

**IV<sup>th</sup> Year EVALUATION SCHEME**  
**Branch: Civil Engineering**

**Year – IV**

**Semester– VII**

SL N O.	Subj ect Cate gory	CODE NO.	NAME OF SUBJECT	PERIODS				EVALUATION SCHEME				SUBJECT TOTAL
				L	T	P	C	SESSIONAL EXAM			EXA M.	
								CT	TA	TOT AL	ESE	
1	DC	CE401/ CEE401	Environmental Engineering-II	3	1	0	4	25	15	40	60	100
2	DC	CE402/ CEE402	Construction Technology and Management	3	1	0	4	25	15	40	60	100
3	DC	CE403/ CEE403	Steel Structure	3	1	0	4	25	15	40	60	100
4	DE		Department Elective-III	3	1	0	4	25	15	40	60	100
5	DE		Department Elective-IV	3	1	0	4	25	15	40	60	100

**PRACTICAL/ DRAWING/ DESIGN**

1	DC	CE418/ CEE418	Environmental Engineering Lab-II	0	0	2	1	30	30	60	40	100
2	DC	CE419/ CEE419	Structural Detailing Lab	0	0	2	1	30	30	60	40	100
3	DC	CE420/ CEE420	Minor Project	--	--	2	1	--	--	60	40	100
4	DC	CE300*/ CEE300*	Industrial Training	--	--	-	0	--	--	--	50	50
<b>Total</b>				<b>15</b>	<b>5</b>	<b>6</b>	<b>23</b>					<b>800</b>

**\*Note: Industrial Training (CE300/CEE300) is a zero credit course. Student must clear this paper with 50% marks and marks will not be included in result**

**DC:** Departmental Core, **DE:** Departmental Elective, **OP:** Open Elective

**IV<sup>th</sup> Year EVALUATION SCHEME**  
**Branch: Civil Engineering**

**Year IV**

**Semester– VIII**

SL. NO.	Subject Category	CODE NO.	NAME OF SUBJECT	PERIODS				EVALUATION SCHEME				SUBJECT TOTAL
				L	T	P	C	SESSIONAL EXAM			EXAM.	
								CT	TA	TOTAL	ESE	
1	OE		Open Elective-II	--	--	--	4	25	15	40	60	100
<b>PRACTICAL/ DRAWING/ DESIGN</b>												
2	DC	CE499/ CEE499	B.Tech Project	--	--	--	4	--	--	60	40	100
3	DC	CE499/ CEE499	B.Tech Project	--	--	--	4	--	--	60	40	100
4	DC	CE499/ CEE499	B.Tech Project	--	--	--	4	--	--	60	40	100
5	DC	CE451/ CEE451	Seminar	--	--	--	3	--	--	60	40	100
6	DC	CE452/ CEE452	Comprehensive Viva Voce	--	--	--	2	--	--	60	40	100
<b>Total</b>				<b>3</b>	<b>1</b>	<b>0</b>	<b>21</b>					<b>600</b>

**DC:** Departmental Core, **DE:** Departmental Elective, **OP:** Open Elective

**INTEGRAL UNIVERSITY, LUCKNOW**  
**DEPARTMENT OF CIVIL ENGINEERING**

**List of Departmental Elective Subjects for IV Year:**

**Elective –III**

<b>Subject code</b>	<b>Name of subject</b>
<b>CE404</b>	Transportation System & Planning
<b>CE405</b>	Advanced Concrete Design
<b>CE406</b>	Environmental Pollution Control
<b>CE407</b>	Design of Waste Water System

**Elective –IV**

<b>Subject code</b>	<b>Name of subject</b>
<b>CE410</b>	Earthquake Resistant Design
<b>CE411</b>	Advanced Foundation Design
<b>CE412</b>	Impact of Climate Change for Civil Engineering Projects
<b>CE413</b>	Plastic Design of Steel Structures

<b>CE401/CEE401</b>		<b>ENVIRONMENTAL ENGINEERING II</b>			
<b>Pre-Requisite</b>	<b>Co-Requisite</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CE310</b>	<b>Nil</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Objective</b>	<p>Students will be familiar with current and emerging environmental engineering and global issues, and have an understanding of ethical and societal responsibilities.</p> <p>Students will have the necessary qualifications for employment in environmental engineering and related professions, for entry into advanced studies.</p>				
<b>Unit I</b>	<b>Wastewater Quality and Quantity Estimation</b>	<b>8 hours</b>			
Introduction to wastewater engineering, wastewater management, Wastewater Quantity Estimation, Fluctuations in Dry Weather Flow, Population Equivalent, Design Periods & Population Forecast, Wastewater Characterization					
<b>Unit II -</b>	<b>Wastewater Collection and conveyance</b>	<b>8 hours</b>			
Conservancy system, Waste water carriage system, wastewater flow rates, storm water flow, Hydraulic design of Sewers, construction of sewers, Sewer Appurtenances,					
<b>Unit III</b>	<b>Wastewater Treatment</b>	<b>8 hours</b>			
<p>Unit operations and unit processes for wastewater treatment, Preliminary and Primary treatment: Screening, grit chamber, Sedimentation and chemical clarification.</p> <p>Secondary treatment: Types of biological treatment systems, theory and design of trickling filter; theory and design of Activated sludge process.</p>					
<b>Unit IV</b>	<b>Miscellaneous Method</b>	<b>8 hours</b>			
Oxidation ditch, aerated lagoons, waste stabilization pond, Rotating biological contactors, Upflow anaerobic sludge blanket reactor, Introduction to Duckweed pond, Vermiculture and Root zone technology.					
<b>Unit V</b>	<b>Waste management</b>	<b>8 hours</b>			
Sludge characteristics, Sludge Treatment process, disposal of sludge, septic tank, solid waste disposal, composting, incineration, Introduction to sanitary landfill.					
<b>References:</b>					
<ol style="list-style-type: none"> <li>1. Birdie G.S and Birdie J.S, <i>Water Supply and Sanitary Engineering</i>, Dhanpat Rai &amp; Sons, 2010.</li> <li>2. Duggal K N, <i>Elements of Environmental Engineering</i>, S Chand &amp; Co Ltd..</li> <li>3. Garg S K, <i>Environmental Engineering Vol II</i>, Khanna Publishers, 2010</li> <li>4. Fair, Gayer and Okun, <i>Water and Waste water Engineering Vol. II</i>, John Wiley. 3<sup>rd</sup> Edition 2011.</li> <li>5. Metcalf and Eddy, <i>Waste Water Engineering, Treatment, Disposal &amp; Reuse</i>, Tata McGraw Hill. 2002</li> </ol>					

CE402/CEE402		CONSTRUCTION TECHNOLOGY AND MANAGEMENT			
Pre-requisite	Co-Requisite	L	T	P	C
<b>Recommended CE542/ CEE542</b>	NIL	3	1	0	4
<b>Objective</b>	To understand the basics of construction management methods, techniques along with the knowledge of their applications in Construction Industry				
<b>Unit-I</b>	<b>Fundamentals of Construction Management</b>				<b>8 Hrs</b>
Introduction, Problems in Construction Industry, History of Construction Management. Construction Projects & its Classifications .Project Cycle, Project Parameters, Organizations in Construction Industry, Planning, Scheduling, Monitoring and Management Information System.					
<b>Unit-II</b>	<b>Network Techniques &amp; Analysis</b>				<b>8 Hrs</b>
Basic Concepts , Application of PERT, CPM, GERT, AOA & AON Networks and its applications , Critical Path, Bar Charts, Milestone Chart, Time Estimates, Preparation of Network Diagrams, Crashing, Cost Planning, Resource Allocation, Resource Planning, Line of Balance Techniques.					
<b>Unit-III</b>	<b>Construction Safety &amp; Engineering Economics</b>				<b>8 Hrs</b>
Introduction, Hazards in Construction Projects, Cause of Accidents, Classifications of Construction Accidents, General Safety Programme, and Accident Report, Safety Precautions at Construction Site. Engineering Economics- Time Value of Money, Cash Flow Diagrams, Payback Period, Replacement Analysis, Concept of Depreciation and its methods, Break even chart Analysis.					
<b>Unit-IV</b>	<b>Contract Management</b>				<b>8 Hrs</b>
Introduction, Indian Contract Act, Labour Laws, Prequalification of Contracts, Selection of Contractor, Classification of Contracts, Conditions of Contract, Prerequisites of Tendering, Tender Document, Tender Notice, Security Deposit , Earnest Money Deposit, Evaluation of Tenders, Contract Negotiation, Award of Contract, Termination of Contract, Settlements of Disputes, Arbitration and Conciliation Act, Commissioning and Closure of Project.					
<b>Unit-V</b>	<b>Construction Equipment Management</b>				<b>8 Hrs</b>
Introduction, Procurement of Equipment, Selection of Equipment, Productivity, Operational Cost, Owning and Hiring Cost, Work motion Study, Equipment Maintenance, Time Concepts for use, Depreciation, earth moving Equipments, Hauling and Hoisting Equipments, Concrete Production Equipments, Operational Use of equipments.					
<b>References</b> <ol style="list-style-type: none"> <li>1. Dr. U.K.Shrivastava “<i>Construction Planning and Management</i>”,Galgotia Publications.; 3<sup>rd</sup> Edition 2005</li> <li>2. Kumar Neeraj Jha, “ <i>Construction Project Management</i> ”, Pearson New Delhi; 1<sup>st</sup> Edition 2005</li> <li>3. A.K.Gupta “<i>Construction Technology and Management</i>”, Shubham Publications,1<sup>st</sup> Edition Reprint 2013</li> <li>4. K.G.Krishnamurthy and S.V.Ravindra “<i>Construction and Project Management</i>” CBS Publishers and Distributers Pvt.ltd.; 2<sup>nd</sup>Edition 2017</li> <li>5. IS 456-2000 Indian Standard “<i>Construction Planning, Equipment and Methods</i> ”, Mc Graw Hill;7<sup>th</sup> Edition 2006.</li> </ol>					
<b>Web links to e-learning:</b> <a href="http://nptel.ac.in/courses/105103093/">http://nptel.ac.in/courses/105103093/</a>					

<b>CE403 /CEE403</b>	<b>STEEL STRUCTURES</b>				
Pre-requisite	Co-Requisite	L	T	P	C
<b>Recommended CE204/ CEE204</b>	NIL	3	1	0	4
<b>Objective</b>	To understand the basic concept and procedure of designing steel structural components.				
<b>Unit-I</b>	<b>Attributes of Steel Structural Design</b>	<b>8 Hrs</b>			
Basis for design, design philosophies, Introduction to Limit State Design, Limit state for steel design, limit state of strength, limit state of serviceability, probabilistic basis for design, design criteria, material, structural steel. Stress - Strain Curve for Mild Steel. Introduction to rolled steel sections, Loads. Riveted, Bolted, Pinned and Welded connections, Strength, Efficiency and Design of joints.					
<b>Unit-II</b>	<b>Design of Steel Compression Members</b>	<b>8 Hrs</b>			
Compression members- Effective length, Slenderness ratio, Strength of Compression members, Design of Struts, Columns, Built-up Columns, Design of eccentrically loaded columns.					
<b>Unit-III</b>	<b>Design of Steel Tension members</b>	<b>8 Hrs</b>			
Tension members – Net and Gross sectional areas, Strength of members and their design. Design of slab and Gusset bases, Design of Grillage footing.					
<b>Unit-IV</b>	<b>Design of Steel Beams</b>	<b>8 Hrs</b>			
Beams – web crippling and web buckling, design of laterally supported beam, design of laterally unsupported beam,					
<b>Unit-V</b>	<b>Design of Industrial Building</b>	<b>8 Hrs</b>			
Design of Industrial Buildings –Elements of an industrial building, Design of elements of roof trusses, i.e purlin and plate girder.					
<b>References</b>					
<ol style="list-style-type: none"> <li>1. Subramanian, "Steel Structures- "Design and Practice", Oxford, University Press</li> <li>2. M.R. Shriyekar, "Limit State Design in Structural Steel", PHI, New Delhi</li> <li>3. Duggal S.K. "Limit State Design of Steel Structures", McGraw-Hill Education (India) Private Limited, New Delhi</li> <li>4. Kazmi, S.M.A and Jindal R.S "Design of Steel Structures" PHI, New Delhi, India</li> <li>5. I.S: 800-2007- Code of Practice for General Construction in Steel, BIS, New Delhi, India</li> <li>6. I.S: 808-1989- Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections, BIS, New Delhi, India</li> </ol>					
Web links to e-learning:					
<ol style="list-style-type: none"> <li>1. <a href="http://nptel.ac.in/courses/105106112/">http://nptel.ac.in/courses/105106112/</a></li> <li>2. <a href="https://youtu.be/CNE4hk_SGTo">https://youtu.be/CNE4hk_SGTo</a></li> <li>3. <a href="https://youtu.be/ruuKvu5Qtkl">https://youtu.be/ruuKvu5Qtkl</a></li> <li>4. <a href="https://youtu.be/utgnv9NIFQc">https://youtu.be/utgnv9NIFQc</a></li> </ol>					

CE404/CEE404	Transportation Systems and Planning				
Pre-requisite	Co-Requisite	L	T	P	C
CE303/CEE303	NIL	3	1	0	4
<b>Objective</b>	Introduce the student to fundamentals of design of hydraulic structures in civil engineering.				
<b>Unit-I</b>	<b>Transport System and its Development</b>	8 Hrs			
Transport System and its Development: Transportation system, classification of transport system, urbanization and transport demand, motorization trends, urban transport problems, role of transportation: social, economic, political, and environmental; transportation today, organizations involved in transportation development in India. Hierarchy of Roads and Capacity: Hierarchy of Roads, Concept of PCU, capacity and level of service, factors affecting capacity and level of service; capacity of rural and urban roads					
<b>Unit-II</b>	<b>Transport Facility Design</b>	8 Hrs			
Public Transportation and Transport Facility Design: Technology in transportation, public transport systems, design of parking facilities, design of pedestrian facilities, design of cycle tracks, design of bus facilities, terminal and its functions, transit planning, transit demand, transit route network.					
<b>Unit-III</b>	<b>Transportation Cost, Demand and Supply</b>	8 Hrs			
Transportation Cost, Demand and Supply: Transport costs: capital cost, operation and maintenance cost, vehicle operating cost (VOC), value of time (VOT), accident cost; transportation demand, supply in transportation, transportation networks and environmental impact.					
<b>Unit-IV</b>	<b>Transport Planning</b>	8 Hrs			
Transport Planning: Transportation planning surveys, transport planning process: trip generation, trip distribution, modal split and trip assignment; economic evaluation of transport plans.					
<b>Unit-V</b>	<b>Modern Transportation Techniques</b>	8 Hrs			
System Operations and ITS: System operation and management, Intelligent Transport System (ITS), Benefits of ITS, ITS services: advanced traffic management system (ATMS), advanced traveler information system (ATIS), advanced vehicle control system (AVCS), commercial vehicle operation (CVO), advanced public transport system (APTS), emergency management system (EMS), electronic payment (EP), safety, working of ITS, application of ITS.					
<b>References:</b>					
<ol style="list-style-type: none"> <li>1. Traffic Engineering &amp; Transport Planning by LR Kadyali, Khanna Publisher, Delhi, 2010.</li> <li>2. Theory and Applications of Economics in Highway and Transport Planning, Vinay Maitri, P.K.Sarkar, Standard Publishers Distributors, Delhi, 2008.</li> <li>3. Transportation Planning, Principles, Practice and Policies, P.K.Sarkar, Vinay Maitri, G.J. Joshi, Prentice-Hall India, Delhi, 2002.</li> <li>4. Transportation Engineering and Planning, C.S.Papacostas, P.D.Prevedouros, Prentice –Hall India, Delhi, 2005.</li> <li>5. Highway Engineering-S.K.Khanna &amp; C.E.G. Justo, Nem Chand &amp; Bros, Roorkee, 2014.</li> </ol>					

<b>CE405/CEE405</b>	<b>ADVANCED CONCRETE DESIGN</b>				
Pre-requisite	Co-Requisite	L	T	P	C
<b>Recommended CE311/ CEE311</b>	NIL	3	1	0	4
<b>Objective</b>	Students are expected to realize the importance of design of heavy RCC structure and their application in civil engineering				
<b>Unit-I</b>	<b>RC Domes and Curved Beams</b>				<b>8 Hrs</b>
Natures of stresses in spherical domes, Analysis of spherical domes, Design of reinforced concrete domes under uniformly distributed load and point load at crown, using IS:456-2000 guide lines. Nature of stresses in Curved beams, Design philosophy, Design of reinforced concrete curved beam using IS:456-2000 guide lines.					
<b>Unit-II</b>	<b>RC Overhead Tank</b>				<b>8 Hrs</b>
Nature of stresses in reinforced concrete overhead tank, Design philosophy, IS Code guide lines, Design of rectangular and cylindrical water tank using IS-3370 design charts.					
<b>Unit-III</b>	<b>Intze Tank</b>				<b>8 Hrs</b>
Elements of Intze tank, Effect of continuity, Design of top dome, Top ring beam, Cylindrical wall, Bottom ring beam, Conical dome, Bottom dome , Bottom circular beam at junction of tank and supporting columns , Design of supporting columns with bracings and raft foundation, Reinforcement detailing of different elements of Intze tank.					
<b>Unit-IV</b>	<b>Building Frames</b>				<b>8 Hrs</b>
Dead load, Live load, Wind load and Earthquake loads, Analysis of building frames by substitute frames ,portal and cantilever methods, Design of building frames.					
<b>Unit-V</b>	<b>RC Bridges and Composite members</b>				<b>8 Hrs</b>
Types of bridges, Economic span, Load, forces and permissible stresses, General design requirements, Design of deck slab using effective width concept, Introduction to Pigeaud's and Courban's theory , Design concept of encased columns, Guide lines as per IS-800, Design of encased columns.					
<b>References</b>					
<ol style="list-style-type: none"> <li>1. N .Krishna Raju “Advance concrete design”, CBS Publishers, 3<sup>rd</sup> edition,2015</li> <li>2. D.J. Victor “Essential of Bridge Engineering” , Oxford &amp; IBH Publishing company, 6<sup>th</sup> edition 2017.</li> <li>3. B.C. Punmia and A.K.Jain “Limit State Design of Reinforced Concrete”, Laxmi Publications,1<sup>st</sup> Reprint2017</li> <li>4 IS:3370(Part-1,2,3,4) -1965-Code of practice for concrete structures for the storage of liquids</li> <li>5 IS 456-2000 Indian Standard “Plain &amp; Reinforced Concrete-code of practice”, BIS, New Delhi</li> <li>6 IS:11682-1985-Criteria for design of RCC staging for overhead water tank</li> </ol>					
<b>Web links to e-learning:</b>					
<a href="http://nptel.ac.in/courses/105105105/">http://nptel.ac.in/courses/105105105/</a> <a href="http://nptel.ac.in/downloads/105105104/">http://nptel.ac.in/downloads/105105104/</a> <a href="http://onlinecourses.nptel.ac.in">http://onlinecourses.nptel.ac.in</a> <a href="http://m.youtube.com&gt;channel">http://m.youtube.com&gt;channel</a>					



CE406/CEE406	ENVIRONMENTAL POLLUTION CONTROL				
Pre-Requisite	Co-Requisite	L	T	P	C
CE310, CE401	Nil	3	1	0	4
<b>Objective</b>	The objective of this course is: <ul style="list-style-type: none"> <li>• Impart knowledge on fundamental aspects of air pollution &amp; control, solid waste management and noise pollution.</li> <li>• Introduces some basics of sanitation methods essential for protection of community health.</li> </ul>				
<b>Unit I</b>	<b>Impact of man on environment</b>				<b>8 hours</b>
The biosphere, hydrologic cycle, nutrient cycles, consequences of population growth, energy problem, Pollution of air, water and land.					
<b>Unit II -</b>	<b>Air pollution</b>				<b>8 hours</b>
Sources and effects, Meteorological aspects, air pollution sampling and measurement, control methods and equipments, control of specific air pollutants					
<b>Unit III</b>	<b>Water pollution:</b>				<b>8 hours</b>
Sources and classification of water pollutants, Wastewater sampling and analysis.					
<b>Unit IV</b>	<b>Land pollution:</b>				<b>8 hours</b>
Types of land pollution, solid waste management, generation, storage, collection, transport, Processing and disposal.					
<b>Unit V</b>	<b>Noise pollution</b>				<b>8 hours</b>
Noise pollution its Sources, effects, preventive measures, rules and regulations.					
<b>References:</b>					
1. Birdie G.S and Birdie J.S, <i>Water Supply and Sanitary Engineering</i> , Dhanpat Rai & Sons, 2010. 2. Duggal K N, <i>Elements of Environmental Engineering</i> , S Chand & Co Ltd.. 3. Garg S K, <i>Environmental Engineering Vol II</i> , Khanna Publishers, 2010 4. Fair, Gayer and Okun, <i>Water and Waste water Engineering Vol. II</i> , John Wiley. 3 <sup>rd</sup> Edition 2011. 5. Metcalf and Eddy, <i>Waste Water Engineering, Treatment, Disposal &amp; Reuse</i> , Tata McGraw Hill. 2002					

CE407/CEE407	DESIGN OF WASTEWATER SYSTEM				
Pre-Requisite	Co-Requisite	L	T	P	C
CE310	Nil	3	1	0	4
<b>Objective</b>	To understand the basic concept and procedure of designing of various wastewater treatment processes.				
<b>Unit I</b>	<b>Wastewater Characteristics</b>	<b>8 hours</b>			
Wastewater Characteristics: Physical, Chemical and Biological characteristics, Composition and Microbiology of Wastewater, BOD kinetics and COD.					
<b>Unit II</b>	<b>Wastewater Treatment</b>	<b>8 hours</b>			
Primary Treatment: Theory and design of Screens, Grit chamber, Sedimentation Tank, Unit operation and processes, Process flow sheets of wastewater treatment plant.					
<b>Unit III</b>	<b>Activated Sludge Process</b>	<b>8 hours</b>			
Secondary Treatment: Theory, Design and Construction of Biological Treatment Processes, Activated Sludge Process, Design of different Units and Modifications, Extended Aeration Systems.					
<b>Unit IV</b>	<b>Trickling Filter</b>	<b>8 hours</b>			
Secondary Treatment: Theory, Design and Construction of Trickling Filter, Types of Trickling Filter, Efficiency Calculation of Trickling Filter, Recirculation of Treated Sewage. SBR Technology: Methodology and Operation.					
<b>Unit V</b>	<b>Miscellaneous Method</b>	<b>8 hours</b>			
Waste Stabilization Ponds, Aerated Lagoon, Oxidation Ditches, and Rotating Biological Contactors (RBC).					
<b>References:</b>					
14. Birdie G.S. and Birdie J.S, “ <i>Water Supply and Sanitary Engineering</i> ”, Dhanpat Rai & Sons, 2010.					
15. Duggal K. N, “ <i>Elements of Environmental Engineering</i> ”, S Chand & Co Ltd..					
16. Garg S. K, “ <i>Environmental Engineering Vol II</i> ”, Khanna Publishers, 2010					
17. Fair, Gayer and Okun, “ <i>Water and Waste water Engineering Vol. II</i> ”, John Wiley. 3 <sup>rd</sup> Edition 2011.					
18. Metcalf and Eddy, “ <i>Waste Water Engineering, Treatment, Disposal &amp; Reuse</i> ”, Tata McGraw Hill. 2002					
19. B.C. Punmia, “ <i>Water supply Engineering</i> ”, Arihant Publications					
<b>Web links to e-learning:</b>					
<a href="http://nptel.ac.in/courses/105105048/">http://nptel.ac.in/courses/105105048/</a>					

CE410/CEE410		EARTHQUAKE RESISTANT DESIGN			
Pre-requisite	Co-Requisite	L	T	P	C
<b>Recommended CE302</b>	NIL	3	1	0	4
<b>Objective</b>	To introduce the students the basics of structural dynamics and to design Earthquake Resistant Structures. The students are familiarized with the codal provisions as well as aseismic design methodology.				
<b>Unit-I</b>	<b>Basics of Structural Dynamics</b>	<b>8 Hrs</b>			
Wind and earthquake loading on structures, structural idealization for dynamic analysis. Free and forced vibration of single degree freedom system.					
<b>Unit-II</b>	<b>Base Shear Determination</b>	<b>8 Hrs</b>			
Two degree and multi degree freedom system, seismic response of the buildings, calculation of time period, base shear, seismic coefficient method and response spectrum method.					
<b>Unit-III</b>	<b>Earthquake Resistant Design of Structures</b>	<b>8 Hrs</b>			
Effect of structural irregularities on the performance of RC building. Earthquake Resistant Design of Masonry building.					
<b>Unit-IV</b>	<b>Design of Shear Wall</b>	<b>8 Hrs</b>			
Design of shear wall. Ductility requirement of RCC frame. Modern techniques in a seismic design.					
<b>Unit-V</b>	<b>Design of Machine Foundation</b>	<b>8 Hrs</b>			
Structural design of machine foundation. Dynamics of soil-structure interaction. Earthquake induced liquefaction of soil.					
<b>References</b>					
<ol style="list-style-type: none"> <li>1. Earthquake- Resistant Design of Structures-S.K. Duggal.</li> <li>2. Basics of Structural Dynamics and Aseismic Design.- S.R. Damodarasamy and S. Kavitha.</li> <li>3. Structural Dynamics-Theory and Computation- Mario Paz.</li> <li>4. Introduction to Structural Dynamics- J.M.Biggs</li> <li>5. IS-13920-1993- Ductile detailing of Reinforced Concrete Structures subjected to a Seismic Forces.</li> <li>6. IS-4326-1993.</li> <li>7. IS-1893-(Part I)-2016 Criterion for Earthquake Resistant Design.</li> </ol>					
<b>Web links to e-learning:</b>					
<a href="https://nptel.ac.in/courses/105105104/40">https://nptel.ac.in/courses/105105104/40</a>					
<a href="https://www.nicee.org/EQTips.php">https://www.nicee.org/EQTips.php</a>					

<b>CE411/CEE411</b>	<b>ADVANCED FOUNDATION DESIGN</b>				
Pre-requisite	Co-Requisite	L	T	P	C
<b>Recommended CE312/ CEE312</b>	NIL	3	1	0	4
<b>Objective</b>	To develop and apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity, analysis & design.				
<b>Unit-I</b>	<b>Introduction</b>				<b>8 Hrs</b>
Introduction, Basic definitions, Gross & Net footing pressure, Rankine's analysis, Terzaghi's analysis, Prandtl's Analysis, Terzaghi's bearing capacity theory,					
<b>Unit-II</b>	<b>Shallow foundations</b>				<b>8 Hrs</b>
Bearing capacity of foundation, types of shear failure, Terzaghi's, Meyerhof's, Hansen, Skempton's & IS methods, Effect of water Table, Plate Load Test.					
<b>Unit-III</b>	<b>Pile foundations</b>				<b>8 Hrs</b>
Load capacity of pile foundations Various factors affecting load carrying capacity of piles, Static and Kinematics analysis of pile groups in sand & clays, Settlement of pile groups, Efficiency, Pile load tests Laterally loaded and battered piles,					
<b>Unit-IV</b>	<b>Well Foundation</b>				<b>8 Hrs</b>
Elements of well foundation, shapes, depth of scour, well sinking, tilts, shift and their prevention, Cofferdams and its types					
<b>Unit-V</b>	<b>Machine Foundation and its Design</b>				<b>8 Hrs</b>
Machine foundation and its types, basic terms and definitions, general design criteria of machine foundation, natural frequency of natural soil system, vibration isolation and control					
<b>References</b>					
<ol style="list-style-type: none"> <li>1. Dr. K K Arora -“Soil Mechanics &amp; Foundation Engineering”, Standard Publisher Distributors. 7<sup>th</sup> Edition Reprint 2015.</li> <li>2. Dr Alam Singh -“Soil engineering in Theory &amp; Practices”, Volume-2, CBS Publishers &amp; Distributors 2<sup>nd</sup> Edition Reprint 2009.</li> <li>3. Gopal Ranjan &amp; A S Rao -“Basics &amp; Applied Mechanics 2<sup>nd</sup> Edition, New Age International (P) Ltd Publishers, 2<sup>nd</sup> edition Reprint 2012.</li> <li>4. P C Verghese – “Foundation Engineering”, Phi Learning Ltd, 9th Printing 1<sup>st</sup> edition.</li> <li>5. Dowlous H S &amp; E H - “Pile Foundation Analysis &amp; Design”, John Willey &amp; sons, New York 1980.</li> </ol>					

<b>CE412/CEE412</b>		<b>Impact of Climate Change for Civil Engineering Projects</b>			
Pr-requisite	Co-Requisite	L	T	P	C
<b>Recommended CE201/CE306</b>	NIL	3	1	0	4
<b>Objective</b>	To identify the factors influencing the global and regional climate systems and develop strategies for adaptation and mitigation measures for sustainable development				
<b>Unit-I</b>	<b>Introduction to weather and climate</b>	<b>8 Hrs</b>			
Basic meteorology, measurement of meteorological parameters, Earth's Climate System, Climate Classification , The general circulation ,Trade Winds and the Hadley Cell , The Westerlies , Cloud Formation and Monsoon Rains(focus on Indian Monsoon) , Storms and Hurricanes , The Hydro-logical Cycle , El Nino and its Effect , Solar Radiation ,The Earth's Natural Green House Effect , Green House Gases and Global Warming ,Carbon Cycle.					
<b>Unit-II</b>	<b>Climate change impacts on water resources</b>	<b>8 Hrs</b>			
Impact on hydrological cycle,floods,droughts,coupling of hydroclimate variability with human systems,impact on water quality and quantity ,Climate change projections,Water management Approaches to climate change adaptation and mitigation.					
<b>Unit-III</b>	<b>Incorporating Climate science in engineering practise</b>	<b>8 Hrs</b>			
Climate change dilemma for engineering, Uncertainty and statistical methods for risk assessment, Risk management, Engineering standards and regulations, Guiding principles.					
<b>Unit-IV</b>	<b>Climate change impacts in civil engineering</b>	<b>8 Hrs</b>			
The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India, Impacts on buildings and other structures,impacts on transportation,impacts on urban water systems,coastal management,air quality and energy supply ,adaptation and mitigation strategies for sustainable development of infrastructure .					
<b>Unit-V</b>	<b>Climate change mitigation strategies</b>	<b>8 Hrs</b>			
Climate Change Adaptation And Mitigation Measures in various sectors - Water – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry –Carbon sequestration – Carbon capture and storage (CCS)- –Carbon Trading examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind –Hydroelectric Power ,green concrete.					
<b>References</b>					
<ol style="list-style-type: none"> <li>1. John M Wallace,Peter V Hobbs “<i>Atmospheric science-, An introductory survey</i> ”, Academic press.; 2<sup>nd</sup> Edition 2006</li> <li>2. J.Rolf Olsen, “<i>Adopting infrastructure and civil engineering practise to a changing climate</i> ”, American Society of Civil Engineers(ASCE) ,ASCE book series , 2015</li> <li>3. Dash Sushil Kumar, “<i>Climate Change – An Indian Perspective</i>”, Cambridge University Press India Pvt. Ltd, 2007</li> </ol>					
<b>Web links to e-learning:</b>					
<a href="https://ascelibrary.org/doi/pdf/10.1061/9780784479193">https://ascelibrary.org/doi/pdf/10.1061/9780784479193</a>					

<b>CE-413/CEE-413</b>		<b>PLASTIC DESIGN OF STEEL STRUCTURES</b>			
<b>Pre-Requisite</b>	<b>Co-Requisite</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CE301/CEE-301</b>	<b>Nil</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Objective</b>	To understand the basic concept and procedure of plastic design of steel structures. To develop the skill to deals with the problem of various beams and frame structures.				
<b>Unit I</b>	<b>Plastic Behavior of Structural Steel</b>			<b>8 hours</b>	
General Introduction, basic hypothesis, stress-strain relation for mild steel, scope of plastic analysis, redistribution of moments, concept of shape factor and load factor, scope of plastic collapse- basic theorems.					
<b>Unit II</b>	<b>Plastic Analysis Methods</b>			<b>8 hours</b>	
Procedure of plastic analysis: Introduction, Static and Kinematic methods, Plastic hinge concept, Plastic collapse load, method of combining mechanisms: Analysis of beams and frames, plastic moment distribution method.					
<b>Unit III</b>	<b>Plastic Moment's Factors</b>			<b>8 hours</b>	
Factors affecting fully plastic moments: Introduction, variations of lower yield stress, effect of shear force, effect of normal force, interaction formula.					
<b>Unit IV</b>	<b>Plastic Design of Beam/Frame</b>			<b>8 hours</b>	
Plastic Design: Introduction, design consideration, Design of simple, fixed and continuous beams, analysis and design of portal and Gable frames, design of two bay and two story frames.					
<b>Unit V</b>	<b>Miscellaneous Methods</b>			<b>8 hours</b>	
Minimum Weight Design: Assumptions, Geometrical analogue and Minimum weight theorem, applications, Methods of solution.					
<b>References:</b>					
1. S.K. Duggal, Design of Steel Structures, Tata Mc Graw Hill publishing co. India.					
2. Arya Ajmani, Design of Steel Structures, Wiley Eastern, New York.					
3. Vazirani & Ratwani Steel Structures, Khanna Publishers Delhi.					
4. B. G. Neal, Plastic Methods of Structural Analysis, Chapman and Hall Ltd. Great Britain					
5. L.S. Negi, Design of Steel Structures, Tata Mc Graw Hill publishing co. India.					
<b>Web links to e-learning:</b>					
<a href="https://nptel.ac.in/courses/105106113/7">https://nptel.ac.in/courses/105106113/7</a>					

**ENVIRONMENTAL ENGINEERING LAB-II****CE418/CEE418****Recommended Co-Requisite: Environmental Engineering-II (CE401)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

1. Determination of total suspended and dissolved solids.
2. Determination of BOD of sample.
3. Determination of COD of sample.
4. Determination of Kjeldahl nitrogen.
5. Determination of fluorides.
6. Determination of rate kinetics constant of aerobic reactions.
7. Field visit of water / wastewater treatment plant.

**STRUCTURAL DETAILING LAB****CE419/CEE419****Recommended Co-Requisite: Steel Structure (CE403)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

Preparation of Plan, Elevation and Sectional Elevation for the following:

1. Rolled sections and connections (welded and riveted).
2. Built-up columns and beams.
3. Gusset bases
4. Grillage footing
5. Roof trusses
6. RC retaining walls
7. RC water tanks.