUNDWATER MANAGEMENT

URBAN TRANSPORTATION SYSTEM AND PLANNING

FINITE ELEMENT METHOD

B.Tech Vth Semester, CE w.e.f. 2018-19

GEOTECHNICAL ENGINEERING

Unit 1

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system.

Unit 2

Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping;

Unit 3

Soil compaction, water content – dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method.

Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation, Contact pressure

Unit 4

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients. Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and $c-\phi$ soils, inclined backfill, Graphical methods of earth pressure determination, Stability of slopes, Culman method & Method of slices, Stability number & chart.

Unit 5

Sub surface structure: Bearing capacity of shallow foundations, SPT, Plate load test; Effect of water table.

Deep foundations: Types of piles, Static and dynamic formulae, Pile group, Settlement of Pile Group, Negative skin friction.

Text & References Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
3. Narasinga Rao, B.N.D, "Soil Mechanics & Foundation Engineering", John Wiley & Sons, Wiley India Pvt. Ltd., Daryaganj, New Delhi – 110 002.
4. Alam Singh – Modern Geotechnical Engineering
5. Brij Mohan Das – Geotechnical Engineering, CENGAGE Learning

6. I.H. Khan – Text Book of Geotechnical Engineering
7. C. Venkataramaiah – Geotechnical Engineering
8. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
9. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics
10. P. Purushottam Raj- Soil Mechanics and Foundation Engineering, Pearson Education in South Asia, New Delhi.
11. Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
12. Gulati, S.K., “Geotechnical Engineering” McGraw Hill Education (India), Pvt. Ltd., Noida.

DESIGN OF STRUCTURE 1

Unit – 1

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

Unit – 2

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

Unit – 3

Introduction to Suspension Bridges, Analysis of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders.

Unit – 4

Basic Force and Displacement Matrix method for analysis of beams, frames and trusses.

Unit – 5

Basics of Plastic Analysis. Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Single Storied Frames.

References:

1. Jain, A. K., "Advanced Structural Analysis", Nem Chand & Bros., Roorkee.
2. Hibbeler, R.C., "Structural Analysis", Pearson Prentice Hall, Sector - 62, Noida-201309
3. C. S. Reddy "Structural Analysis", Tata Mc Graw Hill Publishing Company Limited, New Delhi.
4. Timoshenko, S. P. and D. Young, "Theory of Structures", Tata Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
5. Dayaratnam, P. "Analysis of Statically Indeterminate Structures", Affiliated East-West Press.
6. Wang, C. K. "Intermediate Structural Analysis", Mc Graw-Hill Book Publishing Company Ltd.
7. Thandavamoorthy, T.S., "Structural Analysis" Oxford University Press, New Delhi.
8. Martin, H. C. "Introduction to Matrix Methods of Structural Analysis", Mc-Graw Hill Book Publishing Company Ltd, New Delhi.
9. Mau, "Introduction to Structural Analysis" CRC Press Taylor & Francis Group.
10. Ghali, "Structural Analysis: A Unified Classical and Matrix Approach" 5/e, CRC Press Taylor & Francis Group.
11. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
12. Vazirani & Ratwani et al, "Analysis of Structures", Khanna Publishers
13. Coates, RC, Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson, 1980.
14. SP Gupta & Gupta "Theory of Structure Vol.1 & 2" TMH
15. DS Prakash Rao "Structural Analysis: A Unified Approach" Universities Press.
16. S Ramamurtham "Theory of Structure" Dhanpat Rai.

17. Devdas Menon "Advanced Structural Analysis" Narosa
18. Hsieh, "Elementary Theory of Structures" 4/e, Pearson Education, Noida.
19. Mckenzie, "Examples in Structural Analysis" 2/e, CRC Press Taylor & Francis Group.
20. Jacques Heyman, "Structural Analysis" Cambridge University Press.

QUANTITY ESTIMATION & MANAGEMENT

UNIT I: QUANTITY ESTIMATION FOR BUILDINGS

Measurement units for various building materials, Centreline method, Long and short wall method of estimates, PWD schedule rate, Delhi schedule rate.

