Seventh Semester Structure and Detail Syllabus

Department of Civil Engineering

NIST University, Institute Park, Berhampur, Odisha-761008

B. Tech Program Structure			Semester: Seventh(7th)	Department: CE			
S. N.	**Category**	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**
1	PCC	22CE7PC01T	Advanced Transportation Engineering	3	0	1	4
2	PCC	22CE7PC02T	Water Supply and Sanitary Engineering	3	0	0	3
4	PEC	**Professional Elective-5:**		3	0	0	3
		22CE7PE01T	Pre-stressed concrete				
		22CE7PE02T	Ground Water Engineering				
		22CE7PE03T	Construction Planning and Management				
		22CE7PE04T	Advanced Foundation Engineering				
5	PEC	**Professional Elective-6:**		3	0	0	3
		22CE7PE05T	Environmental Engineering				
		22CE7PE06T	Earth Retaining Structures				
		22CE7PE07T	Transportation System and Planning				
		22CE7PE08T	Remote Sensing and Geographical Information System				
Open elective for non-CE students							
6	OEC1	22CE7OE01T	Environmental Impact Assessment and LifeCycle Analyses	3	0	0	3
		22CE7OE02T	Industrial Waste Management and Disposal				
Open elective for CE students							
7	OEC1			3	0	0	3
Practical							
9	PSI	22CM7PS01L	Minor Project	0	0	6	3
11	PCC	22CE7PC02L	Water Supply and Sanitary Engineering Lab	0	0	2	1
12	HSMC	22CM7HS01L	Entrepreneurship Project	0	0	4	2
	PSI	22CM7PS02L	Summer Internship	0	0	2	1
Total							23

Course Code	Course Name	L	T	P	C
22CE7PC01T	**Advanced Transportation Engineering**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To know about the basics of different components of railway engineering.
COB2	To design the different geometric element of railway track and to know the types and functions of track, junctions and railway stations.
COB3	To learn about the aircraft characteristics, planning and components of airport.
COB4	To explain the components of harbour and docks engineering.
COB5	To know about various urban transportation systems and Intelligent Transportation Systems.

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Understand the fundamentals of railway system.
CO2	Able to design the different components of Railway track and its components.
CO3	Analyse geometric components of runway, taxiway and calculate accurate length of runway.
CO4	Synthesize the features of harbour and Dock engineering.
CO5	Understand the fundamentals of Urban transportation systems.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Railway Engineering**	**Contact Hours (09)**

Location surveys and alignment, Component parts of railway track, selection of gauges, uniformity of gauges, coning of wheels, Permanent way track components, type of rail sections, creep of rails, wear and failure in rails, ballast requirements, sleeper requirements, types of sleepers, and various train resistances

Module II	**Geometric Design of Railway Track**	**Contact Hours (09)**

Gradients, Grade Compensation, cant and Negative Super Elevation, cant Deficiency., Degree of Curves, Safe Speed on Railway Track, Points and Crossings, Layout and Functioning of Left Hand Turn Out and Right-Hand Turn Outs, Station Yards, Signalling and Interlocking.

Module III	**Airport Engineering**	**Contact Hours (10)**

Airport site selection, Aircraft characteristics, airport obstructions, Geometric elements of run way and taxiway, exit taxiway, apron, holding apron, runway configuration, visual aids, Wind rose diagram, Concept of airport runway length, calculations and corrections

