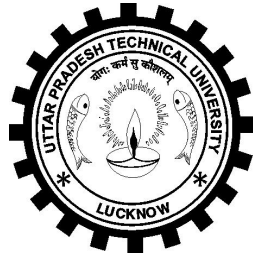


**U. P. TECHNICAL UNIVERSITY,  
IET CAMPUS, SITAPUR ROAD, LUCKNOW- 226 021**



**COURSE STRUCTURE AND SYLLABUS  
(EFFECTIVE FROM Session: 2015-16)**

**B.Tech. (Civil Engineering)**

**Third Year (5th & 6th Semester)**

JULY 10, 2015

U.P. TECHNICAL UNIVERSITY, LUCKNOW  
STUDY & EVALUATION SCHEME  
B. Tech. Civil Engineering  
(Effective from the session – 2015-16)

Third Year, 5th Semester

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			ESE		
			L	T	P	CT	TA	Total			
<b>THEORY SUBJECTS</b>											
1	NHU 501	Engineering Economics	2	0	0	15	10	25	50	75	2
2	NCE 501	Geotechnical Engineering	3	1	0	30	20	50	100	150	4
3	NCE 502	Transportation Engineering-1	3	1	0	30	20	50	100	150	4
4	NCE 503	Environmental Engineering-1	2	1	0	15	10	25	50	75	3
5	NCE 504	Structural Analysis-2	3	1	0	30	20	50	100	150	4
6	NCE 505	Design of Concrete Structure-1	3	1	0	30	20	50	100	150	4
<b>PRACTICAL/DRAWING/DESIGN</b>											
7	NCE 551	Geotechnical Engineering Lab	-	-	3	10	10	20	30	50	1
8	NCE 552	Transportation Engineering Lab	-	-	3	10	10	20	30	50	1
9	NCE 553	CAD Lab-1	-	-	3	10	10	20	30	50	1
10	NCE 554	Estimation Costing & Valuation			3	10	10	20	30	50	1
11	NGP 501	General Proficiency	-	-	-	-	-	50	-	50	
		<b>TOTAL</b>	<b>16</b>	<b>5</b>	<b>12</b>					<b>1000</b>	<b>25</b>

U.P. TECHNICAL UNIVERSITY, LUCKNOW  
STUDY & EVALUATION SCHEME  
B. Tech. Civil Engineering  
(Effective from the session – 2015-16)

Third Year, 6th Semester

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			ESE		
			L	T	P	CT	TA	Total			
<b>THEORY SUBJECTS</b>											
1	NHU 601	Industrial Management	2	0	0	15	10	25	50	75	2
2	NCE 601	Design of Concrete Structure-2	3	1	0	30	20	50	100	150	4
3	NCE 602	Environmental Engineering-2	3	1	0	30	20	50	100	150	4
4	NCE 603	Construction Technology & Management	3	1	0	30	20	50	100	150	4
5	NCE 011 -014	Departmental Elective-1	3	1	0	30	20	50	100	150	4
6	NCE 021-024	Departmental Elective-2	2	1	0	15	10	25	50	75	3
<b>PRACTICAL/DRAWING/DESIGN</b>											
7	NCE 651	Structural Detailing Lab	0	0	3	10	10	20	30	50	1
8	NCE 652	Environmental Engineering Lab	0	0	3	10	10	20	30	50	1
9	NCE 653	CAD Lab-2	0	0	3	10	10	20	30	50	1
10	NCE 654	Survey Camp*	0	0	0	0	0	50	-	50	1
11	NGP 601	General Proficiency	0	0	0	0	0	50	-	50	
		<b>TOTAL</b>	<b>16</b>	<b>5</b>	<b>9</b>					<b>1000</b>	<b>25</b>

Note:\*The teaching load of survey camp will be counted as equivalent to 0-0-3.

**Departmental Elective -1 (Full Unit Course with Credit: 4)**

Sl.No.	Code and Course
5 (A)	NCE 011 – Advanced Foundation Design
5 (B)	NCE 012 – Matrix Analysis of Structures
5 (C)	NCE 013 – Environmental Management for Industries
5 (D)	NCE 014 – Principals of Town Planning and Architecture

**Departmental Elective – 2 (Half Unit Course with Credit: 3)**

Sl.No.	Code and Course
6 (A)	NCE 021 – Advanced Concrete Design
6 (B)	NCE 022 – Earth and Earth Retaining Structure
6 (C)	NCE 023 – Transportation System and Planning
6 (D)	NCE 024 – Rural Water supply and Sanitation

## **5.2 NCE – 501: GEOTECHNICAL ENGINEERING**

**L– 3, T– 1, P- 0  
CT–30, TA–20, ESE -100**

### **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, Particle size analysis, Soil classification.**

### **UNIT – 2**

**Soil Hydraulics: Modes of occurrence of water in soil. Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Bernaulli's equation, Darcy's Law, hydraulic conductivity, laboratory determination of hydraulic conductivity, equivalent hydraulic conductivity in stratified soil.**

**Seepage- Laplace equation of continuity, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, critical hydraulic gradient and quick sand condition.**

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

### **UNIT – 3**

**Stresses in soils: Normal and shear Stresses on a plane, Stresses due to applied loads, Boussinesq's solution for a point load, line load, strip load, uniformly loaded circular and rectangular areas, Isobar and pressure bulb concept, stress distribution on horizontal and vertical planes, Newmark's chart and its application, contact pressure.**

**Consolidation: Consolidation and compaction, 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, consolidation under construction loading.**

### **UNIT – 4**

**Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; vane shear test; sensitivity and thixotropy; pore pressure, Skempton' s pore pressure coefficients. Earth pressure: Classical theories, Coulomb and Rankine approaches for frictional and  $c-\phi$  soils, Smooth and rough walls, Inclined backfill, graphical methods of earth pressure determination. Types of retaining structures.**

### **UNIT – 5**

**Characterization of ground, site investigations, groundwater level, methods of drilling, sampling, in situ tests, SPT, CPT, DCPT.**

**Sub-Structures: Introduction to foundations- types and differences; choice; loads; design philosophies.**

**Bearing capacity of shallow foundations; modes of failures; corrections for size, shape, depth and eccentricity; provisions of IS code of practice. Introduction to deep foundations.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

#### **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.

### **5.3NCE – 502: TRANSPORTATION ENGINEERING-I**

L-3, T-1, P-0

CT-30, TA-20, ESE-100

#### **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, NHAI Act (1988), Road Development Plan Vision: 2021 documents, Expressway Master Plan, Features of PMGSY.**

#### **UNIT-2**

**Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location, Preparation of Detailed Project Report (DPR)**

**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.**

### **UNIT-3**

**Traffic Engineering: Traffic Characteristics, traffic volume and speed study, traffic capacity, density, traffic control devices, signs, signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection**

### **UNIT-4**

**Highway Materials: Road Construction materials : Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications,**

**Design of Highway Pavement : Types of Pavements, Design factors, Design of Flexible Pavement by CBR method (IRC : 37-2012), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2011)**

### **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: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ•**

#### **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:**

- 3. Kadiyali L. R., & Lal, N.B. “Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)”, Khanna Publications, Delhi – 110 006**
- 4. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributers, New Delhi**
- 5. Kumar, R Srinivasa, “A Text book of Highway Engineering”, Universities Press, Hyderabad.**
- 6. Kumar, R Srinivasa, “Pavement Design”, Universities Press, Hyderabad.**
- 7. Chakraborty Partha & Das Animesh., “Principles of Transportation Engineering”, Prentice Hall (India), New Delhi,**
- 8. IRC : 37-2012, “Tentative Guidelines for the design of Flexible Pavements” Indian Roads Congress, New Delhi**

9. IRC: SP:68-2005, “Guidelines for Construction of Roller Compacted Concrete Pavements”, Indian Roads Congress, New Delhi.
10. IRC: 58-2011, “Guidelines for The design of Plain Jointed Rigid Pavements for Highways”, Indian Roads Congress, New Delhi.
11. IRC: 15-2002, “Standard Specifications and Code of Practice for construction of Concrete Roads” Indian Roads Congress, New Delhi.
12. MORTH, “Specifications for Road and Bridge Works”, Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, New Delhi.

## **5.4 NCE – 503 ENVIRONMENTAL ENGINEERING – I**

**L – 2, T – 1, P -0  
CT – 15, TA – 10, ESE – 50**

### **Unit-1**

**Water supply: Water demands and domestic use, variation in demands; population forecasting by various methods using logistic curve method; basic needs and factors affecting consumption; design period. Sources of water and their characteristics, quality of surface and ground waters; factors governing the selection of a source of water supply; intakes structures and their design, determination of the capacity of impounding reservoir.**

### **Unit-2**

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

### **Unit-3**

**Capacity of distribution reservoirs; general design guidelines for distribution system, Hardy - Cross method, equivalent pipe method of pipe network analysis. Plumbing systems in buildings and houses: water connections, different cocks and pipe fittings.  
Wastewater collection: Systems of sanitation and wastewater collection, estimation of wastewater flows and variations in wastewater flows.  
Storm water: Collection and estimation of storm water by different formulae.**

### **Unit-4**

**Flow in sewers: 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.  
Air Pollution: Definition, Sources, Classification of air Pollutants, National ambient**

air quality standards, Lapse rate, Inversion, Plume behavior, Acid rain, Vehicular emission and its standards.

**Note:** The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ•

**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).
5. Seinfeld, J.H. and Pandis, S.N. “Atmospheric Chemistry and Physics: From Air Pollution to Climate Change”, John Wiley
6. <http://cpcb.nic.in/>, National ambient air quality standards, Central Pollution Control Board, Ministry of Environment and Forest, Government of India.

**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.



## 5.5 NCE - 504: STRUCTURAL ANALYSIS-2

L-3, T -1, P-0

CT- 30, TA- 20, ESE- 100

### 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.

### 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.

### 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.

### Unit – 4

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

### Unit – 5

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

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\*

#### Text Books & 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. Jain, O. P. and B. K. Jain, "Theory and Analysis of Structures", Vol. I & II, Nem Chand & Bros., Roorkee.
5. Timoshenko, S. P. and D. Young, " Theory of Structures" , Tata Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
6. Dayaratnam, P. " Analysis of Statically Indeterminate Structures", Affiliated East-West Press.
- 7.

8. Wang, C. K. “ Intermediate Structural Analysis”, Mc Graw-Hill Book Publishing Company Ltd.
9. Thandavamoorthy, T.S., “Structural Analysis” Oxford University Press, New Delhi.
10. Martin, H. C.” Introduction to Matrix Methods of Structural Analysis”, Mc-Graw Hill Book Publishing Company Ltd, New Delhi..

5.6 NCE - 505: DESIGN OF CONCRETE STRUCTURE-1

L -3, T -1, P-0

CT – 30, TA – 20, ESE - 100

#### **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.

#### **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.

#### **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.

#### **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.

#### **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.

#### **Note:**

1. All designs shall be conforming to IS: 456 – 2000.
2. The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ•

#### **Text Books & References:**

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. Gambhir, M L ,”Fundamentals of Reinforced Concrete”, Prentice Hall of India.
4. Unnikrishna Pillai, S. & D. Menon, “ Reinforced Concrete Design”, Tata Mc-Graw Hill Company Limited.
5. Jain, O. P. & Jai Krishna, “ Plain and Reinforced Concrete”, Vol. I & II, Nem Chand & Bros., Rookee.
6. Park, R. and T. Pauley,” Reinforced Concrete Structures”, John Wiley & Sons.
7. Dayaratnam, P,”Reinforced Concrete Design”, Oxford & IBH.
8. Sinha, S.N., “Reinforced Concrete Design” Mc-Graw Hill Book Publishing Company Ltd., New Delhi
9. Subramanian, N.,”Design of Reinforced Concrete Structures”, Oxford University Press,New Delhi – 110 001.

#### **5.7NCE – 551: GEOTECHNICAL ENGINEERING LAB**

L-0, T-0, P-3  
CT-10, TA-10, ESE-30

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. Classify the soil as per the IS 1498- 1970 based on the results obtained from experiments at serial nos. 5 & 6 (grain size distribution and consistency limits).
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.**

### **5.8NCE – 551: TRANSPORTATION ENGINEERING LAB**

**L-0, T-0, P-3**

**CT-10, TA-10, ESE-30**

#### **LIST OF EXPERIMENTS**

- 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.

#### **5.9NCE - 553: CAD LAB I**

**L-0, T-0, P-3  
CT-10, TA-10, ESE-30**

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

#### **5.10 NCE - 553: ESTIMATION COSTING & VALUATION**

**L-0, T-0, P-3  
CT-10, TA-10, ESE-30**

1. Method of Estimation: General items of works for estimates, units and measurement, method of accounting for the deduction of openings etc.
2. Detailed estimates of a single roomed and a two roomed residential building.
3. Analysis of rates: Definition of analysis of rates, Prime cost, and work charged establishment.
4. Quantity of materials per unit of works for major Civil Engineering items. Resource planning through analysis of rates, market rates.
5. PWD scheduled and cost indices for building material and labour.
6. Valuation: Purpose of Valuation, Market Value, Book Value, Rateable Value, Capital Cost, Capilized Value, Ideal investment, Sinking fund, Depreciation, Straight Line method, sinking fund method, quantity survey method, Valuation of building, rent fixation.

#### **References:**

1. Dutta, B.N., “Estimation and Costing in Civil Engineering (Theory and Practice)”, UBS Publishers Distributers Private Ltd., New Delhi.
2. Singh, Gurucharan, Singh Jagadish, “A Text book of Estimation Costing and Valuation” Standard Publishers Distributers, Delhi -110006.
3. Peurifoy, Robert L., Oberlender, Garold D., “Estimating Construction Costs” Tata Mc Graw Hill Education Pvt. Ltd., New Delhi.

## 6.2 NCE- 601 DESIGN OF CONCRETE STRUCTURE II

L -3, T -1, P-0

CT – 30, TA – 20, ESE - 100

### 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).

### 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, Design of strap footing.

### 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, Design of R.C. slab culvert.

### 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.

### Unit – 5

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

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\*

### Text Books & References

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. Dayaratnam, P, “Limit State Design of Reinforced Concrete Structures” Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Gambhir, M L ,”Fundamentals of Reinforced Concrete”, Prentice Hall of India.
5. Unnikrishna Pillai, S. & D. Menon, “ Reinforced Concrete Design”, Tata Mc-Graw Hill Company Limited.
6. Jain, O. P. & Jai Krishna, “ Plain and Reinforced Concrete”, Vol. I & II, Nem Chand & Bros., Rookee.
7. Park, R. and T. Pauley,” Reinforced Concrete Structures”, John Wiley & Sons.
8. Dayaratnam, P,”Reinforced Concrete Design”, Oxford & IBH.

## 6.3 NCE-602: ENVIRONMENTAL ENGINEERING – 2

L – 3, T –1, P-0

CT – 30, TA – 20, ESE - 100

### Unit-1

**Introduction:** Beneficial uses of water and quality requirements, standards. Concepts of water and wastewater quality: physical, chemical and bacteriological examination of water and wastewater, Water borne diseases and their control.

**Wastewater characteristics:** Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. **Objectives of treatment:** Water and wastewater treatment, unit operations and processes and flow sheets.

**Disposal of wastewater on land and in water bodies, Recycling and Reuse of wastewater.**

### Unit-2

**Screen, Sedimentation:** Determination of settling velocity, efficiency of ideal sedimentation tank, short circuiting; different classes of settling; design of settling tanks; removal efficiency for discrete and flocculent settling.

**Coagulation:** Mechanisms of coagulation, coagulants and their reactions, coagulant aids; design of flocculators and clariflocculators. **Adsorption.**

### Unit-3

**Filtration:** Theory of filtration; hydraulics of filtration; Carmen - Kozeny and other equations, slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand 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.

### Unit-4

**Wastewater Treatment:** Preliminary, primary, secondary and tertiary treatment processes. **Primary Treatment:** Screens, grit chamber and their design.

**Secondary Treatment:** Theory of organic matter removal; activated sludge process, design of different units and modifications, extended aeration systems; trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, R.B.C. etc.

**Anaerobic digestion of sludge.**

### Unit-5

**Design of low and high rate anaerobic digesters and septic tank.** Basic concepts of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and upflow anaerobic sludge blanket (UASB) reactor.

**Other emerging technologies for wastewater treatment:** Duckweed pond,

vermiculture, root zone technologies, sequential batch reactor (SBR) etc.  
Solid waste Management: Definition of solid waste and its classification, Hazardous waste, Prevailing regulations of solid waste management in India.  
Noise Pollution: Definition, Sources, Prevailing noise standards in India.

**Note:** The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\*

**References:**

**Text books:**

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering, Mc-Graw Hill.
2. Metcalf and Eddy Inc.: Wastewater Engineering
3. Garg: Water Supply Engineering (Environmental Engineering Vol. – I)
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.