UNIT II: RATE ANALYSIS, SPECIFICATION AND TENDERS

Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc, Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items.

UNIT III: ELEMENTS OF MANAGEMENT & NETWORK TECHNIQUES

Project cycle, Organization, planning, scheduling, monitoring, updating and management system in construction, Bar charts, milestone charts, work break down structure and preparation of networks. Network Techniques like PERT & CPM in construction management. Project monitoring and resource allocation through network techniques.

UNIT IV: EQUIPMENT MANAGEMENT

Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, earth compaction, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Concrete Production Equipment, Tunneling Equipment

UNIT V: PROJECT COST MANAGEMENT

Budgeting, Cost planning, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope. Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison, present worth method Equivalent annual cost method, discounted cash flow method, Depreciation and break even cost analysis.

References:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
2. Srinath, L.S., "PERT and CPM Principles and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
3. Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004
4. Construction Management by Ojha
5. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.

6. Construction Technology By Sarkar, Oxford
7. Delhi Schedule of Rates (latest version)

GEOTECHNICAL ENGINEERING LAB

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remolded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remolded soil sample by an oedometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Tri-axial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

Note: Any 8 experiments are to be performed from the list of experiments.

References:

1. Bowles, Joseph E., "Engineering Properties of Soil and Their Measurement" Fourth Edition, Indian Edition, McGraw Hill Education (India) Pvt. Ltd, New Delhi-110032.

CAD LAB 1

1. Working on Latest Version of ANALYSIS SOFTWARE LIKE ANSYS , ADINA , NISA, MATLAB
2. Working on Latest Version of DESIGN SOFTWARE LIKE STAAD PRO / STRUDS / SAP / ETAB / STRAP
3. Working on Latest Version of GEOTECHNICAL SOFTWARES like GEO-5 / PLAXIS

CONCRETE LAB

1. Study of IS codes for (i) Aggregates (ii) Cements (iii) Admixtures (iv) Fly ash
2. Concrete Mix design computation by ACI 211.1-91 method, IS code method as per 10262- 2007 & 456-2000, DOE method for given sample.
3. Preparation and testing of samples as per any one of the above mentioned computations (Minimum grade of concrete is M30)
4. Tests on Concrete- (a) Workability tests - Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test. (b) Strength tests- compressive strength, flexural strength, split tensile strength.
5. Effects of Admixture - Accelerator, Retarder, Super Plasticizer.
6. Nondestructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test.

References:

1. Concrete Technology – A.M. Neville & J.J.Brooks , Pearson
2. Concrete Technology Theory & Practice-M.S. Shetty, S.Chand Publishers
3. Concrete Technology Theory & Practice-M.L. Gambhir, TMH Publishers
4. IS:10262-2009-Concrete Mix Proportioning Guidelines

CONSTRUCTION MANAGEMENT LAB

1. Estimation of quantities for any one of the following: Building/ Septic tank/Water supply pipe line/road/bridge.
2. Preparation of Bill of Quantities (BOQ) for above project.
3. Practice of MS Project/Primaveera software for same problem.
4. Study of any full set of tender documents (Institute shall provide the set from ongoing/ completed tenders).

These exercises will be done through use of software and spread in 8-10 classes.

References:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
2. Srinath, L.S., "PERT and CPM Principals and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
3. Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004
4. Construction Management by Ojha
5. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.
6. Construction Technology By Sarkar, Oxford
7. Delhi Schedule of Rates (latest version)

B.Tech Vth Semester, CE w.e.f. 2018-19

DESIGN OF STRUCTURE 2

Unit – 1

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method.

Unit – 2

Behavior 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.

Unit – 3

Design of one way, One way continuous and cantilever solid slabs by Limit State Design Method, Design of RCC staircases.

Design of lintels and chajjas. Design of two way slabs by limit state method, Serviceability Limit States, Control of deflection, cracking and vibrations.

Unit – 4

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.

Unit – 5

Structural behavior of footings, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings.

Structural behavior of retaining wall, stability of retaining wall against overturning and sliding, Design of cantilever retaining wall by Limit State Method.

