

SYLLABUS

OF

B. TECH
Civil Engineering

OF

IV YEAR

B. TECH. (CBCS)

**DEPARTMENT OF CIVIL
ENGINEERING**

**INTEGRAL UNIVERSITY
LUCKNOW**

STUDY AND EVALUATION SCHEME
Branch: B.Tech Civil Engineering Program
(w.e.f. Batch 2022-23)

Year – IV, Semester – VII

S. No.	Course Category	Code No	Name of Subject	Periods				Evaluation Scheme			Subject Total	
				L	T	P	C	Continuous Assessment (CA)				Exam ESE
								CT	TA	Total		
1	DC	CE401	Environmental Engineering-II	3	1	0	4	40	20	60	40	100
2	DC	CE403	Steel Structure	3	1	0	4	40	20	60	40	100
3	DE	As per Annexure	Departmental Elective VII	3	1	0	4	40	20	60	40	100
4	DE	As per Annexure	Departmental Elective VIII	3	1	0	4	40	20	60	40	100
5	DE	As per Annexure	Departmental Elective IX	3	1	0	4	40	20	60	40	100
6	DC	CG401	Career Development Course	2	0	0	0	-	-	-	50	50
PRACTICAL / DRAWING / DESIGN												
7	DC	CE418	Environmental Engineering Lab-II	0	0	2	1	40	20	60	40	100
8	DC	CE419	Structural Detailing Lab	0	0	2	1	40	20	60	40	100
9	DC	CE420	Minor Project	-	-	2	1	-	-	60	40	100
10	DC	CE300*	Industrial Training	-	-	-	0	-	-	-	50	50
Total				17	5	6	23					850
** A non credit foundation course, Candidate has to pass the course by securing at least 50% marks up to second semester.												

L – Lecture; T – Tutorial; P – Practical; C – Credits; UE – Unit Exams; TA – Teacher Assessment

Continuous Assessment (CA) = Unit Exams + Teacher Assessment

Subject Total = Continuous Assessment (CA) + End Semester Examination (ESE)

DC – Departmental Core

DE – Departmental Elective

Departmental Elective – VII

CE402 Construction Technology and Management

CE461 Project Management for Professionals*

Departmental Elective – VIII

CE404 Transportation System & Planning

CE405 Advanced Concrete Design

CE406 Environmental Pollution Control

CE407 Design of Waste Water System

CE462 Precast Members- Systems & Construction*

Departmental Elective – IX

CE410 Earthquake Resistant Design

CE411 Advanced Foundation Design

CE412 Impact of Climate Change for Civil Engineering Projects

CE413 Plastic Design of Steel Structures

CE463 Design of Execution of Pile Foundations*

*Courses offered by L&T EduTech

STUDY AND EVALUATION SCHEME

Branch: B.Tech Civil Engineering Program

(w.e.f. Batch 2024-25)

Year – IV, Semester – VIII

S. No.	Course Category	Code No	Name of Subject	Periods			Credits C	Evaluation Scheme				Subject Total
				L	T	P		Sessional Exam			Exam ESE	
							CT	TA	Total			
THEORY SUBJECT												
1	DC	CE450	Artificial Intelligence in Civil Engineering	3	1	0	0	25	15	40	60	100
2	OE	-	Open Elective - II	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
3	DC	CE499	B.Tech Project	-	-	-	4	-	-	60	40	100
4	DC	CE499	B.Tech Project	-	-	-	4	-	-	60	40	100
5	DC	CE499	B.Tech Project	-	-	-	4	-	-	60	40	100
6	DC	CE451	Seminar	-	-	-	2	-	-	60	40	100
7	DC	CE452	Comprehensive Assessment	-	-	-	1	-	-	100	-	100
Total				6	2	0	19					700

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



Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CE401	Title of the Course	Environmental Engineering-II	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE310	Co-requisite	NIL				
Course Objectives	Students will be familiar with current and emerging environmental engineering and global issues and have an understanding of ethical and societal responsibilities. Students will have the necessary qualifications for employment in environmental engineering and related professions, for entry into advanced studies.						

Course Outcomes	
CO1	The learner will learn basic management skill in given environmental condition about various characteristics of sewage.
CO2	Learner will understand the basic water management and design criteria of sewer.
CO3	To understand various treatment process and engineering knowledge for filter design.
CO4	The learner will learn about sewage stabilization and environmental condition of sewage.
CO5	To learn the waste management in given environmental condition in given location.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Wastewater Quality and Quantity Estimation	Introduction to wastewater treatment, Wastewater Quantity Estimation, Fluctuations in Dry Weather Flow, Wastewater Characterization, and treatment standards.	08	CO1
2	Wastewater Collection and Conveyance	Types of Waste water carriage system, wastewater flow rates, storm water flow, Hydraulic design of Sewers, construction of sewers, Sewer Appurtenances.	08	CO2
3	Wastewater Treatment	Preliminary and Primary treatment: Screening, grit chamber, Sedimentation and Coagulation Secondary treatment: Types of biological treatment systems, theory and design of trickling filter; theory and design of Activated sludge process. Tertiary Treatment	08	CO3
4	Miscellaneous Method	Oxidation ditch, aerated lagoons, waste stabilization pond, Rotating biological contactors, Up flow anaerobic sludge blanket reactor, Phytoremediation	08	CO4
5	Waste Management	Sludge characteristics, Sludge Treatment process, disposal of sludge, Designing of septic tank: Dimensioning of septic tank, detention period, free board as per the capacity. solid waste disposal, composting, incineration, Introduction to sanitary landfill.	08	CO5

Reference Books:
Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons, 2010.
Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd.
Garg S K, Environmental Engineering Vol II, Khanna Publishers, 2010.
Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley. 3rd Edition 2011.
Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill. 2002.
e-Learning Source:
https://nptel.ac.in/courses/105105178

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	3	0	0	0	3	0	0	0	0	0	2
CO2	3	2	3	0	0	0	3	0	0	0	0	0	1	2
CO3	3	2	3	0	0	0	3	0	0	0	0	0	1	1
CO4	3	0	0	0	0	0	3	0	0	0	0	0	3	2
CO5	3	0	0	0	0	0	3	0	0	0	0	0	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE402	Title of the Course	Construction Technology and Management	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> To make the students aware regarding general construction practices used in past and in upcoming future. To impart the practical knowledge of Construction Management tools and methods used in Project monitoring and Control. To make them aware about the construction safety and its guidelines to ensure safe construction environment. To develop problem solving skills to overcome practical/situation based site execution problems in construction industry. To enhance the skills by using operation, maintenance and productivity ethics for Equipment end use. 						

Course Outcomes	
CO1	To make students familiar with the past and recent trends of construction industry using project management tools.
CO2	Understand the information based on construction activity monitoring and to analyses the problems using Network diagram techniques.
CO3	To make the students aware about the globally recognized guidelines, theories for safety and other economic benefits.
CO4	Learner will be able to understand the problems associated with contract administration & bidding due to poor management of construction projects.
CO5	To facilitate the need to understand the productivity of construction equipment based on various construction works.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Fundamentals of Construction Management	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.	08	CO1
2	Network Techniques & Analysis	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.	08	CO2
3	Construction Safety & Engineering Economics	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.	08	CO3
4	Contract Management	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.	08	CO4
5	Construction Equipment Management	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.	08	CO5

Reference Books:
Dr. U.K.Shrivastava “Construction Planning and Management”,Galgotia Publications.; 3rd Edition 2005.
Kumar Neeraj Jha, “ Connstruction Project Management ”, Pearson New Delhi; 1st Edition 2005.
K.G.Krishnamurthy and S.V.Ravindra “Construction and Project Management” CBS Publishers and Distributers Pvt.ltd.; 2ndEdition 2017.
IS 456-2000 Indian Standard “Construction Planning, Equipment and Methods”, Mc Graw Hill; 7th Edition 2006.
e-Learning Source:
http://nptel.ac.in/courses/105103093/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	2	3	0	0	0	3	0	0	0	0	0	2	1
CO2	3	2	3	0	0	0	3	0	0	0	0	0	1	2
CO3	3	2	3	0	0	0	3	0	0	0	0	0	1	1
CO4	3	0	0	0	0	0	3	0	0	0	0	0	3	2
CO5	3	0	0	0	0	0	3	0	0	0	0	0	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE403	Title of the Course	Steel Structures	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE204	Co-requisite	Nil				
Course Objectives	<ul style="list-style-type: none"> Learner will understand the types and requirement of connections in steel members, then they should be able to design connection given conditions by following guide line of code IS: 800 of code IS: 800 Learner will understand the behavior & significance of different parameter of compression member, and should be able to design of compression member by following guide line of Indian codes. Learner will understand the behavior & mode of failures of tension member, then they be should able to design of tension member by following guide line of Indian codes. Learner will understand the behavior flexural member, then they be should able to design members by following guide line of Indian codes. Learner will understand the behavior and requirement Industrial building, then they be should able to design of elements of industrial building by following guide line of Indian codes. 						

Course Outcomes	
CO1	Learner should be able to design the various steel structural connections as per conditions and requirements.
CO2	Learner should be able to apply the principles, procedures and codal requirements to the analysis and design compression members by knowing its loading conditions.
CO3	Learner should be able to apply the principles, procedures and codal requirements to the analysis and design tension members for given loading conditions.
CO4	Learner should be able to Apply the principles, procedures and codal requirements to the analysis and design flexure members for given loading conditions.
CO5	Learner should be able to define the requirement of industrial structure and also able design its components for given requirements.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Attributes of Steel Structural Design	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.	08	CO1
2	Design of Steel Compression Members	Compression members- Effective length, Slenderness ratio, Strength of Compression members, Design of Struts, Columns, Built-up Columns, Design of eccentrically loaded columns.	08	CO2
3	Design of Steel Tension Members	Tension members – Net and Gross sectional areas, Strength of members and their design. Design of slab and Gusset bases, Design of Grillage footing.	08	CO3
4	Design of Steel Beams	Beams – web crippling and web buckling, design of laterally supported beam, design of laterally unsupported beam.	08	CO4
5	Design of Industrial Building	Design of Industrial Buildings –Elements of an industrial building, Design of elements of roof trusses, i.e purlin and plate girder.	08	CO5

Reference Books:
Subramanian, “Steel Structures- “Design and Practice”, Oxford, University Press.
M.R. Shriyekar, “Limit State Design in Structural Steel”, PHI, New Delhi.
Duggal S.K. “Limit State Design of Steel Structures”, McGraw-Hill Education (India) Private Limited, New Delhi.
Kazmi, S.M.A and Jindal R.S “Design of Steel Structures” PHI, New Delhi, India.
I.S: 800-2007- Code of Practice for General Construction in Steel, BIS, New Delhi, I
e-Learning Source:
http://nptel.ac.in/courses/105106112/
https://youtu.be/CNE4hk_SGT0
https://youtu.be/ruuKvu5QtKI
https://youtu.be/utgnv9NIFQc

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	3	3	0	0	0	0	3	0	1	0	2	3	3
CO2	3	3	3	0	0	0	0	3	0	1	0	3	3	3
CO3	3	3	3	0	0	0	0	3	0	1	0	3	3	3
CO4	3	3	3	0	0	0	0	3	0	1	0	3	3	3
CO5	3	3	3	0	0	0	0	3	0	1	0	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE404	Title of the Course	Transportation Systems and Planning	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE303	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> To introduce the student to fundamentals of Transport System and it's planning. To gain knowledge about transportation system planning and its economic analysis. 						

Course Outcomes	
CO1	Learner will acquire knowledge about fundamentals of transportation system, role of transportation for various aspects & hierarchy of roads in India.
CO2	Learner will be able to evaluate the concepts of public transport selection & will be able to primary design few transport infrastructure.
CO3	Learner will be able to understand the fundamentals of transportation costs, demand & supply and all effects of transportation on environmental.
CO4	Learner will understand basis of transport planning process & will be able to do economic evaluation of transport projects.
CO5	Learner will understand fundamentals about system operations & intelligent transportation systems.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Transport System and Its Development	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	08	CO1
2	Transport Facility Design	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.	08	CO2
3	Transportation Cost, Demand and Supply	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.	08	CO3
4	Transport Planning	Transport Planning: Transportation planning surveys, transport planning process: trip generation, trip distribution, modal split and trip assignment; economic evaluation of transport plans.	08	CO4
5	Modern Transportation Techniques	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.	08	CO5

Reference Books:
Traffic Engineering & Transport Planning by LR Kadyali, Khanna Publisher, Delhi, 2010.
Theory and Applications of Economics in Highway and Transport Planning, Vinay Maitri, P.K.Sarkar, Standard Publishers Distributors, Delhi, 2008.
Transportation Planning, Principles, Practice and Policies, P.K.Sarkar, Vinay Maitri, G.J. Joshi, Prentice-Hall India, Delhi, 2002.
Transportation Engineering and Planning, C.S.Papacostas, P.D.Prevedouros, Prentice –Hall India, Delhi, 2005.
5. Highway Engineering-S.K.Khanna& C.E.G. Justo, Nem Chand & Bros, Roorkee, 2014.
e-Learning Source:
https://nptel.ac.in/courses/105106058/
http://www.civil.iitb.ac.in/~dhingra/ce751.htm

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	2	2	3	1	3	0	1	0	1	0	2	1	0	0
CO2	1	1	3	1	2	3	1	1	0	0	0	0	0	0
CO3	2	1	3	3	1	0	3	0	0	0	1	0	0	0
CO4	1	3	2	3	0	0	0	2	1	1	3	0	0	0
CO5	0	0	0	0	3	1	2	0	1	0	1	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE405	Title of the Course	Advanced Concrete Design	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE311	Co-requisite	Nil				
Course Objectives	Students are expected to realize the importance of design of heavy RCC structure and their application in civil engineering						

Course Outcomes	
CO1	Student will be able to design reinforced domes under uniformly distributed and point load.
CO2	Student will be able to design rectangular and cylindrical water tank using IS-3370 design charts.
CO3	Student will be able to design Intze tank.
CO4	Student will be able to analyze and design a building frame by substitute frames, portal and cantilever methods
CO5	Student will be able to understand concept of Pigeaud's and Courban's theory and can design deck slab using effective width concept.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	RC Domes and Curved Beams	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.	08	CO1
2	RC Overhead Tank	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.	08	CO2
3	Intze Tank	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.	08	CO3
4	Building Frames	Dead load, Live load, Wind load and Earthquake loads, Analysis of building frames by substitute frames, portal and cantilever methods, Design of building frames.	08	CO4
5	RC Bridges and Composite members	lines as per IS-800, Design of encased columns. 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.	08	CO5

Reference Books:	
N .Krishna Raju "Advance concrete design", CBS Publishers, 3rd edition,2015	
D.J. Victor "Essential of Bridge Engineering", Oxford & IBH Publishing company, 6th edition 2017	
B.C. Punmia and A.K.Jain "Limit State Design of Reinforced Concrete", Laxmi Publications, 1 st Reprint2017.	
IS:3370(Part-1,2,3,4) -1965-Code of practice for concrete structures for the storage of liquids.	
IS 456-2000 Indian Standard "Plain & Reinforced Concrete-code of practice", BIS, New Delhi.	
IS:11682-1985-Criteria for design of RCC staging for overhead water tank.	
e-Learning Source:	
http://nptel.ac.in/courses/105105105/	
http://nptel.ac.in/downloads/105105104	
http://onlinecourses.nptel.ac.in	
http://m.youtube.com/channel	

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	2	3	0	0	0	0	0	0	0	0	2	2	2
CO2	3	2	3	0	0	0	0	0	0	0	0	2	3	2
CO3	3	2	3	0	0	0	0	0	0	0	0	2	3	2
CO4	3	3	3	0	0	0	0	0	0	0	0	2	3	2
CO5	3	2	3	0	0	0	0	0	0	0	0	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE406	Title of the Course	Environmental Pollution Control	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE310, CE401	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> Impart knowledge on fundamental aspects of air pollution & control, solid waste management and noise Pollution. To introduce some basics of sanitation methods essential for protection of community health. 						

Course Outcomes	
CO1	Realize the importance of ecosystem, its elements and biodiversity for maintaining ecological balance.
CO2	Identifying air pollution sources, effects, its measurement and control devices.
CO3	Identifying the sources of water pollution and classify the pollutants and analyze the waste water sample.
CO4	Identify the type of land pollution and understand solid waste management.
CO5	Identifying noise pollution sources, effects, its measurement, prevention and control.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Impact of man on environment	Environment and its Components, Biosphere, Hydrologic Cycle, Nutrient Cycles, Anthropogenic Activities, Consequences of Population Growth, Energy Problem, Pollution of Air, Water and Land. Environmental Protection Act.	08	CO1
2	Air Pollution	Sources and Effects, Meteorological Aspects, Air Pollution Sampling and Measurement, Control Methods and Equipment, Control of Specific Air Pollutants, Air (Prevention and Control of Pollution) Act. National Ambient Air Quality Standards.	08	CO2
3	Water Pollution	Sources and Classification of Water Pollutants, Wastewater Sampling and Analysis. Water (Prevention and Control of Pollution) Act, Water Quality Criteria, WHO Drinking Water Specifications, BIS Drinking Water Specification (IS 10500: 2012)	08	CO3
4	Land Pollution	Definition, Major Types of Land Pollution, Solutions for Land Pollution, Solid Waste Management, Generation, Storage, Collection, Transport, Processing and Disposal. Land Filling with Solid Waste, Solid Waste Management Rules, 2016.	08	CO4
5	Noise Pollution	Definition, Human Diseases Caused by Noise Pollution, Effects of Noise Pollution on Wildlife and Marine Life, Preventive Measures, The Noise Pollution (Regulation And Control) Rules 2000, Noise Level Calculations.	08	CO5

Reference Books:

- Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons, 2010.
- Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd.
- Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley. 3rd Edition 2011.
- Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill. 2002.

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc22_ch45/preview

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	0	0	0	3	3	1	0	0	0	1	2
CO2	3	2	0	0	0	3	3	1	0	0	0	1	1	2
CO3	3	2	0	0	0	3	3	1	0	0	0	1	1	1
CO4	3	2	0	0	0	3	3	1	0	0	0	1	3	2
CO5	3	2	3	0	0	3	3	1	0	0	0	1	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE407	Title of the Course	Design of Wastewater System	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE310	Co-requisite	NIL				
Course Objectives	To understand the basic concept and procedure of designing of various wastewater treatment processes.						

Course Outcomes	
CO1	To give the basic knowledge about the characteristics of wastewater and oxygen requirement of organic material for the decomposition.
CO2	To give the basic idea about the primary treatment of the wastewater.
CO3	To give the knowledge of secondary treatment of wastewater and design process of activated sludge units.
CO4	To give the idea of design of trickling filter and calculation of efficiency of the trickling filters.
CO5	To learn about the waste stabilization pond, Oxidation ditches and Rotating Biological Contactors.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Wastewater Characteristics	Wastewater Characteristics: Physical, Chemical and Biological characteristics, Composition and Microbiology of Wastewater, BOD kinetics and COD.	08	CO1
2	Wastewater Treatment	Primary Treatment: Theory and design of Screens, Grit chamber, Sedimentation Tank, Unit operation and processes, Process flow sheets of wastewater treatment plant.	08	CO2
3	Activated Sludge Process	Secondary Treatment: Theory, Design and Construction of Biological Treatment Processes, Activated Sludge Process, Design of different Units and Modifications, Extended Aeration Systems.	08	CO3
4	Trickling Filter	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.	08	CO4
5	Miscellaneous Method	Waste Stabilization Ponds, Aerated Lagoon, Oxidation Ditches, and Rotating Biological Contactors (RBC).	08	CO5

Reference Books:
Birdie G.S. and Birdie J.S, “Water Supply and Sanitary Engineering”, Dhanpat Rai & Sons, 2010.
Duggal K. N, “Elements of Environmental Engineering”, S Chand & Co Ltd..
Garg S. K, “Environmental Engineering Vol II”, Khanna Publishers, 2010
Fair, Gayer and Okun, “Water and Waste water Engineering Vol. II”, John Wiley. 3rd Edition 2011.
e-Learning Source:
http://nptel.ac.in/courses/105105048/

PO-PSO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	2	3	1	2	2	2	2	0	0
CO2	1	1	3	1	1	2	3	1	1	1	3	1	0	0
CO3	1	3	3	2	2	1	3	1	3	2	2	2	0	0
CO4	2	2	3	2	1	2	2	1	2	2	3	2	0	0
CO5	3	2	2	1	1	2	2	1	1	2	1	2	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE410	Title of the Course	Earthquake Resistant Design	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	To introduce the students to the basics of structural dynamics and to design Earthquake Resistant Structures. The students are familiarized with the codal provisions as well as the aseismic design methodology.						

Course Outcomes	
CO1	Develop an understanding of structural dynamics and determine the response of the structural system under free and forced vibration of a single degree of freedom system.
CO2	Develop an understanding of two degree & multiple degree of freedom system in dynamic analysis and determination of base shear using codal provision.
CO3	Knowledge of various codal provision regarding irregularities in RCC structure. The learner will be able to design earthquake-resistant masonry buildings.
CO4	Knowledge of various codal provisions and modern techniques in earthquake-resistant design.
CO5	Attainment of knowledge of soil structure interaction and design of machine foundation.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Basics of Structural Dynamics	Wind and earthquake loading on structures, structural idealization for dynamic analysis. Free and forced vibration of single-degree freedom system.	08	CO1
2	Base Shear Determination	Two-degree and multi-degree freedom systems, seismic response of the buildings, calculation of time period, base shear, seismic coefficient method, and response spectrum method.	08	CO2
3	Earthquake Resistant Design of Structures	Effect of structural irregularities on the performance of RC building. Earthquake Resistant Design of Masonry building.	08	CO3
4	Design of Shear Wall	Design of shear wall. Ductility requirement of RCC frame. Modern techniques in seismic design.	08	CO4
5	Design of Machine Foundation	Structural design of machine foundation. Dynamics of soil-structure interaction. Earthquake-induced liquefaction of soil.	08	CO5

Reference Books:
Earthquake- Resistant Design of Structures-S.K. Duggal.
Basics of Structural Dynamics and Aseismic Design- S.R. Damodarasamy and S. Kavitha.
Structural Dynamics-Theory and Computation- Mario Paz.
Introduction to Structural Dynamics- J.M.Biggs
IS-13920-1993- Ductile detailing of Reinforced Concrete Structures subjected to Seismic forces.
IS-1893-(Part I)-2016 Criterion for Earthquake Resistant Design.
e-Learning Source:
https://nptel.ac.in/courses/105105104/40
https://www.nicee.org/EQTips.php

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	0	0	0	1	1	2
CO2	3	2	1	1	1	3	1	1	0	0	0	1	1	2
CO3	2	2	1	1	1	3	1	1	0	0	0	1	1	2
CO4	2	2	2	1	2	3	1	2	0	0	0	1	1	2
CO5	2	1	2	1	1	1	1	1	0	0	0	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE411	Title of the Course	Advanced Foundation Design	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE312	Co-requisite	NIL				
Course Objectives	To apply the principles of soil mechanics to design shallow and deep foundations including bearing capacity and analysis						

Course Outcomes	
CO1	Student will be able to determine bearing capacity of different types of soils.
CO2	Student will be able to design the different types of footing.
CO3	Student will be able to design piles for deep foundations.
CO4	Student will be well versed with hydraulic designing of well foundations.
CO5	Student will be able to design foundation of machinery structures.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Introduction, Basic definitions, Gross & Net footing pressure, Rankine's analysis, Terzaghi's analysis, Prandtl's analysis, Terzaghi's bearing capacity theory	08	CO1
2	Shallow Foundations	Bearing capacity of foundation, types of shears Failure, Terzaghi's, Meyerhof's, Hansen, Skemptions & IS methods, Effect of water Table, Plate Load Test.	08	CO2
3	Pile Foundations	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.	08	CO3
4	Well Foundation	Elements of well foundation, shapes, depth of scour, well sinking, tilts, shift and their prevention, Cofferdams and its types.	08	CO4
5	Machine Foundation and its Design	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.	08	CO5

Reference Books:
Dr. K K Arora -"Soil Mechanics & Foundation Engineering", Standard Publisher Distributors.7 th Edition Reprint 2015.
Dr Alam Singh -"Soil engineering in Theory 7 Practices", Volume-2, CBS Publishers & Distributors 2nd Edition Reprint 2009.
Gopal Ranjan & A S Rao -"Basics & Applied Mechanics 2nd Edition, New Age International (P) Ltd Publishers,2nd edition Reprint 2012.
e-Learning Source:
https://nptel.ac.in/courses/105108069/
https://nptel.ac.in/content/syllabus_pdf/105108069.pdf
https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105105039/lec5.pdf

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	3	1	0	2	0	0	0	0	0	1	0
CO2	3	1	2	0	1	2	0	1	0	1	0	1	0	2
CO3	3	1	2	0	1	2	0	1	0	1	0	1	0	2
CO4	3	1	2	0	1	2	0	1	0	1	0	1	0	1
CO5	3	1	2	0	1	2	0	1	0	1	0	1	0	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE412	Title of the Course	Impact of Climate Change for Civil Engineering Projects	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	CE201/CE306	Co-requisite	NIL				
Course Objectives	To identify the factors influencing the global and regional climate systems and develop strategies for adaptation and mitigation measures for sustainable development						

Course Outcomes	
CO1	Students are able to understand Basic meteorology, Earth’s Climate System, Green House Gases and Global Warming.
CO2	Students are able to understand the Impact of climate change on hydrological cycle and impact on water quality and quantity.
CO3	Students are able to understand the Climate change dilemma for engineering, and statistical methods for risk assessment and management.
CO4	Students are able to understand The Montreal Protocol, effect of climate change on a Global Scale and in India, and impacts on urban water systems
CO5	Students are able to understand the Climate Change Adaptation and Mitigation Measures in various sectors like Water, Transport, and Energy.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Weather and Climate	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.	08	CO1
2	Climate Change Impacts on Water Resources	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	08	CO2
3	Incorporating Climate Science in Engineering Practice	Climate change dilemma for engineering, Uncertainty and statistical methods for risk assessment, Risk management, Engineering standards and regulations, Guiding principles	08	CO3
4	Climate Change Impacts in Civil Engineering	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.	08	CO4
5	Climate Change Mitigation Strategies	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	08	CO5

Reference Books:
John M Wallace, Peter V Hobbs “Atmospheric science-, An introductory survey ”, Academic press.; 2nd Edition 2006
J.Rolf Olsen, “Adopting infrastructure and civil engineering practice to a changing climate ”, American Society of Civil Engineers(ASCE) , 2015
Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007
e-Learning Source:
https://ascelibrary.org/doi/pdf/10.1061/9780784479193

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	2	3	1	0	2	0	0	0	0	0	1	0	1
CO2	3	1	2	0	1	2	0	1	0	1	0	1	0	2
CO3	3	1	2	0	1	2	0	1	0	1	0	1	0	2
CO4	3	1	2	0	1	2	0	1	0	1	0	1	0	1
CO5	3	1	2	0	1	2	0	1	0	1	0	1	0	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE413	Title of the Course	Plastic Design of Steel Structures	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> Understand the concept of reserve strength of steel and the basics of plastic analysis theory. Understanding the methods of plastic analysis and analysing the beams and frames. Identifying the factors affecting the plastic moment capacity of the section Plastic design of beams and frames. Design of steel structures using minimum weight design. 						

Course Outcomes	
CO1	Learner will be able to understand the concept of reserve strength of steel and the basics of plastic analysis theory.
CO2	Learner will be able to understand the methods of plastic analysis and do the analysis of beams and frames.
CO3	Learner will be able to identify the factors affecting the plastic moment capacity of the section.
CO4	Learner will be able to do the plastic design of beams and frames.
CO5	Learner will be able to design the steel structures using minimum weight design method.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Plastic Behavior of Structural Steel	General Introduction, basic hypothesis, stress-strain relation for mild steel, the scope of plastic analysis, redistribution of moments, the concept of shape factor and load factor, the scope of plastic collapse- basic theorems.	08	CO1
2	Plastic Analysis Methods	The 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.	08	CO2
3	Plastic Moment's Factors	Factors affecting fully plastic moments: Introduction, variations of lower yield stress, the effect of shear force, effect of normal force, interaction formula.	08	CO3
4	Plastic Design of Beam/Frame	Plastic Design: Introduction, design consideration, Design of simple, fixed, and continuous beams, analysis and design of the portal and Gable frames, design of two bay and two-story frames.	08	CO4
5	Miscellaneous Methods	Minimum Weight Design: Assumptions, Geometrical analog and Minimum weight theorem, applications, Methods of solution.	08	CO5

Reference Books:
S.K. Duggal, Design of Steel Structures, Tata Mc Graw Hill publishing co. India.
Arya Ajmani, Design of Steel Structures, Wiley Eastern, New York.
Vazirani & Ratwani Steel Structures, Khanna Publishers Delhi.
B. G. Neal, Plastic Methods of Structural Analysis, Chapman and Hall Ltd. Great Britain
L.S. Negi, Design of Steel Structures, Tata Mc Graw Hill publishing co. India.
e-Learning Source:
https://nptel.ac.in/courses/105106113/7

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1	1	0	0	0	0	0	0	0	0	0	1	0
CO2	2	2	0	0	0	0	0	0	0	0	0	1	0	2
CO3	2	2	0	0	0	0	0	0	0	0	0	1	0	2
CO4	2	2	1	0	0	1	0	0	0	0	0	1	0	1
CO5	2	2	1	0	0	1	0	0	0	0	0	1	0	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CE461	Title of the Course	Project Management for Professionals	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> Understand the concepts of project management and how to apply them in real world projects. Provide a practical understanding of various project management tools and techniques. 						

Course Outcomes	
CO1	The students will be able to develop construction plans and estimate the resource requirements
CO2	The students will be able to prepare bar charts for work schedule
CO3	The students will be able to outline the cost control monitoring and accounting
CO4	The students will be able to understand the quality control and safety during construction
CO5	The students will be able to learn project information and databases in an organization

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Contract Management and Scope Management:	Introduction to project management, project and project lifecycle – process, phases, organization, project financial feasibility methods, non-numerical feasibility methods. Basic concepts of contract management, essential elements, contract types, tendering and proposal preparation, key commercial terms and conditions, bid evaluation and contract award, contract administration, claim management. work breakdown structures- creation & case study	08	CO1
2	Schedule and Resource Management	Approach to schedule management, charts, sequencing and dependency, network diagram, activity duration, critical path method, float, case study, relationships, case study, precedence diagramming method. Resource allocation and resource levelling, case study on schedule compression, PERT to predict the probability of project completion.	08	CO2
3	Project Cost and Quality Management	Cost estimation, budget and variance analysis, monitoring and control, cash flows, case study. Occupational health, safety and environment, barriers, quality management system – chart and tools.	08	CO3
4	Procurement, Subcontracts and Stakeholder Management	Supply chain management, logistics and transportation, vendor and inventory management. Stakeholder analysis and engagement, project communication, dealing with difficult stakeholders.	08	CO4
5	Project Risk Management and Project Monitoring	Process, terminology, identification, analysis and response strategy. Analysis techniques, monitor and control schedule, cost, resources, quality and risks Creating schedules, assigning resources, cost, evaluation, optimization and tracking	08	CO5

Reference Books:
Dr. U.K.Shrivastava “Construction Planning and Management”,Galgotia Publications.,; 3rd Edition 2005.
Kumar Neeraj Jha, “ Construction Project Management ”, Pearson New Delhi; 1st Edition 2005.
K.G.Krishnamurthy and S.V.Ravindra “Construction and Project Management” CBS Publishers and Distributers Pvt.ltd.; 2ndEdition 2017.
IS 456-2000 Indian Standard “Construction Planning, Equipment and Methods”, Mc Graw Hill; 7th Edition 2006.
e-Learning Source:
http://nptel.ac.in/courses/105103093/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	0	0	0	3	0	0	1	2	1	1	2
CO2	2	1	0	0	1	0	0	0	0	1	2	2	2	2
CO3	2	2	0	0	2	0	0	2	0	2	3	2	1	3
CO4	2	3	0	0	2	0	0	0	0	2	3	2	2	2
	2	2	0	0	2	0	0	0	0	2	3	2	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CE462	Title of the Course	Precast Members - Systems & Construction	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	To help learners understand the concepts about precast fundamentals, precast component behavior, design and structural connections.						

Course Outcomes	
CO1	Learners will know the application, material used and code provision of precast.
CO2	Learners will be know the structural skeletal system as well as the basic design criteria of the frame structure.
CO3	Learners will be able to do production, storage, & handle logistics of Precast.
CO4	Learners will be able to analyse and design precast walls as per given conditions.
CO5	The Learners will be able to perform modelling of analysis and design of frame systems.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Precast	Introduction difference between Precast vs conventional construction methods, Needs, Types, Advantages and Limitations, Residential, Commercial & Industrial Applications of precast, Materials used, Code provisions and clauses.	08	CO1
2	Precast Elements and Structural Systems	Major elements: Classification and Types, Applications of Major Elements (Beam, slab, wall, column, foundation, staircase, roof elements, façade & infra works). Structural System: Skeletal System, Portal Frame system, Block system, Large Panel system, Structural Stability and Behavior. Design Basis Criteria, Loads and Load combinations: Geometric parameters and Occupancy, Location and Associated Parameters, Loads and Load Combinations.	08	CO2
3	Production, Storage, & Logistics of Precast	Plant and Production: Introduction -Types & Process, Moulding & Casting, Concreting and Curing Storage, Delivery, Handling, Erection and Quality Inspection: Installation-Erection, Quality Inspection and Tolerance.	08	CO3
4	Modelling, Analysis and design of Wall system	Modelling, Analysis and design for RC Wall system: Modelling, Analysis and design using ETABS, Foundation-Modelling and design in SAFE, Checks related to foundation and design for stripping, stacking, transportation. Design of structural Elements and connections for RC Wall system: Design of beam, slab & staircase, Design for stripping, stacking, transportation and erection for all elements.	08	CO4
5	Modelling, Analysis and design of Frame system	Modelling and Analysis for Frame system and its connections: ETABS Modelling, Analysis and Design for frame system (foundation, column, beam, slab etc.), Various types of slab design & design for stripping, stacking, transportation and erection of all elements, Joint Connection design of various elements of frame structure like foundation, column, beam, slab, etc.	08	CO5

Reference Books:
Precast Concrete Structures by KIM S. ELLIOT, Second Edition, CRC Press, Taylor & Francis Group.
Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.
The Structural Precast Concrete Handbook 2nd Edition, ISBN : 981-04-3609-2, Building and Construction Authority, May 2001.
Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.
e-Learning Source:
https://archive.nptel.ac.in/courses/105/106/105106118/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	0	0	0	1	0	0	0	0	0	1	1
CO2	3	0	0	0	0	0	1	1	1	0	0	0	1	1
CO3	3	0	1	0	1	1	1	1	1	0	0	1	1	3
CO4	3	3	3	1	2	0	1	2	1	1	2	1	1	3
	3	2	3	1	2	0	1	2	1	1	0	1	1	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CE463	Title of the Course	Design and Execution of Pile Foundations	L	T	P	C
Year	IV	Semester	VII	3	1	0	4
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> • Introduce the concept of Piling works and design requirements for a pile. • Elaborate the construction procedures which are involved in the Piling works. • Explain the different load test which need to be conducted on the pile. • Understand the Environmental, Health and Safety standards which need to be in place for the handling of the pile works. 						

Course Outcomes	
CO1	The students will be able to comprehend Basic design concepts, construction procedures of pile foundation design and Load Testing of piles.
CO2	The students will be able to design and construction of precast driven and under reamed piles.
CO3	The students will be able to find the settlement efficiency and capacity of group pile as able to test pile and integrate results of test.
CO4	The students will be able to design and execute Pile foundations construction.
CO5	The students will be able to prepare bill of quantities for pile foundations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to piles, Design and construction of Bored Cast insitu piles and Driven Cast insitu piles	Overview of Pile foundations, Selection Criteria, Common Design considerations, General Terminologies and Indian standard codes. Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of Bored cast insitu piles and Driven cast insitu piles.	08	CO1
2	Introduction, design and construction of precast driven and under reamed piles	Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of precast driven piles, precast driven piles in pre-bored holes and Under reamed piles.	08	CO2
3	Grouping and settlement of piles and testing	Introduction to Grouping and Settlement of piles, Pile Group efficiency and Spacing, Capacity of Pile group, Settlement of Pile group, Case studies Introduction & Types of testing on piles and General requirements for testing, Pile Integrity tests - introduction & Equipment Types of Pile Integrity test, Data Recording & Interpretation of results, Introduction to quality assurance of piles, General requirement.	08	CO3
4	Quality control and Special Types of piles	Quality Control of BCIS, DCIS piles, Quality records and checklists. Materials, Equipment, manufacturing procedure, Design and installation, suitability and application and failure modes of spun piles and helical piles.	08	CO4
5	Software and Bill of quantities, Construction challenges	Introduction to Bill of quantities for Bored cast insitu, Driven Cast insitu, Precast driven and Precast driven piles in pre-bored holes and undreamed piles. Challenges in bored and driven piles, Introduction to types of piling software, Software demonstrations (e.g., PLAXIS) and step-by-step design techniques for deep foundations. Modelling in Plaxis 2D.	08	CO5

Reference Books:

Pile Foundation Design And Construction 2Ed 2019, Satyendra Mittal, CBS publication,2019.

Piles and Pile Foundations, Carlo Viggiani, Taylor and Francis Books Limited U.K. 2012.

Design of Foundation Systems: Principles and Practices, Third Edition by Nainan P. Kurian (Publ.-2009).

e-Learning Source:

<https://archive.nptel.ac.in/courses/105/105/105105176/>

<http://ocw.mit.edu/courses/civil-and-environmental-engineering/>

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	0	2	0	1	1	0	1	0	0	0	1	1	2
CO2	3	0	2	0	1	1	0	1	0	0	0	1	1	2
CO3	3	1	0	0	1	1	0	1	0	0	0	1	1	2
CO4	3	0	0	1	1	1	0	1	0	0	0	1	1	2
	3	1	0	0	2	0	0	1	0	0	1	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CG401	Title of the Course	Career Development Course	L	T	P	C
Year	IV	Semester	VII	2	0	0	0
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> Aptitude is a person's ability to perform tasks. Organizations assess this skill to measure candidates' reasoning, problem-solving, memory, verbal skills, and mathematical ability. Depending on the job role requirements aptitude tests are used to know candidates' ability to understand tasks and solve work-related problems. As a result, aptitude tests are widely used by organizations during campus placements to hire and retain top talent. The course on soft skills aims at preparing young minds into professionals of tomorrow and to make them aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice. 						

Course Outcomes	
CO1	Awareness on various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
CO2	Counting principles, Analysis and Interpretation of results.
CO3	Job Application Resume writing.
CO4	Students will be better prepared for before, during and after the Interview.
CO5	Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork Inter-personal relationships, conflict management and leadership quality

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Quantitative & Geometry	Simple Interest and Compound Interest, Time Speed and Distance, Boats and Streams, Problem on Trains, Problem on Race, Progression, Time Work, Pipe Cistern, Chain Rule, Allegation and Mixture, Geometry.	06	CO1
2	Advance Quantitative and Data Interpretation	Permutation & Combination, Probability, Graph, Table, Bar diagram, Pie Chart.	06	CO2
3	Writing Job Application	<ul style="list-style-type: none"> Netiquettes: Effective e-mail message. Writing Statement of Purpose -SOP Job Application: Cover letter, Differences between Bio-data, CV and Resume, Resume Construction. Video Resume Creating Professional Profiles on Professional Networking Sites like LinkedIn	04	CO3
4	Interview Process	<ul style="list-style-type: none"> Ensuring success in job interview. Tips to prepare for before, during and after the interview. Interview Body Language Effective use of body language during Interview Grooming Tips: Power Dressing, Wardrobe Etiquette.Grooming for Success. Interview DressCode Common Interview Questions New Interview trends - Telephonic & Skype Interview Mock interviews / Practice interview Sessions and feedback	04	CO4
5	Employability Skill Requirements	<ul style="list-style-type: none"> Employer Expectations and Employability Skill Requirements Decision Making, Negotiation skills, Conflict Management and Leadership Skills Time Management Concept and Essential Tips Office Culture and office etiquettes 	04	CO5

Reference Books:
Arun Sharma, "Quantitative Aptitude for Cat", Mc Graw Hill Education
RS Aggarwal, "Quantitative Aptitude", S Chand
Managing Soft Skills for Personality Development – edited by B.N.Ghosh
English and Soft Skills – S.P.Dhanavel
The Definitive Book of Body Language. Pease
e-Learning Source:
https://www.indiabix.com/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1	1	1	1	1	1				
CO2	2	2	2	2	1	1	1	1	1	1				
CO3	1	1	1	1	1	1	1	1	3	3				
CO4	1	1	1	1	1	1	1	1	3	3				
	1	1	1	1	1	1	1	1	3	3				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CE418	Title of the Course	Environmental Engineering Lab-II	L	T	P	C
Year	IV	Semester	VII	0	0	2	1
Pre-Requisite	CE310	Co-requisite	CE401				
Course Objectives	rt the experimental knowledge of wastewater quality assessment to be applied in environmental engineering.						

Course Outcomes	
CO1	Learners will be able to determine, explain, analyze the physical characteristics of wastewater according to the guidelines prescribed by IS code
CO2	Learners will be able to determine, explain, analyze the chemical characteristics of wastewater according to the guidelines prescribed by IS code

Experiment No.	Content of Experiment	Contact Hrs.	Mapped CO
1	Determination of total solids by IS-3025 (Part 16) for a given wastewater sample	2	CO1
2	Determination of Biochemical Oxygen Demand by IS-3025 (Part 44) for a given wastewater sample	2	CO1
3	Determination of Chemical Oxygen Demand by IS-3025 (Part 58) for a given wastewater sample	2	CO2
4	Determination of Kjeldahl nitrogen by IS-3025 (Part 34) for a given wastewater sample	2	CO2
5	Determination of fluoride by IS-3025 (Part 60) for a given wastewater sample	2	CO2
6	Determination of Chloride by IS-3025 (Part 32) for a given wastewater sample	2	CO2
7	Determination of colour by IS-3025 (Part 4) for a given wastewater sample	2	CO2
8	Determination of Dissolved Oxygen of sample by IS-3025 (Part 38) for a given wastewater sample	2	CO2

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	0	0	0	3	3	0	3	3	3	3	0	3	2	2
CO2	0	0	0	3	3	0	3	3	3	3	0	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2023-24							
Course Code	CE419	Title of the Course	Structural Detailing Lab	L	T	P	C
Year	IV	Semester	VII	0	0	2	1
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> To understand the drawing of reinforced concrete beams and columns. To impart the knowledge of drawing RC footing and retaining walls. To enable the student to draw the various elements of the steel sections and connections. 						

Course Outcomes	
CO1	To learn preparation of working drawings of RC beams and columns
CO2	To learn preparation of working drawing of RC footing and retaining walls.
CO3	To learn preparation of working drawing of steel section and connections.

Unit No.	Experiment No.	Content of Unit	Contact Hrs.	Mapped CO
1	Experiment 1	RC Beam detailing from a two storied building in CAD Drawing.	2	CO 1
2	Experiment 2	RC Column detailing from a two storied building in CAD Drawing.	2	CO 1
3	Experiment 3	RC Beam- Column connection detailing from a two storied building in CAD Drawing.	2	CO 1
4	Experiment 4	RC Footing detailing from a two storied building in CAD Drawing.	2	CO 2
5	Experiment 5	RC Slab detailing from a two storied building in CAD Drawing.	2	CO 2
6	Experiment 6	RC retaining walls in CAD Drawing.	2	CO 2
7	Experiment 7	Steel joint connections in CAD Drawing.	2	CO 3
8	Experiment 8	Built-up columns and beams in CAD Drawing.	2	CO 3

Reference Books:
Subramanian, “Steel Structures- “Design and Practice”, Oxford, University Press
M.R. Shriyekar, “Limit State Design in Structural Steel”, PHI, New Delhi
Kazmi, S.M.A and Jindal R.S “Design of Steel Structures” PHI, New Delhi, India
I.S: 800-2007- Code of Practice for General Construction in Steel, BIS, New Delhi, India
I.S: 808-1989- Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections, BIS, New Delhi, India
A.K..Jain “Reinforced concrete design, limit state Method”, Nem Chand & Bros.; 7th Edition 2012
e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	0	3	0	2	0	1	1	0	2	1	3
CO2	0	0	0	0	3	0	2	0	1	1	0	2	1	3
CO3	0	0	0	0	3	0	2	0	1	1	0	2	1	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE420	Title of the Course	Minor Project	L	T	P	C
Year	IV	Semester	VII	-	-	2	1
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	<ul style="list-style-type: none"> To enable students to work as a team and to select B.Tech project topic. 						

Course Outcomes	
CO1	Skill to work in a team and to select the best topic as per the ability and strength of a team to carry out the literature review work.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
-	-	The students group are expected to fix their topics, do the literature survey, field measurements, if any, methodology, and submit the minor project report in the seventh semester. The project work can be an investigative/experimental/analytical analysis of a technical problem in the various field of Civil Engineering such as planning, designing, material testing, computer application based problems etc.	-	CO1

Reference Books:
-
e-Learning Source:
-

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	3	0	3	3	0	0	3	3	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE300	Title of the Course	Industrial Training	L	T	P	C
Year	IV	Semester	VII	-	-	-	0
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The aim of this course is exposed the learner to the real world situation and provide an opportunity to apply classroom knowledge						

Course Outcomes	
CO1	Learner will able be to apply engineering knowledge learned in classroom to the real situations.
CO2	Learner will able be to show the knowledge of advanced tools and techniques and exposure to professional engineering practices.
CO3	Learner will able be to follow the role and responsibilities as well as code of ethics that engineers should uphold.
CO4	Learner will able be to show awareness about general workplace behaviour and build interpersonal and team skills.
CO5	Learner will able be to prepare professional work, reports and presentations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
-	-	Industrial training under for at least 1 month to acquire field knowledge or develop any emplobility skills.	Minimum 1 months industrial training	CO1, CO2, CO3, CO4 and CO5

Reference Books:
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e-Learning Source:
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Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	0	0	0	0	3	0	0	0	3	3	1	2	3
CO2	0	0	0	0	3	0	0	0	3	3	1	2	3	3
CO3	0	0	0	0	0	0	0	3	3	3	1	2	3	3
CO4	0	0	0	0	0	0	0	3	3	3	1	2	3	3
CO5	0	0	0	0	3	0	0	3	3	3	1	2	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	CE450	Title of the Course	Artificial Intelligence in Civil Engineering	L	T	P	C
Year	IV	Semester	VIII	3	1	0	0
Pre-Requisite	NIL	Co-requisite	NIL				
Course Objectives	<ul style="list-style-type: none"> To develop problem solving skills using AI. To familiarize the learner with machine learning fundamentals. 						

Course Outcomes	
CO1	Learners will be able to understand the foundational concepts of artificial intelligence and its applications in various fields.
CO2	Learners will grasp the fundamental principles of machine learning and its practical implementation in real-world scenarios.
CO3	Learners will possess a comprehensive understanding of optimization techniques and their application in solving complex problems across diverse domains.
CO4	Learners will be equipped with the knowledge and skills to effectively apply artificial intelligence methods and tools to address challenges in civil engineering projects and optimize decision-making processes.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to artificial intelligence, Problem solving through AI	History and evolution of AI, comparison of human and computer skill, Component of AI, Scope and significance in different domains, Ethical considerations in AI development and deployment, Intelligent Agent, logical agent. Defining problem as a state space search, analyzing the problem, solving problem by searching, informed search and Uninformed Search.	10	CO1
2	Machine Learning Basics, Natural Language Processing	Neural networks and deep learning, Supervised and unsupervised learning, Feature selection and engineering, learning from observation, knowledge in learning. Brief history of NLP, Text processing, Sentiment analysis, language translation, Early NLP system, ELIZA system, LUNAR system, General NLP system.	10	CO2
3	Optimization	Introduction to optimization, Optimization requirement, Heuristic and Meta-heuristic algorithms- Simulated Annealing, Particle swarm, Genetic Algorithm. Case study on optimization of civil engineering structures. Coupling metaheuristic algorithm with machine learning.	10	CO3
4	Application in Civil Engineering	Case studies on application in structural engineering, Application in environmental engineering, Application in traffic engineering.	10	CO4

Reference Books:
Winston, P. H. (1992). Artificial intelligence. Addison-Wesley Longman Publishing Co., Inc..
e-Learning Source:
https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	0	2	0	0	2	1	0	2	2	3
CO2	3	1	2	0	2	1	0	0	1	0	1	1	3	2
CO3	2	3	2	2	2	1	0	0	2	1	1	2	2	2
CO4	2	1	2	1	2	2	1	0	1	0	2	1	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE451	Title of the Course	Seminar	L	T	P	C
Year	IV	Semester	VIII	-	-	-	2
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	<ul style="list-style-type: none"> To understand organization of topic for presentation and research. To learn the skill set required to perform research. 						

Course Outcomes	
CO1	Skill to search on any topic to extract the information.
CO2	Ability to organize – deliver presentation and report on any topic.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	-	Select any topic related to civil engineering, investigate the topic and accumulate the knowledge. Organize the information collected and deliver the presentation along with report.	-	CO1 and CO2

Reference Books:
-
e-Learning Source:
-

Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	0	0	0	3	3	1	2	1	3	3	0	3	3
CO2	0	0	0	0	3	1	2	1	3	3	0	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16

Course Code	CE452	Title of the Course	Comprehensive Assessment	L	T	P	C
Year	IV	Semester	VIII	-	-	-	2
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	<ul style="list-style-type: none"> To test the learner's knowledge, skills and understanding of civil engineering at undergraduate level. 						

Course Outcomes

CO1	Learner should be able to demonstrate their knowledge in the field of civil engineering.
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Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	-	Complete syllabus of 4 th year B.Tech Civil Engineering	-	CO1

Reference Books:

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e-Learning Source:

-

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	3	3	3	0	3	0	3	0	0	0	3	3	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	CE499	Title of the Course	B.Tech Project	L	T	P	C
Year	IV	Semester	VIII	-	-	-	1
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	<ul style="list-style-type: none"> To enable students to work as a team to develop the methodology for the project. To develop the capability to apply engineering principles to carry out the project work. To define the conclusion of the project undertaken with in depth understanding of the topic. 						

Course Outcomes	
CO1	Ability to work as a team to plan the execution of the undertaken project.
CO2	Capability to use the engineering knowledge and principles on an undertaken project as required.
CO3	Capacity to complete the undertaken project on time with effective communication to deliver the project successfully.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
-	-	The project work can be an investigative/ experimental/ analytical analysis of a technical problem in the various field of Civil Engineering such as planning, designing, material testing, computer application based problems etc. The assessment for the project will be done internally as well as externally as per the procedure stated by the department. The students are also required to submit a detailed project report at the end of the eight semester.	----	CO1, CO2, and CO3

Reference Books:
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e-Learning Source:
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Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	2	0	1	2	2	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO3	0	0	0	0	2	1	1	3	3	3	3	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation