



# NRI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Permanently Affiliated to JNTUK, Kakinada)  
 (Accredited by NAAC with "A" Grade and ISO 9001:2015 Certified Institution)  
 POTHAVARAPPADU (V), (VIA) NUNNA, AGIRIPALLI (M), PIN - 521 212

## DEPARTMENT OF CIVIL ENGINEERING COURSE STRUCTURE FOR THIRD YEAR B.TECH PROGRAMME

### III YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	18A3101401	Soil Mechanics	2	1	-	2	40	60	100	3
2	18A3101402	Reinforced Concrete Structures	2	1	-	3	40	60	100	3
3	18A3101403	Water Resource Engineering-I	2	-	-	2	40	60	100	2
4	18A3101404	Structural Analysis- II	2	1	-	3	40	60	100	3
5	18A3101511	<b>Professional Elective-1</b> Subsurface Investigation and Instrumentation	3	-	-	3	40	60	100	3
	18A3101512	Advanced Concrete Technology								
	18A3101513	Environmental Pollution and Control								
	18A3101514	Airport Planning and Design								
	18A3101515	Urban Hydrology								
6	18A3101601	<b>Open Elective -II</b> Building Material	3	-	-	3	40	60	100	3
	18A3101602	Air pollution & control								
	18A3101603	Management Science								
7	18A3101491	Soil Mechanics Lab	-	-	3	3	40	60	100	1.5
8	18A3101492	Concrete Technology Lab	-	-	3	3	40	60	100	1.5
9	18A3100801	Constitution of India	2	-	-	2	40	60	100	0
<b>Total</b>			<b>16</b>	<b>3</b>	<b>4</b>	<b>23</b>	<b>360</b>	<b>540</b>	<b>900</b>	<b>20</b>

### III YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	18A3201401	Foundation Engineering	3	-	-	3	40	60	100	3
2	18A3201402	Highway engineering	3	-	-	3	40	60	100	3
3	18A3201403	Environmental Engineering	2	-	-	2	40	60	100	2
4	18A3201511	<b>Professional Elective -II</b> Ground Improvement Techniques	3	-	-	3	40	60	100	3
	18A3201512	Water Resource Engineering-II								
	18A3201513	Air Pollution Engineering								
	18A3201514	Railway Engineering								
	18A3201515	Green buildings and sustainability								
5	18A3201521	<b>Professional Elective -III</b> Expansive Soils	3	-	-	3	40	60	100	3
	18A3201522	Repair and Rehabilitation of Structures								
	18A3201523	Industrial Waste & Waste-Water Engineering								
	18A3201524	Docks and Harbour Engineering								
	18A3201525	Water Resources System Analysis								
6	18A3201601	<b>Open Elective-III</b> Building Construction	3	-	-	3	40	60	100	3
	18A3201602	Green Building								
7	18A3201491	Highway engineering Lab	-	-	3	3	40	60	100	1.5
8	18A3201391	Computer Aided Civil Engineering Drawing	-	-	3	3	40	60	100	1.5
9	18A3200801	Essence of Indian knowledge and traditions	2	-	-	2	40	60	100	0
<b>Total</b>			<b>19</b>	<b>-</b>	<b>6</b>	<b>25</b>	<b>360</b>	<b>540</b>	<b>900</b>	<b>20</b>

## 18A3101401-SOIL MECHANICS

<b>Lecture – Tutorial:</b>	2-1 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites:**

**Course Objectives:**

1. To enable the student to find out the index properties of the soil and classify it.
2. To enable the students to differentiate between compaction and consolidation of soils and to determine the consolidation settlement.
3. To enable the student to determine permeability of soils using various methods.
4. To impart the concept of seepage of water through soils and determine the seepage discharge.

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Identify various soils based on their characteristics.
CO2	Characterize and classify soils based on different limits.
CO3	Evaluate permeability and seepage of soils.
CO4	Determine the permeability of soils and stratified soils
CO5	Determine plasticity characteristics of various soils
CO6	Design consolidation process by predicting settlement of soils.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	-	2	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	1	-	-	-	-
CO3	2	1	-	-	-	1	-	-	-	-	-	-
CO4	2	2	-	-	-	1	-	-	-	-	-	-
CO5	2	2	-	-	-	1	-	-	-	-	-	-
CO6	2	2	2	-	-	1	-	1	-	-	-	-

### UNIT I

**Types and Characteristics of soils**

Types of soils - formation and deposition - moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity. Relationship between various soil parameters. Determination of Moisture content, Specific gravity and Unit weight using various methods.

**LO: 1. Understand the characteristics of soils**

**2. Assess relationships between different parameters**

**1. Determine soil properties**

**Plasticity Characteristics of Soil**

Consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices. Determination of liquid limit, plastic limit and shrinkage limit. Soil classification based on particle size, texture, unified and Indian standard method.

**LO: 1. Determination of Liquid, Shrinkage and Plasticity Limits**

**2. Characterize and classify soils based on different limits.**

### UNIT II

## **Permeability of Soil**

Darcy's law- coefficient of permeability: determination by constant-head and falling-head methods. Permeability of stratified soils - factors affecting - Seepage Analysis- stream and potential functions - flow nets, graphical method to plot flow nets.

**LO: 1. Determine the permeability of soils and stratified soils.**

**2. Understand about the factors effecting permeability**

**3. Estimate and plot flow net**

### **UNIT III**

**Effective Stress Principle** - Introduction, effective stress principle, nature of effective stress, effect of water table. Capillary action, seepage pressure, quick sand condition. Compaction of Soil- theory of compaction- optimum moisture content- maximum dry density. Stresses in soils due to point load, line load, strip load, uniformly loaded circular, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart.

**LO: 1. Compute stresses in soils under various loading conditions.**

**2. Understand compaction of soils**

**3. Calculate stresses in Soils under different loading conditions**

### **UNIT IV**

**Consolidation of Soil** - comparison between compaction and consolidation, initial, primary & secondary consolidation - Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

**LO: 1. Understand the consolidations and settlement of soils.**

**2. Differentiate compaction and consolidation**

**3. Assessment of final settlements of soil**

**4. Differentiate primary and secondary consolidation**

#### **TEXT BOOKS:**

1. K. R. Arora, Soil Mechanics and Foundation Engg., Standard Publishers and Distributors, Delhi.
2. C. Venkataramiah, Geotechnical Engineering, New age International Pvt . Ltd, (2002).

#### **REFERENCE BOOKS:**

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation, Laxmi publications Pvt. Ltd., New Delhi
2. Gopal Ranjan & A. S. R. Rao, Basic and Applied Soil Mechanics, New age International Pvt . Ltd, New Delhi.

#### **E-RESOURCES:**

- <http://www.btechmaterials.com/download/geotechnical-engineering-gte-material-notes/>
- <http://www.nptelvideos.in/2012/11/soil-mechanics.html>

## 18A3101402-REINFORCED CONCRETE STRUCTURES

<b>Lecture – Tutorial:</b>	2-1Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Strength of Materials, Structural Analysis</b>												
<b>Course Objectives:</b>												
<ol style="list-style-type: none"> <li>1) To teach concepts of working stress and limit state methods.</li> <li>2) To impart design procedure of RC elements in flexure, shear and torsion.</li> <li>3) To teach design procedure for short and long RC columns.</li> <li>4) To explain design procedure of RC footings</li> <li>5) To demonstrate design of RC slab</li> </ol>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Work on different types of design philosophies											
CO2	Carryout analysis and design of flexural members and detailing											
CO3	Design of different types of slabs subjected to shear, bond and torsion											
CO4	Design of dog legged stair case											
CO5	Design different types of columns											
CO6	Design different types of footings											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	2	3	-	-	2	-	2	-	-	-	-
CO2	3	3	3	-	-	2	-	2	-	-	-	-
CO3	3	3	3	-	-	2	-	2	-	-	-	-
CO4	3	3	3	-	-	2	-	2	-	-	-	-
CO5	3	3	3	-	-	2	-	2	-	-	-	-
CO6	3	3	3	-	-	2	-	2	-	-	-	-
<b>UNIT I</b>												
<b>Basic concepts of RCC and Design of Beams</b>												
<p>Concepts of Reinforced concrete Design – Working Stress Method - Limit State method – Material Stress- Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456 – 2000. Beams: Limit state analysis and design of singly reinforced, doubly reinforced, T and L beam sections</p> <p><b>LO: 1. Familiarize with working stress and limit stress method of design.</b>  <b>2. Understand stress block parameters in methods of analysis</b>  <b>3. Design of beams of varying cross sections adopting IS Code</b></p>												
<b>UNIT II</b>												
<b>Shear and torsion:</b>												
<p>Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing;</p> <p><b>LO: 1. Understand behaviour of beams under shear and torsion</b>  <b>2. Visualize importance of bond and anchorage</b>  <b>3. Design and Detail RC beams under due to shear and torsion adopting IS Code.</b></p>												
<b>UNIT III</b>												
<p>Design of one way slab, Two-way slabs and continuous slab using I.S. Coefficients Limit state design for serviceability for deflection, cracking and codal provision. Design of doglegged staircase.</p>												

**LO: 1. Classify understand performance of slabs based on dimensions**  
**2. Design reinforced concrete slabs & Stair cases as per IS codal provisions.**

#### **UNIT IV**

Short and Long columns – under axial loads, uniaxial bending and biaxial bending – I S Code provisions.

**LO: 1. Understand behaviour of columns with different slenderness characteristics**

**2. Contrast behaviour of columns axial and under Uniaxial, Biaxial eccentricities**

**3. Design and detail RC columns under different loads adopting IS Code. Footings:**

Different types of footings – Design of isolated, square, rectangular, circular footings and combined footings.

**LO: 1. Classify footings based on shape and utility**

**2. Examine the field conditions and suggest appropriate footings**

**3. Design reinforced concrete footings.**

#### **TEXT BOOKS:**

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design, Laxmi, publications Pvt. Ltd., New Delhi
2. P. C. Varghese, Limit state designed of reinforced concrete, Prentice Hall of India, New Delhi

#### **REFERENCE BOOKS:**

1. N. Krishna Raju, Structural Design and Drawing, Universities Press Pvt Ltd, Hyderabad. 3<sup>rd</sup> Edition 2009.
2. N. C. Sinha and S. K Roy, Fundamentals of reinforced concrete , S. Chand publishers

#### **E-RESOURCES:**

- <https://www.alljntuworld.in/download/reinforced-concrete-structures-design-drawing-materials-notes/>
- <http://www.nptelvideos.in/2012/11/design-of-reinforced-concrete-structures.html>

**18A3101403-WATER RESOURCE ENGINEERING-1**

<b>Lecture – Tutorial:</b>	2-1 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Hydraulics**

**Course Objectives:**

- Introduce hydrologic cycle and its relevance to Civil engineering
- Make the students understand physical processes in hydrology and, components of the hydrologic cycle
- Appreciate concepts and theory of physical processes and interactions
- Learn measurement and estimation of the components hydrologic cycle.
- Provide an overview and understanding of Unit Hydrograph theory and its analysis
- Understand flood frequency analysis, design flood, flood routing
- Appreciate the concepts of groundwater movement and well hydraulics

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Develop design storms and carry out frequency analysis
CO2	Determine storage capacity and life of reservoirs.
CO3	Develop unit hydrograph and synthetic hydrograph
CO4	Estimate flood magnitude and carry out flood routing.
CO5	Determine aquifer parameters and yield of wells.
CO6	Model hydrologic processes

**Contribution of Course Outcomes towards achievement of Program**

**Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	3	-	-	1	-	1	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	1	-	1	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-

**UNIT I**

**Engineering hydrology and Precipitation**

Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. **Precipitation:** Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

**LO 1. Understand basics of engineering hydrology and its applications.**

**2. Demonstrate measurement techniques of precipitation.**

**3. Learn curves related to frequency of rainfall.**

**UNIT II**

**Abstractions from Precipitation:**

Initial abstractions. Evaporation: factors affecting, measurement, reduction  
Evapo transpiration: factors affecting, measurement, control - Infiltration:  
factors affecting, Infiltration capacity curve, measurement, infiltration indices.

**LO 1. Attain knowledge on factors influencing evaporation.**

**2. Analyze factors influencing infiltration.**

**UNIT III****Runoff and Hydrograph analysis:**

Catchment characteristics, Factors affecting runoff, components, computation-empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph.

**UNIT IV**

**Floods:** Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management. **Flood Routing:** Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

**LO 1. Develop knowledge on floods and its effects.**

**2. Understand flood routing techniques.**

**TEXT BOOKS:**

1. Engineering Hydrology, Jayarami Reddy, P., Laxmi Publications Pvt. Ltd., (2013), New Delhi
2. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P) Ltd.

**REFERENCE BOOKS:**

1. Engineering Hydrology Subramanya, K, Tata McGraw-Hill Education Pvt Ltd (2013), New Delhi.
2. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers

**E-RESOURCES:**

- <http://www.nptelvideos.in/2012/11/water-resources-systemsmodeling.html>
- <http://www.nptelvideos.in/2012/11/advanced-hydrology.html>
- <http://freevideolectures.com/Course/100/Water-Resources-Engineering>
- <http://www.btechmaterials.com/download/water-resources-engineering-materials-notes/>
- <http://www.btechmaterials.com/download/water-resources-engineering-ii-materials-notes/>

**18A3101401 -STRUCTURAL ANALYSIS-II**

<b>Lecture – Tutorial:</b>	2-1 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Strength of Materials, Structural Analysis-I</b>												
<b>Course Objectives:</b>												
<ul style="list-style-type: none"> <li>➤ Familiarize Students with Different types of Structures</li> <li>➤ Equip student with concepts of Arches</li> <li>➤ Understand Concepts of lateral Load analysis</li> <li>➤ Familiarize Cables and Suspension Bridges</li> <li>➤ Understand Analysis methods Moment Distribution, Kanis Method and Matrix Methods</li> </ul>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Analyze three Hinged Arches and two Hinged Arches											
CO2	Analyze structures using Slope deflection method											
CO3	Analyze structures using Moment Distribution method											
CO4	Carryout lateral Load analysis of structures											
CO5	Analyze structures using Flexibility Matrix method											
CO6	Analyze structures using Stiffness Matrix method											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	3	-	-	-	2	-	1	-	-	-	-
CO2	3	3	-	-	-	2	-	1	-	-	-	-
CO3	3	3	-	-	-	2	-	1	-	-	-	-
CO4	3	3	-	-	-	2	-	1	-	-	-	-
CO5	3	3	-	-	-	2	-	1	-	-	-	-
CO6	3	3	-	-	-	2	-	1	-	-	-	-
<b>UNIT I</b>												
<p><b>Three Hinged Arches:</b> Elastic theory of arches – Eddy’s theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.</p> <p><b>Two Hinged Arches:</b> Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question).</p>												
<b>UNIT II</b>												
<p><b>Slope-Deflection:</b> Analysis of single bay, single storey, portal frame including side sway.</p> <p><b>LO. 1. Analyze 2D frames using slope-deflection method.</b></p> <p><b>Moment Distribution Method:</b> Introduction to moment distribution method- application to continuous beams with and without settlement of supports. Analysis of single storey portal frames – including Sway.</p> <p><b>LO.1. Develop moment distribution expressions</b></p> <p><b>2. Analyze structures with and without support sinking</b></p> <p><b>3. Analyze single storey portal frames</b></p>												
<b>UNIT III</b>												
<p><b>Lateral Load Analysis</b> Using Approximate Methods: Application to building frames. (i) Portal Method (ii) Cantilever Method.</p>												



## UNIT IV

### Matrix Methods:

**Flexibility method:** Introduction, application to continuous beams (maximum of two unknowns) including support settlements. Analysis of single bay, single storey portal frame including sway.

**Stiffness method:** Introduction, application to continuous beams (maximum of two unknowns) including support settlements. Analysis of single bay, single storey portal frame including sway.

### TEXT BOOKS:

1. Structural Analysis, T. S. Thandavamoorthy, Oxford university press, India.
2. Structural Analysis, R.C. Hibbeler, Pearson Education, India
3. Theory of Structures – II, B. C. Punmia, Jain & Jain, Laxmi Publications, India.

### REFERENCE BOOKS:

1. Intermediate Structural Analysis, C. K. Wang, Tata McGraw Hill, India
2. Theory of structures, Ramamuratham, Dhanpatrai Publications.
3. Analysis of structures, Vazrani & Ratwani – Khanna Publications.

### E-RESOURCES:

- <http://www.btechmaterials.com/download/structural-analysis-materials-notes/>
- <http://www.nptelvideos.in/2012/11/structural-analysis-i.html>

**PROFESSIONAL ELECTIVE-1**  
**18A3101511-SUBSURFACE INVESTIGATION AND INSTRUMENTATION**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Soil Mechanics**

**Course Objectives:**

- 1) To discuss the importance of site investigation,
- 2) To narrate various exploration techniques
- 3) To describe soil sampling techniques.
- 4) To train with in situ sub soil exploration methods
- 5) To demonstrate instrumentation for sub soil exploration.

**Course Outcomes: Soil Mechanics**

**Upon successful completion of the course, the student will be able to:**

CO1	Plan and execute sub soil investigation programme.
CO2	Different exploration techniques
CO3	Handle both laboratory and in-situ testing techniques.
CO4	Carry out collection, handling and preservation of samples.
CO5	In situ exploration methods
CO6	Handle instruments during sub soil exploration process.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	2	-	2	-	1	-	-	-	-
CO2	2	-	-	-	-	2	-	-	-	-	-	-
CO3	2	-	-	-	-	2	-	2	-	-	-	-
CO4	2	-	2	2	-	2	-	1	-	-	-	-
CO5	2	-	-	-	-	2	-	2	-	-	-	-
CO6	2	-	-	-	-	1	-	1	-	-	-	-

**UNIT I**

**Exploration and geophysical methods:**

Exploration program planning -methods of exploration- preliminary and detailed design- spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole -down hole methods.

- LO: 1. Understand exploration process  
 2. Learn different methods of methods.

**UNIT II**

**Exploration Techniques**

Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs.

- LO: 1. Learn various exploration techniques.  
 2. Determine appropriate methods of exploration based on limitations

**UNIT III**

**Soil Sampling**

Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of

samples.

- LO: 1. Understand concepts of sampling  
2. Study different types of sampling techniques.

#### **UNIT IV**

##### **Field Testing In Soil Exploration**

Field tests, penetration tests, Field vane shear, Insitu shear and bore hole shear test, pressure meter test, dilatometer test - plate load test-monotonic and cyclic; field permeability tests – block vibration test. Procedure, limitations, correction and data interpretation.

- LO: 1. Develop insitu soil exploration methods.  
2. Interpret data of soil exploration and documentation

##### **Instrumentation**

Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements - slope indicators, sensing units, case studies.

- LO: 1. Choose appropriate instrumentation in sub soil exploration process

##### **TEXT BOOKS:**

1. Alam Singh and Chowdhary G. R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation, CBS Publishers and Distributors, New Delhi, 2006.
2. Dunicliff J., and Green, G. E., "Geotechnical Instrumentation for Monitoring Field Performance", John Wiley, 1993.

##### **REFERENCE BOOKS:**

1. Bowles J. E., "Foundation Analysis and Design", 5th Edition, The McGraw-Hill companies, Inc., New York, 1995.
2. Hanna T. H., "Field Instrumentation in Geotechnical Engineering", Trans Tech., 1985.

##### **E-RESOURCES:**

- <http://www.nptelvideos.in/2012/11/foundation-engineering.html>
- <http://www.btechmaterials.com/download/foundation-engineering-fe-material-notes/>

**PROFESSIONAL ELECTIVE-1**  
**18A3101512-ADVANCED CONCRETE TECHNOLOGY**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Building materials and Construction</b>												
<b>Course Objectives:</b>												
To learn the concepts of Concrete production and its behaviour in various environments.												
To learn the test procedures for the determination of properties of concrete.												
To understand durability properties of concrete in various environments												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand the basic concepts of concrete.											
CO2	Realise the importance of quality of concrete.											
CO3	Familiarise the basic ingredients of concrete and their role in the production of concrete and its behaviour in the field.											
CO4	Fresh concrete properties and the hardened concrete properties.											
CO5	Familiarise the basic concepts of special concrete and their production and applications.											
CO6	Understand the behaviour of concrete in various environments.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	1	-	-	-	-
CO2	2	-	-	-	-	1	-	-	-	-	-	-
CO3	2	-	-	2	-	2	-	1	-	-	-	-
CO4	2	-	-	-	-	-	-	1	-	-	-	-
CO5	2	-	-	-	-	-	-	1	-	-	-	-
CO6	2	-	-	-	-	-	-	1	-	-	-	-
<b>UNIT I</b>												
<b>Concrete Making Materials :</b> Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alakali Silica Reaction –Admixtures – Chemical and Mineral Admixtures. Bureau of Indian Standards (BIS) Provisions.												
<b>UNIT II</b>												
<b>Fresh And Hardened Concrete:</b> Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding. Hardened Concrete : Abrams Law, Gel space ratios, Maturity concept – Stress strain Behaviour – Creep and Shrinkage – Durability Tests on Concrete – Non Destructive Testing of Concrete. BIS Provisions.												
<b>UNIT III</b>												
<b>High Strength Concrete</b> – Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete. High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations. BIS Provisions.												
<b>UNIT IV</b>												
<b>Special Concretes:</b> Self Compacting concrete, Polymer Concrete, Fibre												

Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications. Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method– Light Weight Concrete, Self Compacting Concrete. Form work – materials – structural requests – form work systems – connections – specifications – design of form work – shores – removal for forms - shores – reshoring – failure of form work.

**TEXT BOOKS:**

1. Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.
2. Concrete Technology by M.S. Shetty, S.Chand & Co 2009.

**REFERENCE BOOKS:**

1. Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J. Monteiro,. Mc. Graw-Hill Publishing Company Ltd. New Delhi
2. Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.

**E-RESOURCES:**

- [https://onlinecourses.nptel.ac.in/noc16\\_ce10/preview](https://onlinecourses.nptel.ac.in/noc16_ce10/preview)
- <http://nptel.ac.in/courses/105104030/http://freevideolectures.com/Course/3357/Concrete-Technology>
- <http://textofvideo.nptel.iitm.ac.in/105102012/lec1.pdf>

**PROFESSIONAL ELECTIVE-1**  
**18A3101513-ENVIRONMENTAL POLLUTION AND CONTROL**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Environmental Studies**

**Course Objectives:**

- 1) Impart knowledge on aspects of air pollution & control and noise pollution**
- 2) Impart concepts of treatment of waste water from industrial source.**
- 3) Differentiate the solid and hazardous waste based on characterization**
- 4) Introduce sanitation methods essential for protection of community health.**
- 5) Provide basic knowledge on sustainable development.**

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Identify the air pollutant control devices
CO2	Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
CO3	Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards.
CO4	Differentiate the treatment techniques used for sewage and industrial wastewater treatment.
CO5	Inventing the methods of environmental sanitation and the management of community facilities without spread of epidemics.
CO6	Appreciate the importance of sustainable development while planning a project or executing an activity.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	2	1	-	-	-	-
CO2	2	-	-	-	-	-	2	1	-	-	-	-
CO3	2	-	-	-	-	-	2	1	-	-	-	-
CO4	2	-	-	-	-	-	2	1	-	-	-	-
CO5	2	-	-	-	2	-	2	1	-	-	-	-
CO6	2	2	-	-	-	-	2	1	-	-	-	-

**UNIT I**

**Air Pollution:**

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

- LO: 1. Understand control mechanism of air pollutants  
 2. Design noise reduction techniques

**UNIT II**

**Industrial waste water Management:**

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

LO: 1. Understand the importance of treatment process of industrial effluents.

2. Design treatment plants

**UNIT III**

**Solid Waste Management:** solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling. Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

LO: 1. Classification of solid waste and separation and procession solid waste

2. Identification of Hazardous wastes

3. Plan and execute solid waste and hazardous waste management.

**UNIT IV**

**Environmental Sanitation:** Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

LO: 1. Understand importance of hygienic environment

2. Suggest appropriate rural sanitation methods to keep surrounding clean.

**TEXT BOOKS:**

1. Peavy, H. S., Rowe, D.R, Tchobanoglous, **Environmental Engineering, G.Mc-Graw Hill International Editions, New York 1985.**
2. J. G. Henry and G.W. Heinke, **Environmental Science and Engineering, Pearson Education.**

**REFERENCE BOOKS:**

1. G. L. Karia and R.A. Christian, **Waste water treatment- concepts and design approach, Prentice Hall of India**
2. Ruth F. Weiner and Robin Matthews **Environmental Engineering, 4th Edition Elsevier, 2003**

**E-RESOURCES:**

<http://www.nptelvideos.in/2012/11/environmental-air-pollution.html>

**PROFESSIONAL ELECTIVE-1**  
**18A3101514-AIRPORT PLANNING AND DESIGN**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: ----**

**Course Objectives:**

- 1) Introduction to the growth of air transport and aircraft characteristics.
- 2) Competence in building the background in Airport engineering and understanding its features with a technical sense.
- 3) Synthesis in incorporating the planning and design of airport.
- 4) Required Development of the theoretical basis of subject and to design the various airport components.
- 5) Better Comprehension of various probable alternatives to design airport components

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	<b>Obtain a basic Knowledge of the fundamental issues in Airport engineering.</b>
CO2	<b>Demonstrate the clear understanding of the airport components.</b>
CO3	<b>Learn principles in airport components geometric</b>
CO4	<b>Learn the airport components capacity and delays</b>
CO5	<b>Learn critical factors consideration in airport design</b>
CO6	<b>Design and be able to apply these principles in field</b>

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	-	3	-	-	2	-	2	-	-	-	-

**UNIT I**

**Growth and Characteristics of Airport and Aircraft:**

Growth of air transport, airport organization and associations, Classifications of airports airfield components, airport traffic zones and approach areas. Aircraft Components, size turning radius, speed, airport characteristics.

- LO: 1. Understanding planning aspects of airports  
2. Understand aircraft components and deciding dimensions

**UNIT II**

**Airport Engineering:**

Airport site selection – factors affecting site selection and surveys- runway orientation – wind rose diagram – basic runway length – correction for runway length – terminal area – layout and functions – concepts of terminal building – simple building, linear concept, pier concept and satellite concept – typical layouts

- LO: 1. Explain factors affecting site selection of airport



2. Identify features of terminal building layout

### **civiUNIT III**

#### **Capacity and Delay, Airport planning, surveys and Design:**

Factors affecting capacity, Determination of runway capacity related to delay, gate capacity, and Taxiway capacity Airport Site Selection, Runway length and width, sight distances, longitudinal and transverse grades, runway intersections, taxiways, clearances, aprons, numbering, holding apron, noise control, Problems.

LO: 1. Classification of taxiway and features

2. Design of airport component for handling operations on land

### **UNIT IV**

#### **Planning and Design of the Terminal area:**

Design of drainage systems, construction methods, layout of surface drainage and subsurface drainage system, Problems. Runways and taxiways markings, day and night landing aids, airport lighting, ILS and other associated aids.

LO: 1. Develop knowledge on grading and planning of airport layout.

2. Understand Airport landing systems

#### **Geometric design of runways**

Aircraft characteristics – influence of characteristics on airport planning and design – geometric design elements of runway – runway lighting.

LO: 1. Design of runways

#### **TEXT BOOKS:**

1. **Khanna, Arora and Jain, Airport Planning and Design, Nem Chand and Bros., Roorkee**

2. **Rangwala, Airport Engineering – Charotar Publisher**

#### **REFERENCE BOOKS:**

1. **R. Srinivasa Kumar, Transportation Engineering: Railways, Airports, Docks and Harbors, Universities Press Pvt Ltd, Hyderabad. 2014.**

2. **Virender Kumar and Satish Chandra, Airport Planning and Design, Galgotia Publication press.**

#### **E-RESOURCES:**

- <https://www.alljntuworld.in/download/transportation-engineering-ii-materials-notes/>
- <http://www.nptelvideos.in/2012/11/transportation-engineering-ii.html>
- <http://www.nptelvideos.in/2012/11/urban-transportation-planning.html>
- <http://www.nptelvideos.in/2012/11/transportation-engineering-ii.html>

**PROFESSIONAL ELECTIVE-1**  
**18A3101515-URBAN HYDROLOGY**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites:</b>												
<b>Course Objectives:</b>												
1) To impart impact of urbanization on catchment hydrology.												
2) Narrate the importance of rainfall runoff data for urban hydrology.												
3) Teach techniques for peak flow estimation for storm water drainage system design.												
4) Explain the design concepts of components in urban drainage systems.												
5) Train for preparation of master urban drainage system.												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Impact of urbanization on catchment hydrology											
CO2	Develop intensity duration frequency curves for urban drainage systems.											
CO3	Peak flow estimations											
CO4	Develop design storms to size the various components of drainage systems.											
CO5	Apply best management practices to manage urban flooding.											
CO6	Develop master drainage plan for an urbanized area.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	2	-	1	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	3	-	-	2	-	1	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	2	3	-	-	2	-	1	-	-	-	-
<b>UNIT I</b>												
<b>Urbanization and Precipitation Analysis</b>												
Urbanization and its effect on water cycle – urban hydrologic cycle – Effect of urbanization on hydrology. <b>Precipitation Analysis:</b> Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration and design of urban drainage systems, Intensity-Duration - Frequency (IDF) curves, design storms for urban drainage systems.												
<b>LO: 1. Define Urbanization and its effects</b>												
<b>2. Understand basic concepts of hydrological cycle.</b>												
<b>UNIT II</b>												
<b>Methods of Urban Drainage:</b>												
Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse , major and minor systems. Drainage systems: Open channel, underground drains, appurtenances, pumping, and source control.												
<b>LO: 1. Acquire skills for rainfall data acquisition</b>												
<b>2. Design of drainage system.</b>												

### UNIT III

#### **Analysis and Management:**

Storm water drainage structures, design of storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management.

**LO: 1. Design drainage network scheme.**

### UNIT IV

#### **Drainage plans:**

Issues – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, and use of models in planning.

**LO: 1. Prepare proper plan for storm water drainage system**

#### **TEXT BOOKS:**

1. Akan A.O and R.L. Houghtalen, Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling (2006), Wiley International.
2. Hall M. J., Urban Hydrology (1984), Elsevier Applied Science Publisher.

#### **REFERENCE BOOKS:**

1. Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, Manual on Drainage in Urbanised area' (1987 – 2 volumes), UNESCO,
2. Wanielista M. P. and Eaglin, Hydrology – Quantity and Quality Analysis (1997), Wiley and Sons.

#### **E-RESOURCES:**

## Open Elective-2 (Offered by Department of civil engineering)

### 18A3101601-BUILDING MATERIALS

<b>Lecture – Tutorial:</b>	2-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	2	<b>External Marks:</b>	60									
<b>Prerequisites: Engineering chemistry, engineering geology and physics</b>												
<b>Course Objectives:</b>												
➤ To learn the availability, types, uses and various tests for building materials.												
➤ To know about activities in building construction.												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand the process of making quality stones with its applications.											
CO2	Understand the process of making quality bricks with its applications.											
CO3	Assess quality of lime in a detailed manner on the usage in the present-day construction.											
CO4	Assess quality of timber in a detailed manner on the usage in the present-day construction.											
CO5	Assess quality of steel in a detailed manner on the usage in the present-day construction.											
CO6	Acquire the knowledge about paints, varnishes, distempers											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	-	-	-	-	2	-	1	-	-	-	-
CO2	3	-	-	-	-	1	-	1	-	-	-	-
CO3	2	2	-	-	-	1	-	1	-	-	-	-
CO4	3	-	-	-	-	1	-	2	-	-	-	-
CO5	2	2	-	-	-	-	-	1	-	-	-	-
CO6	3	1	-	-	-	1	-	2	-	-	-	-
<b>UNIT I</b>												
<b>STONES</b> Qualities of a good building stone; Stone quarrying; Tools for blasting; Materials for blasting; Process of blasting; Precautions in blasting; Dressing of stones; Common building stones of India.												
<b>BRICKS</b> General; Composition of good brick earth; Harmful ingredients in brick earth; Classification of brick earth; Manufacture of bricks; Comparison between clamp burning and kiln burning; Qualities of good bricks; Tests for bricks; Classification of bricks; Substitutes for bricks												
<b>UNIT II</b>												
<b>LIME</b> General, Some definitions, sources of lime, constituents of lime stones, classification of limes, comparison between fat lime and hydraulic lime , manufacture of fat lime												
<b>TIMBER</b> Definition; Classification of trees; Structure of a tree; Felling of trees; Defects in timber; Qualities of good timber; Decay of timber; Preservation of timber; Fire resistance of timber; Seasoning of timber; Market forms of timber; Industrial timber; Advantages of timber construction; Use of timber; Indian timber trees.												
<b>UNIT III</b>												
<b>STEEL</b> General; Manufacture of steel; Uses of steel; Factors affecting physical properties; Defects in steel; Market forms of steel; Properties of mild steel; Properties of hard steel; Corrosion of ferrous metals.												
<b>UNIT IV</b>												
<b>PAINTS, VARNISHES AND DISTEMPERS</b> General; Painting; Varnishing; Distempers; Wall paper; White washing; Colour washing.												

**TEXT BOOKS:**

1. Engineering Materials, (36th edition) by Rangwala, S.C., Anand Charotar Publishing House, 2009.
2. Building construction, (10th edition) by Punmia, B. C., Laxmi Publications, Bangalore, 2009.

**REFERENCE BOOKS:**

1. Building construction and construction materials by Birdie, G.S. and Ahuja, T.D., Dhanpath Rai Publishing company, New Delhi, 1986.

**E-RESOURCES:**

- <http://nptel.ac.in/courses.php>
- <http://jntuk-coeerd.in/>

## Open Elective-2 (Offered by Department of civil engineering)

### 18A3101602-AIR POLLUTION & ITS CONTROL

<b>Lecture – Tutorial:</b>	2-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	2	<b>External Marks:</b>	60

**Prerequisites:** Environmental studies

#### **Course Objectives:**

- To identify the pollutants and their sources and then the transport mechanisms of the pollutants followed by the affected population and respective controls.
- To learn the techniques and instrumentation of ambient air monitoring,
- Establishment of ambient air monitoring stations, stacks monitoring.
- To know the methods of analysis air and air pollutants.

#### **Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1 Understand of contemporary pollution issues.

CO2 Analyze specific examples of various sources of air pollution.

CO3 Understand the properties of atmosphere

CO4 Comprehend the causes of key types of air pollution.

CO5 Comprehend the effects of key types of air pollution

CO6 Classify of different pollution control strategies

#### **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	1	-	-	-	-	-	2	-	-	-	-
CO2	2	2	-	-	-	1	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	1	-	-	-	-
CO4	3	2	-	-	-	-	-	1	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	2	-	1	-	-	-	-

#### **UNIT I**

**AIR POLLUTION** Air pollution - definitions-scope, significance - air pollutants - measurements of pollution classification –natural and artificial-primary and secondary, point and non-point.

**EFFECT OF AIR POLLUTION** Effect of air pollutants on man-material and vegetation-global effects of air pollution green house effect, heat lands, acid rains and ozone.

#### **UNIT II**

**METEROLOGY AND PLUME DISPERSION** Properties of atmosphere-heat, pressure, wind forces, moisture and relative humidity influence of meteorological phenomenon on air quality- wind rose diagram.

#### **UNIT III**

**METHODS OF CONTROLLING** Control of particulates-control at sources-controlling equipments-settling chamber centrifugal separators-fabric filters –dry and wet scrubbers-electrostatic precipitators.

#### **UNIT IV**

**INPLANT CONTROL MEASURES** Process Change-Dry and Wet Methods of Removal and Recycling-Dust Collection Devices-Internal Separators-Catalyst Reduction

**AIR POLLUTION CONTROL BY DILUTION** General-Meteorological Factors-Atmospheric Temperature Lapse Rate-Speed and Direction of Wind- Wind Velocity Profile-Diffusion Theories-Objects of Stack

**TEXT BOOKS:**

1 Air Pollution and Control by Rao, M.N and Rao, H.N., Tata McGraw Hill, New Delhi, 2007.

2. Environmental Engineering and Management, (2nd Edition) by Suresh, S.K.Kartarai & Sons, 2005.

**REFERENCE BOOKS:**

1. An Introduction to Air pollution by Trivedy, R.K., B.S.Publications, 2005.

2. Air pollution by Wark and Warner, Addison-Wesley Publications, 1998.

**E-RESOURCES:**

NPTEL

## Open Elective-2

### 18A3101602-MANAGEMENT SCIENCE

<b>Lecture – Tutorial:</b>	2-1 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: -----</b>												
<b>Course Objectives:</b>												
<ol style="list-style-type: none"> <li>1. To develop knowledge of fundamental management concepts, skills and tools, to aid in problem solving and decision making.</li> <li>2. To develop and understanding about the organizational structure and relationship between authority and responsibility in various structures.</li> <li>3. To discuss the evolution of principles that make it possible to design facilities, processes, and control systems with a degree of predictability as to their performance.</li> <li>4. To develop comprehensive skills in planning, selecting, motivating, and developing the human resources for organisational effectiveness.</li> <li>5. To understand the broad scope of marketing, societal, ethical and other diverse aspects of marketing.</li> </ol>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Design of organizational structure both industries and academia.											
CO2	Analyse various functions of management that include operations management, material management, marketing management, HR management helpful in success of organisations.											
CO3	Understand the importance of planning for the long-term through strategic management.											
CO4	Understand quality control standards & contemporary management practices being followed both in industries and academia											
CO5	Compare conceptual models of strategic management and to understand its applicability in understanding the constraints and opportunities in the sectors.											
CO6	Understand the contemporary issues in the field of management science and their applicability in the real world at every level											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	-	2	-	3	-
CO2	2	-	-	-	-	-	-	-	1	-	3	-
CO3	2	-	-	-	-	-	-	-	2	-	3	-
CO4	2	-	-	-	-	-	-	-	1	-	3	-
CO5	2	-	-	-	-	-	-	-	2	-	3	-
CO6	2	-	-	-	-	-	-	-	2	-	3	V
<b>UNIT I</b>												
<b>Introduction to Management:</b> Concepts of Management and organization- nature, importance and Functions of Management, Taylor’s Scientific Management Theory and thinkers. Fayol’s. Basic motivational theories- Maslow’s hierarchy needs MC.Douglas Gregory theory.												
<b>Designing Organisational Structures:</b> Basic concepts related to Organisation -Types												



of organisation structures (Line, Functional & line& staff) - their merits, demerits and suitability. Formal and Informal Organizations.

## UNIT II

**Operations Management:** Principles and Functions -Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement- Statistical Quality Control: chart, R chart, c chart,  $p$  chart, Mean Chart, (simple Problems).

**Materials Management:** Objectives, Need, procedure and Types of Inventory control. EOQ(simple Problems), Materials Requirement Planning (MRP), Just-In-Time (JIT), Total Quality Management (TQM), six sigma and Capability Maturity Model (CMM) Levels.

## UNIT III

**Marketing Management:** Functions of Marketing and Marketing Strategies based on Product Life Cycle, Channels of distribution.

**Human Resources Management (HRM):** Concepts of HRM & HRD. Basic functions of Human Resource Management. Performance Appraisal, Job Evaluation and Merit Rating. Performance Management.

## UNIT IV

**Strategic Management:** Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation. Value Chain Analysis, Enterprise Resource Planning (ERP), and Business Process outsourcing (BPO), Business Process Re-engineering (BPR), Bench Marking, and Balanced Score Card.

### TEXT BOOKS:

3. Management Science, Aryasri, TMH, 2004.
4. Management Science, Rajesh C. Jampala, P. Adi Lakshmi, Duvuri Publications, Machilipatnam, 2010.

### REFERENCE BOOKS:

3. Kotler Philip & Kevin Lane Keller, Marketing Mangement . 12th Edition, PHI, 2005.
4. Koontz & Weihrich, Essentials of Management, 6th Edition, TMH, 2005.
5. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004.
6. Production and Operations Management, Kanishka Bedi, Oxford University Press, 2004.
7. Personnel Management, Memoria & S.V. Gauker Himalaya, 25th Edition, 2005.
8. Lawrence R Jauch, R.Gupta &William F.Glueck:Business Policy and Strategic Management, Frank Bros.2005.

### 18A3101491-Soil Mechanics Lab

<b>Practical</b>	3 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	1.5	<b>External Marks:</b>	60									
<b>Prerequisites:</b>												
<b>Course Objectives: Soil Mechanics</b>												
<ul style="list-style-type: none"> <li>➤ To impart knowledge of determination of index properties required for classification of soils.</li> <li>➤ To teach how to determine compaction characteristics and consolidation behaviour from relevant lab tests; to determine permeability of soils.</li> <li>➤ To teach how to determine shear parameters of soil through different laboratory tests.</li> </ul>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Determine index properties of soil and classify them.											
CO2	Determine permeability of soils											
CO3	Determine Compaction, Consolidation and shear strength characteristics											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	3	-	3	-	2	-	2	-	-	-	-
CO2	3	3	-	3	-	2	-	2	-	-	-	-
CO3	3	3	-	3	-	2	-	2	-	-	-	-
<b>List of Experiments</b>												
<ol style="list-style-type: none"> <li>1. <b>Specific gravity</b></li> <li>2. <b>Atterberg's Limits.</b></li> <li>3. <b>Field density-Core cutter and Sand replacement methods</b></li> <li>4. <b>Grain size analysis by sieving</b></li> <li>5. <b>Hydrometer Analysis Test</b></li> <li>6. <b>Permeability of soil - Constant and Variable head tests</b></li> <li>7. <b>Compaction test</b></li> <li>8. <b>Consolidation test (to be demonstrated)</b></li> <li>9. <b>Direct Shear test</b></li> <li>10. <b>Triaxial Compression test (UU Test)</b></li> <li>11. <b>Unconfined Compression test</b></li> <li>12. <b>Vane Shear test</b></li> <li>13. <b>Differential free swell (DFS)</b></li> <li>14. <b>CBR Test</b></li> </ol>												
<b>TEXT BOOKS:</b>												
<ol style="list-style-type: none"> <li>1. K. R. Arora, Soil Mechanics and Foundation Engg., Standard Publishers and Distributors, Delhi.</li> <li>2. C. Venkataramiah, Geotechnical Engineering, New age International Pvt . Ltd, (2002).</li> </ol>												
<b>REFERENCE BOOKS:</b>												
<ol style="list-style-type: none"> <li>1. 'Determination of Soil Properties' by J. E. Bowles.</li> <li>2. IS Code 2720 – relevant parts.</li> </ol>												

## 18A3101492-Concrete Technology Lab

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	1.5	<b>External Marks:</b>	60									
<b>Prerequisites: Concrete Technology</b>												
<b>Course Objectives:</b>												
To test the basic properties ingredients of concrete, fresh and hardened concrete												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Determine the consistency and fineness of cement.											
CO2	Determine the setting times of cement.											
CO3	Determine the specific gravity and soundness of cement.											
CO4	Determine the compressive strength of cement.											
CO5	Determine the workability of cement concrete by compaction factor, slump and Vee- Bee tests											
CO6	Determine the specific gravity of coarse aggregate and fine aggregate by Sieve analysis											
CO7	Determine the flakiness and elongation index of aggregates.											
CO7	Determine the bulking of sand.											
CO8	Understand the non-destructive testing procedures on concrete.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	3	-	3	-	2	-	2	-	-	-	-
CO2	3	3	-	3	-	2	-	2	-	-	-	-
CO3	3	3	-	3	-	2	-	2	-	-	-	-
<b>List of Experiments</b>												
<ol style="list-style-type: none"> <li>1. Determination of normal Consistency and fineness of cement.</li> <li>2. Determination of initial setting time and final setting time of cement.</li> <li>3. Determination of specific gravity and soundness of cement.</li> <li>4. Determination of compressive strength of cement.</li> <li>5. Determination of grading and fineness modulus of coarse aggregate by sieve analysis.</li> <li>6. Determination of specific gravity of coarse aggregate</li> <li>7. Determination of grading and fineness modulus of fine aggregate (sand) by sieve analysis.</li> <li>8. Determination of bulking of sand.</li> <li>9. Determination of workability of concrete by compaction factor method.</li> <li>10. Determination of workability of concrete by slump test</li> <li>11. Determination of workability of concrete by Vee-bee test.</li> <li>12. Determination of compressive strength of cement concrete and its young's modulus.</li> <li>13. Determination of split tensile strength of concrete.</li> <li>14. Non-Destructive testing on concrete (for demonstration)</li> </ol>												
<b>TEXT BOOKS:</b>												
<ol style="list-style-type: none"> <li>1. Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.</li> <li>2. Concrete Technology by M.S. Shetty, S.Chand &amp; Co 2009.</li> </ol>												
<b>REFERENCE BOOKS:</b>												
<ol style="list-style-type: none"> <li>1. Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J.</li> </ol>												

Monteiro,. Mc. Graw-Hill Publishing Company Ltd. New Delhi

2. Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.

# 18A3100801-INDIAN CONSTITUTION

Type of Course: Audit Course

<b>Lecture – Tutorial- Practical::</b>	0-1-2	<b>Internal Marks:</b>	40									
<b>Credits:</b>	0	<b>External Marks:</b>	60									
<b>Prerequisites:</b>												
<b>Course Objectives:</b>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand the meaning, history, features and characteristics of Indian Constitution											
CO2	Gain knowledge on fundamental rights duties and Principles and importance of State Policy											
CO3	Understand the powers of Union, the States and Indian President.											
CO4	Know about amendments of the constitution and Emergency Provisions											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2-Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	3	2	-	-	-	-	2	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	2
CO4	-	-	3	-	-	-	-	2	-	-	-	2

## UNIT I

- Meaning of the constitution law and constitutionalism
- Historical perspective of the Constitution of India
- Salient features and characteristics of the Constitution of India

## UNIT II

- Scheme of the fundamental rights
- The scheme of the Fundamental Duties and its legal status
- The Directive Principles of State Policy – Its importance and implementation

## UNIT III

- Federal structure and distribution of legislative and financial powers between the Union and the States
- Parliamentary Form of Government in India – The constitution powers and status of the President of India

## UNIT IV

- Amendment of the Constitutional Powers and Procedure
- The historical perspectives of the constitutional amendments in India
- Emergency Provisions : National Emergency, President Rule, Financial Emergency

## Reference Books

1. Durgadas Basu – Introduction to the Constitution of India
2. Sharma, Sharma B. K. – Introduction to the Constitution of India
3. Randhir Sarma Srkar – The Constitution of India
4. Govt. of India – The Constitution of India

## **III-II SYLLABUS**

**18A3201401-FOUNDATION ENGINEERING**

<b>Lecture – Tutorial:</b>	2-1 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Soil Mechanics**

**Course Objectives:**

- 1) To impart knowledge on soil exploration.
- 2) To teach slope stability and safety assessment of earth retaining structures.
- 3) To impart knowledge on bearing capacity and settlement of shallow foundations.
- 4) To throw light on pile and well foundation designs.

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Understand the methods of soil exploration.
CO2	Compile soil investigation report
CO3	Assess stability of slopes and earth retaining structures
CO4	Determine safe bearing capacity and settlement of shallow foundations.
CO5	Design pile foundations.
CO6	Design well foundations.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	2	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	2	-	1	-	-	-	-
CO6	2	3	3	-	-	2	-	1	-	-	-	-

**UNIT I**

**Soil Exploration:**

Methods of soil exploration – Boring and Sampling methods – Penetration Tests – Pressure meter – Programme planning and preparation of soil investigation report.

**LO: 1. Identify importance of soil exploration**

**2. Distinguish different soil exploration methods**

**3. Compile soil investigation report**

**Earth Retaining Structures:**

Infinite and finite earth slopes in sand and clay – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices – Taylor’s Stability Number-Stability of slopes of dams and embankments - different conditions. Rankine’s & Coulomb’s theory of earth pressure – Culmann’s graphical method - earth pressures in layered soils.

**LO: 1. Understand different types of failures**

**2. Explain different types of stability analysis**

**3. Estimation of earth pressure in different types of soils and conditions**

**4. Design of earth retaining structures according to stability concepts.**

## UNIT II

### **Shallow Foundations:**

Types of foundations and influencing factors - Bearing capacity - determination of bearing capacity - factors influencing bearing capacity - analytical methods to determine bearing capacity - Terzaghi's theory - settlements - Design aspects of shallow foundations-IS Methods.

**LO: 1. Understand the different types of foundations**

**2. Determine the bearing capacity of soils.**

**3. Interpret settlements under different conditions**

## UNIT III

### **Pile Foundations:**

Types of piles - Load carrying capacity based on static and Dynamic formulae- Pile load tests - pile groups in sands and clays- pile cap design.

**LO: 1. Classify different types of piles**

**2. Assess load bearing capacity of different types of piles**

**3. Demonstrate pile load tests and to assess strength of pile**

**4. Understand functioning of different combinations of pile in groups**

**5. Design piles and pile caps in different soils.**

## UNIT IV

### **Well Foundations:**

Types - Different shapes - Components of well foundation - forces acting on well foundations - Design Criteria - Determination of staining thickness and plug - construction and Sinking of wells - Tilt and shift.

**LO: 1. Classify different types of wells based on shape**

**2. Assess loads acting on well foundations**

**3. Understand procedures like well sinking and tilts and shifts**

### **TEXT BOOKS:**

1. C. Venkataramiah, Geotechnical Engineering, New age International Pvt . Ltd, (2002).
2. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation by, Laxmi, publications Pvt. Ltd., New Delhi

### **REFERENCE BOOKS:**

1. T. N. Ramamurthy, A Textbook Of Geotechnical Engineering (Soil Mechanics), S. Chand and Company Limited, New Delhi
2. Purushtoma Raj, Soil Mechanics and Foundation Engineering, Pearson Publications

### **E-RESOURCES:**

- <http://www.nptelvideos.in/2012/11/foundation-engineering.html>
- <http://www.btechmaterials.com/download/foundation-engineering-fe-material-notes/>



## 18A3201402-HIGHWAY ENGINEERING

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: -----**

**Course Objectives:**

- 1) To impart knowledge on highway development and materials.
- 2) To teach concepts of Geometric design and alignment.
- 3) To throw light on traffic volume studies and regulation.
- 4) To teach design of highway intersections
- 5) To impart knowledge on design of pavements

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1 Carry out highway surveying and planning.

CO2 Understand characteristics of highway materials.

CO3 Geometric design and alignment

CO4 Design components of highway.

CO5 Design highway intersections.

CO6 Design highway pavements

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	2	-	1	-	-	-	-
CO4	2	3	3	-	-	2	-	1	-	-	-	-
CO5	2	3	3	-	-	2	-	1	-	-	-	-
CO6	2	3	3	-	-	2	-	1	-	-	-	-

### UNIT I

**UNIT -I**

**Highway development and planning:**

Highway development in India – Necessity for Highway Planning- Road Development Plans- Classification of Roads- Road Network Patterns – Highway Alignment and influencing Factors - Engineering Surveys – highway materials and testing.

**LO: 1. Understand importance of highway development**

**2. Classify highways based in field conditions and alignment**

**3. Carryout highway materials and testing**

**Basic Concepts of Geometric Design**

Geometric Design- Design Criteria- Cross Section Elements

### UNIT II

**Highway geometric design:**

Sight Distance - Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

**LO: 1. Understand different aspects govern highway design**

**2. Design highway features like alignment and super elevation**

### 3. Design vertical and horizontal alignment of highways

#### UNIT III

##### **Traffic engineering and regulation:**

Basic Parameters - Traffic Volume Studies- Data Collection and Presentation- speed studies- Data Collection and Presentation- Parking Studies and characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams- Road Traffic Signs – Road markings- Design of Traffic Signals –Webster Method –Saturation flow – phasing and timing diagrams.

**LO: 1. Identify need and basic parameters of traffic channelling**

**2. Understand traffic volume and regulation.**

**3. Visualize causes for road accidents**

**4. Design safety features traffic using different methodologies**

##### **Intersection design:**

Conflicts at Intersections- Channelization –Traffic Islands and Design - Types of Intersections – Rotary Intersection and Design.

**LO: 1. Study causes for conflicts at intersections**

**2. Plan types and positioning of traffic intersections on highway.**

#### UNIT IV

##### **Pavement design:**

Flexible and rigid pavements – Components and Functions – design of Flexible pavement (G.I method and CBR Method as per IRC 37-2018 –Design of Rigid pavements – Westergaard’s stress equations – CC pavements - Design of Expansion and contraction joints - Design of Dowel bars and Tie bars.

**LO: 1. Distinguish flexible and rigid pavements**

**2. Design of pavements using different methods**

**3. Study expansion and contraction joints and their importance**

##### **TEXT BOOKS:**

1. S. K. Khanna and C. E. G. Justo, Highway Engineering, Nemchand & Bros., 7th edition (2000).
2. R. Srinivasa Kumar, Text Book of Highway Engineering, Universities Press Pvt Ltd, Hyderabad. 2011.

##### **REFERENCE BOOKS:**

1. S K Sharma, A Textbook Of Highway Engineering, S. Chand and Company Limited, New Delhi
2. L. R. Kadiyali and Lal, Principles and Practice of Highway Engineering Design, Khanna Publications.

##### **E-RESOURCES:**

- <http://www.btechmaterials.com/download/transportation-engineering-materials-notes/>
- <http://www.nptelvideos.in/2012/11/introduction-to-transportation.html>
- <https://www.alljntuworld.in/download/transportation-engineering-ii-materials-notes/>
- <http://www.nptelvideos.in/2012/11/transportation-engineering-ii.html>
- <http://www.nptelvideos.in/2012/11/urban-transportation-planning.html>
- <http://www.nptelvideos.in/2012/11/transportation-engineering-ii.html>

## 18A3201403- ENVIRONMENTAL ENGINEERING

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Environmental Studies</b>												
<b>Course Objectives:</b>												
<ol style="list-style-type: none"> <li>1) To teach requirements of water and its treatment.</li> <li>2) To impart knowledge on sewage treatment methodologies.</li> <li>3) To provide facts on Air pollution and control.</li> <li>4) To enable with design concepts of wastewater treatment units</li> <li>5) To throw light on importance of plumbing.</li> </ol>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand about quality of water and purification process											
CO2	Select appropriate technique for treatment of waste water.											
CO3	Assess the impact of air pollution											
CO4	Understand consequences of solid waste and its management.											
CO5	Design domestic plumbing systems.											
CO6	Selection of suitable treatment flow for raw water treatments.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	1	-	-	-	-
CO2	2	-	-	-	-	-	-	1	-	-	-	-
CO3	2	-	-	-	-	-	-	1	-	-	-	-
CO4	2	-	-	-	-	-	-	1	-	-	-	-
CO5	2	2	3	-	-	-	-	1	-	-	-	-
CO6	2	-	-	-	-	-	-	1	-	-	-	-
<b>UNIT I</b>												
<p><b>Estimation of quality and quantity of water-</b> Importance and Necessity of Protected Water Supply systems; Routine water analysis - physical, chemical and bacteriological tests; Standards for drinking water; Water borne diseases, Sources of Water: Surface and Ground water, comparison of sources with reference to quality, quantity and other considerations</p> <p><b>Flow chart of public water supply system,</b> Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it - Types of water demands and its variations factors affecting water demand, Design Period Population Forecasting. - Capacity of storage reservoirs, Mass curve analysis.</p> <p><b>LO: 1</b> Teach causes for water borne diseases.  <b>2.</b> Estimation of water demand for a colony /town/city.  <b>3.</b> Able to identify the sources of water.</p>												
<b>UNIT II</b>												

**Treatment of Water and distribution:** Flowchart of water treatment plant, Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration-Slow sand and rapid sand filters; Construction and Operation; Disinfection methods-chlorination; Removal of hardness.  
Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks.

- LO:**
1. Enlightens the efforts involved in converting raw water into clean potable water.
  2. Able to apply treatment methods
  3. Impart knowledge on water distribution network

### UNIT III

**Estimation of quantity and quality of sewage** - Estimation of sewage flow and storm water drainage – fluctuations- classification of sewerage systems – types of sewers - Hydraulics of sewers and storm drains– design diameter of sewers – appurtenances in sewerage – Man holes, Street Inlets

Sewage characteristics – Sampling and analysis of wastewater - Physical, Chemical and Biological Examination- Measurement of BOD and COD - BOD equations.

- LO:**
1. Outline planning and the design of wastewater collection, conveyance and treatment systems for a community/town/city
  2. Summarize the appurtenance in sewerage systems and their necessity
  3. Provide knowledge of characterization of wastewater generated in a community.

### UNIT IV

**Treatment of sewage and disposal:** Primary treatment-Screens-grit chambers-grease traps– floatation– sedimentation – design of preliminary and primary treatment units. Design of septic tank

**Secondary treatment:** Aerobic and anaerobic treatment process comparison.

Suspended growth process: Activated Sludge Process, principles, and operational problems, Activated Sludge Processes, Attached Growth Process: Trickling Filters– mechanism of impurities removal- classification–operation and maintenance problems. Methods of disposal – disposal into water bodies-Oxygen Sag Curve-Disposal into sea, disposal on land- sewage sickness

- LO:**
- 1 Impart understanding of treatment of sewage and the need for its treatment.
  2. Teach planning, and design of septic tank.
  3. Effluent disposal method and realize the importance of regulations in the disposal of effluents in Rivers.

### TEXT BOOKS:

1. Elements of Environmental Engineering – K. N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.
2. Environmental Engineering water supply Engineering- vol. 1 Santosh kumar Garg ,Khanna Publishers 2018 edition
3. Sewage waste disposal and Air pollution Engineering Santosh kumar Garg ,Khanna Publishers 2018 edition

### REFERENCE BOOKS:

1. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, -2011 edition.
2. Wastewater engineering treatment and reuse - Metcliff & Eddy McGraw Hill Education (India) private Limited- 2003 edition

### E-RESOURCES:

- <https://www.alljntuworld.in/download/environmental-engineering-ee-materials-notes/>

**PROFESSIONAL ELECTIVE-II**

**18A3201511-GROUND IMPROVEMENT TECHNIQUES**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Soil Mechanics and Foundation Engineering**

**Course Objectives:**

- 1) To understand need for different ground improvement methods adopted for improving the properties of remoulded and in-situ soils by adopting different techniques
- 2) To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
- 3) To know geo-textiles and geo-synthetics can to improve the performance of soils.
- 4) To learn the concepts, purpose and effects of grouting.

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Perceive the knowledge of various methods of ground improvement and their suitability to different field situations.
CO2	Design a reinforced earth embankment and check its stability.
CO3	Understand the functions of Geo-synthetics and their applications in Civil Engineering practice.
CO4	Understand the concepts and applications of grouting.
CO5	Concept of dewatering
CO6	Stabilization of soils

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	1	-	1	-	-	-	-
CO2	2	-	-	-	-	1	-	1	-	-	-	-
CO3	2	-	-	-	-	1	-	1	-	-	-	-
CO4	2	-	-	-	-	1	-	1	-	-	-	-
CO5	2	-	-	-	-	1	-	1	-	-	-	-
CO6	2	-	-	-	-	1	-	1	-	-	-	-

**UNIT I**

**UNIT- I**

**In situ densification methods-** in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

**LO: 1. Understand methods of insitu densification**

**2. Study different types of drains for soil densification**

**Dewatering** – sumps and interceptor ditches – single and multi stage well points – vacuum well points – horizontal wells – criteria for choice of filler material around drains – electro osmosis

**LO: 1. Understand methods of dewatering**

**2. Study different types of dewatering and working criteria**

**UNIT II**

## **UNIT- II**

**Stabilization of soils** – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

**LO: 1. Study different methods of stabilization of soils**

**2. Study utilization of industrial wastes to stabilize soils**

## **UNIT III**

**Reinforced earth** – Principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing

**LO: 1. Understand principles of reinforced earth in ground improvement**

**2. Study procedures for verification of stability of slopes**

**Geosynthetics** – Geotextiles – types – functions, properties and applications – Geogrids, Geomembranes and gabions - properties and applications.

**LO: 1. Utilization of advanced materials for ground improvement**

**2. Compare different types of synthetic based soil stabilization material and understand performance**

## **UNIT IV**

**Grouting** – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – post grout tests

**LO: 1. Understand methods of grouting**

**2. Assess efficiency of grouting adopting different tests**

### **TEXT BOOKS:**

1. Purushotham Raj, Ground Improvement Techniques, Laxmi Publications, New Delhi.
2. Nihar Ranjan Patro, Ground Improvement Techniques, Vikas Publishing House (p) Limited, New Delhi.

### **REFERENCE BOOKS:**

1. M. P. Moseley, Ground Improvement, Blackie Academic and Professional, USA.
2. R. M. Koerner, Designing with Geosynthetics, Prentice Hall.

### **E-RESOURCES:**

- <http://www.btechmaterials.com/download/ground-improvement-techniques-git-material-notes/>
- <http://www.btechmaterials.com/download/ground-improvement-techniques-git-material-notes/>

**PROFESSIONAL ELECTIVE-II**

**18A3201512-WATER RESOURCE ENGINEERING-II**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Hydraulics, Water resource engineering-I**

**Course Objectives:**

- 1) To discuss the importance of site investigation,
- 2) To narrate various exploration techniques
- 3) To describe soil sampling techniques.
- 4) To train with insitu sub soil exploration methods
- 5) To demonstrate instrumentation for sub soil exploration.

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Estimate irrigation water requirements
CO2	Design irrigation canals and canal network
CO3	Design irrigation canal structures
CO4	Plan and design diversion head works
CO5	Analyse stability of gravity and earth dams
CO6	Design ogee spillways and energy dissipation works

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	-	-	-	2	-	1	-	-	-	-
CO2	2	3	3	-	-	2	-	1	-	-	-	-
CO3	2	3	3	-	-	2	-	1	-	-	-	-
CO4	2	3	3	-	-	2	-	1	-	-	-	-
CO5	2	2	-	-	-	2	-	1	-	-	-	-
CO6	2	3	3	-	-	2	-	1	-	-	-	-

**UNIT I**

**Irrigation:** Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

**UNIT II**

**Canals:** Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible

Canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

**Canal Structures:**

**Falls:** Types and location, design principles of Sarda type fall and straight glacis fall.

**Regulators:** Head and cross regulators, design principles

**UNIT III**

**Cross Drainage Works:** Types, selection, design principles of aqueduct, siphon aqueduct and super passage. **Outlets:** types, proportionality, sensitivity and flexibility

**River Training:** Objectives and approaches

**Diversion Head Works:** Types of diversion head works, weirs and barrages, Layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for Subsurface flow, exit gradient.

#### UNIT IV

**Reservoir Planning:** Investigations, site selection, zones of storage, yield and

Storage capacity of reservoir, reservoir sedimentation.

**Dams:** Types of dams, selection of type of dam, selection of site for a dam.

**Gravity dams:** Forces acting on gravity dam, causes of failure of a gravity dam,

Elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries, grouting.

**Earth Dams:** Types, causes of failure, criteria for safe design, seepage, measures

For control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions.

**Spillways:** Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances.

#### TEXT BOOKS:

1. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok

Kumar Jain, Arun Kumar Jain, Lakshmi Publications (P) Ltd.

2. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna

Publishers.

#### REFERENCE BOOKS:

1. Irrigation and Water Resources Engineering, Asawa G L (2013), New Age International Publishers

2. Irrigation Water Resources and Water Power Engineering, Modi P N (2011), Standard Book House, New Delhi

#### E-RESOURCES:

- <http://www.nptelvideos.in/2012/11/water-resources-systemsmodeling.html>
- <http://www.nptelvideos.in/2012/11/advanced-hydrology.html>
- <http://freevideolectures.com/Course/100/Water-Resources-Engineering>
- <http://www.btechmaterials.com/download/water-resources-engineering-materials-notes/>
- <http://www.btechmaterials.com/download/water-resources-engineering-ii-materials-notes/>



## PROFESSIONAL ELECTIVE-II

### 18A3201513-AIR POLLUTION ENGINEERING

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: -----**

**Course Objectives:**

- 1) To teach the basics of air pollution
- 2) To impart the behaviour of air due to metrological influence
- 3) To throw light on air quality management
- 4) To teach the design of air pollution control methods

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Evaluating the ambient air quality based on the analysis of air pollutants
CO2	Design particulate and gaseous control measures for an industry
CO3	Judge the plume behaviour in a prevailing environmental condition
CO4	Estimate carbon credits for various day to day activities
CO5	Pollution control methods
CO6	Properties of atmosphere

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	-	-	1	-	1	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	1	-	1	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	-	-	-	-	-	-	-	-	-

#### UNIT I

**Air Pollution:**

Sampling and analysis of air pollutants, conversion of ppm into  $\mu\text{g}/\text{m}^3$ . Definition of terms related to air pollution and control - secondary pollutants - Indoor air pollution – Ozone holes and Climate Change and its impact - Carbon Trade.

**LO: 1. Learn the basics of air pollutants.**

**2. Estimate the impact of air pollution**

#### UNIT II

**Thermodynamics and Kinetics of Air-pollution:**

Applications in the removal of gases like  $\text{SO}_x$ ,  $\text{NO}_x$ , CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution. Odour pollution control, Flares.

**LO: 1 Analyse and compute the parameters of air pollutants**

**2. Evaluate procedures for control of pollution**

#### UNIT III

**Meteorology and Air Pollution:**

Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena

on plume behavior and Air Quality - Wind rose diagrams and Isopleths  
Plume Rise Models

**LO: 1. Study properties of atmosphere**

**2. Learn plume behaviour in different environmental conditions**

#### **UNIT IV**

##### **Air Pollution Control Methods:**

Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of Control Equipments –Control of NO<sub>x</sub> and SO<sub>x</sub> emissions – Environmental friendly fuels - In-plant Control Measures, process changes, methods of removal and recycling. Environmental criteria for setting industries and green belts.

**LO: 1. Acquire the design principles of particulate and gaseous control.**

**2. Develop environmental friendly fuels and study properties**

##### **TEXT BOOKS:**

1. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw Hill Company.
2. K. V. S. G. Murali Krishna, Air Pollution and Control Laxmi Publications, New Delhi, 2015.

##### **REFERENCE BOOKS:**

1. R. K. Trivedy and P. K. Goel, An Introduction to Air pollution, B.S. Publications.
2. Wark and Warner, Air Pollution, Harper & Row, New York.

##### **E-RESOURCES:**

<http://www.nptelvideos.in/2012/11/environmental-air-pollution.html>

## PROFESSIONAL ELECTIVE-II

### 18A3201514-RAILWAY ENGINEERING

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: Highway Engineering**

**Course Objectives:**

- 1) Comprehend different parts of railway track their functions and operating system
- 2) Teach track construction and engineering applications
- 3) Explain different essential features and requirements of different types of crossings
- 4) Demonstrate signalling system and maintenance of tracks

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Explain components of Railway track, different Gauges.
CO2	Design Track Gradients as per given requirements.
CO3	Designing various types of Track Turnouts.
CO4	Discover purposes and facilities at railway stations.
CO5	Explain interlocking and modern signal systems.
CO6	Identify surface defects on Railway Track and their remedial measures.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	2	-	1	-	-	-	-
CO3	3	3	3	-	-	2	-	1	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	-	-	-	-	-	-	-	-	-

#### UNIT I

**Components of Railway Track:**

History and Importance of Indian Railways Construction and Maintenance- Components- Gauges, Types, Uniformity of Gauge- Different Gauges in Indian Railways- Associated problems- Ideal Alignment- Standard rail Sections- Causes and Effects of Creep- Measurement to reduce Creep- Fittings and Fastening- Factors effecting on tracks Coning

**LO: 1. Understand the basics of railway components.**

**2. Examine gauges, alignment and standard rail sections**

**3. Explain different types of fittings and fastenings**

#### UNIT II

**Sleepers and Geometric Design of Tracks:**

Functions and Requirements of sleepers- Types and Spacing- Methods of fixing rails with prespressed Concrete and Wooden Sleepers- Details of Geometric Design of track-Gradient Grade compensation on curves- Curves and Super Elevation

**LO: 1. Learn functions and requirements of sleepers**

## 2. Design sleepers and tracks.

### UNIT III

#### **Resistance to Traction Points and Crossings:**

Resistance to friction, wave action, track irregularity, wind- Resistance to Gradient, Curvature, Starting and acceleration- Stress in rails, sleepers, ballast and formations- Necessity of Points & Crossings- Track Layout and Turnouts- Types of crossings and Track Turnouts

**LO: 1. Study causes of resistance to tracks**

**2. Evaluate stresses in rails**

**3. Design track layout and turnouts**

**Railway Stations and Yards:** Purposes- Facilities required at Railway stations- Requirements of Station Yard- Classification of Yards

**LO: 1. Study basics on railway stations and yards.**

### UNIT IV

**Signalling and Interlocking Maintenance of Railway Track:** Maintenance Programme- Monsoon, Pre Monsoon, Post Monsoon Maintenance- Causes for maintenance- Tools for Railway Track Maintenance & Their Functions- Surface defects and their remedial Measures

**LO: 1. Develop knowledge on signalling and maintenance in railways.**

**3. Study requirements and different types of maintenance of tracks**

**Metro rails** -History of metro rail in India -Types of metros -Classification of metro rails world wide - Reliability of metro rail than other modes of transport

#### **TEXT BOOKS:**

1. S. C. Saxena and S. P. Arora, A Text book of Railway Engineering, Dhanpatrai & Sons, Delhi
2. Satish Chandra and M. M. Agarwal, Railway Engineering- Oxford University Press, New Delhi

#### **REFERENCE BOOKS:**

1. R. Srinivasa Kumar, Transportation Engineering: Railways, Airports, Docks and Harbors Universities Press Pvt Ltd, Hyderabad. 2014.
2. Vazirani & Chandola, Transportation Engineering Vol I & II

#### **E-RESOURCES:**

- <http://www.nptelvideos.in/2012/11/urban-transportation-planning.html>
- <http://www.nptelvideos.in/2012/11/transportation-engineering-ii.html>

## PROFESSIONAL ELECTIVE-II

### 18A3201515-GREEN BUILDINGS AND SUSTAINABILITY

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Basics of Civil engineering</b>												
<b>Course Objectives:</b>												
1) Teach Students with concepts of Power potential in the world and India												
2) Impart with different types of Hydropower Plants and Classification												
3) demonstrate different Water Conveyance systems												
4) Teach turbines draft tubes and water hammers												
5) Throw light on Design of Power house planning												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Recognize what is a green building and green building materials.											
CO2	Understand the Green Building Opportunities and Benefits											
CO3	Differentiate different rating agencies and features of green buildings.											
CO4	Recognize sources of carbon emissions and its impact on climate.											
CO5	Understand the concept of Sustainable development and social ethics											
CO6	Plan land use conforming to zonal regulations											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	2	1	-	-	-	-
CO2	2	-	-	-	-	-	2	1	-	-	-	-
CO3	2	-	-	-	-	-	2	1	-	-	-	-
CO4	2	-	-	-	-	-	2	1	-	-	-	-
CO5	2	-	-	-	-	-	2	1	-	-	-	-
CO6	2	-	-	-	-	-	2	1	-	-	-	-
<b>UNIT I</b>												
<b>Green Building</b> -Benefits of Green Buildings- Green Building Materials and Equipment in India- Key Requisites for Constructing a Green Building, Important Sustainable features for Green Building												
<b>Green building concepts</b> Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings												
<b>UNIT II</b>												
<b>Green Building Opportunities and Benefits:</b> Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings,												
<b>Green Building Rating Systems-</b> LEED India Rating System and Energy Efficiency												
<b>UNIT III</b>												
<b>SUSTAINABILITY</b> -Human development index, Sustainable development and social ethics, definitions of sustainability, populations and												

consumptions.

**THE CARBON CYCLE AND ENERGY BALANCES**- Introduction, Climate science history, carbon sources and emissions, The carbon cycle, carbon flow pathways, and repositories, Global energy balance, Global energy balance and temperature model, Greenhouse gases and Effects, Climate change projections and impacts

#### **UNIT IV**

#### **SUSTAINABILITY AND BUILT ENVIRONMENT**

Introduction, Land use and land cover change, Land use planning and its role in sustainable development-Zoning and land use planning, smart growth, Environmentally sensitive design- low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings

#### **TEXT BOOKS:**

1. Standard for the Design of High-Performance Green Buildings by ASHRAE
2. Engineering Applications in Sustainable Design and Development by Bradley A.Striebig, Adebayo A.Ogundipe and Maria Papadakis. First edition, 2016, CENGAGE Learning.

#### **REFERENCE BOOKS:**

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

### PROFESSIONAL ELECTIVE-III

#### 18A3201521-EXPANSIVE SOILS

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Soil Mechanics and Foundation Engineering</b>												
<b>Course Objectives:</b>												
1) Familiarize Students with Nature of Soils and Soil Structure												
2) Equip student with concepts of Swelling and methods of determination												
3) Understand foundation practices in expansive soils												
4) Familiarize different materials and techniques for stabilization												
5) Understand procedure to improve shear strength of expansive soils												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Demonstrate behaviour of expansive soils.											
CO2	Explain need of foundation practice on expansive soils.											
CO3	Perform methods of stabilization of expansive soils.											
CO4	Select additives and methodology for stabilization.											
CO5	Apply the gained knowledge for suitable performance.											
CO6	Concepts of swelling											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	1	1	-	-	-	-
CO2	2	-	-	-	-	-	1	1	-	-	-	-
CO3	2	-	-	-	-	-	1	-	-	-	-	-
CO4	2	-	-	-	-	-	1	-	-	-	-	-
CO5	2	-	-	-	-	-	1	-	-	-	-	-
CO6	2	-	-	-	-	-	1	-	-	-	-	-
<b>UNIT I</b>												
<b>Clay Mineralogy:</b> Nature of Soils-Clay mineral structure- Cation exchange – Soil water- Soil Structure-Soil water interaction												
<b>LO: 1. Understand mineralogical structure of soil.</b>												
<b>2. Explain effects of soil water interaction</b>												
<b>UNIT II</b>												
<b>Swelling Characteristics-</b> Swelling- Factors effecting Swelling- Swelling Potential- Swell Pressure- Methods of Determination-Factors effecting Swelling potential and swell pressure- Heave- Factors effecting Heave-Methods of determination of heave.												
<b>LO: 1. Understand swelling and its effects</b>												
<b>2. Understand heave and its effects</b>												
<b>UNIT III</b>												
<b>Foundation Practices in Expansive Clays:</b> Sand Cushion-Belled Piers-CNS layer technique-Under reamed Pile foundation- Construction Techniques- Design Specifications- Load-carrying capacity in compressive and uplift of single and multi under reamed piles in clays and sands-Granular pile Anchors.												
<b>LO: 1. Understand inconveniences with expansive soils</b>												

## **2. Design of foundation on expansive soils.**

### **UNIT IV**

Lime Soil columns and Lime Slurry pressure injection- Stabilization with admixtures-Propounding- Vertical and Horizontal Moisture barriers.

**LO: Design of stability concepts with various admixtures.**

**Shear strength of expansive soils-** Katti's concept of bilinear envelope- Stress –state variables in partly saturated soils- Frelend's strength parameters- Determination of matrix suction by axis translation technique- field suction measurement.

**LO: 1. Determine shear strength of expansive soils by different techniques**

#### **TEXT BOOKS:**

1. F. C. Chen, Foundation on Expansive Soils, Elsevier Scientific Publishing Company, Newyork
2. J. D. Nelson and D. I. Miller, Expansive soils- Problems and Practice in Foundation and pavement Engineering, John Wiley & Sons Inc

#### **REFERENCE BOOKS:**

1. D. G. Fredlund and H. Rhardjo, Soil Mechanics for Unsaturated Soils, WILEY Inter Science Publication, John Wiley & Sons, Inc
2. D. R. Katti, A. R. Katti, Behavior of Saturated Expansive Soils and Control Methods, Taylor and Francis

#### **E-RESOURCES:**

- <http://www.btechmaterials.com/download/geotechnical-engineering-gte-material-notes/>
- <http://www.nptelvideos.in/2012/11/soil-mechanics.html>



**PROFESSIONAL ELECTIVE-III**

**18A3201522-REPAIR AND REHABILITATION OF STRUCTURES**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Reinforced concrete structures, Concrete Technology</b>												
<b>Course Objectives:</b>												
1) To describe causes of distress in concrete structures and plan repair strategies.												
2) To explain issues on serviceability and durability of concrete.												
3) To throw light on various repair materials and their characteristics.												
4) To demonstrate repair techniques and protection measures.												
5) To illustrate suitable retrofitting schemes.												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand evaluation procedure and plan for repair.											
CO2	Design suitable rehabilitation scheme for serviceability and durability.											
CO3	Choose suitable repair material for different magnitudes of distress.											
CO4	Apply efficient repair and retrofitting schemes.											
CO5	Understand the methods of strengthening methods for concrete structures											
CO6	Physical evaluation on condition of the structure											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	2	-	-	-	-	-	-	-
CO2	2	3	3	-	2	1	-	1	-	-	-	-
CO3	2	-	-	-	2	-	-	-	-	-	-	-
CO4	2	-	-	-	2	-	-	-	-	-	-	-
CO5	2	-	-	-	2	-	-	-	-	-	-	-
CO6	2	-	-	-	2	-	-	-	-	-	-	-
<b>UNIT I</b>												
<b>Maintenance and repair strategies:</b>												
Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.												
<b>LO: 1. Understand importance and requirement of maintenance</b>												
<b>2. Gain knowledge on quantification of repairs and documentation</b>												
<b>UNIT II</b>												
<b>Materials for Repair</b>												
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete.												
<b>LO: 1. List characteristics of materials used for repair.</b>												
<b>2. Understand suitability of certain materials for a specific type of repair</b>												
<b>UNIT III</b>												
<b>Techniques for Repair And Protection Methods</b>												
Rust eliminators and polymers coating for rebars during repair, foamed												

concrete, mortar and drypack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures – case studies

**LO: 1. Explain techniques for repair and rehabilitation.**

**2. Understand methods of corrosion protection and inhibition**

#### **UNIT IV**

#### **Retrofitting of Structures**

Repairs to overcome low member strength. Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

**LO: Develop effective strategies for retrofitting.**

#### **TEXT BOOKS:**

1. Dension Campbell, Allen and Harold Roper, Concrete Structures, Materials,
2. Maintenance and Repair, Longman Scientific and Technical, U.K.

#### **REFERENCE BOOKS:**

1. R T. Allen and S.C. Edwards, Repair of concrete Structures, Blakie and sons, UK.
2. Santhakumar, A. R. Training Course notes on damage assessment and Repair in Structures

#### **E-RESOURCES:**

- <http://www.btechmaterials.com/download/rehabilitation-retrofitting-structures-materials-notes/>

**PROFESSIONAL ELECTIVE-III**

**18A3201523-INDUSTRIAL WASTE & WASTE-WATER ENGINEERING**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	3	<b>External Marks:</b>	60

**Prerequisites: -----**

**Course Objectives:**

- 1) To teach Health and Environment Concerns in waste water management
- 2) To teach material balance and design aspects of the reactors used in waste water treatment.
- 3) To impart knowledge on selection of treatment methods for industrial waste water
- 4) To teach common methods of treatment in different industries
- 5) To provide knowledge on operational problems of common effluent treatment plant

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Design treatment methods for any industrial wastewater.
CO2	Examine the manufacturing process of various industries.
CO3	Assess need for common effluent treatment plant for an industry
CO4	Test and analyse BOD, COD, TSS and MPN in wastewater.
CO5	Understand options for waste water disposal.
CO6	Understand the character of waste water from Steel plants and refineries

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	3	3	-	-	1	-	1	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	-	-	-	-	-	-	-	-	-

**UNIT I**

**Industrial water Quantity and Quality requirements:**

Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills Selection of source based on quality, quantity and economics. Use of Municipal wastewater in Industries – Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, Elutriation, Removal of Colour, Odour and Taste.

**LO: 1. Learn the procedures for assessment of quality of Industrial water**

**2. Suggest different processes of handling waste water**

**UNIT II**

**Basic theories of Industrial Wastewater Management:** Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization and Equalization, Segregation and proportioning- recycling, reuse and resources recovery

**LO: 1. Measurement of Industrial waste water**

**2. Characterize waste water**

**3. Suggest techniques for treatment of waste water.**

#### **UNIT III**

**Industrial wastewater disposal management:** Discharges into Streams, Lakes and oceans and associated problems, Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges-Recirculation of Industrial Wastes- Effluent Disposal Method

**LO: 1. Understand options for waste water disposal.**

**2. Explain functioning of common effluent treatment plants**

#### **UNIT IV**

**Process and Treatment of specific Industries-1:** Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants

**LO: 1. Understand the character of waste water from Steel plants and refineries**

**2. Suggest suitable waste water treatment techniques**

#### **TEXT BOOKS:**

1. M. N. Rao and A. K. Dutta, Wastewater Treatment, Oxford & IBH, New Delhi.
2. K.V. S. G. Murali Krishna, Industrial Water and Wastewater Management

#### **REFERENCE BOOKS:**

1. A. D. Patwardhan, Industrial Wastewater treatment, PHI Learning, Delhi
2. Metcalf and Eddy Inc., Wastewater Engineering, Tata McGraw Hill co., New Delhi.
3. G. L. Karia & R.A. Christian Wastewater Treatment- Concepts and Design Approach, Prentice Hall of India.

**PROFESSIONAL ELECTIVE-III**

**18A3201524-DOCKS AND HARBOUR ENGINEERING**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: -----</b>												
<b>Course Objectives:</b>												
1) To teach Water Transportation in India												
2) To impart knowledge on water waves and effects on harbour and structure design												
3) Development of facilities that are required for setting up of a port												
4) Planning of ports for effective cargo handling and economical considerations												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Enhance the knowledge on Docks and Harbour Engineering for water transportation in the context of regional and intercontinental transportation.											
CO2	Know techniques of planning the Infrastructures required for Harbour and Port area.											
CO3	Know techniques of designing the Infrastructures required for Harbour and Port area.											
CO4	Analyze cargo and passenger demand forecasting cargo handling capacity of ports and economic evaluation of port project.											
CO5	Understand environmental and other impact impended due to water transportation and port activities.											
CO6	Procedure to follow during planning of ports.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	-	-	-	-	-	-	-	-	-
<b>UNIT I</b>												
<b>Water Transportation:</b>												
Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, canal, Inland water Transportation, Development of Port & Harbors, Harbor Classification, Site Selection, Harbor Dimensioning												
<b>LO: 1. Classify different modes of transportation by water</b>												
<b>2. Explain development and classification of ports and harbors</b>												
<b>UNIT II</b>												

**Natural Phenomena:** Wind, Ties, Water waves, Wave decay & Ports, Wave Diffraction Breaking, Reflection, Littoral drift, Sedimentation transport, Effects on Harbor and Structure Design

**LO: 1. Understand effects of natural forces**

**2. Understand conditions for design of harbors**

**Harbor Infrastructure:**

Types of Break Waters, Jetty, Dock Fenders, Wharves, Dolphin Mooring accessories, Repair facilities, Wet Docks, Lift Docks, Dry Docks, Gates for Graving docks, Floating Docks, Slipways, Locks and Gates

**LO: 1. Understand components of harbor.**

### UNIT III

**Port Facility:**

Transit Shed, Warehouses, Cargo handling, Container Handling, Inland port facility, Navigational Aids, Types, Requirements of Signals, Lighthouses, Beam lights, Buoys, Dredging & Coastal protection, Types of Dredges, Choices, usage of dredge material, Sea wall protection, Sea wall revetments, bulkhead.

**LO: 1. Knowledge on facilities to be developed in ports.**

**2. Decide different features to be incorporated in ports**

### UNIT IV

**Planning of Ports:**

Regional and intercontinental transportation development, forecasting cargo & Passenger demand, regional connectivity, Cargo handling, Capacity of Port, Economic Evaluation of Port projects, Impact of Port activities.

**LO: 1. Study procedure to follow during planning of ports.**

**TEXT BOOKS:**

1. Bindra, S.P, A Course in Docks and Harbor Engineering, Dhanpat Rai and Sons, New Delhi, India, 1992.
2. R. Srinivasa Kumar, Transportation Engineering: Railways, Airports, Docks and Harbors, Universities Press Pvt Ltd, Hyderabad. 2014.

**REFERENCE BOOKS:**

1. Seetharaman, S., Dock and Harbour Engineering, Umesh Publications, New Delhi, India, 1999.
2. V.N. Vazirani and S.P. Chandola, Docks and Harbour Engineering – Text book of Transport Engineering Vol. II, Khanna Publishers, New Delhi.

**PROFESSIONAL ELECTIVE-III**

**18A3201525-WATER RESOURCES SYSTEM ANALYSIS**

<b>Lecture – Tutorial:</b>	3-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	3	<b>External Marks:</b>	60									
<b>Prerequisites: Water Resource Engineering</b>												
<b>Course Objectives:</b>												
1) Teach Concepts of systems techniques in water resources engineering												
2) Teach Linear Optimization concepts												
3) Demonstrate the Development system approach to reservoir operation												
4) Planning water allocation to different crops												
5) Expertise on River operation policies												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Apply basic principles of system approach.											
CO2	Judging Economics of water resources of multipurpose projects.											
CO3	Apply optimization principles to single and multi crop applications.											
CO4	Designing reservoir operation leading to optimum crop water application.											
CO5	Apply optimization methods to solve problems related to water resource systems											
CO6	Formulate optimization models for decision making in water resources systems.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	3	-	-	-	-	1	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	2	-	-	-	-	-	1	-	-	-	-
<b>UNIT I</b>												
<b>UNIT 1</b>												
<b>Concept of System and System Analysis</b> - Definition and Types of Systems - Basic Principles of Systems Approach and Analysis. Systems Techniques in Water Resources.												
<b>LO: 1. Understand the concepts of water resource system.</b>												
<b>Introduction to Optimization</b> - Linear and Dynamic Programming - Simulation - Combined Simulation and Optimization. Economics of Water Resources Projects - Cost Benefit Analysis - Cost Allocation among various projects in a Multi-purpose Project.												
<b>LO: 1. Explain optimization of water resource projects.</b>												
<b>2. Carryout cost analysis on different projects</b>												
<b>UNIT II</b>												

Systems Approach to Reservoir - Deterministic Flows - Reservoir Sizing and Reservoir Operations. Basic Concepts of Random Flows Reliability.

**LO: 1. Learn types of operations in water resource system.**

### **UNIT III**

Application of Linear Programming to Water Resources Systems - Irrigation Water Allocation for Single and Multiple Crops. Reservoir Operation for Irrigation and Hydropower Generation.

**LO: 1. Understand applications of linear programming on applications of water resource system for crops.**

### **UNIT IV**

Applications of Dynamic Programming to Water Resources Systems - Optimal Crop Water Application - Steady State Reservoir Operating Policy for Irrigation. Real Time Reservoir Operation for Irrigation.