References

1. IS: 456 – 2000.
2. Reinforced Concrete Design by S. U. Pillai & D. Menon, Tata Mc.- Graw, New Delhi
3. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.
4. Reinforced Concrete Vol. - II by H.J. Shah, Charotar Publisher, Gujarat.
5. RCC Designs (Reinforced Concrete Structures) by B.C. Punmia, Ashoka Kumar Jain and Arun Kumar Jain, Laxmi Publishers, New Delhi.
6. Reinforced Concrete Structures by R. Park and Pauley.
7. Reinforced Concrete Design by P. Dayaratnam.
8. Reinforced Concrete Design by M.L. Gambhir
9. Reinforced Concrete Design by S.N. Sinha, TMH
10. Plain and Reinforced Concrete Vol. I & II by O.P. Jain & Jai Krishna, Nem Chand & Bros.
11. SP-16: Design Aid to IS- 456.

ENVIRONMENTAL ENGINEERING

Unit-1

Fresh Water, Water demands, variation in demands, population forecasting by various methods, basic needs and factors affecting consumption, design period.

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.

Unit-2

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, Concept of service and balancing reservoirs.

Capacity of distribution reservoirs; general design guidelines for distribution system.

Unit-3

Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. Quality requirements, standards of water and waste water. Disposal of wastewater on land and water bodies.

Unit-4

Objectives of Water treatment: unit operations, processes, and flow sheets.

Water Treatment: Screening, Sedimentation, Determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber.

Primary sedimentation and coagulation. Filtration: Theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters.

Disinfection: Requirements of an ideal disinfectant; various disinfectants, chlorination and practices of chlorination. Water softening and ion exchange.

Unit-5

Objectives of Waste water treatment: unit operations, processes, and flow sheets

Secondary and Tertiary Treatment: Secondary sedimentation and Theory of organic matter removal. Activated sludge process, design of different units. Working of Trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, Rotating biological contactors (RBC).

Anaerobic digestion of sludge: Design of low and high rate anaerobic digesters and septic tank. Upflow anaerobic sludge blanket (UASB) reactor. Other emerging technologies for wastewater treatment

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. Garg, S.K.: Water Supply Engineering (Environmental Engineering Vol. – I)
4. Garg, S.K.: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol.–II).
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).
5. Davis, M.L. & Cornwell, D.A.: Introduction to Environmental Engineering, Mc-Graw Hill.

References:

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
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Hammer and Hammer Jr.: Water and Wastewater Technology
6. Raju: Water Supply and Wastewater Engineering
7. Rao: Textbook of Environmental Engineering
8. Davis and Cornwell: Introduction to Environmental Engineering
9. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
10. Punmia: Water Supply and Wastewater Engineering Vol. I and II
11. Birdie: Water Supply and Sanitary Engineering
12. Ramalho: Introduction to Wastewater Treatment Processes
13. Davis Mackenzie L., Cornwell, David A., "Introduction to Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., New Delhi.
14. Birdie: Water Supply and Sanitary Engineering
15. Ramalho: Introduction to Wastewater Treatment Processes
16. Parker: Wastewater Systems Engineering

TRANSPORTATION ENGINEERING

UNIT-1

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

Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location,

UNIT-2

Geometric Design(IRC:73-Latest revision): Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves.

UNIT-3

Traffic Engineering: Traffic Characteristics, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, traffic capacity, density, traffic control devices: signs, Island, signal design by Webster's and IRC method . Intersection at grade and grade separated intersections, design of roundabouts as per IRC:65-2017. Highway capacity and level of service of rural highways and urban roads as per latest IRC recommendation

UNIT-4

Highway Materials: Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications, Design of Highway Pavement : Types of Pavements, Design factors, Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015)

UNIT-5

Highway Construction: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB), Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Semi dense bituminous concrete (SDBC) and Bituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction, Roller Compacted Concrete Roads.

Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section

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.

References:

1. Kadiyali L. R., & Lal, N.B. "Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)", Khanna Publications, Delhi – 110 006
2. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributors, 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. Chakraborty Partha & Das Animesh., "Principles of Transportation Engineering", Prentice Hall (India), New Delhi,
6. IRC : 37- Latest revision, "Tentative Guidelines for the design of Flexible Pavements" Indian Roads Congress, New Delhi
7. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (with CD)
8. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (First Revision)
9. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban) Highways
10. IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas
11. IRC:93-1985 Guidelines on Design and Installation of Road Traffic Signals.
12. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (First Revision)
13. IRC: SP: 68-2005, "Guidelines for Construction of Roller Compacted Concrete Pavements", Indian Roads Congress, New Delhi.
14. IRC: 15-2002, "Standard Specifications and Code of Practice for construction of Concrete Roads" Indian Roads Congress, New Delhi.
15. MORTH, "Specifications for Road and Bridge Works", Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, New Delhi.

ENVIRONMENTAL ENGINEERING LAB

1. Determination of turbidity and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of MPN (most probable number) of coliforms.
6. Measurement of SPM and PM10 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.

13. Determination of optimum dose of coagulants by Jar Test Apparatus.

14. Field Visit of Water/ Sewage Treatment Plant of a nearby area.

Note: 1. Experiment at S.NO. 14 is mandatory.

2. Any 8 Experiments out of the S.NO 1 to 13 are to be performed.

References:

1. A.P.H.A. “Standard Methods for the Examination of Water and Wastewater”, American Public Health Association.

2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. “Chemistry for Environmental Engineering”, Mc-Graw Hill.

3. Mathur, R.P. “Water & Wastewater Testing”, Lab Manual, Roorkee.

CAD LAB 2

1. Working on Latest Version of Environmental Engineering software for Analysis and Design of water & wastewater treatment and distribution systems (WATER CAD / SEWER CAD / WATER GEM / SEWER GEM / LOOP)

2. Working on Latest Version of Transportation Engineering software like MAX ROAD/ Surveying Software.

3. Working on Latest Version of GIS software (ARC GIS / ENVI / GEPSY)

STRUCTURAL DETAILING LAB

1. Study of SP34/IS13920/IS456:2000 for detailing of structural elements.

2. Preparation of working hand sketches and Auto CAD drawings for the following-

- RC Beams- Simply supported, Continuous, Cantilever
- T – beam / L-beam floor
- Slabs – Simply supported, Continuous, One way and two way slabs.
- Columns – Tied Columns and Spirally reinforced columns.
- Isolated footings for RC Columns.
- Combined rectangular and trapezoidal footings.

3. Preparation of bar bending schedule

4. Detailing of Buildings with respect to Earthquake Resistant Design

5. Study of full set of structural drawing of a building as made available by Institute.

References: Krishna Raju N., “Structural Design and Drawing” University Press (India), Pvt.Ltd., Hyderabad.

TRANSPORTATION ENGINEERING LAB

1. To Determine the Crushing Value of Coarse Aggregates.

2. To Determine the Impact Value of Coarse Aggregates.

3. To determine the Flakiness Index and Elongation Index of Coarse Aggregates.

4. To determine the Los Angeles Abrasion Value of Coarse Aggregates.
5. To determine the Stripping Value of Coarse Aggregates.
6. To determine the penetration Value of Bitumen.
7. To determine the Softening Point of Bituminous material.
8. To determine the Ductility Value of Bituminous material.
9. To determine the Flash and Fire Point of Bituminous material.
10. To determine the Stripping Value of Bituminous material.
11. Classified both directional Traffic Volume Study.
12. Traffic Speed Study. (Using Radar Speedometer or Enoscope).
13. Determination of CBR Value of soil sample in the Lab or in Field.

Note: A minimum of 8 experiments are to be performed from the list of Experiments.

References:

1. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee- 247 667.
2. Gambhir, M.L., Jamwal, Neha," Lab Manual: Building and Construction Materials, Testing and Quality Control" McGraw Hill Education (India), Pvt.Ltd., Noida.
3. Duggal, Ajay K., Puri, Vijay P.," Laboratory Manual in Highway Engineering" New Age International (P) Limited, Publishers, New Delhi.
4. Sood Hemant, Mittal, L.N., Kulkarni,P.D., " Laboratory Manual on Concrete Technology" CBS Publishers & Distribiters Pvt. Ltd. New Delhi.