**Reference books:**

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban
  2. Development, Government of India, New Delhi
  3. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
  4. Fair and Geyer: Water Supply and Wastewater Disposal
  5. Arceivala: Wastewater Treatment for Pollution Control
  6. Hammer and Hammer Jr.: Water and Wastewater Technology
  7. Raju: Water Supply and Wastewater Engineering
  8. Sincero and Sincero: Environmental Engineering: A Design Approach
  9. Pandey and Carney: Environmental Engineering
  10. Rao: Textbook of Environmental Engineering
  11. Davis and Cornwell: Introduction to Environmental Engineering
  12. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
  13. Punmia: Water Supply and Wastewater Engineering Vol. I and II
  14. Birdie: Water Supply and Sanitary Engineering
  15. Ramalho: Introduction to Wastewater Treatment Processes
  16. Parker: Wastewater Systems Engineering
- 6.4 NCE-603: CONSTRUCTION TECHNOLOGY & MANAGEMENT

L – 3, T –1, P-0

CT – 30, TA – 20, ESE - 100

**Unit-1**

**Elements of Management and Network Techniques: Project Cycle, Organisation, Planning, Scheduling, Monitoring, updating and Management System in Construction.**



## **Unit-2**

**Network Techniques: Bar Chart, Mile stone chart, work break down structure, and preparation of networks. Net work techniques like PERT and CPM. In construction Management, Project Monitoring and resource allocations through network techniques.**

## **Unit-3**

**Project Cost Control: Cost Planning, Direct Cost, Indirect Cost, Total Cost Curve, Cost Slope. Time Value of Money, Present Economy studies, Equivalence Concept, financing of projects, Economic comparisons present worth method, Equivalent annual cost method, discounted cash flow method. Depreciation and break even cost analysis of construction projects.**

## **Unit-4**

**Contract Management: 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 qualifications of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract, settlement of disputes, arbitration and commissioning of project.**

## **Unit-5**

**Equipment Management: Productivity, operational cost, owning and hiring cost. Construction equipment: Earth moving, Hauling equipments, Hoisting equipments, Conveying Equipments, Concrete Production equipments, Tunneling equipments.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

### **References:**

- 1. Robert L. Peurifoy, Clifford J., Schexnayder, Aviad Shapira “ Construction Planning Equipment and Methods” McGraw Hills Education (India), Private Ltd.,New Delhi.**
- 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.**

**DEPARTMENTAL ELECTIVE – 1 SUBJECT (NCE-011 to NCE-014)**

**6.5 (A) NCE-011: ADVANCED FOUNDATION DESIGN**

L – 3, T –1, P-0

CT – 30, TA – 20, ESE – 100

Unit -1

**Modern methods of soil investigations ,Geophysical methods; soil resistivity methods seismic refraction method ,stress below ground due to loads**

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.**

Unit -3

**Classification of piles, load carrying capacity of single piles in clay, silt and sand by dynamic and static methods, Pile load test, Pile group, Negative skin friction, Settlement of pile group.**

**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.**

Unit -5

**Stability of slopes, Limit equilibrium method, Method of slices, Simplified Bishop method, Stability Charts. Soil behavior under dynamic loads ,Machine foundation: classification, definitions, design principle in brief, Barken’s method.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

**Text & Reference Books:**

- 1. K. R. Arora – Soil Mechanics & Foundation Engineering.**
- 2. Alam Singh – Modern Geotechnical Engineering.**
- 3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics**
- 4. J. E. bowles – Analysis and Design of Foundation.**
- 5. V. N. S. Murthy – Soil Mechanics and Foundation Engineering.**
- 6. B. M. Das – Foundation Engineering, CENGAGE Learning**

## **6.5 (B) NCE – 012 MATRIX ANALYSIS OF STRUCTRES**

L – 3, T –1, P-0

CT – 30, TA – 20, ESE - 100

### **UNIT – 1**

**Introduction of Flexibility and stiffness method. Hand computation of problems on beam,**

### **UNIT – 2**

**Hand computation of problems on trusses, frames and grids.**

### **UNIT – 3**

**Generalized computer oriented treatment of stiffness method, Method of assembling the stiffness matrix, substructure technique for solving very large structures.**

### **UNIT – 4**

**Analysis for imposed deformation, temperature, support settlement, etc.**

### **UNIT – 5**

**Transfer matrix method of analyzing framed structure.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

#### **Reference:**

- 1. Weaver & Gere, Matrix Analysis of Framed structures.**
- 2. H.C. Matrix, Introduction to Matrix Methods, of structural Analysis, McGraw Hill New York**
- 3. Pandit, G.S.,” Structural Analysis: A Matrix Approach” McGraw Hill Education (India) Pvt. Ltd., Noida.**

## **6.5(C) NCE – 013: ENVIRONMENTAL MANAGEMENT FOR INDUSTRIES**

L – 3, T –1, P-0

CT – 30, TA – 20, ESE – 100

### **Unit-1**

**Environmental legislations for setting up and for operation of an industrial activity, Compliance procedure of these legislations, Need of Environmental Impact Assessment (EIA) study, Other Pollution control legislations.**

### **Unit-2**

**Defining the industrial activity: Location, approach, manufacturing processes, raw**

materials and other inputs of natural resources; Defining the local environment format: Physical environment, biological, environment and socio-economic environment.

### **Unit-3**

Detailing of the local environment: Physical environment- water, air, land resources & solid wastes, noise emissions, radiation emissions etc.; biological environment- all flora & fauna including microbial activities in the local vicinity; Socio-economic environment- history of the area, customs & rituals, demography, infrastructural activities, education, health, and developmental profile of the area, specific local environmental issues.

### **Unit-4**

Environmental Pollution in Industries: various industrial processes, sources and types of pollutions - solid, liquid, gaseous, noise & radiation emissions. Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.

### **Unit-5**

Environmental Impact Assessment (EIA): definitions, methodologies, environmental toxicology; Environmental management Plan, Risk Assessment & risk management plan, pollutant exposure assessment, Environmental Management Cell (EMC): Environmental monitoring schedules, Environmental Statement, Application for consent, Authorization for hazardous wastes, ISO and ISO 14000 etc.

**Note:** The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ.

### **References:**

1. EIA Manuals of MOEF (Available on <http://envfor.nic.in/essential-links/eia-specific-manuals> and <http://envfor.nic.in/division/introduction-8> )
2. Environment (protection) Act 1986. Any authorized & recent publication on Government Acts. Also available on CPCB/MoEF Website
3. Environmental Impact Assessment-Training resource manual, UNEP 2001
4. Wastewater Reuse and Recycling Technology-Pollution Technology Review 72, Culp, Gordan,
5. George Wasner, Robert Williams and Mark , V.Hughes Jr., Noyes Data Corporation, New Jersey.
6. Industrial Pollution Control –Issues and Techniques. Nancy, J. Sell, Van Nostrand Reinhold Co, NY.
7. Industrial Pollution Prevention Handbook. Shen, T.T., Springer-Verlag, Berlin.
8. Environmental Engineering. Pandey, G.N. and Corney, G.C., Tata McGraw Hill, New Delhi

## **6.5 (D) NCE – 014 PRINCIPLES OF TOWN PLANNING AND ARCHITECTURE**

**L – 3, T –1, P-0**

**CT – 30, TA – 20, ESE – 100**

**Unit - 1**

**Principles and history of town planning, Comprehensive planning of towns: Contemporary planning concepts, Problems of urban growth. Land use classification and patterns, Housing demographic and social surveys, economic and environmental aspects. Concept of master plan, Zoning and Density. Transportation network and planning. Planning standards for different land use allocation. Role of town planners.**

**Unit - 2**

**An overview of ancient human settlements, Evolution of towns: Garden city movement, Linear city and concentric city concepts, Neighbourhood and Radburn, La-cite industrielle, Radiant city to present day planning, Satellite town concepts. Concept of habitat, Neighborhood planning, problems of metropolis.**

**Unit -3**

**Factors influencing architectural development. Impact of development of materials and techniques through ages. Evolution of architectural forms. Brief history of architecture.**

**Unit - 4**

**Elements of Architectural Design: Line, Form, Shape, Space, texture, value and colour. Principles of Architectural Design: Balance, Rhythm, Emphasis, Proportion and Scale, Movement, Contrast, Unity, Harmony, Repetition, Hierarchy. Creation of 2 D and 3 D compositions. Role of architects.**

**Unit - 5**

**Functional planning of buildings: Occupancy classification of buildings, General requirements of site and building. Building codes, Acts and Bye-laws, Licensing of building works. Functional planning of building such as residential, institutional, public, commercial, industrial buildings - identifying activity areas and linkages, checking for circulation, ventilation, structural requirements and other constraints. Different symbols used in building industry as per NBC and preparing sketch plan, working drawing etc.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

## References:

1. Sir Banister Fletcher's, A History of Architecture, CBS Publisher.
2. Percy Brown, Indian architecture (Buddhist and Hindu Period), D. B. Taraporevala Sons & Co., Bombay.
3. Percy Brown, Indian architecture (The Islamic Period), D. B. Taraporevala Sons & Co., Bombay.
4. G.K. Hiraskar, Great Ages of World Architecture, Dhanpat Rai Publications.
5. Geoffrey Broadbent, Design in Architecture: Architecture and the Human Sciences, John Wiley & Sons, London.
6. Arthur Gallion, The Urban Pattern: City Planning & Design, D.Van Nostrand CD. Inc.
7. Nelson P. Lewis, Planning to Modern City, Routledge.
8. George S. Salvan, Architectural Theories of Design, JMC Press, Quezon city
9. S.C. Rangwala, Town Planning, Charotar Publishing House.
10. G.K. Hiraskar, Fundamentals of Town Planning, Dhanpat Rai Publications.
11. S.C. Agarwala, Architecture and Town Planning, Dhanpat Rai & Co.
12. A. Bandopadhyay, Text book of town planning, Books and Allied, Calcutta
13. B.B.Dutt, Town Planning in Ancient India, Gyan Publishing House, New Delhi
14. National Building Code of India, latest edition

### DEPARTMENTAL ELECTIVE –2 SUBJECT (NCE-021 to NCE-024) (Half Unit Course)

#### 6.6 (A) NCE-021: ADVANCED CONCRETE DESIGN

L – 2, T –1, P-0

CT – 15, TA – 10, ESE – 50

#### Unit - 1

Design of over-head tanks: Design of RC domes and beams curved in plan, design of Cylindrical and rectangular tanks with different end conditions using IS: 3370 tables, Intze tank design based on membrane analysis with mention of continuity effects. Design of staging: Braces, Columns and Raft Foundation.

#### Unit - 2

Building Frames: Dead, Live, Wind and Earthquake loads, Analysis of framed building by approximate methods for vertical and horizontal loads, concept of Exact Analysis, joint detailing.

#### Unit - 3

Design of Bridges: Loads, Forces and Permissible Stresses, Code Recommendations regarding design and detailing, Design of slabs under-concentrated loads using, Effective width and Pigeaud's method, Courbon's method of load distribution, Detailed design of Highway Bridges: RC slab and R.C. T-beam types.

#### Unit - 4

High performance concrete, Production and no -conventional concrete. Design of composite Sections: Composite beam and slabs in simple conditions.

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

**References:**

- 1. Reinforced Concrete Design by M L Gambhir**
- 2. Reinforced Concrete Design by B C Punamia**
- 3. Essentials of Bridge Engineering by D.J. Victor**

## **6.6(B) NCE- 022: EARTH AND EARTH RETAINING STRUCTURE**

**L – 2, T –1, P-0**

**CT – 15, TA – 10, ESE – 50**

### **Unit -1**

**Earth and Rock Fill Dam, Choice of types, material, foundation, requirement of safety of earth dams, seepage analysis. Mechanically Stabilized Earth retaining walls: General considerations, backfill and reinforced materials, construction details, design method, stability**

### **Unit -2**

**Soil nailing: applications, advantages, limitations, methods of soil nailing, case histories, analysis and design.**

### **Unit - 3**

**Reinforced Soil: Introduction, basic components, strength characteristics, soil-reinforcement interface-friction, Reinforced Earth wall: Stability analysis, construction procedure, drainage, design Procedure**

### **Unit -4**

**Foundation on Reinforced Soil Bed: Pressure ratio, analysis of strip, isolated, square and rectangular footing on reinforced soil bed, Ultimate bearing capacity of footing on reinforced earth slab. Fiber reinforced soil.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

**References:**

- 1. V N S Murthy - Soil Mechanics and Foundation Engg**
- 2. Swami Saran - Reinforced Soil and its Engineering Application**
- 3. J. E. Bowles - Analysis and Design of Foundation.**
- 4. B. M. Das - Foundation Engineering , CENGAGE Learning**
- 5. P.C Varghese- Foundation Engineering, PHI Learning Pvt. Ltd., Delhi**
- 6. N.N.SOM, S.C.Das, Theory and Practice of Foundation Design, PHI Learning Pvt. Ltd., Delhi**

## **6.6 (C) NCE-023: TRANSPORTATION SYSTEM AND PLANNING**

L – 2, T –1, P-0  
CT – 15, TA – 10, ESE – 50

### **UNIT-1**

**Introduction: Overview of transportation system, nature of traffic problems in cities. Present Scenario of road transport and rail transport assets. Role of transportation: Social, Political, Environmental. Goals and objective of Transportation planning,**

### **UNIT-2-**

**Type of transportation system: Different modes of surface transport, Public Transport Intermediate Public Transport (IPT), Rapid and mass transport system like MRTS & bus rapid transit. Traffic Flow and traffic stream theory & variables, Queing theory.**

### **UNIT-3**

**Travel demand: Estimation and fore casting, trip classification, trip generation: factor and methods, multiple regression analysis. Trip distribution methods, modal split, trip assignment.**

### **UNIT-4**

**Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods like Net present Value methods, Benefit Cost method, Internal rate of return method, Land use transport models. Transport system management: Long term and short term planning**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ•**

### **References:**

- 1. Introduction to Transportation Engineering: William W. Hay.**
- 2. Introduction to Transportation Engineering planning- E.K.Mortak.**
- 3. Metropolitan Transportation planning-J.W.Dickey.**
- 4. Traffic Engineering, L.R. Kadiyali**
- 5. Banks, James H., "Introduction to Transportation Engineering", McGraw Education (India), Pvt. Ltd., Noida.**



## **6.6 (D) NCE-024: RURAL WATER SUPPLY AND SANITATION**

L – 2, T –1, P-0  
CT – 15, TA – 10, ESE – 50

### **Unit-1**

**Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits- National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies.**

**Low Cost water Treatment: Introduction – Epidemiological aspects of water quality methods for low cost water treatment - Specific contaminant removal systems**

### **Unit-2**

**Rural Sanitation: Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems Effluent disposal. Identify problems pertaining to rural water supply and sanitation. Design water supply and sanitation system for rural community.**

### **Unit-3**

**Industrial Hygiene and Sanitation: Occupational Hazards- Schools- Public Buildings-Hospitals- Eating establishments- Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation.**

### **Unit-4**

**Solid Waste Management: Disposal of Solid Wastes- Composting- land filling incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation.**

**Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TAQ\***

### **References:**

- 1. 'Water Treatment and Sanitation – Simple Method for Rural Area' by Mann H.T. and Williamson D.**
- 2. Operation and maintenance of rural water supply and sanitation systems by Brikké F**
- 3. 'Water Supply for Rural Areas & Small Communities' by Wanger E.G. and Lanoix J.N.,**
- 4. WHO 'Water Supply and Sewerage', by E.W.Steel & T.J.McGhee, McGraw Hill.**
- 5. 'Manual on Water Supply and Treatment', CPHEEO, Ministry of Urban Development, Govt. of India.**

6. 'Manual on Sewerage and Sewage Treatment', CPHEEO, Ministry of Urban Development, Govt. of India
7. 'Environmental Engineering' by D. Srinivasan, PHI Learning Pvt. Ltd. 2009.
8. Metcalf & Eddy, " Wastewater Engineering: Treatment and Reuse", McGraw Hill Education Pvt. Ltd. (India) Noida.

6.7 NCE- 651: STRUCTURAL DETAILING LAB

L -0, T -0, P -3  
CT – 10, TA – 10, ESE – 30

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

**References:**

1. Krishna Raju N., "Structural Design and Drawing" University Press (India), Pvt. Ltd., Hyderabad.

**6.8NCE-652: ENVIRONMENTAL ENGINEERING LAB**

L -0, T -0, P -3  
CT – 10, TA – 10, ESE – 30

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 PM<sub>10</sub> 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: Any 8 Experiments out of the list of experiments 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.

6.9 NCE-653: CAD LAB II

L -0, T -0, P -3

CT – 10, TA – 10, ESE – 30

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 )
4. Working on Latest Version of Project Management software (PRIMAVEERA / MS PROJECT )

#### 6.10NCE-654: SURVEY CAMP

TOTAL MARKS: 50

The purpose of the camp is to train students in using modern surveying techniques and equipment such as GPS, total stations, automatic and digital levels, electronic theodolites, etc. to prepare a detailed digital map.

The course will be run in the form of a camp for 7 working days and will involve the following components:

1. Reconnaissance of the area to be mapped.
2. Control establishment: Observations and Adjustment using GPS and/or Total station traverse to yield adjusted coordinates of control points.
3. Detail digital mapping using Total station/GPS.
4. Preparing a digital map using open source mapping software and report writing.

Note: Teaching load will be equivalent to 0-0-3.