SYLLABUS

OF

B. TECH

OF

III YEAR

B. TECH. (CBCS)

DEPARTMENT OF CIVIL ENGINEERING

INTEGRAL UNIVERSITY LUCKNOW

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

Year – III, Semester – V

S. No.	Course Category	Code No	Name of Subject	Periods			Credits	Evaluation Scheme				Subject Total
								Sessional Exam			Exam	
				L	T	P	C	CT	TA	Total	ESE	
1	DC	CE301	Structural Analysis-II	3	1	0	4	25	15	40	60	100
2	DC	CE302	Design of Reinforced Concrete Structure-I	3	1	0	4	25	15	40	60	100
3	DC	CE303	Transportation Engineering	3	1	0	4	25	15	40	60	100
4	DC	CE304	Geotechnical Engineering-I	3	1	0	4	25	15	40	60	100
5	DC	CE305	Engineering Geology	3	1	0	4	25	15	40	60	100
6	DC	CE306	Water Resources Engineering	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
7	DC	CE307	Structural Analysis Lab	0	0	2	1	30	30	60	40	100
8	DC	CE308	Transportation Engineering Lab	0	0	2	1	30	30	60	40	100
9	DC	CE309	Quantity Surveying & Estimation	0	0	2	1	30	30	60	40	100
Total				**18**	**6**	**6**	**27**					**900**

L – Lecture; **T –** Tutorial; **P –** Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher Assessment
Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC – Departmental Core
DE – Departmental Elective
OE – Open Elective

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

Year – III, Semester – VI

S. No.	Course Category	Code No	Name of Subject	Periods			Credits	Evaluation Scheme				Subject Total
								Sessional Exam			Exam	
				L	T	P	C	CT	TA	Total	ESE	
THEORY SUBJECT												
1	DC	CE310	Environmental Engineering-I	3	1	0	4	25	15	40	60	100
2	DC	CE311	Design of Reinforced Concrete Structure-II	3	1	0	4	25	15	40	60	100
3	DC	CE312	Geotechnical Engineering-II	3	1	0	4	25	15	40	60	100
4	DE	CE313-CE317	Departmental Elective-I	3	1	0	4	25	15	40	60	100
5	DE	CE320-CE324	Departmental Elective-II	3	1	0	4	25	15	40	60	100
6	OE	-	Open Elective	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
8	DC	CE327	Environmental Engineering Lab–I	0	0	2	1	30	30	60	40	100
9	DC	CE328	Geotechnical Engineering Lab	0	0	2	1	30	30	60	40	100
10	DC	CE329	Survey Camp	0	0	0	1	0	0	100	0	100
Total				**18**	**6**	**4**	**27**					**900**

L – Lecture; **T –** Tutorial; **P –** Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher Assessment
Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC – Departmental Core
DE – Departmental Elective
OE – Open Elective

List of Departmental Electives (I & II)

Departmental Elective - I

CE313/CEE313	Traffic Engineering
CE314/CEE314	Open Channel Flow
CE315/CEE315	Matrix Methods of Structural Analysis
CE316/CEE316	Sustainable Construction Techniques
CE317/CEE317	Ground Improvement Techniques

Departmental Elective - II

CE320/CEE320	Dock Harbor Tunnel Engineering
CE321/CEE321	Design of Hydraulic Structures
CE322/CEE322	Maintenance & Rehabilitation of Structures
CE323/CEE323	Occupational Health and Safety Engineering
CE324/CEE324	Principles of Town Planning and Architecture

CE301/CEE301	STRUCTURAL ANALYSIS – II				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE212/ CEE212 Recommended	NIL	3	1	0	4
Objectives	To develop an understanding of theory and application of the various advanced methods of structural analysis. To develop the skill to deals with the problems of moving loads in the structures and their analysis techniques.				
Unit-I	**Analysis of Linear and Two dimensional Structures**				**08 Hrs**
Analysis of fixed beam, continuous beam and simple frames with or without translation of joints. Slope deflection method, Moment distribution method, strain energy method.					
Unit-II	**Two Hinged Arches & Influence Line Diagram for Indeterminate Structures**				**08 Hrs**
Muller-Breslau's principle and its application for drawing influence line for Indeterminate beams. Analysis of two hinge arches, Influence line diagram for maximum bending moment, shear force and thrust.					
Unit-III	**Analysis of Suspension Cable & Bridge Girders**				**08 Hrs**
Suspension bridges, Analysis of cable with concentrated and continuous loadings, Analysis of two and three hinge stiffening girder, Influence line diagram for maximum bending moment and shear force in the stiffening girders.					
Unit-IV	**Matrix Methods of Structure Analysis**				**08 Hrs**
Basics of force and displacement matrix, matrix method for the analysis of beams and frames.					
Unit-V	**Plastic Analysis of Structures**				**08 Hrs**
Basics of plastic analysis, Application of static and kinematics theorem, Plastic analysis of beams and frames.					

References:

1. Theory of Structures by Pundit and Gupta, Vol. I & II, McGraw Hill Publication, New Delhi, First Edition, 2000
2. Basic structural analysis by CS Reddy, TMH publishing Company Ltd. New Delhi, 3rd Edition, 2010
3. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company, Delhi, 2nd Edition 2015
4. Analysis of statically indeterminate structures P. Dayaratnam. Affiliated East-West press Pvt. Ltd.
5. Indeterminate structural Analysis C.K.Wang, McGraw Hill Publications, 5th Edition 2014
6. Structural Analysis (Matrix Approach) by Pundit and Gupta, McGraw Hill Publication, New Delhi. 2nd edition, 2008.
7. Theory of structures Vol. II Vazirani and Ratwani, Sixteenth edition (2017)
8. Fundamentals of Structural Mechanics and Analysis by M.L Gambhir, PHI Learning Private Limited, New Delhi.

Web links to e-learning:

1. https://nptel.ac.in/courses/105104102/

CE302/CEE302	DESIGN OF REINFORCED CONCRETE STRUCTURE-I				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
Recommended CE204/ CEE204	NIL	3	1	0	4
Objectives	To understand the Basic concept and procedure of Designing Reinforced Concrete Structural Components.				
Unit-I	**Attributes of Structural Design**				**08 Hrs**
Material properties of RCC Making materials, Basic design approach, Working stress & Limit state method of design. Assumptions, Analysis and Design of a rectangular singly and doubly reinforced section by Working stress design method.					
Unit-II	**Limit State Design of Beams**				**08 Hrs**
Assumption in Limit state design method, Codal recommendations, Design of a rectangular singly & doubly reinforced section, T & L sections by limit state method.					
Unit-III	**Behavior of RC Beams in Shear**				**08 Hrs**
Shear strength of beam with and without shear reinforcement, Minimum & maximum shear reinforcement, Design of beam in shear using Limit state method. Nature of bond between steel and concrete, Concept of development length and anchorage, Calculation of development length using Limit state methods.					
Unit-IV	**Limit State Design of Slab & Stair**				**08 Hrs**
One way solid slabs, Simply supported and continuous. Two way slabs: Simply supported and continuous. Types of RCC stairs, loads and load effects on stairs, design of doglegged stairs. Introduction to Short term, long term deflections & Cracks in RCC.					
Unit-V	**Limit State Design of Compression Members**				**08 Hrs**
Classification of compression members, Codal provisions relating to design of RC columns, Effective length of RC column, Minimum eccentricity, Design of Axially loaded (tied and helically reinforced) short columns by Limit state method.					

References:

1. A.K. Jain "Reinforced concrete design, limit state Method", Nem Chand & Bros.; 7th Edition 2012
2. S.Unnikrishna. and Devdas Menon, "Reinforced concrete design", McGraw Hill Education; 3rd Edition 2009
3. B.C. Punmia and A.K. Jain "Limit State Design of Reinforced Concrete", Laxmi Publications,1st Edition Reprint 2007
4. Sayal I.C and Goel A.K., "Reinforced Concrete Structures" S Chand & Company; 4th Edition 2007
5. IS 456-2000 Indian Standard "Plain & Reinforced Concrete-code of practice", BIS, New Delhi.

Web links to e-learning:

1. http://nptel.ac.in/courses/105105105/
2. http://nptel.ac.in/downloads/105105104/

CE303/CEE303	TRANSPORTATION ENGINEERING				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of design and construction of roads, railways, airports and harbours.				
Unit-I	**Introduction and Geometric Design of Highways**				**08 Hrs**
Modes of Transportation, History of road development road types and patterns. Introduction to highway alignment and engineering surveys; Geometric design of highways –cross-sectional elements, sight distances, horizontal and vertical alignments.					
Unit-II	**Pavement Design and Highway Materials**				**08 Hrs**
Design factors for flexible and rigid pavements; Design of flexible pavement by CBR method; Design of rigid pavement: Westergaard's theory, load and temperature stresses, critical combination of stresses, joints.Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes.					
Unit-III	**Traffic Engineering**				**08 Hrs**
Traffic flow studies, speed studies, travel time: delay study and O-D study, PCU, peak hour factor, Microscopic and macroscopic parameters of Traffic flow, Fundamental relationships, Traffic Simulation: An introduction to microsimulation; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service.					
Unit-IV	**Railway Engineering**				**08 Hrs**
Introduction to Railways:Permanent way, capacity of railway track, cross-section of subgrade. Track geometry, gradient, horizontal curves, vertical curves, super elevation and safe speed on curve, widening of tracks, cant deficiency, negative super elevation and compensation for curvature on gradients, tractive resistant and tractive power. Point and crossing: Element of a turnout, detail of a switch and crossing numbers and angles of crossings, design of a turnout.					
Unit-V	**Airport and Harbour**				**08 Hrs**
Aircraft characteristics affecting airport planning, Site selection and design, airport layout, runway orientation, wind rose diagram.Airport runway length and corrections, taxiway and exit taxiway design. Harbours, layout and port facilities, Break waters, Jetties, wharves, navigation aids. .					

References:

1. Dr. S.K. Khanna, M.G Arora and S.S Jain, Airport Planning & Design, Nem Chand & Bros., Roorkee, 5th Edition 2012
2. SK Khanna & CG Justo, Highway Engineering, Nem Chand and Brothers, Roorkee, 4th Reprint 2015
3. L.R. Kadiyali, Highway Engg., Kanna Tech Publications, Delhi 6th Edition, 2014
4. Specification for Roads & Bridges by Ministry of Road Transport & Highways and Indian Road Congress, 2014
5. Satish Chandra and M.M Agarwal, Railway Engineering, Oxford University Press, Delhi, 4th Edition 2014.

Web links to e-learning:

1. http://nptel.ac.in/downloads/105101008/
2. http://nptel.ac.in/courses/105105107/
3. http://nptel.ac.in/courses/105107123/

CE304/CEE304	GEOTECHNICAL ENGINEERING- I				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To introduce students to soil mechanics, understand soil behavior with loading and time.				
Unit-I	**Introduction to Soil and Index Properties**				**08 Hrs**
Engineering Geology of Soil and its formation, Preliminary definitions of Soil Properties, phase diagram, inter-relationship, Index properties of Soil. Classification of Soils: Classification of soil systems – Particle size classification, Textural classification, AASHTO classification, Unified soil classification and Indian soil classification.					
Unit-II	**Permeability in Soil**				**08 Hrs**
Soil Water: Types of soil water, Capillarity in soils, Permeability of soils, Darcy's law, Determination of permeability of soils, Permeability of stratified soils, Seepage velocity, flow net, Absolute coefficient of permeability, Factors affecting permeability, Effective stress principle- Effective stress under different field conditions- Seepage pressure-Quick sand condition.					
Unit-III	**Stresses in Soil**				**08 Hrs**
Stresses in soils: Normal and shear Stresses on a plane, Stresses due to applied loads, Boussinesq's solution for a point load, line load, strip load, uniformly loaded circular and rectangular areas, Isobar and pressure bulb concept, stress distribution on horizontal and vertical planes, Newmark's chart and its application, contact pressure.					
Unit-IV	**Compaction and Consolidation**				**08 Hrs**
Soil structure. Compaction of soil – Theory of compaction, laboratory compaction tests, optimum moisture content and zero air void line, Field methods and compaction control. Compressibility and Consolidation: Virgin compression curve, Normal and Over Consolidated soils, Over Consolidation Ratio, Terzaghi's one dimensional consolidation theory, Laboratory consolidation test. Determination of coefficient of consolidation by log of time fitting and square root of time fitting methods, Consolidation settlement.					
Unit-V	**Shear Strength**				**08 Hrs**
Introduction of Shear Strength of Soil: State of stress at a point, Mohr's stress circle. Shear strength of soil. Mohr-Coulomb failures envelop. Direct, Triaxial, Unconfined and Vane shear tests, principles of drained and undrained tests, Strength of loose and dense sands, pore pressures.					

References:

1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International (P) Ltd, 2nd Edition (2005), New Delhi
2. K R Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist., 2nd Edition 2009.
3. V.N.S.Murty, "Soil Mechanics and Foundation Engineering", Sai Kripa Technical Consultants, 1st edition 2009.
4. By B. C. Punmia, Ashok Kumar Jain, "Soil Mechanics and Foundations", Laxmi Publications Ltd., 16th edition (2017), New Delhi.

Web links to e-learning:

1. https://nptel.ac.in/courses/105105168/
2. https://nptel.ac.in/courses/105101201/

CE305/CEE305	ENGINEERING GEOLOGY				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of rocks ,minerals, internal structure of earth, ground water condition, soil formation and tunneling				
Unit-I	**General Geology**				**08 Hrs**
Introduction to the Earth Sciences. Elementary idea about the internal structure of the earth. The elementary knowledge and demonstration of the physical properties of the common rock forming minerals. Introduction and demonstration to the major group of rocks, mode of origin classification and properties.					
Unit-II	**Structural Geology, Earthquake and Landslides**				**08 Hrs**
Theory and demonstration of Strike and Dip, Out crops, volcanoes, overlaps, inliers and outliers types and classification of folds, faults, joints, unconformities Classifications, causes and effects of Earthquakes and Landslides, seismic curve, seismograph, seismogram, seismic problems of India, seismic zones of India, case histories.					
Unit-III	**Geological Investigation, Geology of Dams and Reservoirs**				**08 Hrs**
Interpretation of geological maps, use of aerial maps in geological surveying, Topographic maps, Geological Cross-section, outcrop patterns. Geophysical methods as applied to civil engineering for subsurface analysis. Types of dams, preliminary and detailed geological investigation for a dam site, important International and Indian examples of failure of dams and their causes, factors affecting the seepage and leakage of the reservoirs and the remedial measures.					
Unit-IV	**Ground Water Geology**				**08 Hrs**
Ground water, zones of ground water, water table and perched water table, ground water provinces of India, water bearing properties of rocks, springs, selection of a site for well sinking and groundwater investigations. Concept of water shed management, Ground water Pollution, Impact of mining activity on ground water.					
Unit-V	**Soil formation, Rock Mechanics and Tunnelling**				**08 Hrs**
Soil profile and classification, engineering properties of soil. Purposes of tunnelling and geological problems connected with tunnelling, geological consideration in road alignment, roads in complicated regions, problems after road construction, geology of bridge sites					

References:

1. Subinoy Gangopadhyay "Engineering Geology" Oxford University Press (2013).
2. Parbin Singh. "Engineering and General Geology", Katson Publishing House (2008).
3. P.K.Mukerjee, "A text book of Geology", Calcutta, Word Publisher (14 January 2013).
4. K.M.Bangar "Principle of Engineering Geology", Standard publishers Distributors (2009).

Web links to e-learning:

1. https://nptel.ac.in/courses/105105106/
2. https://web.viu.ca/earle/geol111/lecture-notes.htm

CE306/CEE306	WATER RESOURCES ENGINEERING				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
Recommended CE201/ CEE201	NIL	3	1	0	4
Objectives	Students are expected to realize the importance of water resources and its application in Civil engineering.				
Unit-I	**Hydrology**				**08 Hrs**
Hydrologic cycle, Precipitation types and forms, rainfall and its measurement, rain gauges, rain gauge network, presentation of rainfall data, computation of mean rainfall using arithmetic mean, Theissen polygon and Isohyetal methods , estimation of missing rainfall Infiltration – process, infiltration indices and Horton's equation; Evaporation and Evapotranspiration – Pan evaporation, empirical equations for estimating evaporation and evapotranspiration.					
Unit-II	**Runoff and Hydrographs**				**08 Hrs**
Runoff- definition, types, catchment characteristics, factors affecting runoff, methods of runoff estimation, flow duration curve and flow mass curve, stage-discharge relationship and rating curve Hydrograph Analysis: Flood hydrograph, Components of hydrograph, base flow separation, direct runoff hydrograph, Unit hydrograph theory, derivation of unit hydrograph and its duration, S-hydrograph and instantaneous unit hydrograph, Derivation of unit hydrograph for ungauged catchments using Snyder's method.					
Unit-III	**Analysis of Floods**				**08 Hrs**
Peak discharge estimation methods,Concepts of return period, flood frequency analysis, Gumbel's and Log-Pearson Type-III distributions, Flood Routing: Concepts of flow routing, hydraulic and hydrologic routing, Reservoir routing, Channel routing, Muskinghum method of channel routing and flood forecasting. Flood control management.					
Unit-IV	**Ground Water Hydrology**				**08 Hrs**
Zones of ground water ,types of aquifers, aquiclude, aquifuge, aquitard, confined and unconfined aquifers, perched aquifer, aquifer properties-specific storage, specific capacity, transmissivity, Theims and Dupit theory for yield calculation in Confined and unconfined aquifers, Darcy's law, types of wells,interference of wells, well losses, recuperation test for yield determination from an open well.					
Unit-V	**Irrigation Engineering**				**08 Hrs**
Irrigation: necessity, Types of irrigation , advantages and disadvantages of irrigation, irrigation efficiencies, Consumptive use and its determination, water requirement of various crops, Duty, Delta, Base period and crop period, relationship between base period, duty and delta. Soil moisture: Hygroscopic water, capillary water, gravity water, saturation capacity, field capacity, permanent wilting point.					

References:

1. Subramanya K., Engineering Hydrology, Tata McGraw Hill (2016)
2. S.K Garg, Irrigation Engineering and Hydraulic structures, Khanna publishers(2016)
3. P. Jaya Rami Reddy , A Textbook of Hydrology, Laxmi Publications; Third edition (2016)
4. Punmia B.C. & Lal P.B., Irrigation and Water Power, Laxmi Publications(2016)
5. Dr. Modi P.N. Seth, Irrigation Water Resources & Water Power, Standard publishers(2016)
6. G.L.Asawa, Irrigation Engineering, Wiley Eastern(2016)
7. N N Basak ,Irrigation Engineering, McGraw Hill Education; 1st edition (1 July 2017).

Web links to e-learning:

1. https://gradeup.co/well-hydraulics-and-aquifers-i-ed587c01-975d-11e6-bf75-9c0e0d13dead
2. https://www.youtube.com/watch?v=fx1uUek3Iqg
3. http://nptel.ac.in/courses/105104103/1

CE307/CEE307	STRUCTURAL ANALYSIS LAB				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	Structural Analysis-II (CE-301)	0	0	2	1

1. To determine flexural Rigidity (EI) of a given beam.
2. To verify Maxwell's Reciprocal Theorem.
3. To find horizontal thrust in a three hinged arch and to draw influence line diagrams for Horizontal Thrust and Bending Moment.
4. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for Horizontal Thrust and Bending Moment.
5. To find carry over factor for the beam with far end fixed.
6. To find deflection of curved members
7. To find bar forces in a three member structural frames with pin jointed bar.
8. To find Critical loads in Struts with different end conditions.
9. To find forces in elastically Coupled Beam.
10. To find deflections in beam having unsymmetrical bending.
11. To determine the fatigue strength of mild steel specimen.

References:

1. Theory of Structures by Pundit and Gupta, Vol. I & II, McGraw Hill Publication, New Delhi, First Edition, 2000
2. Basic structural analysis by CS Reddy, TMH publishing Company Ltd. New Delhi, 3rd Edition, 2010
3. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company, Delhi, 2nd Edition 2015
4. Analysis of statically indeterminate structures P. Dayaratnam. Affiliated East-West press Pvt. Ltd.
5. Indeterminate structural Analysis C.K.Wang, McGraw Hill Publications, 5th Edition 2014
6. Structural Analysis (Matrix Approach) by Pundit and Gupta, McGraw Hill Publication, New Delhi. 2nd edition, 2008.
7. Theory of structures Vol. II Vazirani and Ratwani, Sixteenth edition (2017)
8. Fundamentals of Structural Mechanics and Analysis by M.L Gambhir, PHI Learning Private Limited, New Delhi.

CE308/CEE308	TRANSPORTATION ENGGINEERING LABORATORY				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	Transportation Engineering (CE-303)	0	0	2	1

1. To determine Crushing strength of a given Aggregate sample.
2. To determine Aggregate Impact Vale of a given Aggregate sample.
3. To determine Abrasion Value of a given Aggregate sample.
4. To determine Angularity of a given Aggregate sample.
5. To determine Penetration Point of a given Bituminous sample.
6. To determine Softening Point of a given Bituminous sample.
7. To determine Flash and Fire Point of a given Bituminous sample.
8. To determine Stripping Value of a given Bituminous sample.
9. To determine Ductility of a given Bituminous sample.
10. To Perform Traffic Volume Study at a given Stretch of Road.
11. To Perform Traffic speed study given point of Road.

References:

1. Dr. S.K. Khanna, M.G Arora and S.S Jain, Airport Planning & Design, Nem Chand & Bros., Roorkee, 5th Edition 2012.
2. SK Khanna & CG Justo, Highway Engineering, Nem Chand and Brothers, Roorkee, 4th Reprint 2015.
3. L.R. Kadiyali, Highway Engg., Kanna Tech Publications, Delhi 6th Edition, 2014.
4. Specification for Roads & Bridges by Ministry of Road Transport & Highways and Indian Road Congress, 2014.
5. Satish Chandra and M.M Agarwal, Railway Engineering, Oxford University Press, Delhi, 4th Edition 2014.

CE309/CEE309	QUANTITY SURVEYING & ESTIMATION				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	0	0	2	1

1. Importance of estimation, different types of estimates specifications general and detailed.
2. Methods of Estimation: General items of work for estimates units and measurement, method of accounting for the deduction of openings etc.
3. Detailed estimates of a single roomed and a two roomed residential building.
4. Analysis of rates: Definition of analysis of rates, Prime cost, Work charged establishment.
5. Quantity of materials per unit of work for major civil engineering items Resource planning through analysis of rates, market rates, PW.D. Scheduled and cost indices for building material and labour. Public works Organization, M.E.S. Organization, India Railway Organization and concept of organizational set up for Public Work Execution.

References:

1. Dr. Rang Wala, Estimation, Costing & Valuation, Charator Publising House Pvt. Ltd., 17th Edition 2015.
2. S.V Deodhar, Estimation, Costing & Valuation, Khanna Publising, 6th Edition 2015.

CE310/CEE310	ENVIRONMENTAL ENGINEERING -I				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To educate the students about the basic principles of water treatment processes and air pollution engineering.				
Unit-I	**Water Quality Assessment**				**08 Hrs**
Importance and necessity for planned water supplies, various types of Water demands, Per capita demand, Variations in demand, Design Periods & Population Forecast, Sources of water, Intakes for collecting surface water. Guideline Specification For Drinking Water Quality- IS-10500:2012, Indicator Organism.					
Unit-II	**Sedimentation and Coagulation**				**08 Hrs**
Water Treatment Concept, Screening, Settling operation, Plain Sedimentation. Coagulation and its Mechanism, Coagulants, Flocculation, Mechanism of Flocculation. Sedimentation aided with coagulation.					
Unit-III	**Water Filtration and Softening**				**08 Hrs**
Filtration: Theory, Types Of Filter, Mechanism and Operation Of Slow Sand, Rapid Sand And Pressure Filter. Disinfection: Methods of Disinfection, Kinetics of disinfection, Chlorination and Practices of Chlorination. Softening and its Methods, Calculation of Doses.					
Unit-IV	**Storage and Distribution of Water**				**08 Hrs**
Distribution System, Methods Of Distribution, Layouts Of Distribution Networks, Detection of Leakage in the Distribution Pipes, Pipe Network Analysis- Hardy-Cross Method, Equivalent Pipe Method. Appurtenances in The Distribution System. Plumbing System, House Water Connection, Different Cocks and Pipe Fittings.					
Unit-V	**Air Pollution Engineering**				**08 Hrs**
Air Pollution: Natural And Man-Made Air Pollution, Causes And Effect Of Air Pollution, Air Pollution Control Methods, Control Of Particulate Pollutants, Control Of Gaseous Pollutants.					

References:

1. S. K. Garg, Water Supply Engineering: Environmental Engineering v. 1, 29th Edition, Khanna Publication, 2013
2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, Environmental Engineering, 1st Edition, McGraw Hill Education; 2013.
3. Gilbert M. Masters, Wendell P. Ela, Introduction to Environmental Engineering and Science, 3rd Edition, Publisher: Prentice Hall, ISBN-13: 978-0-13-148193-0, ISBN-10: 0-13-148193-2
4. K.V.S.G. Murali Krishna, Air Pollution and Control, Laxmi Publications, 1st Edition, 2017.
5. Standard Methods for the Examination of water and wastewater: AWWA, APHA, WPCF 2012.
6. I.S. 10500: 2012, Drinking Water Standards, 2012.

Web links to e-learning:

1. http://envirocomp.org
2. https://www.hindawi.com/journals/tswj/2013/231768/

CE311/CEE311	DESIGN OF REINFORCED CONCRETE STRUCTURE - II				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
Compulsory CE302/CEE302	NIL	3	1	0	4
Objectives	To bring about an exposure to advanced topics in structural design comprising of Torsional Effect on Beams, Footings, Flat and Circular Slabs ,water tanks, RC retaining walls and prestressed concrete.				
Unit-I	**Torsional Effect on Beams and Design of Footing**				**08 Hrs**
Effect of torsion on beam, concept of equivalent shear and moments. Design of beam under torsion. Structural behavior of footings, Design of wall, isolated and combined footing.					
Unit-II	**Flat and Circular Slabs**				**08 Hrs**
Nature of stresses in flat slabs. Design of flat slab with and without drops by direct method, reinforcement in flat slab. Design of Circular slab with various edges and loading condition..					
Unit-III	**Water Tanks**				**08 Hrs**
Design criteria, material specifications and permissible stress for tanks, design of circular and rectangular tanks situated on the ground under hoop stresses, Introduction of underground and overhead tanks.					
Unit-IV	**Retaining Walls**				**08 Hrs**
Structural behavior of retaining wall, stability of retaining wall against overturning, sliding and pressure developed under the base design of T- shaped retaining wall, design of shear key concept of counter fort retaining wall.					
Unit-V	**Prestressed Concrete**				**08 Hrs**
Introduction of pre-stressed concrete, advantages of pre-stressed concrete, types of pre-stressing, methods of pre-stressing, losses in pre-stress, analysis of simple pre-stressed rectangular and T-sections.					

References:

1. Ramamurtham S., "Design of Reinforced Concrete Structures", Dhanpatrai Publishing Company, 18th Edition 2015, Reprint 2016.
2. Bhawikatty S. S. " Advanced Concrete Design", New Age International, 3rd Edition (2016)
3. Sinha S.N. "Reinforced Concrete Design", Tata McGraw-Hill Education, 2nd Edition (2002)
4. Punmia B.C Jain A.K, "Limit State Design of Reinforced Concrete", Laxmi Publications 1st Edition (2007)
5. Jain A.K., "Reinforced concrete design, limit state Method", Nem Chand & Bros.; 7th Edition (2012)
6. IS 456-2000 Indian Standard "Plain & Reinforced Concrete-code of practice", BIS, New Delhi.

Web links to e-learning:

1. http://nptel.ac.in/courses/105105105/
2. http://nptel.ac.in/courses/105105104/

CE312/CEE312	GEOTECHNICAL ENGINEERING - II				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE304	NIL	3	1	0	4
Objectives	1. To develop an understanding to perform site investigations and to determine the soil parameters needed to carry out foundation design. 2. To apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity, stability analysis of slopes and settlement calculations. 3. To compute the lateral earth pressure, select size of retaining walls and ensure safety against external forces and moments.				

Unit-I	**Soil Exploration and Site Investigation**	**08 Hrs**

Introduction, Planning and stages in sub-surface exploration, depth and spacing of exploration, Disturbed and undisturbed soil samples, Area ratio, External and internal clearance, Methods of exploration, Geophysical methods: Seismic refraction and Electrical resistivity method.

Boring: Auger boring, Wash boring and Rotary drilling. Types of soil sample: Disturbed and undisturbed soil samples, Features of sampler affecting soil disturbance.

Characterization of ground, site investigations, Standard Penetration Test, Static and Dynamic cone penetration test, ground water level etc. Preparation of Bore log report

Unit-II	**Shallow Foundation and Bearing Capacity**	**08 Hrs**

Introduction- contact pressure distributions, Bearing capacity of footing, types of shear failure, correction for size, shape, depth, compressibility, etc., ultimate and allowable stresses, Terzaghi's, Meyerhof's, Hansen, Skempton's and BIS methods, Effect of rising and lowering of water table on bearing capacity, Plate load test, Standard and Cone penetration tests for determining allowable bearing pressure, Total and Differential settlements as per IS Code, causes and methods of minimizing settlement, Introduction to Floating foundation

Unit-III	**Deep Foundations**	**08 Hrs**

Pile foundations: Introduction to pile foundation, factors influencing the selection of pile, Load carrying capacity of Single Pile by static formula and dynamic formulae (Engineering News and Hileys), Feld's rule, Capacity from in-situ penetration tests, piles load test; Negative skin friction; under reamed pile foundations; Pile groups – Necessity, Efficiency, Group capacity and settlements.

Well Foundation: Types of casissons and their construction; Different shapes of wells, component parts and forces, sinking of wells and remedial measures for tilts and shifts.

Unit-IV	**Stability of Slopes**	**08 Hrs**

Types of slopes, Types of slope failures, limit equilibrium methods of slices and simplified Bishop Method, factor of safety, friction circle method, Taylor stability number method, Stabilization of soil slopes.

Unit-V	**Earth Pressures and Retaining Structures**	**08 Hrs**

Earth pressure theories, Plastic equilibrium, Coulomb's and Rankine's approaches, pressure distribution diagram for lateral earth pressures against retaining walls for different conditions in cohesion less and cohesive soils, smooth and rough walls, inclined backfills, depth of tension cracks, retaining structures, gravity cantilever, counter fort, reinforced earth, etc., design and check for stability, Rebhann's and Culmann's graphical constructions of active pressure for cohesionless soil.

References:

1. Bowles .J.E, "Foundation analysis and design", McGraw Hill, 5th Edition, 2001.
2. Murthy .V.N.S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi, 1st Edition, 2009.
3. Garg, S.K., "Soil Mechanics and Foundation Engineering", Khanna Publishers, New Delhi, India. Khanna (2003)
4. Khan I. H., "A Text Book of Geotechnical Engineering", Prentice –Hall of India Pvt. Ltd., Delhi, India. 2nd Revised edition edition (30 March 2005)
5. Arora, K. R., "Soil Mechanics and Foundation Engineering", Standard Publishers, New Delhi, India. STANDARD PUBLISHER DIST. (2009)
6. Punmia, B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 1995. Prentice Hall India Learning Private Limited (2011)

Web links to e-learning:

1. https://nptel.ac.in/courses/105105185/

CE313/CEE313	TRAFFIC ENGINEERING				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE303	NIL	3	1	0	4
Objectives	To familiarize about the fundamentals of Traffic Engineering, its surveys and methods to analyse and controls its operations.				
Unit-I	**Traffic Engineering Principles**				**08 Hrs**
Traffic on road, mixed traffic, concept of PCU, Traffic Engineering- scope and objectives, road user and vehicle characteristics, Traffic characteristics, Hierarchy of Roads, Typical road cross sections, fundamental definitions, traffic flow parameters, time-space diagram, speed-flow-density relationship, capacity and level of service, factors effecting level of service.					
Unit-II	**Traffic Flow Theory and Regulation**				**08 Hrs**
Traffic stream and its components, stream parameters, Interrupted and un-interrupted traffic flow, trajectory diagrams, shock wave theory and it application, queuing theory and its application. Regulation of speed, regulation of vehicles, regulation concerning drivers, regulation concerning traffic, parking regulations, general rules, enforcement of regulations.					
Unit-III	**Traffic Survey and Studies**				**08 Hrs**
Traffic Volume study-need, methods, format preparation, analysis and presentation; Origin Destination studyneed, methods, format preparation, zoning, analysis and presentation; Speed and Delay Study- need, methods, format preparation, analysis and presentation; Parking Study- need, type of surveys, format preparation, demand estimation, type of parking facilities; Road Network Inventory Survey- need, format preparation and data collection.					
Unit-IV	**Traffic Operation and Control**				**08 Hrs**
Traffic control devices, Traffic Signs - principles, types and design considerations; Road Markings-principles, type and design; Traffic Signals - types, optimal cycle length and signal settings, warrants, designing of traffic signals by Webster's method and IRC method, signal approach dimensions; Street Lighting; Street Furniture.					
Unit-V	**Traffic Management, Road Safety and Intersections:**				**08 Hrs**
Traffic management measures, Intersections-at grade and grade separated intersections, rotary intersections and channelization. Accident situation in India, collection of accident data, collision and condition diagram, road and its effect on accidents, vehicles and its effect on accidents, drivers, pedestrian safety, cyclist safety, legislations, enforcement, educations and awareness, road safety audit.					

References:

1. Traffic Engineering & Transport Planning by LR Kadyali, Khanna Publisher, Delhi, 2010.
2. Transportation Engineering and Planning, C.S.Papacostas, P.D.Prevedouros, Prentice –Hall India, Delhi, 2005.
3. Highway Engineering-S.K.Khanna & C.EG. Justo, Nem Chand & Bros, Roorkee, 2014.
4. Transportation Engineering, an Introduction, C Jotin Khisty,B.Kent Lall, Prentice-Hall India, Delhi
5. Transportation Planning, Principles, Practice and Policies,P.K. Sarkar, Vinay Maitri, G.J. Joshi, Prentice-Hall, India, Delhi

Web links to e-learning:

1. https://nptel.ac.in/courses/105101008/
2. https://nptel.ac.in/courses/105105107/

CE314/CEE314	OPEN CHANNEL FLOW				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE209	NIL	3	1	0	4
Objectives	To understand and apply the fundamental principles governing open channel hydraulics to the design of engineering systems.				
Unit-I	**Introduction to Open Channel Flow**				**08 Hrs**
Classifications, description, types energy and momentum equation for prismatic and non-prismatic channels. Uniform flow, critical flow, critical depth, specific energy. Use of Design charts and Semi empirical relations.					
Unit-II	**Gradually Varied Flow**				**08 Hrs**
Gradually varied flow, dynamic equation, flow profiles, computation, analytical and graphical methods, and transitions of sub critical and supercritical flow.					
Unit-III	**Analytical and Numerical Methods of Gradually Varied Flow**				**08 Hrs**
Basic principles and assumptions in analysis of flow profile, methods of numerical integration. Compound channel, Equivalent Roughness.					
Unit-IV	**Rapidly Varied Flow**				**08 Hrs**
Characteristics of the rapidly varied flow, classification of hydraulic jump, hydraulic jump in horizontal, and sloping channels, submerged hydraulic jump, jump in gradually and suddenly expanding channels, empirical solutions.					
Unit-V	**Analysis of Flow in Channels of Nonlinear Alignment**				**08 Hrs**
Flow in channel of non-linear alignment and non-prismatic channel sections, design considerations for sub critical and super critical flows. Hydraulic design of culvert. .					

References:

1. K.Subramanya : Flow in open channels, Tata Mcgraw Hills, 2014.
2. V.T.Chow : Open Channel Hydraulics,Blackburn Press, 2009.
3. K.RangAraju:Open channel flow,Mcgrawhill Education, 2001.
4. Madan Mohan Das: Open Channel Flow,PHI learning private limited, 2008.

Web links to e-learning:

1. https://nptel.ac.in/courses/105107059/

CE315/CEE315	MATRIX METHODS OF STRUCTRAL ANALYSIS				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE301	NIL	3	1	0	4
Objectives	To understand the Basic concept and analysis Structural Components by matrix methods.				
Unit-I	**Classification of Structures**				**08 Hrs**
Classification of structure, equation of static equilibrium, degree of static and kinematic determinacy. Basic methods of structure analysis.					
Unit-II	**Introduction of Matrix Method and Analysis of Beam**				**08 Hrs**
Introduction of Flexibility and stiffness method. Formulation analysis of continuous beams.					
Unit-III	**Analysis of Pin Joined Structure**				**08 Hrs**
Formulation analysis of two-dimensional pin jointed frames and space frame by matrix approach.					
Unit-IV	**Analysis Two Dimensional Rigid Structure**				**08 Hrs**
Formulation analysis of two-dimensional rigid frames by flexibility and stiffness methods.					
Unit-V	**Analysis Three Dimensional Structure**				**08 Hrs**
Analysis of three dimension structure by displacement method.					

References:

1. Weaver & Gere, Matrix Analysis of Framed structures. CBS Publication & Distributors Pvt. Ltd., Edition: 2nd edition (2004).
2. H.C. Matrix, "Introduction to Matrix Methods of structural Analysis", McGraw Hill (2012).
3. Pandit, G.S & Gupta.," Structural Analysis: A Matrix Approach" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (2008).

Web links to e-learning:

1. https://nptel.ac.in/courses/105106050/

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CE316/CEE316	SUSTAINABLE CONSTRUCTION TECHNIQUES				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of design and construction of roads, railways and airports.				
Unit-I	**Introduction to Sustainability**				**08 Hrs**
Sustainability, challenges in sustainable construction, design construction and equipment, materials and systems, maintenance and conservation, waste materials, site waste management, re-use and recycling of materials.					
Unit-II	**Energy Efficient Buildings**				**08 Hrs**
Energy efficient buildings, concepts of green and sustainable buildings, natural lighting, rainwater harvesting.					
Unit-III	**Alternative Building Materials**				**08 Hrs**
Alternative Building Material for Low Cost Housing: Introduction, Substitute, for scarce materials, timber substitution, industrial waste, Agricultural waste, Strategies of Promotion of Alternative Building Materials.					
Unit-IV	**Modern Housing Scenario**				**08 Hrs**
Housing scenario, status of urban and rural housing and construction land use and physical planning for housing, building bye laws, housing finance: approaches and strategies, housing for urban poor					
Unit-V	**Precast and Prefabricated Systems**				**08 Hrs**
Adoption of innovative cost effective construction technology, prefabrication, precast roofing/ flooring systems, walls.					

References:

1. A.K Lal, Handbook of low cost housing, New Age Publishers, 4th Edition, 2010.
2. India Green Building Congress Recommendations, 3rd Revision, 2011.
3. Ajla Aksamija, "Sustainable Facades: Design Methods for High-Performance Building Envelopes", Jhon Wiley & Sons Inc, 2nd Edition, 2011.
4. Kibert J.Charles, "Sustainable Construction: Green Building Design and Delivery", Jhon Wiley & Sons Inc, 6th Edition, 2014.
5. Phillip F. Ostwald, "Construction Cost Analysis and Estimating", Prentice Hall Press, Delhi, 3rd Reprint, 2015.

Web links to e-learning:

1. https://www.youtube.com/watch?v=WPRgRBxfbss
2. https://www.youtube.com/watch?v=SJ0H6kheN_c

CE317/CEE317	GROUND IMPROVEMENT TECHNIQUES				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE-304/CEE-304	CE312/CEE312	3	1	0	4
Objectives	Introduce the student to fundamentals of design of hydraulic structures in civil engineering.				
Unit-I	**Dewatering**				**08 Hrs**
Introduction - Scope and necessity of ground improvement in Geotechnical engineering- basic concepts and philosophy. Drainage - Ground Water lowering by well points deep wells- vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques.					
Unit-II	**Compaction and Sand Drains**				**08 Hrs**
Insitu compaction of granular and cohesive soils, Shallow and Deep compaction sand piles – concept, factors influencing compaction, Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains – theories of sand drain – design and relative merits.					
Unit-III	**Geo-synthetics & Applications of Geo-synthetics**				**08 Hrs**
Development – Types of Geosynthetics – Geotextiles – Geogrids- Geonets – Geomembranes – Geocomposites – Functions – Reinforcement – Use of geosynthetics for filtration and drainage – Use of geosynthetics in roads – Use of reinforced soil in Retaining walls – Improvement of bearing capacity – Geosynthetics in land fills.					
Unit-IV	**Stone Column, Lime Piles and Earth Reinforcement**				**08 Hrs**
Stone column, lime piles – Functions – Methods of installation – Earth reinforcement – Principles and basis mechanism of reinforced earth-reinforced soil retaining structures.					
Unit-V	**Grouting**				**08 Hrs**
Grouting techniques – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – principle of injection-injection methods – properties of treated ground-application of jet grouting-grout monitoring – Electro – chemical stabilization – Stabilization with cement, lime etc. – Stabilization of expansive clays.					

References:

1. Koerner, R.M., "Designing with Geo-synthetics", Xlibris Publication, 6th Edition (2012).
2. Rowe, R.K., "Geotechnical and Geo-environmental Engineering Handbook", Springer 1st edition (2012).
3. P. Purushothama Raj, "Ground Improvement Techniques Paperback" , Laxmi Publications; Second edition (2016).
4. Sivakumar Babu, "An Introduction to Soil Reinforcement & Geosynthetics", Universities Press; 1st edition (2005).
5. Satyendra Mittal, An Introduction to Ground Improvement Engineering, Medtech, 1st edition (2013).

Web links to e-learning:

1. https://nptel.ac.in/courses/105108075/

CE320/CEE320	DOCK HARBOR AND TUNNEL ENGINEERING				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of design Tunnels and Harbors.				
Unit-I	**Introduction: Harbor Planning and Natural**				**08 Hrs**
Harbor Planning: Harbor components, characteristics of good harbor, principles of harbor planning, site selection criteria and layout of harbors. Natural Phenomena: tides and currents phenomena, generation characteristics and effects on marine structures, silting, erosion and littoral drift.					
Unit-II	**Marine Structures**				**08 Hrs**
Marine Structures: General design aspects, breakwaters - function, types general design principles, wharves, quays, jetties, piers, pier heads, dolphin fenders, mooring accessories function, types, suitability, design and construction features.					
Unit-III	**Dock and Repair Facilities**				**08 Hrs**
Docks and Locks: Tidal basin, wet docks-purpose, design consideration, operation of lock gates and passage, repair docks - graving docks, floating docks, marine railway.					
Unit-IV	**Tunnels: Introduction and Construction Methods**				**08 Hrs**
Site investigations, Geotechnical Considerations of tunneling, Construction & Excavation methods, soft ground tunnels, Rock tunnels.					
Unit-V	**Micro Tunneling and Tunnel Utilities**				**08 Hrs**
Micro tunneling techniques, Tunnel support design, Ventilation of tunnels, tunnel utilities, safety aspects.					

References:

1. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 2012, Charotar Pub. House.
2. S. P. Bindra, A Course in Docks and Harbour Engineering, 2015, Dhanpat Rai & Sons, New Delhi.

Web links to e-learning:

1. https://nptel.ac.in/courses/114106025/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/114106025/lec3.pdf

CE321/CEE321	DESIGN OF HYDRAULIC STRUCTURES				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
Recommended CE201/CEE201	CE306	3	1	0	4
Objectives	Introduce the Student to Fundamentals of Design of Hydraulic Structures in Civil Engineering				
Unit-I	**Hydraulic Structures General**				**08 Hrs**
Failure of hydraulic structures founded on permeable soils, Bligh's creep theory, Khosla's theory of independent variables for design of impervious floors, Types of canal falls, Design of sharda type fall.					
Unit-II	**Head Works and Cross Drainage Works**				**08 Hrs**
Function, location and layout of head works, cross drainage works: necessity and types, design of siphon aqueduct.					
Unit-III	**Dams and Reservoirs**				**08 Hrs**
Investigation and planning of dams and reservoirs, zones of storage, reservoir sedimentation and its control, classification of dams.					
Unit-IV	**Gravity Dams**				**08 Hrs**
Elementary profile of a gravity dam, Low and high gravity dams, Modes of failure and factor of safety, Galleries in dams, Temperature control in mass concrete.					
Unit-V	**Earth Dams and Spillways**				**08 Hrs**
Earth Dam their component and functions, causes of failure. Types of spillways, energy dissipation below spillways, spillways gates.					

References:

1. Subramanya K., Engineering Hydrology, Tata McGraw Hill, 2014.
2. Punmia B.C. &Lal P.B., Irrigation and Water Power Engineering, Laxmi Publications, 2015
3. Asawa, Irrigation Engineering, Wiley Eastern Edition, 2013.
4. S.K Garg, Irrigation Engineering and Hydraulic structures, Khanna publishers, 2016.

Web links to e-learning:

1. https://nptel.ac.in/courses/105105040/

CE322/CEE322	MAINTENANCE & REHABILITATION OF STRUCTURES				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To provide knowledge practices adopted for maintenance of structures.				
Unit-I	**Introduction**				**08 Hrs**
Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.					
Unit-II	**Quality Assurance for Concrete**				**08 Hrs**
Strength, Durability and Thermal properties, of concrete Cracks, different types, causes– Effects due to climate, temperature, Sustained elevated temperature, Corrosion -Effects of cover thickness and cracking.					
Unit-III	**Advanced Materials**				**08 Hrs**
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferrocement, Fiber reinforced concrete.					
Unit-IV	**Rehabilitation Techniques**				**08 Hrs**
Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite 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					
Unit-V	**Repairing of Structures**				**08 Hrs**
Repairs to overcome low member strength. Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.					

References:

1. Shetty M.S., "Concrete Technology-Theory and Practice", S. Chand and Company, 2008.
2. Dov Kominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001.
3. Ravishankar .K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir .M.L., "Concrete Technology", McGraw Hill, 2013.

Web links to e-learning:

1. https://nptel.ac.in/courses/105/106/105106202/
2. https://nptel.ac.in/courses/105104030/

CE323/CEE323	OCCUPATIONAL HEALTH AND SAFETY ENGINEERING				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE310 & CE401	NIL	3	1	0	4
Objectives	To educate the students on the basic principles, development and application of occupational health and safety engineering				
Unit-I	**Introduction to Occupational Health and Safety**				**08 Hrs**
Introduction to occupational health and safety: Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. Importance of Industrial safety, role of safety department, OHSAS 18001.					
Unit-II	**Construction Safety**				**08 Hrs**
Hazards in Construction Industry :Introduction of Construction industry, Scaffolding and Working plat form, Welding and Cutting, Excavation Work, Concreting and Cementing work, Transportation of men and material, Handling and Storage of compressed gas.					
Unit-III	**Electrical Safety**				**08 Hrs**
Electrical Hazards: Safe limits of amperages, voltages, distance from lines, etc., Joints and connections, Effects of Electrical Hazards, Effects of Current on Human Body, Control of hazards due to static electricity.					
Unit-IV	**Fire Safety**				**08 Hrs**
Fire Hazards: Fire Types, Fire Hazard Analysis and Prevention of Fire, Fire Risk, Fire Protection and its Prevention, hazards and control in mines, Portable Fire Extinguishers, Firefighting.					
Unit-V	**Safety Guidelines and Recommendations**				**08 Hrs**
Construction hazards and safety guidelines; Prevention techniques for construction accidents; Site management with regard to safety recommendations; Training for safety awareness and implementation.					

References:

1. B. G. Dale, Managing quality,5 th ed., Blackwell Publishing, Oxford, 2007.
2. D. Reese and J. V. Eidson, Handbook of OSHA construction safety and health, 2 n d ed., CRC Press, Boca aton, 2006.
3. F. Harris, R. McCaffer and F. Edum-Fotwe, Modern construction management, 6 t h ed., Blackwell Publishing, Oxford, 2006
4. K. Knutson, C. J. Schexnayder, C. M. Fiori and R. Mayo, Construction management fundamentals, 2nd ed., McGraw Hill, New York, 2008. .
5. S. J. Holt, Principles of construction safety, Blackwell Publishing, Oxford, 2008.
6. R.K.Jain and Sunil S.Rao , Industrial Safety , Health and Environment Management Systems, Khanna publishers , New Delhi, 2006.
7. Journal of Occupational Safety and Health, ISSN 1675-5456 PP13199/12/2012 (032005)

Web links to e-learning:

1. https://www.osha.gov/SLTC/generalshreferences/journals.html
2. https://www.osha.gov/

CE324/CEE324	PRINCIPLES OF TOWN PLANNING AND ARCHITECTURE				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	NIL	3	1	0	4
Objectives	To educate the students on the basic principles, concept and development of planning town, city, smart city etc.				
Unit-I	**Introduction**				**08 Hrs**
Principles and history of town planning, Comprehensive planning of towns: Contemporary planning concepts, Problems of urban growth. Land use classification and patterns, Housing demographic arid social surveys, economic and environmental aspects. Concept of master plan, Zoning and Density.					
Unit-II	**History of Town Planning**				**08 Hrs**
An overview of ancient human settlements, Evolution of towns: Garden city movement, Linear city and concentric city concepts, Neighborhood and Radburn, Lacite industrielle, Radiant city to present day planning, Satellite town concepts. Concept of habitat, Neighborhood planning, problems of metropolis.					
Unit-III	**Development of Town Planning**				**08 Hrs**
Factors influencing architectural development. Impact of development of materials and techniques through ages. Evolution of architectural forms. Brief history of architecture.					
Unit-IV	**Architectural Design**				**08 Hrs**
Elements of Architectural Design: Line. Form, Shape, Space, texture, value and colour. Principles of Architectural Design: Balance, Rhythm, Emphasis, Proportion and Scale, Movement, Contrast, Unity, Harmony, Repetition, Hierarchy. Role of architects.					
Unit-V	**Planning of Buildings**				**08 Hrs**
Functional planning of buildings: Classification of buildings, General requirements of site and building. Building codes, Acts and Bye-laws, Licensing of building works. Functional planning of building such as residential, institutional, public, commercial, industrial buildings, checking for circulation, ventilation, structural, preparing sketch plan, working drawing etc.					

References:

1. Sir Banister Fletcher's, A History of Architecture, CBS Publisher. 2002.
2. S.C. Rangwala, Town Planning, Charotar Publishing House, 2009.
3. G.K. Hiraskar, Fundamentals of Town Planning, Dhanpat Rai Publications, 2012.
4. S.C. Agarwala, Architecture and Town Planning, Dhanpat Rai & Co. 2013.

Web links to e-learning:

1. https://nptel.ac.in/content/storage2/courses/109104047/pdf/lecture35.pdf

CE327/CEE327	ENVIRONMENTAL ENGINEERING LAB - I				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
NIL	CE310	0	0	2	1

1. Determination of Turbidity, colour and conductivity.
2. Determination of pH, Alkalinity and acidity.
3. Determination of Hardness and chlorides.
4. Determination of Residual chlorine and chlorine demand.
5. Determination of dissolved oxygen.
6. Determination of most probable number of coliforms.

References:

1. S. K. Garg, Water Supply Engineering: Environmental Engineering v. 1, 29th Edition, Khanna Publication, 2013
2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, Environmental Engineering, 1st Edition, McGraw Hill Education; 2013.
3. Gilbert M. Masters, Wendell P. Ela, Introduction to Environmental Engineering and Science, 3rd Edition, Publisher: Prentice Hall, ISBN-13: 978-0-13-148193-0, ISBN-10: 0-13-148193-2
4. K.V.S.G. Murali Krishna, Air Pollution and Control, Laxmi Publications, 1st Edition, 2017.
5. Standard Methods for the Examination of water and wastewater: AWWA, APHA, WPCF 2012.
6. I.S. 10500: 2012, Drinking Water Standards, 2012.

CE328/CEE328	GEOTECHNICAL ENGINEERING LAB				
Pre-requisite	**Co-Requisite**	**L**	**T**	**P**	**C**
CE304	CE312	0	0	2	1

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

References:

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