**LO: 1. Develop knowledge on operating systems for irrigation.**

#### **TEXT BOOKS:**

1. Loucks, D. P. and Eelco Van Beek, Water Resources systems planning and management: An Introduction to methods, models and applications. (2005), UNESCO.
2. Vedula, S. and Mujumdar, P. P., Water resources Systems: Modeling techniques and analysis, (2005), Tata McGraw Hill, New Delhi.

#### **REFERENCE BOOKS:**

1. Simonovic, S.P., Managing water resources: Methods and tools for a systems approach, (2009). UNESCO Publishing, France.
2. R. K. Sharma & T. K. Sharma, A Textbook Of Irrigation Engineering, S. Chand and Company Limited, New Delhi

#### **E-RESOURCES:**

- <http://www.nptelvideos.in/2012/11/water-resources-systemsmodeling.html>
- <http://www.nptelvideos.in/2012/11/advanced-hydrology.html>
- <http://freevideolectures.com/Course/100/Water-Resources-Engineering>
- <http://www.btechmaterials.com/download/water-resources-engineering-materials-notes/>
- <http://www.btechmaterials.com/download/water-resources-engineering-ii-materials-notes/>



## Open Elective-3 (Offered by Department of civil engineering)

18A3201601-GREEN BUILDINGS

<b>Lecture – Tutorial:</b>	2-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	2	<b>External Marks:</b>	60									
<b>Prerequisites: Engineering chemistry, engineering geology and physics</b>												
<b>Course Objectives:</b>												
<ul style="list-style-type: none"> <li>➤ This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century.</li> <li>➤ To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings</li> <li>➤ To give a fuller understanding of Building Form and Fabric, Infiltration,</li> <li>➤ To give a fuller understanding of ventilation, Lighting, cooling and water conservation</li> </ul>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand why buildings should be made energy efficient.											
CO2	Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating											
CO3	Have a fuller grasp on Ground source heat pumps, and their adaption to green											
CO4	Understand the concepts of Site and Climate, Building Form, Building Fabric.											
CO5	Understand the concepts of Infiltration and ventilation, Lighting, Heating.											
CO6	Understand the concepts of Cooling, Energy Management and water conservation.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	-	-	-	-	2	-	2	-	-	-	-
CO2	3	2	-	-	-	1	-	2	-	-	-	-
CO3	2	2	-	-	-	1	-	2	-	-	-	-
CO4	3	-	-	-	-	1	-	2	-	-	-	-
CO5	2	2	-	-	-	-	-	2	-	-	-	-
CO6	3	1	-	-	-	2	-	2	-	-	-	-
<b>UNIT I</b>												
<b>Green Buildings</b> within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design.												
<b>UNIT II</b>												
<b>Renewable Energy</b> sources that can be used in Green Buildings – Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewable. A passive solar strategy, Photovoltaic’s, Climate and Energy, Macro and Microclimate. Indian Examples.												
<b>UNIT III</b>												
<b>Building Form</b> – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, rrouping of buildings.												
<b>Building Fabrics-</b> Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material.												
<b>UNIT IV</b>												
<b>Infiltration and ventilation</b> , Natural ventilation in commercial buildings, passive cooling, odelling air flow and ventilation, Concepts of daylight factors and day lighting, daylight assessment, artificial lighting, New light sources. Cooling buildings, passive cooling, and												

mechanical cooling. Water conservation- taps, toilets and urinals, novel systems, collection and utilization of rain water.

**TEXT BOOKS:**

1. William T. Meyer., Energy Economics and Building Design., New York: McGraw- Hill, Inc Indian Green Building Council
2. Public Technology, Inc. (1996). Sustainable Building Technical Manual: Green Building Design, Construction, and Operations. Public Technology, Inc., Washington, DC.

**REFERENCE BOOKS:**

1. Richard D. Rush, . Building System Integration Handbook., New York: John Wiley & Sons
2. Ben Farmer & Hentie Louw., Companion to Contemporary Architectural Thought, London & New York: Routledge
3. Peter Noever (ed)., Architecture in Transition: Between Deconstruction and New Modernism., Munich: Prestel.

**E-RESOURCES:**

<http://nptel.ac.in/courses.php>

<http://jntuk-coeerd.in/>

**Open Elective-3 (Offered by Department of civil engineering)**  
**18A3201602-BUILDING CONSTRUCTION**

<b>Lecture – Tutorial:</b>	2-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	2	<b>External Marks:</b>	60									
<b>Prerequisites:</b> Engineering chemistry, engineering geology and physics												
<b>Course Objectives:</b>												
➤ To know about activities in building construction.												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Understand types of foundation											
CO2	Understand stone and brick masonry for the different construction activities in the											
CO3	Understand block masonry for the different construction activities in the building											
CO4	Comprehend the floors & roofs and their types											
CO5	Comprehend the application of damp proofing, scaffolding											
CO6	Comprehend the application of shoring, underpinning and formwork.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	2	-	-	-	-	-	2	-	-	-	-
CO2	2	2	-	-	-	2	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	1	-	-	-	-
CO4	3	2	-	-	-	-	-	1	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-
CO6	2	1	-	-	-	1	-	1	-	-	-	-
<b>UNIT I</b>												
<b>FOUNDATIONS:</b> Concept of foundations; Factors affecting selection of foundations; Types of foundations; Strip, Isolated, Strap, Combined Footings, Grillage foundations, Piles and their classification; Foundation on black cotton soils.												
<b>UNIT II</b>												
<b>STONE, BRICK &amp; BLOCK MASONRY:</b> Technical terms; Classification of stone masonry; Types of bonds in brickwork and their suitability, Plan, elevation and section of brick bonds up to two bricks thickness; Classification of walls, Block masonry – Hollow concrete blocks – FAL- G Blocks, Hollow clay Blocks.												
<b>UNIT III</b>												
<b>FLOORS &amp; ROOFS:</b> Technical terms; Types of ground floors; Classification of roofs.												
<b>UNIT IV</b>												
<b>DAMP PROOFING, SCAFFOLDING, SHORING, UNDER PINNING &amp; FORMWORK:</b> Causes of dampness; Methods of preventing dampness; Types of scaffolding; Types of shoring; Methods of underpinning; Types of formwork												
<b>TEXT BOOKS:</b>												
1. Building construction, (10th edition) by Punmia, B. C., Laxmi Publications, Bangalore, 2009.												
<b>REFERENCE BOOKS:</b>												
1. Building construction and construction materials by Birdie, G.S. and Ahuja, T.D., Dhanpath Rai Publishing company, New Delhi, 1986.												
<b>E-RESOURCES:</b>												

<http://nptel.ac.in/courses.php>  
<http://jntuk-coeerd.in/>

**18A3201491-HIGHWAY ENGINEERING LAB**

<b>Practical's</b>	3 Hours	<b>Internal Marks:</b>	40
<b>Credits:</b>	1.0	<b>External Marks:</b>	60

**Prerequisites: Highway Engineering**

**Course Objectives:**

- To test crushing value, impact resistance, specific gravity and water absorption, percentage attrition, percentage abrasion, flakiness index and elongation index for the given road aggregates.
- To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
- To test the stability for the given bitumen mix
- To carry out surveys for traffic volume, speed and parking.

**Course Outcomes:**

**Upon successful completion of the course, the student will be able to:**

CO1	Ability to test aggregates and judge the suitability of materials for the road Construction
CO2	Ability to test the given bitumen samples and judge their suitability for the road construction
CO3	Ability to obtain the optimum bitumen content for the mix design
CO4	Ability to determine the traffic volume, speed and parking characteristics

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	3	-	3	-	2	-	2	-	-	-	-
CO2	3	3	-	3	-	2	-	2	-	-	-	-
CO3	3	3	-	3	-	2	-	2	-	-	-	-
CO4	3	3	-	3	-	2	-	2	-	-	-	-

**List of Experiments**

**ROAD AGGREGATES:**

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Attrition Test
5. Abrasion Test.
6. Shape tests

**II. BITUMINOUS MATERIALS:**

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

**III. BITUMINOUS MIX:**

1. Marshall Stability test.

**IV. TRAFFIC SURVEYS:**

1. Traffic volume study at mid blocks.

2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

**V. DESIGN & DRAWING:**

1. Earthwork calculations for road works.
2. Drawing of road cross sections.
3. Rotors intersection design.

**TEXT BOOKS:**

Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.

**REFERENCE BOOKS:**

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

**E-RESOURCES:**

## 18A3201391-COMPUTER AIDED CIVIL ENGINEERING DRAWING

<b>Practical's</b>	3 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	1.0	<b>External Marks:</b>	60									
<b>Prerequisites: Reinforced Concrete Structures and Building Planning</b>												
<b>Course Objectives:</b>												
1) To make the student prepare engineering drawings conventionally involving various design parameters.												
2) To introduce fundamentals of computer aided drawing in Civil Engineering.												
3) to enable the student develop drawing of building components												
4) to train the student in Producing 2D & 3D drawings												
5) to enable the students Communicate designs graphically												
6) to teach methodologies for understanding and verification of CAD												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
CO1	Develop drawing skills for effective demonstration of building details											
CO2	Draw building plans using Computer Aided Design and Drafting software's.											
CO3	Develop engineering project drawings incorporating details and design parameters in 2D & 3D.											
CO4	Examine efficacy of CAD design.											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
CO1	3	3	-	3	-	2	-	2	-	-	-	-
CO2	3	3	-	3	-	2	-	2	-	-	-	-
CO3	3	3	-	3	-	2	-	2	-	-	-	-
CO4	3	3	-	3	-	2	-	2	-	-	-	-
<b>List of Experiments</b>												
1. Sign conventions and symbols												
2. Masonry bonds												
3. Doors and windows												
4. Buildings with load bearing walls including details of doors and windows.												
5. Taking standard drawings of a typical two storied building including all MEP.												
6. Joinery, rebars, finishing and other details and writing out a description of the RCC framed structures												
7. Reinforcement drawings for typical slabs, beams, columns and spread footings. Industrial buildings - North light roof structures - Trusses												
8. Perspective view of one and two storey buildings												
<b>TEXT BOOKS:</b>												
1. Engineering Graphics, K.C. john, PHI Publications.												
2. Engineering drawing by N.D Bhatt, Charotar publications.												
<b>REFERENCE BOOKS:</b>												

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex.
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad–T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age.
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson

**E-RESOURCES:**



## 18A3200801-ESSENCE OF INDIAN KNOWLEDGE AND TRADITIONS

<b>Lecture – Tutorial:</b>	2-0 Hours	<b>Internal Marks:</b>	40									
<b>Credits:</b>	0	<b>External Marks:</b>	60									
<b>Prerequisites: -----</b>												
<b>Course Objectives:</b>												
<p>6. To develop knowledge of fundamental management concepts, skills and tools, to aid in problem solving and decision making.</p> <p>7. To develop and understanding about the organizational structure and relationship between authority and responsibility in various structures.</p> <p>8. To discuss the evolution of principles that make it possible to design facilities, processes, and control systems with a degree of predictability as to their performance.</p> <p>9. To develop comprehensive skills in planning, selecting, motivating, and developing the human resources for organisational effectiveness.</p> <p>10. To understand the broad scope of marketing, societal, ethical and other diverse aspects of marketing.</p>												
<b>Course Outcomes:</b>												
<b>Upon successful completion of the course, the student will be able to:</b>												
C01	Understand the concept of Traditional knowledge and its importance											
C02	Know the need and importance of protecting traditional knowledge											
C03	Know the various enactments related to the protection of traditional knowledge											
C04	Understand the concepts of Intellectual property to protect the traditional knowledge											
C05	Develop comprehensive skills in planning, selecting, motivating, and developing the human resources for organisational effectiveness.											
C06	Understand the broad scope of marketing, societal, ethical and other diverse aspects of marketing											
<b>Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)</b>												
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
C01	2	-	-	-	-	-	-	2		-	-	-
C02	2	-	-	-	-	-	-	2		-	-	-
C03	2	-	-	-	-	-	-	2		-	-	-
C04	2	-	-	-	-	-	-	2		-	-	-
C05	2	-	-	-	-	-	-	2		-	-	-
C06	2	-	-	-	-	-	-	2		-	-	-
<b>UNIT I</b>												
<p><b>Introduction to traditional knowledge:</b> Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge</p>												
<b>UNIT II</b>												

**Protection of traditional knowledge:** the need for protecting traditional knowledge  
Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

**Legal framework and TK: A:** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);**B:** The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

### **UNIT III**

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

### **UNIT IV**

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

### **TEXT BOOKS:**

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.

### **REFERENCE BOOKS:**

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
2. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino