



TULSIRAMJI GAIKWAD-PATIL COLLEGE OF ENGINEERING & TECHNOLOGY

Wardha Road, Nagpur - 441108

Accredited with NAAC A+ Grade & NBA Accredited (EE, ME, CE & ECE)

Approved by AICTE, New Delhi, Govt. of Maharashtra

(An Autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)



Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

B.Tech. Civil Engineering

V Semester

Teaching Scheme & Syllabus

Considering

National Education Policy (NEP) – 2020

From

Academic Year 2025-26

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

- **M1:** To strive for rearing standard and stature of the students by practicing high standards of Professional ethics, transparency and accountability
- **M2:** To provide facilities and services to meet the challenges of Industry and Society
- **M3:** To facilitate socially responsive research, innovation and entrepreneurship
- **M4:** To ascertain holistic development of student and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To forge learning Center of Excellence in the field of Civil Engineering

Mission of the Department

- **M1:** To promote academic and ethical development while upholding high standards.
- **M2:** To provide advance facilities with the skills needed to face Industry and societal challenges.
- **M3:** To promote socially responsible research, innovation, and entrepreneurship in the field of Civil Engineering.
- **M4:** To foster the holistic development of both students and faculty members by inculcating a blend of knowledge and professional work methods for overall progress.

Program Educational Objectives (PEO)

- **PEO 1:** Analyze and design civil engineering structures while keeping social awareness and ethical responsibilities in mind.
- **PEO 2:** Demonstrate leadership abilities in supporting sustainable practices in Civil Engineering
- **PEO 3:** Exhibit a commitment to lifelong learning, staying updated on developing technologies and industry trends, and adjusting to the evolving world of Civil Engineering.
- **PEO 4:** Execute proficiency in creative problem-solving and innovation, demonstrating an entrepreneurial attitude within the context of Civil Engineering.

Program Outcomes (PO)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.





11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

- **PSO1:** Competency to manage large infrastructure projects while providing safe and cost-effective project execution, along with expertise of rapid construction and project management.
- **PSO2:** Plan, execute, manage, maintain and rehabilitate civil engineering systems and processes.
- **PSO3:** Apply innovative construction and management techniques to compete with modern structural design and construction within the budget and time frame.

Semester – V

				Dec, 2024	1.00	Applicable for AY 2025-26 Onwards
Chairperson	Dean Academics	Vice-Principal	Principal	Date of Release	Version	

Department of Civil Engineering
T.G.P.C.E.T. Nagpur

Dr. Pragati Patil
Vice-Principal
Tulsiramji Gaikwad Patil College of
Engineering & Technology, Nagpur

Dr. Premanand Naktode
Principal
TGPCET, Nagpur

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

Program: Civil Engineering

List of Program Electives offered By Civil Engineering Department


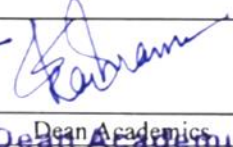


Program Elective- I	Program Elective-II	Program Elective- III	Program Elective- IV	Program Elective- V
Semester V	Semester VI	Semester VI	Semester VIII	Semester VIII
BCE33506-Water Resources Engineering	BCE33606-Rural Water Supply and Sanitation	BCE33610- Building Construction Practice	BCE34802-Pavement Design	BCE34806-High Rise Structures
BCE33507-Water Quality Engineering	BCE33607-Environmental Laws and Policy	BCE33611- Advanced Building Construction Methods	BCE34803-Urban Transportation Planning	BCE34807-Industrial Structures
BCE33508-Surface Hydrology	BCE33608-Solid and Hazardous Waste Management	BCE33612- Structural Audit & Retrofitting of Structures	BCE34804-Airport Planning and Design	BCE34808-Prestressed Concrete
BCE33509-Flood Control & Drainage Engineering	BCE33609-Air and Noise Pollution Control	BCE33613- Construction Equipment & Automation	BCE34805-High Speed Rail Engineering	BCE34809-Earthquake Engineering

List of Open Electives offered By Civil Engineering Department

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	Semester-IV	Semester-V
BCE32306: Green Structures and Smart Cities	BCE32406: Plastic Waste Management	BCE33510: Railways & Airport Engineering

List of Multidisciplinary Minor Courses offered By Civil Engineering Department

SN	Sem	Type	BoS/ Dept	Sub. Code	Subject
1.	III	MDM-I	S&H	BSH32302	Numerical Methods for Engineers
2.	IV	MDM-II	ECE	BEC32406	Instrumentation & Sensor Technologies for Civil Engineering Applications
3.	V	MDM-III	IT	BIT33516	Cyber Security & Laws
4.	VI	MDM-IV	EE	BEE33613	Solar Energy Engineering & Technology
5.	VIII	MDM-V	BA	BBA34801	Professional Practices, Laws & Ethics

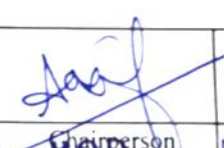
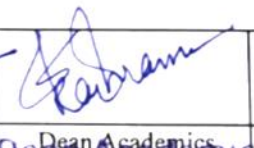


				Dec, 2024	1.00	Applicable for AY 2025-26 Onwards
Chairperson	Dean Academics	Vice Principal	Dr. Pragati Patil	Dr. Premanand Nakode	Version	
Department of Civil Engineering	T.G.P.C.E.T. Nagpur	Vice-Principal	Principal	TGPCET, Nagpur		

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Program: Civil Engineering

Course Category	BSC (Basic Science Course)	ESC (Engineering Science Course.)	PCC (Program Core courses)	PEC (Program Elective courses)	Multidisciplinary courses	VSEC (Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC (Liberal Learning Courses)	Semester Wise Credits
Semester -I	08	05	02	--	--	02	02	--	02	21
Semester -II	08	08	--	--	--	02	02	--	02	22
Semester -III	--	--	08	--	06	--	04	02	--	20
Semester -IV	--	--	10	--	04	02	06	--	--	22
Semester -V	--	--	11	03	06	--	--	--	--	20
Semester -VI	--	--	10	06	02	02	--	--	--	20
Semester -VII	--	--	08	--	--	--	--	12	--	20
Semester -VIII	--	--	03	07	04	--	--	08	--	22
Cumulative Sum	16	13	52	16	22	08	14	22	04	167

				Dec, 2024	1.00	Applicable for AY 2025-26 Onwards
HOD	Dean Academics	Vice Principal	Dr. Premanand Naktode	Version		

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 Engineering & Technology, Nagpur

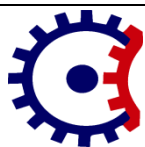
		Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441 108 NAAC Accredited with A+ Grade (An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)			
B.Tech. Civil Engineering - Third Year (Semester-V)					
BCE33501: Design of Steel Structures					
Teaching Scheme				Examination Scheme	
Theory	3 Hrs./week			CT-I	15Marks
Tutorial				CT-II	15 Marks
Total Credits	3			CA	10 Marks
Duration of ESE: 3Hrs.				ESE	60 Marks
				Total Marks	100 Marks
Course Objectives:					
1.	To understand formation of soil & identify types of soils such as sand, gravel, organic soil, clay, Betonies, black cotton soil				
2.	Knowledge to identify, determine & correlate index properties of soil like water content, specific gravity sieve analysis, particle size distribution				
3.	Knowledge about the engineering properties of soils & to understand permeability & seepage characteristics of soil				
4.	To understand concepts of consolidation & compaction of soils using mechanisms, factors, equipments & techniques				
5.	To understand stress distribution in soil, use of Newmarks chart & shear strength				
Course Contents					
Unit I	Steel as a Structural Material: Physical and mechanical properties of Structural Steel, Merits and Demerits of Steel as a Structural Material, Grades of Structural Steel, Shape factor of various Structural Steel Sections, IS 800:2007, Introduction to Limit State Method.				
Unit II	Structural Fasteners: Behavior of bolted and welded connections, failure of bolted and welded joints. Strength of bolt and strength of weld. Efficiency of joints. Design of simple bolt and welded connections.				
Unit III	Tension Member: Types of Tension Member, Stresses, Design of Tension Member Compression Member: Effective length, Slenderness ratio, Design of Compression Member. Design of connection: Beam to beam, beam to column.				
Unit IV	Design of simple and built-up beams: Laterally restrained and un-restrained, (symmetrical as well as unsymmetrical section). Design of welded plate girder and Curtailment of plates.				
Unit V	Column: Design of Axially loaded columns, Design of Laced and Battened Columns (Design of Built-up Columns) with Bolted and Welded End Connection. Column Bases Types of Column Bases, Slab Base, Gusset Base, Design of Slab Base and Gusseted Base. Design of Base plate.				
Text Books					
T.1	“Design of steel structure” authored by L.S. Negi, Tata McGraw hills Publisher Co. Ltd, New Delhi.				
T.2	“Design of Steel Structures”, authored by N. Subramanian, OXFORD University Press.				
T.3	“Limit State Design of Steel Structures”, authored by S. K. Duggal, McGraw Hill Education Private Limited.				

T.4	“Fundamentals of Structural Steel Design”, authored by M. L. Gambhir, McGraw Hill Education.
Reference Books	
R.1	“Stability Analysis and Design of Steel Structure”, authored by M. L. Gambhir, McGraw Hill Education.
R.2	“Design of steel structure “authored by S. S. Bhavikatti, dreamtech, distributed by Willey.
R.3	“Design of steel structure” authored by A. S. Arya and J.L. Ajmani, Nem chand bros, Roorkee.
R.4	“Design of steel structure” authored by P Dayaratnam, S. Chand of Co. Delhi.
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105162/
2	https://nptel.ac.in/courses/105/104/105104030/

	Course Outcomes	CL
BCE33501.1	Use the knowledge of IS code of practice (IS 800) for the design of steel structural elements.	3
BCE33501.2	Design structural fasteners (Bolted and welded connections) used in steel construction.	4
BCE33501.3	Design the Tension and Compression members.	4
BCE33501.4	Evaluate simple & built-up beams and built-up columns.	5
BCE33501.5	Develop axially loaded columns	5


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B.Tech. Civil Engineering - Third Year (Semester-V)

BCE33502: Environmental Engineering

Teaching Scheme			Examination Scheme	
Theory	3 Hrs./week		CT-I	15 Marks
Tutorial			CT-II	15 Marks
Total Credits	3		CA	10 Marks
Duration of ESE: 3Hrs.			ESE	60 Marks
			Total Marks	100 Marks

Course Objectives:

1.	To identify various types of water demands, per capita demand, variations in demand & suitable surface & subsurface sources of raw water
2.	Ability to predict the future population & estimate corresponding water demand to calculate design period of water treatment units
3.	To become adept at using hydraulic design aspects for planning water pipe networks, joints, fittings, valves & appurtenances
4.	To articulate a firm understanding regarding physical, chemical & biological water quality parameters as per Drinking Water Standards
5.	Formulate & design water treatment units to meet standards of drinking water quality, it's storage & distribution along with water softening & swimming pool water treatment

Course Contents

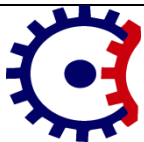
Unit I	Introduction: Importance and necessity of water supply scheme. Water Demand: All types of water demand, empirical formulae, factors affecting per capita demand, variation in demand, design period, population forecasting methods and examples. Sources of water: Rain water, Ground water-springs, infiltration galleries, dug wells, tube wells, Surface water stream, lake, river, impounding reservoirs, ponds & sea. Intake structures: Location, types - river, lake, canal, reservoir etc.
Unit II	Conveyance of water: Types of pipes, joints, fittings, valves & appurtenances. Hydraulic design aspects: Friction, Manning's, Darcy-Weishbach & Hazen-Williams equation and problem. Design of pipe distribution network. Rising main and pumps: Concept of rising main, Classification, working, merits and demerits, selection of pumps.
Unit III	Water quality: Physical, Chemical and bacteriological characteristics of water, Health effects of various water characteristics, Standards of drinking water. (WHO 2011, CPHEOO, IS 10500). Water borne diseases Water treatment: Objective of treatment, unit operations and processes, house hold & community based rural water treatment, flow sheet of conventional water treatment plant. Aeration: Purpose, types of aerators, design of cascade aerator. Coagulation and Flocculation: Definition, Principles, types of coagulants and reactions, coagulant doses, types of mixing and flocculation devices.

Unit IV	<p>Sedimentation: Principles, types of setting basins, inlet and outlet arrangements, simple design of sedimentation tank.</p> <p>Clariflocculators: Principles and operation.</p> <p>Filtration: Mechanism of filtration, types of filters-RSF, SSF, Pressure filters, elements of filters sand specification, operational problems in filtration, Design of SSF and RSF, Membrane filtration technique of water treatment.</p>
Unit V	<p>Disinfection: Purpose, Mechanism, criteria for good disinfectant, various disinfectants, their characteristics, disinfection by chlorination using different forms of chlorine. Types of chlorination.</p> <p>Distribution systems: Requirements of a good distribution system, methods of distribution systems and layouts, Leakage and leak detector, Study of fire hydrants.</p> <p>Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.</p> <p>Miscellaneous Methods of Water Treatment: Colour, Odors & Taste removal, removal of iron & manganese - water softening processes, base exchange process, swimming pool water treatment.</p>
Text Books	
T.1	Water supply & Sanitary Engineering - B.C. Punmia, Laxmi Publication
T.2	Water supply and Sanitary Engineering - Birdie G.S., Dhanpat Rai Publication
T.3	Environmental Engg. I - P. N. Modi, Standard Book House
T.4	Environmental Engg.(Water supply Engg.) - S.K.Garg, Khanna Publication
T.5	Environmental Engg. – N.N.Basak, Tata Mcgraw Hill Publication
T.6	Environmental Engg. – G.N. Pandey, Tata Mcgraw Hill Publication
Reference Books	
R.1	Water Supply and Sanitary Engineering – S.C. Rangwala, Charotar Publishing House
R.2	Water supply and sewage - M.J. McGhee, Mc.Graw Hill
R.3	Environmental Pollution Control Engg. - C.S. Rao, New Age International Publishers
R.4	Elements of Environmental Engineering – Dr. K.N. Duggal, S.Chand Publication
R.5	CPHEOO manual on Water Supply & Treatment 2009, New Delhi, Ministry of Urban Development, G.O.I.
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105201/
2	https://nptel.ac.in/courses/105/106/105106119/

	Course Outcomes	CL
BCE33502.1	Describe the importance and necessity of water supply scheme.	2
BCE33502.2	Implement the basic concepts of water conveyance systems & hydraulic design aspects.	3
BCE33502.3	Determine characteristics of water, BIS & WHO drinking water standards and necessity of water treatment.	3
BCE33502.4	Examine sedimentation & filtration water treatment units	4
BCE33502.5	Analyze disinfection & miscellaneous units of conventional water treatment plant.	4


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B.Tech. Civil Engineering - Third Year (Semester-V)

BCE33503: Geotechnical Engineering

Teaching Scheme		Examination Scheme	
Theory	3 Hrs./week	CT-I	15 Marks
Tutorial		CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs.		ESE	60 Marks
		Total Marks	100 Marks

Course Objectives:

1.	To understand formation of soil & identify types of soils such as sand, gravel, organic soil, clay, Betonies, black cotton soil
2.	Knowledge to identify, determine & correlate index properties of soil like water content, specific gravity sieve analysis, particle size distribution
3.	Knowledge about the engineering properties of soils & to understand permeability & seepage characteristics of soil
4.	To understand concepts of consolidation & compaction of soils using mechanisms, factors, equipments & techniques
5.	To understand stress distribution in soil, use of Newmarks chart & shear strength

Course Contents



Unit I	Introduction: Formation of soil, residual & transported soil, major deposits found in India, soils generally used in practice such as sand, gravel, organic soil, clay, Betonies, black cotton soil etc. Introduction to clay mineralogy. Index Properties & Their Determination, Water content, specific gravity, sieve analysis, particle size distribution curve, sedimentation analysis, Differential and free swell value, Consistency of soil, Atterberge's limits, Introduction of IS Code 2720.
Unit II	Phases of soil: Various soil weight & volume inter-relationship. Density index, methods of determining in situ density. Classification of Soil: Particle size classification, Textual classification, Unified & I.S. classification system, field identification of Expansive soil, Swelling pressure.
Unit III	Permeability: Darcy's law & its validity, Discharge & seepage velocity, factors affecting permeability, Determination of coefficients of permeability by Laboratory and field methods, permeability of stratified soil. Seepage: Seepage pressure, quick sand condition, characteristics & uses of flow nets, Preliminary problems of discharge estimation in homogeneous soils.
Unit IV	Stress Distribution: Stress distribution in soil Mass, Effective, Neutral and total stresses in soil mass. point load and uniformly distributed load over rectangular & circular areas, Use of Newmarks charts. Shear Strength: Introduction, Mohr's Circle Theory, Mohr's Coulomb's theory, Drainage condition, applications & significance of C , ϕ (phi), Measurement of shear strength by direct

	shear test, triaxial test, unconfined compression test, vane shear test.
Unit V	Compaction: Mechanism of compaction, factors affecting compaction, standard & modified proctor Tests, field compaction equipment, quality control, Advance compaction Techniques. Consolidation: Compression of laterally confined soil, Terzaghis 1-D consolidation theory (formation of Differential equation), Determination of coefficient of consolidation, Degree of consolidation. Determination of preconsolidation pressure, Settlement, Rate of settlement.
Text Books	
T.1	Soil Mechanics & Foundation Engg. – K.R. Arora, Standard. Publisher
T.2	Soil Mechanics & Foundations – B.C. Punmia, Laxmi Publication
T.3	Basic & Applied Soil Mechanics – Gopal Ranjan & Rao, Newage International Publication
T.4	Geotechnical Engg. – T.N. Ramamurthy & T.G. Sitharam, S. Chand Publishing
Reference Books	
R.1	Soil Mechanics & Foundation Engg – P.N. Modi, Standard Book House
R.2	Soil Mechanics & Foundation Engg – V.N.S. Murthy, CBS Publisher
R.3	Geotechnical Engg. – P. Purushothama Raj, McGraw-Hill Education
R.4	Soil Mechanics & Foundation Engg – P. Purushothama Raj, Pearson Education India
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101201/
2	https://nptel.ac.in/courses/105/105/105105168/
3	https://nptel.ac.in/courses/105/106/105106142/

	Course Outcomes	CL
BCE33503.1	Illustrate the knowledge about origin and classification of soils	4
BCE33503.2	Distinguish index and engineering properties of the soil and develop a proficiency in handling experimental data	4
BCE33503.3	Estimate the influence of water flow on the engineering behavior of soils	4
BCE33503.4	Evaluate the concept of effective stress and its influence on soil behavior	5
BCE33503.5	Analyze and compute principles of permeability, compaction, consolidation and shear strength parameters of soil	4


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B.Tech. Civil Engineering - Third Year (Semester-V)			
BCE33506: Water Resources Engineering (Program Elective-I)			
Teaching Scheme		Examination Scheme	
Theory	3 Hrs./week	CT-I	15Marks
Tutorial		CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs.		ESE	60 Marks
		Total Marks	100 Marks
Course Objectives:			
1.	To comprehend the types of water resources and the scientific principles underlying measurement technologies and protocols used in water resource assessments.		
2.	To equip students with the ability to design experimental frameworks for field-scale studies of water resources and environmental systems.		
3.	To develop students' skills in analyzing field study methods, instruments, and protocols for monitoring surface water and groundwater resources.		
4.	To facilitate students' understanding of water quantity management principles, including surface water storage, reservoir design, and groundwater management strategies for various uses.		
5.	To enable students to evaluate the legal frameworks and environmental constraints governing water rights, allocation, and resource development.		
Course Contents			
Unit I	Introduction to Water Resources Field Methods. Types of water resources available, Scientific principles of measurement technologies and protocols used for water-resources measurements.		
Unit II	Experimental design of field-scale water-resources and environmental studies of water resources.		
Unit III	Water resources Planning, field studies; instruments and protocols for surface-water, groundwater. Groundwater hydrology, steady state, well hydraulics & aquifers.		
Unit IV	Water Quantity Management: Surface Water Storage Requirements, Storage Capacity and Yield, Reservoir Design, Water Allocations for Water Supply, Irrigation, Hydropower and Flood Control, Reservoir Operations, Groundwater management.		
Unit V	Legal Aspects of Water & Environment Systems: Principles of Law applied to Water Rights and Water Allocation, Water Laws, Environmental Protection Law, Environmental Constraints on water Resources Development		
Text Books			
T.1	“Managing Water Resources Methods and Tools for a Systems Approach” authored By Slobodan P. Simonovic		
T.2	“Hydrology” authored by Raghunath H.M., New Age International Publishers		
T.3	“Elements of Water Resources Engineering” authored by Duggal K N &Soni J P, New Age International Publisher		

T.4	“Irrigation and Water Resources Engineering” authored by G L Asawa, New Age International Publisher
Reference Books	
R.1	“Water Resource Systems Planning and Management: An Introduction to Methods, Models, and Applications” authored by Daniel P. Loucks, Eelco van Beek, Deltares and UNESCO-IHE
R.2	“Groundwater hydrology” authored by David Reith Tod, John Wiley publisher
R.3	“Water Resources Engineering” authored by Linsley R. K. and Franzini J. B., McGraw Hill Book Co., NY
R.4	“Water Resources Engineering” authored by Ralph A. Wurbs, Wesley P Jamer, Prentice Hall
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105110/
2	https://nptel.ac.in/courses/105/104/105104030/

	Course Outcomes	CL
BCE33506.1	Illustrate the types of techniques related to water resources field methods.	3
BCE33506.2	Analyze field scale water resources considering environmental impact.	4
BCE33506.3	Use the instruments and protocols for water resources.	3
BCE33506.4	Apply the knowledge of quantity management surface and sub-surface water	3
BCE33506.5	Use legal aspects of water and environment systems in water resource management	3


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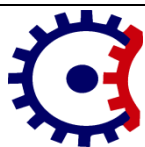
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B.Tech. Civil Engineering - Third Year (Semester-V)					
BCE33507: Water Quality Engineering (Program Elective-I)					
Teaching Scheme				Examination Scheme	
Theory	3 Hrs./week			CT-I	15Marks
Tutorial				CT-II	15 Marks
Total Credits	3			CA	10 Marks
Duration of ESE: 3Hrs.				ESE	60 Marks
				Total Marks	100 Marks
Course Objectives:					
1.	To enable students to understand the holistic approach to wastewater management and the self-purification process of streams.				
2.	To equip students with the ability to apply principles of preliminary and primary wastewater treatment processes in designing basic treatment units.				
3.	To develop students’ skills in analyzing the principles and operational mechanisms of secondary biological treatment processes.				
4.	To facilitate students’ comprehension of advanced biological treatment units and the need for advanced treatment methods to remove trace organics and nutrients.				
5.	To enable students to evaluate treatment alternatives for industrial wastewater.				
Course Contents					
Unit I	Holistic approach to Wastewater management, Water-quality sampling, Effluent & Stream standards, wastewater characteristics and their significance, disposal methods for wastewater on land and in water and its impact, self-purification of streams				
Unit II	Preliminary and primary treatment processes and units: Screens, grit chamber and primary settling tank- Principles, types & designs.				
Unit III	Secondary treatment processes & units: Concepts in biological treatment, bacterial growth, Activated sludge process, Trickling filter- Principles, types. Simple design problems / exercise.				
Unit IV	Other biological treatment units: Aerated lagoons, Stabilization Ponds, Up flow Sludge Blanket Reactors, Sludge Digester. Need of advanced treatment, removal of trace organics, micro screening and control of nutrients, nitrification and de-nitrification, removal of phosphorus.				
Unit V	Treatment alternatives for Industrial waste, volume reduction, strength reduction, equalization tank, neutralization tank, Specific industrial wastewater treatment for paper and pulp industry, sugar industry, distillery industry, dairy industry, textile industry. Introduction to hazardous liquid waste management.				
Text Books					
T.1	“Wastewater engineering” authored by B.C. Punmia, Laxmi Publications (P) Ltd., New Delhi				
T.2	“Environmental Engineering (Volume-2)” authored by S. K. Garg, Khanna Publication				
T.3	“Water quality and treatment” authored by James KEdzwald, American Water works Association				

T.4	“Water Supply Engineering” authored by Dr P.N. Modi, Standard book house
Reference Books	
R.1	“Wastewater Treatment Disposal and reuse” authored by Metcalf and Eddy, Tata McGraw Hill publishing company Ltd.
R.2	“Water Quality Engineering Physical/Chemical treatment” authored by Mark Benjamin & Desmond Lawler Wiley Publication
R.3	“Water Quality Engineering in natural systems” authored by David A. Chin, Wiley Publication
R.4	“Water Quality Engineering & Wastewater treatment by Yung Tse Hung, Hamidi Aziz, Issam A. Al-Khatib, etc, MDPI
Useful Links	
1	https://nptel.ac.in/courses/105/104/105104029/
2	https://nptel.ac.in/courses/105/107/105107129/

	Course Outcomes	CL
BCE33507.1	Use the knowledge of disposal methods for waste water on land and in water.	3
BCE33507.2	Illustrate necessity, objectives, layout of a wastewater treatment plant.	3
BCE33507.3	Apply the concept of advanced treatment processes for waste water.	3
BCE33507.4	Examine the biological characteristics and treatment of waste water.	4
BCE33507.5	Analyze types of treatment units for industrial waste water	4


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B.Tech. Civil Engineering - Third Year (Semester-V)

BCE33508: Surface Hydrology (Program Elective-I)

Teaching Scheme			Examination Scheme	
Theory	3 Hrs./week		CT-I	15Marks
Tutorial			CT-II	15 Marks
Total Credits	3		CA	10 Marks
Duration of ESE: 3Hrs.			ESE	60 Marks
			Total Marks	100 Marks

Course Objectives:

1.	To enable students to recall the scope, importance, and applications of hydrology, along with the principles of watershed concepts and modeling techniques used in water resource management.
2.	To equip students with the ability to apply methods for calculating evapo-transpiration (AET, PET) and infiltration, using statistical tools like probability distributions and parameter estimation.
3.	To develop students' skills in analyzing water power planning processes, including power duration curves, load studies, and system-integrated operational studies for hydropower projects.
4.	To facilitate students' comprehension of the classification of hydropower developments and the structural and layout considerations of hydropower plants.
5.	To enable students to evaluate the design and functionality of water conductor systems, including intakes, penstocks, pressure shafts, and surge tanks, in hydropower engineering.

Course Contents

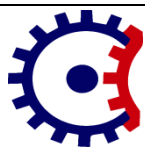
Unit I	Introduction: Scope and importance of hydrology, Global and India's Water resources, Applications of hydrology, Climate and Weather seasons in India. Watershed concept and modeling: Catchment-topographic and ground water divide, Description of the catchment, demarking a catchment, stream patterns, flood estimation by empirical method, water budgeting. Classification of models.
Unit II	Evapo-transpiration-AET & PET, Reference Crop Evapo-transpiration by Blaney Criddle formula, Infiltration-Probability and Statistics-Introduction, Probability and Random variables, PDF and CDF, Distribution functions, Selection of distribution function and its parameter estimation.
Unit III	Planning for water power development – estimation of available water power, power duration curve – storage and pondage – load studies – load duration curve – variations in load factor – power system load – system integrated operational studies – load prediction – market requirements of power – installed capacity – Benefits evaluation of installed capacity.
Unit IV	Classification of hydropower development – storage power development – runoff river power development – pumped storage power development – small hydro power development. Hydro power plants – power plant structure – layout of hydropower plants – types of power

	houses – sizing of power house.
Unit V	Water conductor system – intakes – location and types of intakes – penstock and pressure shafts – water hammer – water hammer equation – types of surge tanks.
Text Books	
T.1	“Engineering Hydrology” authored by Ojha, C.S.P., Berndtsson, R., and Bhunya, P, Oxford University Press
T.2	“Hydrology” authored by Raghunath H.M., New Age International Publishers
T.3	“Surface Water Hydrology” authored by V. P. Singh, M. Al-Rashed and M. M. Sherif, CRC Press
T.4	“Engineering Hydrology” authored by K Subramanya , M c Graw Hills
Reference Books	
R.1	“Applied Hydrology” authored by Ven Te Chow, David, Larry, Mac Graw Hill Publications
R.2	“Groundwater Hydrology “authored by David Keith Todd, Wiley publication
R.3	“Applied Surface Hydrology” authored by O. Starosolszky, Water Resources Publication
R.4	“Engineering Hydrology” authored by Saeid Eslamian, Taylor and Francis Group
Useful Links	
1	https://nptel.ac.in/courses/105/104/105104029/
2	https://nptel.ac.in/courses/105/107/105107129/

	Course Outcomes	CL
BCE33508.1	Apply hydrology principles to solve water resources management problems.	3
BCE33508.2	Evaluate evapo-transpiration & infiltration rate values.	5
BCE33508.3	Evaluate water power development criteria & characteristics.	5
BCE33508.4	Plan Hydro power plant structure & layout.	5
BCE33508.5	Analyze water conductor system & water hammer	4


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B.Tech. Civil Engineering - Third Year (Semester-V)

BCE33509: Flood Control & Drainage Engineering (Program Elective-I)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs./week	CT-I	15Marks
Tutorial		CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs.		ESE	60 Marks
		Total Marks	100 Marks

Course Objectives:

1.	To enable students to recall the fundamentals of flood engineering, including causes of floods, their environmental and economic impacts, and the role of flood control structures and mitigation strategies.
2.	To equip students with the ability to apply methods for estimating design floods and routing floods through reservoirs using techniques like Gumbel's method, ISD method, and Modified Pulse method.
3.	To develop students' skills in analyzing risk assessment and management strategies, including the use of advanced warning systems like GPS, remote sensing, GIS, and IT in natural hazard mitigation.
4.	To facilitate students' comprehension of land drainage systems, urban drainage challenges, and the operation and maintenance requirements of drainage infrastructure.
5.	To enable students to evaluate drainage criteria formulation for off-season, crop-season, and salt drainage, incorporating steady-state and unsteady-state approaches and accounting for intentional and unavoidable losses.

Course Contents



Unit I	Flood Engineering: General: Introduction, Basics of floods, Natural and man-made floods, flows in catchments, Causes of flooding, Environmental and economic losses, Flood control structures. Flood Hazard Mitigation: Flood management measures, Flood control strategies.
Unit II	Estimation of Design Flood: Introduction, Methods of design flood computations: Observation of Highest Flood, Empirical flood formulae, Rational formulae, Unit hydrograph method, Flood frequency studies - Gumbel's method-Design flood and design storm. Flood routing through reservoirs - general, basic principles of flood routing ISD method- Modified Pulse method.
Unit III	Risk Management: Risk assessment, Risk reduction and management, Advanced Warning Systems: Global positioning systems, Applications of remote sensing and GIS, Role of Information Technology in natural hazard mitigation management
Unit IV	Drainage Engineering: Land Drainage systems: necessity-types-surface and subsurface drainage-design considerations. Introduction to Drainage Problems in Different Climates: Urbanization - Its effects and consequences for drainage.

	Operation and Maintenance of Urban Drainage Systems: Maintenance requirements and planning, Cleansing of sewers and drains, repair options.
Unit V	Patterns of drainage system: Drainage criteria formulation for off season drainage, crop season drainage, salt drainage - use of steady state and unsteady state approaches in formulation. - criteria for irrigated area. – incorporation of intentional and unavoidable losses.
Text Books	
T.1	“A text book of Hydrology”, Dr. P. Jayarami Reddy, Laxmi publications
T.2	“Applied Hydrology”, Linsley R.K, Kohler.M.A & Palhus.J.L, Mc Graw Hill
T.3	“Land Drainage Principles: Methods and Applications”, Bhattacharya A K and Michael A M, Konark Publishers Pvt. Ltd., New Delhi
T.4	"Hydrology", H M Reghunath, New Age International (P) Limited, Publishers
Reference Books	
R.1	“Floods: Hydrological, Sedimentological and Geomorphological Implications”, Beven, K. and Carling, P., British Geomorphological Research Group Symposia Series, Wiley, Chichester
R.2	“Hazard Mitigation and Preparedness”, A.K. Schwab, K. Eschelbach, David J. Brower, John Wiley
R.3	“Economic Effects of Floods”, Brown, J.P, Springer-Verlag, Berlin
R.4	“Wrath of Nature: Impact of Environmental Destruction on Floods and Droughts”, Centre for Science & Environment, New Delhi
Useful Links	
1	https://nptel.ac.in/courses/105103193

	Course Outcomes	CL
BCE33509.1	Relate the role and responsibility of engineers in Flood Mitigation.	3
BCE33509.2	Relate the role and responsibility of engineers in Estimation of Design Flood	3
BCE33509.3	Apply the knowledge of GPS, GIS, Remote Sensing in Natural Hazard Mitigation	3
BCE33509.4	Apply the Concept in Operation and Maintenance of Urban Drainage System.	3
BCE33509.5	Examine pattern of Drainage system at Irrigation area.	4


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B.Tech. Civil Engineering - Third Year (Semester-V)					
BIT33516: Cyber Security & Laws					
Teaching Scheme				Examination Scheme	
Theory	4 Hrs./week			CT-I	15Marks
Tutorial				CT-II	15 Marks
Total Credits	4			CA	10 Marks
Duration of ESE: 3Hrs.				ESE	60 Marks
				Total Marks	100 Marks
Course Objectives:					
1.	To enable students to recall the basic concepts and significance of cybersecurity in modern contexts.				
2.	To facilitate students’ comprehension of how cybersecurity integrates with civil engineering and smart city initiatives.				
3.	To equip students with the ability to apply basic cybersecurity principles to safeguard engineering-related data and systems.				
4.	To develop students’ skills in analyzing the legal frameworks governing cybersecurity and their implications for engineering practice.				
5.	To encourage students to evaluate ethical considerations and future trends in cybersecurity within the context of civil engineering.				
Course Contents					
Unit I	Introduction to Cybersecurity: Definition and importance of cybersecurity in the digital age. Overview of cyber threats: Hacking, phishing, malware, and ransomware. Relevance of cybersecurity to civil engineering (e.g., protecting infrastructure data, smart cities). Evolution of cyber threats and their impact on society.				
Unit II	Cybersecurity in Infrastructure and Smart Cities: Role of cybersecurity in protecting critical infrastructure (e.g., dams, bridges, transportation systems). Introduction to smart cities and their reliance on digital systems. Vulnerabilities in civil engineering projects due to cyber-attacks (e.g., data breaches in construction plans). Case studies of cyber incidents affecting infrastructure (e.g., power grids, water systems).				
Unit III	Fundamentals of Cyber Threats and Protection: Types of cyber-attacks: Denial of Service (DoS), social engineering, and data theft. Basic methods of protection: Passwords, encryption, and firewalls (conceptual overview). Importance of secure data management in civil engineering projects. Human factors in cybersecurity: Role of awareness and training.				
Unit IV	Cyber Laws and Regulations: Introduction to cyber laws: Definition and purpose. Overview of key cyber laws in India (e.g., Information Technology Act, 2000) or relevant national laws. Legal implications of cybercrimes in engineering contexts (e.g., intellectual property theft, project sabotage). Responsibilities of engineers under cyber laws (e.g., data privacy, ethical use of technology).				
Unit V	Ethical Issues and Future Trends in Cybersecurity: Ethical dilemmas in cybersecurity: Privacy vs. security, surveillance in smart cities. Role of civil engineers in promoting ethical				



	cybersecurity practices. Emerging trends: Artificial intelligence, IoT, and their impact on cybersecurity. Future challenges in securing civil infrastructure against cyber threats.
Text Books	
T.1	Cyber Security, Nina Godbole, Wiley India
T.2	Cyber Law in India, Pavan Duggal, Universal Law Publishing
T.3	Cybersecurity Essentials, Charles J. Brooks, Sybex (Wiley)
T.4	Introduction to Cybersecurity: A Multidisciplinary Challenge, Robin C. Burke, CRC Press, 1 st Edition
Reference Books	
R.1	Information Security and Cyber Laws, Sarika Gupta, Khanna Publishing House
R.2	Cybercrime and Cybersecurity, V.K. Jain, S. Chand Publishing
R.3	Cybersecurity and Cyberwar: What Everyone Needs to Know, P.W. Singer & Allan Friedman, Oxford University Press
R.4	The Basics of Cyber Safety: Computer and Mobile Device Safety Made Easy, John Sammons, Syngress (Elsevier)
Useful Links	
1	https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
2	https://onlinecourses.nptel.ac.in/noc23_cs127/preview

	Course Outcomes	CL
BIT33516.1	Describe fundamental cybersecurity principles and common cyber threats in engineering.	2
BIT33516.2	Explain cybersecurity's relationship with civil infrastructure using real examples.	2
BIT33516.3	Demonstrate fundamental measures to protect civil engineering data practically.	3
BIT33516.4	Assess cyber laws' relevance to civil engineering projects and responsibilities.	4
BIT33516.5	Justify ethical cybersecurity importance and predict emerging technology influence.	5


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B.Tech. Civil Engineering - Third Year (Semester-V)				
BCE33510: Railways & Airport Engineering (Open Elective-III)				
Teaching Scheme			Examination Scheme	
Theory	2 Hrs./week		CT-I	7 Marks
Tutorial			CT-II	7 Marks
Total Credits	2		CA	6 Marks
Duration of ESE: 2Hrs.			ESE	30 Marks
		Total Marks	50 Marks	
Course Objectives:				
1.	To explain the development of railway systems in India and the roles of key track components (rails, sleepers, ballast, and subgrade) in ensuring track stability and functionality.			
2.	To apply principles of railway station design and signaling systems to classify and justify the layout of stations, yards, and track junctions for efficient train operations.			
3.	To evaluate the suitability of an airport site and its master plan based on ICAO and FAA standards, considering factors like zoning laws, obstructions, and runway capacity.			
Course Contents				
Unit I	Railways: Development of railways in India, Permanent way and railway track components, different gauges in India. Functions of various Components - Rails, Sleepers and Ballast: Rails - types of rails, Sleepers – types, Ballast – types, advantages and disadvantages.			
Unit II	Railway stations - requirements, facilities, classifications, platforms, loops, sidings. Railway yards – types, required equipment in yards. Signaling and control system – objectives, classification.			
Unit III	Airport Engineering: Airport Planning - Regional planning-concepts and advantages, location, planning & classification of airport as per ICAO and FAA. Airport Master plan, Airport site selection. Need of Air traffic control, landing information system, airport markings and lighting.			
Text Books				
T.1	S.C. Saxena and S. P. Arora, “A Text Book of Railway Engineering”, Dhanpat Rai & Sons, New Delhi			
T.2	S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, “Principles of Railway Engineering”, Charotar Publishing House Pvt. Ltd, Anand			
T.3	S.C. Rangwala, P. S. Rangwala, “Airport Engineering”, Charotar Publishing House Pvt. Ltd, Anand			
T.4	G.V. Rao, “Airport Engineering”, Tata McGraw Hill Pub. Co., New Delhi			
Reference Books				
R.1	Satish Chandra and M.M. Agrawal, “Railway Engineering”, Oxford University Press, New Delhi			
R.2	Dr. S. K. Khanna, M.G.Arora and S.S. Jain, “Airport Planning & Design”, Nem Chand &			

	Bros., Roorkee
R.3	Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, "Airport Engineering: Planning, Design and Development of 21st Century Airports", John Wiley & Sons
Useful Links	
1	https://nptel.ac.in/courses/105107123
2	https://archive.nptel.ac.in/courses/105/107/105107123/

	Course Outcomes	CL
BCE33510.1	Understand railway development, track components, gauges, and their functions.	2
BCE33510.2	Describe railway stations, yards, their equipment, and signaling systems.	2
BCE33510.3	Interpret airport planning, classification, master plan, and air traffic control.	2


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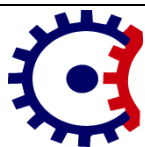
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B.Tech. Civil Engineering - Third year (Semester-V)				
BCE33504: Environmental Engineering Lab				
Teaching Scheme			Examination Scheme	
Practical	2 Hrs./week		CA	25 Marks
Tutorial				
Total Credits	1		ESE	25 Marks
Duration of ESE:				
		Total Marks	50 Marks	
Course Objectives:				
1.	To understand the principles and significance of measuring chloride content and solid concentrations in water samples for assessing water quality.			
2.	To apply standard laboratory techniques to evaluate turbidity and acidity in water and explain their environmental implications.			
3.	To develop students' skills in analyzing dissolved oxygen levels and electrical conductivity in water samples to assess aquatic health and ionic content.			
4.	To facilitate students' comprehension of water disinfection and coagulation processes by determining residual chlorine and optimal coagulant dosage in laboratory settings.			
5.	To evaluate the organic pollution load in wastewater by measuring Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD) and relate these to wastewater treatment design.			
Course Contents				CO
1	Determination of Chlorides			CO1
2	Determination of Solid's (Suspended & dissolved)			CO1
3	Determination of Turbidity			CO2
4	Determination of Acidity			CO2
5	Determination of Dissolved Oxygen			CO3
6	Determination of Conductivity			CO3
7	Determination of Residual Chlorine			CO4
8	Determination of coagulant by Jar Test apparatus			CO4
9	Determination of COD in waste water			CO5
10	Determination of BOD in waste water			CO5
Text Books				
T.1	Water supply & Sanitary Engineering - B.C. Punmia, Laxmi Publication			
T.2	Water supply and Sanitary Engineering - Birdie G.S., Dhanpat Rai Publication			
T.3	Environmental Engg. I - P. N. Modi, Std. Publication			
T.4	Environmental Engg.(Water supply Engg.) - S.K.Garg, Khanna Publication			

Reference Books	
R.1	CPHEOO manual, New Delhi, Ministry of Urban Development, G.O.I.
R.2	Water supply and sewage - M.J.McGhee, Mc. Graw Hill
R.3	Environmental Pollution Control Engg. - C.S.Rao, Mc. Graw Hill
R.4	Relevant IS Codes: IS 3025 Part 11 (1983), and 22 (1986), IS 3025 Part 32 (1988), IS 3025-15 (1984), IS 3025-10 (1984), IS 3025 Part 22 (1986), IS 3025-50 (2001)
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105201/
2	https://nptel.ac.in/courses/105/106/105106119/

	Course Outcomes	CL
BCE33504.1	Identify and recommend water quality analysis tests for determining pollution in water	3
BCE33504.2	Identify and recommend tests for analysis of physical constituents of water	3
BCE33504.3	Investigate properties of chemical constituents of water using identification tests	6
BCE33504.4	Evaluate & acquire the knowledge to test strength & quality of reagents & coagulants	5
BCE33504.5	Examine the concepts of water quality related to Environmental Engineering	4


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B.Tech. Civil Engineering - Third year (Semester-V)

BCE33505: Geotechnical Engineering Lab

Teaching Scheme			Examination Scheme	
Practical	2 Hrs./week		CA	25 Marks
Tutorial			ESE	25 Marks
Total Credits	1		Total Marks	50 Marks
Duration of ESE:				

Course Objectives:

1.	To impart knowledge about the engineering properties of soil
2.	To introduce the fundamental concepts relevant to the behavior of soils
3.	To enable the students to understand the factors that control the behavior of the soils
4.	Apply principles of soil mechanics to solve civil engineering problems

Course Contents (Perform any 8)		CO
1		
1	To classify the coarse-grained soils	CO1
2	To determine the moisture content (water content) of a given soil sample.	CO2
3	To determine the specific gravity of the soil sample.	CO2
4	To determine liquid limit, plastic limit and shrinkage limit of soil.	CO2
5	To determine the mass density of soils by Sand replacement method.	CO2
6	To determine the mass density of soils by Core Cutter method.	CO2
7	Proctors' compaction Test and Proctor needle test.	CO2
8	To determine coefficient of permeability of given soil sample at desired density by a suitable method.	CO3
9	To determine shear strength parameters of the given soil sample by Direct Shear Test.	CO4
10	To determine the unconfined compressive strength of cohesive soil sample.	CO5
11	To determine CBR value of the given soil sample	CO5

Text Books

T.1	Soil Mechanics & Foundation Engineering - K.R. Arora, Standard Publisher
T.2	Soil Mechanics & Foundation Engineering - B.C.Punmia, Laxmi Publication
T.3	Basic & Applied Soil Mechanics - Gopal Rajan & Rao, Newage International Publication
T.4	Geotechnical Engineering - P. Raj, Dorling Kindersley Pvt. Ltd

Reference Books

R.1	Soil Mechanics & Foundation Engineering - Modi, Std. Publisher
R.2	Soil Mechanics & Foundation Engineering - V.N.S. Murthy, CBS Publisher

Useful Links	
1	https://nptel.ac.in/courses/105/101/105101201/
2	https://nptel.ac.in/courses/105/105/105105168/
3	https://nptel.ac.in/courses/105/106/105106142/

	Course Outcomes	CL
BCE33505.1	Illustrate the knowledge about origin and classification of soils	4
BCE33505.2	Distinguish index and engineering properties of the soil and develop a proficiency in handling experimental data	4
BCE33505.3	Estimate the influence of water flow on the engineering behavior of soils	4
BCE33505.4	Evaluate the concept of effective stress and its influence on soil behavior	5
BCE33505.5	Analyze and compute principles of permeability, compaction, consolidation and shear strength parameters of soil	4


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