Module IV	**Docks and Harbours**	**Contact Hours (06)**

Classification of Harbour basin, general layout of harbours, Docks, Different components of docks.		
Module V	**Urban transportation systems**	**Contact Hours (06)**
Classification of Transit Systems-Bus transit - Mass Rapid Transit System - Light Rail Transit. Introduction to Intelligent Transportation Systems (ITS)		
	Total Lecture Hours	**40**
Textbooks		
1	S.C.Saxena and M.G.Arora, "*A Text Book of Railway engineering*" Dhanpat Rai Publications, New Delhi, 2010.	
2	S.K.Khanna and M.G.Arora, "*Airport Planning and Design*" Nem Chand, Roorkee, Uttarakhand, 1999.	
3	Gautam H. Oza and Hasmukh P. Oza, "*Dock and Harbour Engineering*" Charotar Publishing House Pvt. Ltd.; 8th Edition, 2017.	
4	David Johnson Victor and S. Ponnuswamy, Urban, "*Transportation: Planning, Operation and Management*" McGraw Hill Education, 2012.	
Reference Books		
1	Satish Chandra and M.M Agarwal "*Railway Engineering*" Oxford Higher Education, University Press New Delhi, 2007.	
2	C. Venkatramaih "*Transportation Engineering, Volume-II- Railways, Airports, Docks and Harbours, Bridges and Tunnels*", Orient Blackswan Private Limited, 2016.	
3	C.S. Papacostas and P.D. Prevedouros, "*Transportation Engineering and Planning*" Pearson, 2nd edition, 1992.	
Digital Learning Resources		
Course Name: Transportation Engineering II Course Link: https://nptel.ac.in/courses/105107123 Course Instructor: Prof. Rajat Rastogi, Department of Civil Engineering, IIT Roorkee		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PC02T	**Water Supply and Sanitary Engineering**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)	
COB1	To make the students familiar with sources of water and the design of basic components of water supply lines.
COB2	To expose the students to understand the characteristics of water and its measurement.
COB3	To depict the information on water treatment processes and its design and also provide adequate knowledge on water distribution system.
COB4	To understand the generation and collection of waste water and its disposal standards.
COB5	To provide knowledge on biological wastewater treatment system.

Course Outcome (CO)	
On completion of the course, the students will be able to:	
CO1	Analyse the principles and operation of water treatment systems.
CO2	Analyse the suitability of the design of treatment plants and unit processes.
CO3	Analyse process operations and performance.
CO4	Analyse coagulation, flocculation, and sedimentation, filtration, and disinfection processes.
CO5	Analyse the principles and operation of water treatment systems.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**General requirement for water supply**	**Contact Hours (08)**
Sources, quality of water, intake, pumping and transportation of water. Physical, chemical and biological characteristics of water and their significance, water quality criteria, water borne diseases, natural purification of water sources.		
Module II	**Engineered systems for water treatment**	**Contact Hours (08)**
Aeration, sedimentation, softening coagulation, filtration, adsorption, ion exchange, and disinfection. Design of water distribution system.		
Module III	**Generation and collection of waste water**	**Contact Hours (08)**
Sanitary, storm and combined sewerage systems, quantities of sanitary waste and storm water, design of sewerage system Primary, secondary and tertiary treatment of wastewater. Waste water disposal standards.		
Module IV	**Basic of microbiology**	**Contact Hours (08)**

Biological wastewater treatment system: Aerobic processes activated sludge process and its modifications, trickling filter, RBC, Anaerobic Processes conventional anaerobic digester.		
Module V		**Contact Hours (08)**
High rate and hybrid anaerobic reactors, Sludge digestion and handling, Disposal of effluent and sludge, Design problems on water distribution, sewerage, water treatment units, wastewater treatment units and sludge digestion.		
	Total Lecture Hours	**40**
Textbooks		
1	S.K. Garg, "*Water Supply Engineering-Environmental Engineering*", Khanna Publishers; 37th Latest Edition,1977.	
2	S.K. Garg, "*Environmental Engineering (Vol. II), Sewage Waste Disposal and Air Pollution Engineering"*, Khanna Publishers; 43rd Edition 2024.	
3	B.S. Birdi, "*Water Supply and Sanitary Engineering*", Dhanpat Rai Publishing Company (p) Ltd (1 January 2010)	
Reference Books		
1	B. C. Punmia and A.K. Jain, "*Water Supply Engineering*", Laxmi Publications, 2016.	
2	M.J. Hammer, "*Water and Wastewater Technology*" PHI Learning Private Limited; 7th edition, 2012.	
Digital Learning Resources		
Course Name: **Water supply and Waste Water engineering** Course Link: https://archive.nptel.ac.in/courses/105/106/105106119/# Course Instructor: Prof. C. Venkobachar, Department of Civil Engineering, Madras.		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PC02L	**Water Supply and Sanitary Engineering Laboratory**	0	0	2	1

Pre-requisite	NIL
Branch	Civil Engineering (CE)
Batch	2022

Course Objective (COB)

COB1	To understand the basic concepts of water quality parameter.
COB2	To understand the basic knowledge about the waste water characteristics

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Understand the different water quality parameter.
CO2	Analyse the various characteristics of waste water.

List of Experiments

Analysis of water Quality Parameter

a) Measurement of pH, Electrical conductivity
b) Determination of Turbidity of water samples.
c) Determination of Chlorides in water.
d) Determination of Iron and Fluoride in water.
e) Determination of Acidity and Alkalinity of water.
f) Determination of Sulphate in water.
g) Determination of Hardness of water.
h) Determination of Residual Chlorine of water.
i) Determination of Total Dissolved Solids.
j) Determination of optimum coagulant dosage.
k) Microbiological culture analysis of bacterial samples.
l) MPN Test.

Analysis of Waste Water Characteristics

a) Determination of Total Solids, Settlable Solids, Dissolved Solids, Suspended Solids andVolatile Solids.
b) Determination of Dissolved Oxygen, COD and BOD.
c) Determination of Ammonia–nitrogen and Nitrates.

Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE01T	**Prestressed Concrete**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)	
COB1	To introduce the need for prestressing in a structure
COB2	To explain the methods, types and advantages of prestressing to the students.
COB3	To make the students to design a prestressed concrete structural elements and systems
COB4	To introduce the students the effect of prestressing in the flexural behaviour of structural elements.
COB5	To introduce the students the effect of prestressing in the tension and compression behaviour of structural elements.

Course Outcome (CO)	
On completion of the course, the students will be able to:	
CO1	Understand the behaviour of prestressed concrete members and able to analyse the prestressed concrete beams.
CO2	Design the prestressed concrete members for flexure and shear as per the relevant design code (IS 1343).
CO3	Analyse for deflection of prestressed concrete members and design the anchorage zone.
CO4	Analyse and design of composite beams and continuous beams.
CO5	Design of prestressed concrete structures - sleepers, Tanks, pipes and poles.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Introduction**	**Contact Hours (08)**

Theory and behavior basic concepts, advantages and disadvantages, materials required, systems and methods of prestressing, analysis of sections, stress concept, strength concept, load balancing concept, effect of loading on the tensile stresses in tendons, effect of tendon profile on deflections, factors influencing deflections, calculation of deflections, short term and long-term deflections, losses of prestress, estimation of crack width.

Module II	**Design for flexure and shear**	**Contact Hours (08)**

Basic assumptions of flexural design, permissible stresses in steel and concrete as per I.S.1343 code, different types of sections, design of sections of type I and type II post-tensioned and pre tensioned beams, check for flexural capacity based on I.S. 1343 code, influence of layout of cables in post, tensioned beams, location of wires in pre-tensioned beams, design for shear based on I.S. 1343 code

Module III	**Deflection and design of anchorage**	**Contact Hours (08)**

Zone factors influencing deflections, short term deflections of uncracked members, prediction of long-term deflections due to creep and shrinkage, check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams, design of anchorage zone reinforcement, check for transfer bond length in pre-tensioned beams.		
Module IV	**Composite beams and continuous beams analysis**	**Contact Hours (08)**
Design of composite beams, methods of achieving continuity in continuous beams, analysis for secondary moments, concordant cable and linear transformation, calculation of stresses, principles of design.		
Module V	**Tension and compression members**	**Contact Hours (08)**
Role of prestressing in members subjected to tensile forces and compressive forces, design of tension and compression members, tanks, pipes and poles, partial prestressing, definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.		
	Total Lecture Hours	**40**

Textbooks	
1	Krishna Raju N., "*Prestressed concrete*", 5th Edition, Tata McGraw Hill Company, New Delhi,2012
2	Pandit.G.S. and Gupta.S.P., "*Prestressed Concrete*", CBS Publishers and Distributers Pvt. Ltd,2012
Reference Books	
1	Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
2	Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
3	Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4	IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012

Digital Learning Resources		
Course Name: **Pre-stressed Concrete Structures** Course Link: https://archive.nptel.ac.in/courses/105/106/105106118/ Course Instructor: Prof. Devdas Menon, Department of Civil Engineering, IIT Madras		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE02T	**Groundwater Engineering**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To understand the concept hydrological cycle.
COB2	To gain knowledge about the deep and shallow wells.
COB3	To understand the surface and subsurface investigations of groundwater.
COB4	To understand the groundwater pollution.
COB5	To learn the ground water management.

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Analyze the hydrological cycle.
CO2	Design the deep and shallow wells.
CO3	Analyze the surface and subsurface investigations of groundwater.
CO4	Analyse Ground water pollution.
CO5	Do the groundwater management.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Hydrologic cycle**	**Contact Hours (08)**

Water balance, Occurrence of ground water: Origin, geological formations as aquifers, type of aquifers, groundwater basins, springs. Darcy's Law, validity of Darcy's Law permeability, laboratory and field measurement of permeability, groundwater Flow lines. Steady flow to a well, steady radial flow to a well in confined aquifer and unconfined aquifer, Unsteady radial flow into a confined aquifer, non-equilibrium Theis's equation, Theis's method of solution, multiple well system.

Module II	**Methods of constructions of deep and shallow wells**	**Contact Hours (08)**

The percussion (or cable tool) method of drilling, Direct circulation hydraulic rotary method, Down the hole hammer method, well logs- receptivity logging, testing of wells for yield, Effect of irrigation, stream flow, rainfall on groundwater fluctuations, seasonal and secular variations, fluctuation due to miscellaneous causes.

Module III	**Surface and Subsurface investigations of groundwater**	**Contact Hours (08)**

Geophysical exploration, Electrical resistivity method, aerial photo interpretation, remote sensing applications to ground water exploration, test drilling, Artificial recharge by water spreading, through pits and shaft, recharge through other methods

Module IV	Groundwater pollution	Contact Hours (08)
Municipal sources, liquid wastes from domestic uses, solid wastes, Industrial sources, tank and pipeline leakage, mining activity, agricultural sources, septic tank and cesspools, saline water intrusion in coastal aquifers, methods to control saline water intrusion		
Module V	**Groundwater management**	**Contact Hours (08)**
Concepts of Basin management, Equation of hydrologic equilibrium, groundwater basin investigations, conjunctive use of surface and groundwater.		
	Total Lecture Hours	**40**

Textbooks	
1	D. K. Todd, "*Ground Water Hydrology*, Jhon Wiley India Pvt Ltd; Third edition, 2011.
2	S. P. Garg, Ground Water and Tube Wells, Oxford and IBH Publishing Co., New Delhi, 1982.
Reference Books	
1	H.M. Raghunath, "*Ground Water*", New Age International Private Limited; Fourth edition, 2021.
2	F. W. Schwartz & H. Zhang, "*Fundamental of Ground Water*", John Wiley & Sons Inc; 1st edition, 2003.
3	*Ground Water Manual: A Water Resources Technical Publication*, Scientific Publishers, Jodhpur, 2017.
4	*L. Harvil and F. G. Bell, "Ground Water Resources and Development*", Butterworth-Heinemann, London, 2013.

Digital Learning Resources

Course Name: **Ground Water Hydrology**
Course Link: https://nptel.ac.in/courses/105103026
Course Instructor: Dr. Rajib Kumar Bhattacharjya, Department of Civil Engineering, IIT Guwahati

Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)

Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE03T	**Construction planning and Management**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To train the students in the field work so as to have a first-hand knowledge of practical problems related to Construction Management in carrying out engineering tasks.
COB2	To optimize the time of construction of a project-by-project planning tool.
COB3	To update the planners at site for material resources, time scheduling and project cost.
COB4	To update the planners on process of updating
COB5	To update the planners on Resources smoothing and Resources Levelling

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Analyze schedule of work and control the construction of the project
CO2	Analyze project using CPM and PERT.
CO3	Analyze the cost of project.
CO4	Analyze the project updating.
CO5	Analyze planning on Resources smoothing and Resources Levelling.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Project Management and tools**	**Contact Hours (08)**

Introduction, Project planning, scheduling, controlling, Role of decision in project management, Project management Process and role of Project Manager. Bar Charts and Milestones Chart: Introduction, Development of bar chart, short comings and remedial measures, Milestone charts.

Module II	**Network Analysis using CPM & PERT**	**Contact Hours (08)**

Elements of network, Time estimates, frequency distribution, mean, variance and standard deviation, probability distribution. Slack, Float, Critical path, crashing of activity.

Module III	**Cost Analysis**	**Contact Hours (08)**

Introduction, Projects cost: Direct cost, Indirect cost, slope of direct cost curve, total project cost and optimum duration, cost optimization.

Module IV	**Project Updating**	**Contact Hours (08)**

Introduction, updating process, data required for updating, steps in process updating.

Module V	**Resources Allocation**	**Contact Hours (08)**

Introduction, Resources usage profile: histograms, Resources smoothing and Resources Levelling

Total Lecture Hours	**40**

Textbooks	
1	B. C. Punmia, K.K. Khandelwal, "*Project Planning and Control with PERT and CPM*", 4th Edition, Laxmi Publications Pvt Ltd; 4th edition, 2023.
2	S.C. Sharma, "*Construction equipment and management*", Khanna Book Publishing Company; First Edition, 2019.
Reference Books	
1	Michael Callahan, James Rowings, Daniel Quackenbush, "*Construction Project Scheduling*", McGraw-Hill Series in Construction Engineering and Project Management ,1991.
2	A.A Kwakye, "*Construction Project Administration in Practice*" Routledge, 1997.
Digital Learning Resources	
Course Name: **Project Planning & Control** Course Link: https://archive.nptel.ac.in/courses/105/106/105106149/ Course Instructor: Dr. Koshy Varghese, Department of Civil Engineering, IIT Madras	
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)	

Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE04T	**Advanced Foundation Engineering**	3	0	0	3
Pre-requisite	Geotechnical Engineering, Foundation Engineering				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To understand the design of shallow foundations.
COB2	To understand the concept and design of deep foundations.
COB3	To learn design of Caisson Foundation.
COB4	To understand the problems associated with expansive soil and their geotechnical solutions.
COB5	To understand the concept of soil dynamics and its application to design of machine foundations.

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Design the shallow foundations.
CO2	Design the deep foundations.
CO3	Get the knowledge about the Caisson foundation.
CO4	Identify the problems associated with expansive soil and their geotechnical solutions.
CO5	Analyze the concept of soil dynamics and its application to design of machine foundations.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Shallow Foundation**	**Contact Hours (08)**

Location and depth of foundation, Determination of bearing capacity of shallow foundation on cohesive and cohesionless soils, contact pressure and related study for the rigid and flexible foundation. Floating or compensating foundations.

Module II	**Pile Foundation**	**Contact Hours (08)**

Classification, Influence of installation method on the behaviour of piles, load- carrying capacity of single and pile group in cohesive and cohesionless soils (both end-bearing end friction piles). Settlement of pile foundation. Negative friction and its effect on pile capacity.

Module III	**Caisson foundations**	**Contact Hours (08)**

Types of Caissons, their advantages and disadvantages, Components of well. Determination of depth, Size and number of wells under a heavy footing or pier, Phenomena of bottom heaving. Well, sinking and related problems of the sinking of well foundations.

Module IV	**Foundation on Expansive Soils**	**Contact Hours (08)**

Identification, Characteristics of expensive soils, Factors affecting swelling, Swelling pressure and its effect on foundations for single end multi-storeyed buildings. Under-reamed piles, Accepted

precautionary measures.		
Module V	**Machine Foundations**	**Contact Hours (08)**
Types of machines, Free and forced vibrations, vibration isolations, Design consideration for simple machine foundations under reciprocating, centrifugal and impact type machines. Recent developments in foundation engineering.		
	Total Lecture Hours	**40**
Textbooks		
1	Swami Saran., "*Analysis and Design of Substructures: Limit State Design*", Oxford & IBH Publishing Co Pvt. Ltd; 2nd edition, 2018.	
2	P. Srinivasulu & C. V. Vaidyanathan, "*Hand Book of Machine Foundation*", Tata Mc Graw Hill Pub Co. Ltd., New Delhi, 2017.	
Reference Books		
1	Joseph Bowles, "*Foundation Analysis and Design*", McGraw-Hill Education; 5th edition, 2001.	
2	F.H. Chen, "Foundations on Expansive Soils (Developments in Geotechnical Engineering)" Elsevier Science Ltd; 2nd edition, 1988.	
Digital Learning Resources		
Course Name: **Advanced Foundation Engineering** Course Link: https://archive.nptel.ac.in/courses/105/105/105105207/ Course Instructor: Prof. Koushik Das, Department of Civil Engineering, IIT Kharagpur.		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE05T	**Environmental Engineering**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To gain knowledge about water and wastewater qualities.
COB2	To Design of water treatment plant.
COB3	To Design of wastewater treatment plant.
COB4	To understand air quality monitoring and its modelling.
COB5	To understand the municipal solid waste management.

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Analyze the environmental problems and its remedies.
CO2	Design water and wastewater treatment plants.
CO3	Analyze the environmental pollution level.
CO4	Analyze the air quality index and its modelling.
CO5	Analysis and design of solid waste management system.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**General requirement for water supply**	**Contact Hours (08)**

Population Forecast, Quality and quantity of water, Domestic water quality standards Sources of water and their yield, design period, intake, pumping water quality criteria, water borne diseases, appurtenances of water treatment and distribution systems. DO and BOD demand in streams. Essentials of wastewater engineering, quantities of wastewater and storm water, wastewater characteristics.

Module II	**Water and Waste Water Quality and Treatment**	**Contact Hours (08)**

Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment.

Module III	**Sewerage System Design**	**Contact Hours (08)**

Quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Module IV	**Air Pollution**	**Contact Hours (08)**

Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits. Sampling and monitoring of air pollutants. Prediction of air pollution dispersion, air

quality modelling		
Module V	**Municipal Solid Wastes**	**Contact Hours (08)**
Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal)		
	Total Lecture Hours	**40**
Textbooks		
1	Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, "*Environmental Engineering"*, McGraw Hill Education; First Edition,2017.	
2	Gerard Kiely, "*Environmental Engineering*" McGraw Hill Education, 2006.	
3	Noel De Nevers, "*Air Pollution Control Engineering*", Waveland Pr Inc; Reissue edition, 2010.	
Reference Books		
1	W. Eckenfelder, "*Industrial Water Pollution Control*", McGraw-Hill Education; 3rd edition, 1999.	
Digital Learning Resources		
Course Name: Introduction to Environmental Engineering Course Link: https://nptel.ac.in/courses/103107084 Course Instructor: Dr. V. C. Srivastava, Environmental Engineering, IIT Roorkee		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE06T	Earth Retaining Structures	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To understand the basic principles of lateral earth pressure.
COB2	To understand various theories related to lateral earth pressure and earth retaining structure.
COB3	To understand the basic concept various earth retaining structures.
COB4	
COB5	

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Analyse the various earth pressure theories.
CO2	Design the lateral earth pressure and earth retaining structure.
CO3	Analysis and design of various earth retaining structures.
CO4	
CO5	

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Contact Hours (08)**

Fundamental relationships between the lateral pressures and the strain with a back fill. Rankine and Coulomb theories, Active, passive and pressure at rest Backfill with broken surface, wall with broken back, concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill. Passive earth pressure in engineering practice Assumption and conditions, point of application of passive earth pressures

Module II	**Contact Hours (08)**

Bulkheads: Definition and assumptions, conditions of end supports and distribution of active earth pressure and bulkheads, bulkheads with free and fixed earth supports, equivalent beam method, Improvements suggested by Rowe, Tschebotarioff's method.

Module III	**Contact Hours (08)**

Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates, Consideration of effects of ground water, seepage, surcharge loading together with possibility of shallow and deep sliding failures on retaining structure

Module IV	**Contact Hours (08)**

Sheet Pile wall: Free earth system, fixed earth system, Dead man Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits		
Module V		**Contact Hours (08)**
Arching and Open Cuts: Arching in soils, Braced excavations, Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays Reinforced earth retaining structures- Design of earth embankments and slopes Recent advances in Earth retaining structures.		
	Total Lecture Hours	**40**
Textbooks		
1	R.F. Craig, "*Soil Mechanics*", CRC Press; 1st edition,1992.	
2	B. M. Das, "*Principles of Foundation Engineering*", Cengage Learning; 6th edition, 2007.	
Reference Books		
1	P. Purushothama Raj, "*Geotechnical Engineering*", McGraw-Hill Education, 1995.	
2	Joseph Bowles, "*Foundation Engineering: Analysis and Design*", McGraw-Hill Education; 5th edition, 2001.	
Digital Learning Resources		
Course Name: **Geosynthetics and Reinforced Soil Structures** Course Link: https://nptel.ac.in/courses/105106052 Course Instructor: Dr. K. Rajagopal, Department of Civil Engineering, IIT Madras		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE07T	**Transportation System and Planning**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)	
COB1	To understand modes of transportation and transportation planning process.
COB2	To understand the concept of urban activity system and evaluation stages.
COB3	To understand the concept of four step planning process.
COB4	To understand the route choice modelling and different models of land use.
COB5	

Course Outcome (CO)	
On completion of the course, the students will be able to:	
CO1	Analyse the modes and characteristics of transportation and transportation planning process.
CO2	Analyse the concept of urban activity system and evaluation stages.
CO3	Analysis and design of appropriate method for trip generation and distribution.
CO4	Analyse appropriate method for route choice modelling and different models of land use.
CO5	

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Introduction**	**Contact Hours (08)**

Role of transportation in the development of a society, Land use-Transportation interaction, Goal, objectives and Constraints in transportation planning process, Transportation Systems overview, Transportation issues and challenges, Basic steps in systems planning process Different modes of transport, Characteristics of different modes, integration of modes and interactions, impact on environment, Relationship between Movement and Accessibility, Hierarchy of transportation facilities, Brief Study of Urban Travel Patterns and Urban Transportation Technologies, Comprehensive Mobility Plan.

Module II	**Urban Transportation Planning**	**Contact Hours (08)**

Urban Activity System, Trip-based and Activity-based approaches inventory, model building, forecasting and evaluation stages, Definition of study area, zoning, Urban Structure and its Characteristics

Module III		**Contact Hours (08)**

Four Step Planning process, Trip generation, trip production and trip attraction models regression and

category analysis, Trip Distribution-Growth factor models, Gravity models, mode split models		
Module IV	**Route choice modeling**	**Contact Hours (08)**
Diversion curves, basic elements of transportation networks, coding, minimum path trees, traffic assignment, capacity restraint techniques		
Module V	**Land use transport models**	**Contact Hours (08)**
Lowry derivative models, Quick response techniques, non-transport solutions for transport problems.		
	Total Lecture Hours	**40**
Textbooks		
1	M. J. Bruton, "*Introduction to Transportation Planning*", Routledge; 3rd edition Revised edition, 1992	
2	J. W. Dickey, "*Metropolitan Transportation Planning*", McGraw Hill Higher Education; 2nd edition, 1983.	
3	C.S. Papacostas, P.D. Prevedouros, "*Transportation Engineering and Planning"* (OldEdition), Pearson (3rd edition), 2000.	
Reference Books		
1	P. Chakroborty and A. Das, "*Principles of Transportation Engineering*", PHI Learning; 2nd edition, 2017.	
2	P. K. Sarkar, V. Maitri and G. J. Joshi, "*Transportation Planning: Principles, Practices and Policies*", PHI Learning Pvt. Ltd, 2014.	
3	L.R. Kadiyali, "*Traffic Engineering and Transport Planning*", Khanna Publishers,1999.	
Digital Learning Resources		
Course Name: **Transportation System and Planning** Course Link: https://archive.nptel.ac.in/courses/105/105/105105208/ Course Instructor: Prof. Bhargab Maitra, Department of Civil Engineering, IIT Kharagpur		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7PE08T	**Remote Sensing and Geographical Information System**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	To enable the students to improve their understanding regarding data acquisition through remote sensing.
COB2	To empower the students with skills in managing spatial data in digital format.
COB3	To enable the students to improve their skill regarding the radar system.
COB4	
COB5	

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	To understand the scope of Remote Sensing and GIS.
CO2	To apply these tools to solve problems related to water resources
CO3	To develop geospatial maps for practical application and decision making.
CO4	
CO5	

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Introduction**	**Contact Hours (08)**

Mechanism of Remote sensing, Passive and Active Remote Sensing, Electromagnetic radiations, Electromagnetic Spectrum, Interaction with the atmosphere, Interaction with targets, Characteristics of images, Satellite Characteristics, Orbits, Swath, Nadir, Pixel size.

Module II	**Sensors**	**Contact Hours (08)**

Sensor resolutions- Spatial, Spectral, Radiometric and Temporal. Indian Satellites and other purpose driven satellites, Data products, Digital Image techniques, Optical and infra-red Remote sensing, Thermal remote sensing, Microwave remote sensing

Module III	**Data Acquisition**	**Contact Hours (08)**

Basics of Radar, Digital image processing system, Pre-processing of raw data, Image enhancement, Transformation, Supervised and un-supervised Classification, Integration, analysis and interpretation

Module IV	**Introduction to GIS**	**Contact Hours (08)**

GIS components, Data sources and products, Spatial reference system and geo- referencing, Projection system, Data acquisition- raster and vector data, Registration and relating different data, Spatial analysis, Data integration, Data modelling, Data models, Data structures, Measurement of length, perimeter and area, management, Database models		
Module V	**Geospatial analysis**	**Contact Hours (08)**
Geospatial analysis, Spatial statistics, Database query, Reclassification, Buffering, Overlaying of Maps, Spatial interpolation, Surface analysis, Network analysis, Principal Component analysis, applications of GIS		
	Total Lecture Hours	**40**
Textbooks		
1	T. M. Lillesand, R. W. Kiefer, J. W. Chipman, "*Remote Sensing and Image Interpretation*", Willey; Sixth edition, 2011.	
2	A. M. Chandra and S. K. Ghosh, "*Remote Sensing and Geographical Information System*", Alpha Science International Ltd; 2nd edition, 2015.	
3		
Reference Books		
1	George Joseph, "*Fundamentals of Remote Sensing*", The Orient Blackswan; Third edition, 2018.	
2	J.A. Richards, "*Remote Sensing Digital Image Analysis*", Springer-Verlag Berlin and Heidelberg GmbH & Co. K; 5th ed. 2013 edition, 2012.	
Digital Learning Resources		
Course Name: **Remote Sensing and GIS** Course Link: https://nptel.ac.in/courses/105103193 Course Instructor: Prof. Rishikesh Bharti, Department of Civil Engineering, IIT Guwahati.		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code	Course Name	L	T	P	C
22CE7OE02T	**Industrial Waste Management and Disposal**	3	0	0	3
Pre-requisite	NIL				
Branch	Civil Engineering (CE)				
Batch	2022				

Course Objective (COB)

COB1	Study of Industrial Pollution, Environmental legislations and Pollution Control Boards.
COB2	To gain knowledge about the Waste Management Approach.
COB3	To know the basic concepts of Industrial Waste Water Treatment.
COB4	To gain knowledge about the Advanced Waste Water Treatment Processes.
COB5	To gain comprehensive knowledge about the Case Studies of Industrial Pollution Control.

Course Outcome (CO)

On completion of the course, the students will be able to:

CO1	Analysis about the industrial pollution, Environmental legislations related to prevention and control of industrial effluents and hazardous wastes and Pollution Control Boards.
CO2	Analyse the concept of Waste management approach.
CO3	Analyse the Industrial Waste Water Treatment.
CO4	Analyse the Advanced Waste Water Treatment Processes.
CO5	Analyse Case Studies of Industrial Pollution Control.

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

Detailed Syllabus

Module I	**Industrial Pollution**	**Contact Hours (08)**

Types of industries and industrial pollution, Characteristics of industrial wastes, Effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health, Hazardous wastes, Environmental legislations related to prevention and control of industrial effluents and hazardous wastes, Pollution Control Boards.

Module II	**Waste Management Approach**	**Contact Hours (08)**

Waste management approach, Waste Audit, Volume and strength reduction, Material and process modifications, Recycle, Reuse and by-product recovery, Applications.

Module III	**Industrial Waste Water Treatment**	**Contact Hours (08)**

Sources, Quantification and characterization of effluent, Waste water treatment process, Primary and secondary treatment of waste water, Aerobic and anaerobic treatment processes, various reactor configurations.		
Module IV	**Advanced Wastewater Treatment Processes**	**Contact Hours (08)**
Fundamentals and mechanism of adsorption, adsorption isotherms, absorption, membrane separation and chemical oxidation processes and their design principles.		
Module V	**Case Studies of Industrial Pollution Control**	**Contact Hours (08)**
Sources & their Characteristics, Waste water and air quality management in specific industries: Textiles, Tanneries, Distilleries, Refineries, Thermal power plants, Fertilizer plant, Steel plant, Pulp and paper industries, Sugar and dairy industries, Cement industries, Sponge iron industries.		
	Total Lecture Hours	**40**

Textbooks	
1	M.N. Rao & A.K. Dutta, "*Wastewater Treatment*", Oxford IBH Publication, 1995.
2	Nelson, L. Nemerow, "*Liquid Waste of Industry, Theories, Practices and Treatment*", Addison-Wesley Publishing Company, London, 2000
3	Metcalf and Eddy, "*Wastewater treatment processes*", McGraw-Hill Science Engineering, 2002.
4	Peavy and Rowe, "*Environmental Engineering*", McGraw Hill Education; First Edition, 2017.
Reference Books	
1	T.T. Shen, "*Industrial Pollution Prevention*", Springer publications, 1999
2	R.L. Stephenson & J.B. Blackburn Jr, "*Industrial Wastewater Systems Hand book*", Lewis Publishers, New York, 1998.
3	"*Environmental Assessment Source book*", Vol. I, II & III., The World Bank, Washington, D.C., 1991.
4	Judith Petts, "*Hand book of Environmental Impact Assessment*", Vol. I & II, Blackwell Science, 1999

Digital Learning Resources		
Course Name: **Industrial Wastewater Treatment** Course Link: https://nptel.ac.in/courses/105105350 Course Instructor: Prof Alok Sinha, Prof S K Gupta, IIT-ISM Dhanbad		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date: