



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.

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SCHEME OF INSTRUCTION & SYLLABI

Program: Civil Engineering

Scheme of Instructions: Second Year B.Tech. in Civil Engineering (As Per NEP 2020)

Semester – V

SN	Som	Tune	BoS/	Sub Code	Subject		Con	tact H	ours	Credits	% W	eight	age	ESE	Total
211	Sem	1 ype	Dept	Sub Code	Subject	1/1	L	Р	Hrs.		CT/IA	CA	ESE	Duration	Marks
1	V	PCC	CE	BCE33501	Design of Steel Structures	Т	3	0	3	3	30	10	60	3 Hrs.	100
2	V	PCC	CE	BCE33502	Environmental Engineering	Т	3	0	3	3	30	10	60	3 Hrs.	100
3	V	PCC	CE	BCE33503	Geotechnical Engineering	Т	3	0	3	3	30	10	60	3 Hrs.	100
4	V	PEC	CE	BCE33506-09	Program Elective – I	Т	3	0	3	3	30	10	60	3 Hrs.	100
5	V	MDM	IT	BIT33516	Cyber Security & Laws	Т	4	0	4	4	30	10	60	3 Hrs.	100
6	V	OEC		B\$\$335XX	Open Elective-III	Т	2	0	2	2	14	06	30	2 Hrs.	50
7	V	PCC	CE	BCE33504	Environmental Engineering - Lab	Р	0	2	2	1	-	25	25	-	50
8	V	PCC	CE	BCE33505	Geotechnical Engineering - Lab	Р	0	2	2	1	-	25	25	-	50
							18	4	22	20	164	106	380	17 Hrs.	650

Course Category	BSC/ ESC (Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC (Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits (5 th sem)		11	03	06				
Cumulative Sum	16 / 13	31	03	16	06	14	02	04

PROGRESSIVE TOTAL CREDITS: 85+20=105



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

Jast Gabranne Quite public Dec, 2024	1.00	Applicable for AY 2025-26			
Reviperson Degen Academiestucs VicePrincipal Paril Drockremanand Maktons	e Version	Onwards			
Principal T.G.P.C.E.T.Nagpur Ollege Of Engineering and Tachpology NEdstramii Gaikwad Patil College of TGPCET, Nagpur					
Engineering & Technology, Nagpur					

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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

Program: Civil Engineering





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B.Tech. Civil Engineering - Third Year (Semester-V)									
		I	SCE33501: Design of Steel Structures						
Tea	aching	Scheme		Examinati	on Scheme				
Theor	ſy	3 Hrs./week		CT-I	15Marks				
Tutor	ial			CT-II	15 Marks				
Total Cr	edits	3		СА	10 Marks				
Duration	of ESE	: 3Hrs.		ESE	60 Marks				
				Total Marks	100 Marks				
Course ()bject i	ives:							
1	Το ι	inderstand form	ation of soil & identify types of soils such a	as sand, gravel	, organic soil,				
1.	clay	, Betonies, black	cotton soil						
2	Kno	wledge to ident	ify, determine & correlate index properties	s of soil like v	vater content,				
	spec	ific gravity sieve	e analysis, particle size distribution						
3.	Kno	wledge about th	e engineering properties of soils & to unders	tand permeabil	ity & seepage				
	char	characteristics of soil							
4.	Τοι	inderstand conc	epts of consolidation & compaction of soils	s using mechan	isms, factors,				
	equi	pments & techn		0 1 4 41					
5.	lou	inderstand stress	distribution in soil, use of Newmarks chart a	& shear strength	1				
	Ctoo	1	Course Contents	an of Stars stores 1	Steel Merita				
Unit I	Steel as a Structural Material: Physical and mechanical properties of Structural Steel, Merits								
Unit I	various Structural Steel Sections IS 800:2007 Introduction to Limit State Method								
	Stru	Various Structural Steel Sections, IS 800:2007, Introduction to Limit State Method.							
Unit II	ioints Strength of holt and strength of weld Efficiency of joints Design of simple holt and								
om n	welded connections								
	Tens	sion Member: Ty	vpes of Tension Member, Stresses, Design of	Tension Mem	ber				
Unit III	Con	Compression Member: Effective length, Slenderness ratio. Design of Compression Member							
	Desi	gn of connection	n: Beam to beam, beam to column.	1					
TT	Desi	gn of simple an	d built-up beams: Laterally restrained and u	n-restrained, (sy	ymmetrical as				
Unitiv	well	well as unsymmetrical section). Design of welded plate girder and Curtailment of plates.							
	Colu	mn: Design of A	Axially loaded columns, Design of Laced and	d Battened Col	umns (Design				
Unit V	of E	Built-up Column	s) with Bolted and Welded End Connection	on. Column Ba	ises Types of				
	Colu	imn Bases, Slab	Base, Gusset Base, Design of Slab Base ar	nd Gusseted Ba	se. Design of				
Text Boo	Dase	e plate.							
	"Desi	ign of steel struc	ture" authored by L.S. Negi, Tata McGraw	hills Publisher	Co. Ltd. New				
1.1	Delhi				,				
T.2	"Desi	ign of Steel Stru	ctures", authored by N. Subramanian, OXFO	RD University	Press.				
Т.3	"Lim Priva	it State Design (te Limited.	of Steel Structures", authored by S. K. Dug	gal, McGraw H	Iill Education				

T.4	"Fundamentals of Structural Steel Design", authored by M. L. Gambhir, McGraw Hill Education.						
Reference	ce 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 L	Useful Links						
1	https://nptel.ac.in/courses/105/105/105162/						
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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G

B.Tech. Civil Engineering - Third Year (Semester-V)									
	B	CE33502: Environmental Engineering							
Tea	ching Scheme		on Scheme						
Theory	y 3 Hrs./week		CT-I	15 Marks					
Tutoria	ો		CT-II	15 Marks					
Total Cre	dits 3		СА	10 Marks					
Duration o	f ESE: 3Hrs.		ESE	60 Marks					
			Total Marks	100 Marks					
Course O	bjectives:								
1.	To identify various	types of water demands, per capita deman	nd, variations i	in demand &					
	suitable surface & su	ibsurface sources of raw water							
2.	Ability to predict th	e future population & estimate correspondin	g water deman	d to calculate					
	design period of wat	er treatment units							
3.	To become adept at	using hydraulic design aspects for planning	water pipe net	works, joints,					
	fittings, valves & ap	purtenances	1 0 1 • 1 • 1	11.					
4.	To articulate a firm understanding regarding physical, chemical & biological water quality								
	parameters as per Di	inking Water Standards	. 1 · 1 · .	1					
5.	Formulate & design	water treatment units to meet standards of	drinking wate	r quality, it's					
	storage & distributio	on along with water softening & swimming po	bol water treath	nent					
	Course Contents								
	Water Demand: Al	l types of water demand empirical formulae	factors affect	ing per capita					
	demand variation in demand design period population forecasting methods and examples								
Unit I	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.						
	Conveyance of wat	er: Types of pipes, joints, fittings, valves & a	ppurtenances.						
	Hydraulic design aspects: Friction, Manning's, Darcy-Weishbach & Hazen-Williams								
Unit II	equation and problem. Design of pipe distribution network.								
	Rising main and	pumps: Concept of rising main, Classific	ation, working	g, merits and					
	demerits, selection of pumps.								
	Water quality: Ph	sysical, Chemical and bacteriological chara	acteristics of v	water, Health					
	effects of various wa	ater characteristics, Standards of drinking wa	ter. (WHO 201	1, CPHEOO,					
	IS 10500). Water bo	rne diseases							
Unit III	Water treatment:	Objective of treatment, unit operations an	d processes, h	ouse hold &					
	community based ru	ral water treatment, flow sheet of convention	ai water treatm	ent plant.					
	Aeration: Purpose,	uppes of aerators, design of cascade aerator.	f accoulants	nd respective					
	coagulant doses tre	es of mixing and flocoulation devices	or coagurants a	ind reactions,					
	i obagulalli ubses, tvD	co or mixing and nocculation devices.							

	Sedimentation: Principles, types of setting basins, inlet and outlet arrangements, simple
	design of sedimentation tank.
Unit IV	Clariflocculators: Principles and operation.
	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.
	Disinfection : Purpose, Mechanism, criteria for good disinfectant, various disinfectants, their
	characteristics, disinfection by chlorination using different forms of chlorine. Types of
	chlorination.
Unit V	Distribution systems : Requirements of a good distribution system, methods of distribution
Unit v	systems and layouts, Leakage and leak detector, Study of fire hydrants.
	Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.
	Miscellaneous Methods of Water Treatment: Colour, Odors & Taste removal,
	pool water treatment.
Text Boo	ks
T.1	Water supply & Sanitary Engineering - B.C. Punmia, Laxmi Publication
T.2	Water supply and Sanitary Engineering - Birdie G.S., Dhanpat Rai Publication
Т.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
Referenc	e 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.
Usetul Li	nks
1	https://nptel.ac.in/courses/105/105/105105201/
2	https://npte1.ac.1n/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		heme		Examinati	on Scheme	
Theory 3 Hrs./week		Hrs./week		CT-I	15 Marks	
Tutoria	al			CT-II	15 Marks	
Total Cre	dits	3		СА	10 Marks	
Duration o	f ESE: 3H	Hrs.		ESE	60 Marks	
				Total Marks	100 Marks	
Course O	bjectives	:				
1.	To unde	erstand form	ation of soil & identify types of soils s	such as sand, gravel	, organic soil,	
	clay, Be	etonies, black	c cotton soil			
2.	Knowle	dge to iden	tify, determine & correlate index prop	perties of soil like v	vater content,	
	specific	gravity siev	e analysis, particle size distribution			
3.	Knowle	dge about th	e engineering properties of soils & to u	inderstand permeabil	ity & seepage	
	characte	eristics of soi	ll ente ef concelidation & commention et	f	iana fatana	
4.	10 unde	erstand conc	epts of consolidation & compaction of	solls using mechan	isms, factors,	
5	equipments & techniques					
J.	10 unac		Course Contents	nart & shear strengt	1	
	Introduc	rtion: Forms	ation of soil residual & transported so	il major deposits fo	und in India	
	soils generally used in practice such as sand gravel organic soil clay Betonies black cotton					
	soil etc. Introduction to clay mineralogy.					
Unit I	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.					
	Phases	of soil: Vari	ous soil weight & volume inter-relatio	onship. Density index	x, methods of	
Unit II	determining in situ density.					
Unit II	Classification of Soil: Particle size classification, Textual classification, Unified & I.S.					
	classific	classification system, field identification of Expansive soil, Swelling pressure.				
	Permeal	bility: Darcy	r's law & its validity, Discharge & so	eepage velocity, fac	tors affecting	
	permeability, Determination of coefficients of permeability by Laboratory and field methods,					
Unit III	permeability of stratified soil.					
	Seepage: Seepage pressure, quick sand condition, characteristics & uses of flow nets,					
	Prelimit	hary problem	is of discharge estimation in homogeneo	ous soils.	t 1t	
	Stress L	Distribution:	Stress distribution in soil Mass, Effec	tive, Neutral and to	tal stresses in	
∐nit IV	Soli mas	ss. point load rike oberte	and uniformity distributed load over re	cuangular & circular	areas, Use of	
Unit IV	Shear S	iks cliaits. Strength: Int	roduction Mohr's Circle Theory Mol	hr's Coulomb's the	nry Drainaga	
	conditio	on, application	ons & significance of C \cdot Ø (phi). Measure	rement of shear stre	ngth by direct	
	1	/ 11				

	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 Boo	ks
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	e 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 L	inks
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

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

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	NAAC Accredited with A+ Grade	
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	B.Tech. Civil Engineering - Third Year (Semester-V)	

BCE33506: Water Resources Engineering (Program Elective-I)					
Tea	ching Scheme		Examination Scheme		
Theor	y 3 Hrs./week		CT-I	15Marks	
Tutori	al		CT-II	15 Marks	
Total Cr	edits 3		CA	10 Marks	
Duration of	of ESE: 3Hrs.		ESE	60 Marks	
			Total Marks	100 Marks	
Course C	bjectives:				
1	To comprehend th	e types of water resources and the scien	ntific principle	es underlying	
1.	measurement techno	ologies and protocols used in water resource a	ssessments.		
2	To equip students v	vith the ability to design experimental frame	works for field	-scale studies	
2.	of water resources a	nd environmental systems.			
3.	To develop student	s' skills in analyzing field study methods, in	struments, and	protocols for	
0.	monitoring surface	water and groundwater resources.			
4.	To facilitate studer	nts' understanding of water quantity manag	ement princip	les, including	
	surface water storag	ge, reservoir design, and groundwater manag	ement strategie	es for various	
	uses.				
5.	To enable students to evaluate the legal frameworks and environmental constraints governing				
	water rights, allocat	ion, and resource development.			
		Course Contents			
T T 1 / T	Introduction to W	on to Water Resources Field Methods. Types of water resources available,			
Unit I	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 F	lanning, field studies; instruments and p	rotocols for s	surface-water,	
	groundwater. Groun	dwater hydrology, steady state, well hydrauli	cs & aquifers.		
Un:4 IV	Water Quantity Ma	nagement: Surface Water Storage Requirem	nents, Storage	Capacity and	
Unit IV Yield, Reservoir Design, Water Allocations for Water Supply, Irrigation, H		Irrigation, Hyd	aropower and		
Legal Aspects of Water & Environment Systems: Principles of La		Law applied to	Water Rights		
Unit V	and Water Alloca	tion, Water Laws, Environmental Protect	ction Law, E	Invironmental	
	Constraints on water Resources Development				
Text Boo	Text Books				
T.1	"Managing Water Resources Methods and Tools for a Systems Approach" authored By Slobodan P. Simonovic				
Т.2	"Hydrology" authored by Raghunath H.M., New Age International Publishers				
Т.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	ce 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 L	inks
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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3	Tulsiramji Gaikwad-Patil College of Engineering and Technology	
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	B.Tech. Civil Engineering - Third Year (Semester-V)	

BCE33507: Water Quality Engineering (Program Elective-I)						
Tea	ching	Scheme		Examination Scheme		
Theory		3 Hrs./week		CT-I	15Marks	
Tutori	al			CT-II	15 Marks	
Total Cr	edits	3		СА	10 Marks	
Duration of	of ESE	: 3Hrs.		ESE	60 Marks	
				Total Marks	100 Marks	
Course C	bjecti	ives:				
1.	To e	enable students	to understand the holistic approach to wast	ewater manage	ment and the	
1.	self-	purification pro	cess of streams.			
2.	To e	equip students w	ith the ability to apply principles of prelimit	nary and prima	ry wastewater	
	treat	ment processes	in designing basic treatment units.			
3.	To	develop student	s' skills in analyzing the principles and	operational m	echanisms of	
	seco	ndary biological	treatment processes.			
4.	To f	acilitate students	s' comprehension of advanced biological trea	atment units an	d the need for	
-	adva	inced treatment	methods to remove trace organics and nutrier	nts.		
5.	To e	nable students to	o evaluate treatment alternatives for industria	l wastewater.		
	TT 1'	. 1.	Course Contents	1: 5:00	<u>.</u>	
TT •4 T	Holi	stic approach to	Wastewater management, Water-quality s	ampling, Efflu	ent & Stream	
Unit I	stand	standards, wastewater characteristics and their significance, disposal methods for wastewater				
			and its impact, sen-purification of streams	·, 1 1	1 '	
Unit II	Pren	Preliminary and primary treatment processes and units: Screens, grit chamber and primary				
	setti		mes, types & designs.	1	(· 1 (1	
TT •4 TTT	Secondary treatment processes & units: Concepts in biological treatment, bacterial growth,					
Unit III	Activated sludge process, Trickling filter- Principles, types. Simple design problems /					
	Othe	use.	atment unity Aeroted lagoons. Stabilizati	on Donda Un	flow Sludge	
.	Blanket Reactors Sludge Digester Need of advanced treatment removal of trace organics					
Unit IV	micro screening and control of nutrients, nitrification and de-nitrification, removal of					
	phos	sphorus.				
	Trea	Treatment alternatives for Industrial waste, volume reduction, strength reduction,				
Unit V	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	"Wast	tewater engineerii	ng" authored by B.C. Punmia, Laxmi Publication	s (P) Ltd., New I	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	ee 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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	D. I ecn.	Civil Engineering - Third Tear (Se	emester-v)		
BCE33508: Surface Hydrology (Program Elective-I)					
Tea	Ceaching Scheme Examination Scheme		on Scheme		
Theory	y 3 Hrs./week		CT-I	CT-I 15Marks	
Tutoria	al		CT-II	15 Marks	
Total Cre	edits 3		СА	10 Marks	
Duration o	f ESE: 3Hrs.		ESE	60 Marks	
		-	Total Marks	100 Marks	
Course O	bjectives:				
1.	To enable students the principles of management.	to recall the scope, importance, and appli- watershed concepts and modeling tech	cations of hydrolog niques used in w	gy, along with rater resource	
2.	To equip students PET) and infiltrat estimation.	with the ability to apply methods for calcu ion, using statistical tools like probabil	lating evapo-transp ity distributions a	biration (AET, nd parameter	
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					
	Introduction: Scope and importance of hydrology, Global and India's Water resources,				
Unit I	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 Boo	ks
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
Referenc	e 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 Li	inks
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
Tutoria	1		CT-II	15 Marks
Total Cree	lits 3		СА	10 Marks
Duration of	ESE: 3Hrs.		ESE	60 Marks
			Total Marks	100 Marks
Course Ob	ojectives:			
	To enable students	to recall the fundamentals of flood engin	eering, includi	ng causes of
1. floods, their environ		mental and economic impacts, and the role of	f flood control	structures and
	mitigation strategies			
	To equip students w	vith the ability to apply methods for estimating	ng design flood	ls and routing
2.	floods through reser	voirs using techniques like Gumbel's method	l, ISD method,	and Modified

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.
 To facilitate students' comprehension of land drainage systems, urban drainage challenges,

Pulse method.

- 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.

- 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.

 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 IVDrainage 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 Boo	ks
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
Т.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	e 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 Li	inks
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	-		
Tea	ching Scheme		Examination	on Scheme	
Theory	y 4 Hrs./week		CT-I	15Marks	
Tutoria	al		CT-II	15 Marks	
Total Cre	edits 4		CA	10 Marks	
Duration of ESE: 3Hrs.			ESE	60 Marks	
· · · ·			Total Marks	100 Marks	
Course O	bjectives:				
To enable students		to recall the basic concepts and significance of cybersecurity in modern			
1.	contexts.				
2	To facilitate students' comprehension of how cybersecurity integrates with civil engineering				
4.	and smart city initiatives.				
3	To equip students with the ability to apply basic cybersecurity principles to safeguard				
٥.	engineering-related data and systems.				

To develop students' skills in analyzing the legal frameworks governing cybersecurity and 4. their implications for engineering practice.

To encourage students to evaluate ethical considerations and future trends in cybersecurity 5. within the context of civil engineering.

Course	Contents

Introduction to Cybersecurity: Definition and importance of cybersecurity in the digital age. Overview of cyber threats: Hacking, phishing, malware, and ransomware. Relevance of Unit I cybersecurity to civil engineering (e.g., protecting infrastructure data, smart cities). Evolution of cyber threats and their impact on society.

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 Unit II cyber-attacks (e.g., data breaches in construction plans). Case studies of cyber incidents affecting infrastructure (e.g., power grids, water systems).

Fundamentals of Cyber Threats and Protection: Types of cyber-attacks: Denial of Service (DoS), social engineering, and data theft. Basic methods of protection: Passwords, Unit III encryption, and firewalls (conceptual overview). Importance of secure data management in civil engineering projects. Human factors in cybersecurity: Role of awareness and training.

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 **Unit IV** 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).

Ethical Issues and Future Trends in Cybersecurity: Ethical dilemmas in cybersecurity: Unit V 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 Boo	oks
T.1	Cyber Security, Nina Godbole, Wiley India
T.2	Cyber Law in India, Pavan Duggal, Universal Law Publishing
Т.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	ce 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 L	inks
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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Head of Dept. (Information Technology) Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur.

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

D. Teen. Civil Eligineering - Timer Tear (Seinester-V)							
BCE33510: Railways & Airport Engineering (Open Elective-III)							
Teaching Scheme		Scheme		Examination Scheme			
Theory		2 Hrs./week		CT-I	7 Marks		
Tutori	al			CT-II	7 Marks		
Total Cr	edits	2		CA	6 Marks		
Duration of	of ESE	: 2Hrs.		ESE	30 Marks		
				Total Marks	50 Marks		
Course O	bjecti	ves:					
1.	To com func	explain the dev ponents (rails, tionality.	velopment of railway systems in India a sleepers, ballast, and subgrade) in en	nd the roles suring track	of key track stability and		
2.	To a layo	pply principles ut of stations, ya	of railway station design and signaling system ords, and track junctions for efficient train ope	ms to classify a erations.	and justify the		
3.	To e stand	evaluate the suit dards, considerin	ability of an airport site and its master plan ng factors like zoning laws, obstructions, and	n based on IC. runway capaci	AO and FAA ty.		
	-		Course Contents				
	Rail	ways: Developn	nent of railways in India, Permanent way an	d railway track	components,		
Unit I	different gauges in India. Functions of various Components - Rails, Sleepers and Ballast:						
	Rails	s - types of rails.	, Sleepers – types, Ballast – types, advantages	s and disadvant	ages.		
IIm:4 II	Kail	Railway stations - requirements, facilities, classifications, platforms, loops, sidings. Railway					
Unit II	class	s – types, requ	nred equipment in yards. Signating and c	ontrol system	– objectives,		
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 Boo	ks						
T.1	S.C. S. New	Saxena and S. F Delhi	P. Arora, "A Text Book of Railway Enginee	ring", Dhanpat	t Rai & Sons,		
T.2	S.C. Charo	Rangwala, K.S. otar Publishing H	Rangwala and P.S. Rangwala, "Principle House Pvt. Ltd, Anand	s of Railway	Engineering",		
Т.3	S.C. Rangwala, P. S. Rangwala, "Airport Engineering", Charotar Publishing House Pvt. Ltd, Anand						
T.4	G.V.	Rao, "Airport E	ngineering", Tata McGraw Hill Pub. Co., Ne	w Delhi			
Reference	e Bool	ks					
R.1	Satish Chandra and M.M. Agrawal, "Railway Engineering", Oxford University Press, New Delhi						
R.2	Dr. S	. K. Khanna, N	I.G.Arora and S.S. Jain, "Airport Planning	& Design", N	em 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 L	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.	
BCE33510.3	Interpret airport planning, classification, master plan, and air traffic control.	2

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Diften, eith Engineering find year (Semester V)						
BCE33504: Environmental Engineering Lab						
Teaching Scheme		Scheme		Examinati	on Scheme	
Practical		2 Hrs./week		CA	25 Mortra	
Tutorial					2.5 IVIAI KS	
Total Ci	edits	1		ESE	25 Marks	
Duration	of ESE	:		ESE	2.5 WidtK5	
				Total Marks	50 Marks	
Course (Objecti	ives:	••••	11 1	. 1 1.1	
1.	To u	nderstand the j	principles and significance of measurin	g chloride conte	ent and solid	
	To an	ntrations in wate	er samples for assessing water quality.	nd acidity in wate	ar and explain	
2.	their e	pry standard lat	unlications	id acturity in wate	and explain	
	To de	velop students'	skills in analyzing dissolved oxygen level	s and electrical c	onductivity in	
3.	water	samples to asse	ss aquatic health and ionic content.		5	
4.	To fa	cilitate students	' comprehension of water disinfection	and coagulation	processes by	
	detern	nining residual o	hlorine and optimal coagulant dosage in la	boratory 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					
	desigr	1.				
-	D /		Course Contents		CO	
1	Determination of Chlorides CO1			COL		
2	Determination of Solid's (Suspended & dissolved) CO1					
3	Determination of Turbidity CO2			CO2		
5	Determination of Dissolved Oxygen			CO2		
6	Determination of Dissolved Oxygen			C03		
0	Determination of Conductivity		C03			
/	Deteri	mination of Res			C04	
8	Deter	mination of coag	gulant by Jar Test apparatus		CO4	
9	Determination of COD in waste water			CO5		
10	Determination of BOD in waste water CO5			CO5		
Text Books						
T.1	Water supply & Sanitary Engineering - B.C. Punmia, Laxmi Publication					
T.2	Wate	Water supply and Sanitory Engineering - Birdie G.S., Dhanpat Rai Publication				
T.3	Environmental Engg. I - P. N. Modi, Std. Publication					
T.4	Envir	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/105/105/105201/		
2	https://nptel.ac.in/courses/105/106/105106119/		

	Course Outcomes	
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	
BCE33504.5	Examine the concepts of water quality related to Environmental Engineering	4

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

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D. Teen. Civit Eligineering - Tintu year (Semester-V)						
BCE33505: Geotechnical Engineering Lab						
Teaching Scheme			Examination		on Scheme	
Practical		2 Hrs./week			CA	25 Marks
Tutor	rial				CA	
Total C	redits	1			ESE	25 Marks
Duration	of ESE	:				
C	01.1	·			Total Marks	50 Marks
	D bjecti	ves:	hout the engineering pr	operties of soil		
1.	To int	roduce the fund	mental concents relevan	t to the behavior of	soils	
3.	To en	able the students	to understand the factor	s that control the bel	navior of the so	ils
4.	Apply	principles of sc	l mechanics to solve civ	vil engineering proble	ems	115
	11 7	1 1	Course Contents	0 01		CO
			(Perform any 8)			CO
1	To cla	ssify the coarse	grained soils			CO1
2	To de	termine the mois	ure content (water conte	ent) of a given soil s	ample.	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.			y CO3		
9	To determine shear strength parameters of the given soil sample by Direct Shear CO4 Test.			ar CO4		
10	To determine the unconfined compressive strength of cohesive soil sample.			CO5		
11	1 To determine CBR value of the given soil sample			CO5		
Text Bo	oks					
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 N	Mechanics & Fo	ndation Engineering - V	V.N.S. Murthy, CBS	Publisher	

Useful Links				
1	https://nptel.ac.in/courses/105/101/105101201/			
2	https://nptel.ac.in/courses/105/105/105168/			
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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