



Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441 108 NAAC A+ Accredited

Approved by AICTE, New Delhi, Govt. of Maharashtra (An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

Structure & Curriculum

From

Academic Year 2023-24

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

> To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

- > To provide facilities and services to meet the challenges of Industry and Society.
- > To facilitate socially responsive research, innovation and entrepreneurship.

> To ascertain holistic development of the students 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

- > To promote academic and ethical development while upholding high standards.
- > To provide advance facilities with the skills needed to face Industry and societal challenges.
- > To promote socially responsible research, innovation, and entrepreneurship in the field of Civil Engineering.
- > 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 Education Objectives (PEO)

Graduates will be able to

- PEO1 : Analyse and design civil engineering structures while keeping social awareness and ethical responsibilities in mind.
- PEO2 : Demonstrate leadership abilities in supporting sustainable practices in Civil Engineering
- PEO3 : Exhibit a commitment to lifelong learning, staying updated on developing technologies and industry trends, and adjusting to the evolving world of Civil Engineering.
- PEO4 : Executing 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.

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Programme: Civil Engineering

Scheme of Instructions: Third Year B. TECH in Civil Engineering

Semester-V

Sr.	Course	Course Code	Course Title				Contact		EXAM SCHEME				
No.	Category	Course Coue			Т	Р	Hrs./Wk	Credits	CT1	CT2	TA/CA	ESE	TOTAL
1	PCC	BCE3501	Reinforced Cement Concrete Structures		-	-	3	3	15	15	10	60	100
2	PCC	BCE3502	Advanced Structural Analysis	3	1	-	4	4	15	15	10	60	100
3	PCC	BCE3503	Advanced Surveying	3	-	-	3	3	15	15	10	60	100
4	PEC	BCE3504-07	Program Elective-I	3	-	-	3	3	15	15	10	60	100
5	PEC	BCE3508-11	Program Elective-II	3	-	-	3	3	15	15	10	60	100
6	OEC	BCEXX01-14	Open Elective-I	3	-	-	3	3	15	15	10	60	100
7	PCC	BCE3516	Reinforced Cement Concrete	-	-	2	2	1	-	-	25	25	50
/	ree		Structures Lab										
8	PCC	BCE3517	Advanced Structural Analysis Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	BCE3518	Advanced Surveying Lab	-	-	2	2	1	-	-	25	25	50
10	PROJ	BCE3519	Micro Project	-	-	2	2	1			25	25	50
11	MCC	BAU3505	Heritage	2	-	-	2	Audit	-	_	-	-	_
			Total	20	1	8	29	23	90	90	160	460	800

L-Lecture

T-Tutorial

P-Practical

CT1- Class Test 1

CT2- Class Test 2

ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits			-	13	06	03	01	Yes
Cumulative Sum	06	27	18	41	06	03	02	

PROGRESSIVE TOTAL CREDITS :80+23 =103

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TA/CA- Teacher Assessment/Continuous Assessment

Tulsirami Galkwad-Patil Crillage Of Sogineering & Pachnology, Nagpur

Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagem

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Programme: Civil Engineering

Scheme of Instructions: Third Year B. TECH in Civil Engineering

Semester-VI

Sr.	Course	Course Code	Course Title	т	Т	D	Contact	Cradita		EXAM SCHEME			
No.	Category	Course Coue	Course The	L	1	Γ	Hrs./Wk	Creans	CT1	CT2	TA/CA	ESE	TOTAL
1	PCC	BCE3601	Advanced Fluid Mechanics	3	-	I	3	3	15	15	10	60	100
2	PCC	BCE3602	Design of Steel Structures	3	-	-	3	3	15	15	10	60	100
3	PCC	BCE3603	Geotechnical Engineering	3	-	I	3	3	15	15	10	60	100
4	PEC	BCE3604-07	Program Elective-III	3	-	I	3	3	15	15	10	60	100
5	PEC	BCE3608-11	Program Elective-IV	3	-	-	3	3	15	15	10	60	100
6	OEC	BCEXX01-14	Open Elective -II	3	-	-	3	3	15	15	10	60	100
7	PCC	BCE3616	Geotechnical Engineering Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	BCE3617	Steel Structures Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	BCE3618	Advanced Fluid Mechanics Lab	-	-	2	2	1	-	-	25	25	50
10	PROJ	BCE3619	Mini Project#	-	-	2	2	1+1#	-	-	25	25	50
11	MCC	BAU3606	Social Awareness	2	-	-	2	Audit	-	-	-	-	-
			Total	20	-	8	28	23	90	90	160	460	800

Every Student will undergo Industrial Training/Internship of Two weeks in summer vacation after B. TECH VI Sem. Examinations, upon successful completion of industrial training/internship 01 credit will be awarded after submission of the report in prescribed format.

L-Lecture

T-Tutorial

P-Practical

CT1- Class Test 1

TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2

ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits				12	06	03	02	Yes
Cumulative Sum	06	27	18	53	12	06	04	

PROGRESSIVE TOTAL CREDITS: 103+23 = 126

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Principal Principal Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagam

Program: Civil Engineering List of Electives offered by Civil Engineering Department

Program Elective- I	Program Elective- II	Program Elective- III	Program Elective- IV
Semester V Environmental Engineering	Semester V Hydrology & Water Resources Engineering	Semester VI Hydraulics	Semester VI Construction Engineering & Management
BCE3504-Rural Water	BCE3508-Water Resources	BCE3604-Design of hydraulic	BCE3608-Building
Supply and Sanitation	Engineering	structures	Construction Practice
BCE3505-Environmental Laws and Policy	BCE3509-Water Quality Engineering	BCE3605-Hydraulic modelling	BCE3609- Advanced Building Construction Methods
BCE3506-Solid and Hazardous Waste Management	BCE3510- Surface Hydrology	BCE3606- Urban Hydrology and Hydraulics	BCE3610-Structural Audit & Retrofitting of Structures
BCE3507-Air and Noise Pollution Control	BCE3511- Flood Control & Drainage Engineering	BCE3607-River Engineering	BCE3611- Construction Equipment & Automation

Program Elective- V	Program Elective- VI	Program Elective- VII	Open Elective- I	Open Elective- II
Semester VII Transportation Engineering	Semester VII Structural Engineering	Semester VII Geotechnical Engineering	Semester V	Semester VI
BCE4703-Pavement Design	BCE4707-High Rise Structures	BCE4715-Foundation Engineering	BCEXX07- Introduction to art and Aesthetics	BCEXX08- Metro Systems & Engineering
BCE4704- Urban Transportation Planning	BCE4708- Industrial Structures	BCE4716-Geotechnical Design		
BCE4705- Airport Planning and Design	BCE4709-Prestressed Concrete	BCE4717-Structural Geology		
BCE4706- High Speed Rail Engineering	BCE4710- Earthquake Engineering	BCE4718-Rock Mechanics		

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Wardha Ro					Nagpur-441 108					
		mour	NAA Instituto	C Accredi	ited (A+ Grade)	niversity Normu				
Program	Program: B.Tech. Civil Engineering									
Semester	-VI BCE3601:	: Adv	anced Flu	id Mechar	nics					
Tea	ching Scheme					Examinati	ion Scheme			
Theor	y 3 Hrs/wee	ek				CT-I	15 Marks			
Tutori	al					CT-II	15 Marks			
Total Cr	edits 3					СА	10 Marks			
Duration of	of ESE: 3Hrs					ESE	60 Marks			
Pre-Requ	isites: Fluid Mechar	anics, I	Engineerin	g mechanic	s		1			
		,	<u> </u>	Course	Contents					
-	Flow Through H	Pipes	: Friction	nal resistan	ce to flow of fluid,	loss of energy in	pipe, Darcy-			
Unit I	Weis-bach & Ha	łazen	William'	s equation	for frictional head l	oss, Hydro-dynam	nically smooth			
Omti	and rough surfac	aces, H	Hydraulic	gradient a	nd energy gradient li	nes: Pipes in serie	s and parallel,			
	equivalent pipe.									
	Flow Through Pipes: Syphon, Branched pipes, Three reservoir, pipe networks, Hardy – Cross									
Unit II	method. Introduction, fundamental quantity, derived quantity, dimensions, dimensional									
	homogeneity, methods of dimensional analysis, repeated variable, Buckingham pi method,									
	Transient behavior of Fluid - Water hammer phenomenon									
	Uniform flow in Open Channel: Types of channels and their geometrical properties, Types of									
Unit III	flow in open channel. Chezy's and Manning's equations for computations of normal depth of									
	flow, hydraulically most efficient rectangular, triangular, trapezoidal, circular sections.									
	Critical Flow and Rapidly Varied Flow: Specific energy and specific energy diagram,									
Unit IV	alternate depths, Computations of critical depth, section factor for critical flow, Conditions of									
	critical flow, Definition, application of hydraulic jump, Classifications of jump, energy loss,									
	belanger momen	entum	equation.	. i ransient	behavior of Fluid - S	surge				
	(A) Turbines: De	Definit	tion, Class	sification o	of Turbines; compone	ent parts and work	ing principles.			
	(B) Reciprocating Pumps: Components parts, working principle, Work done of single &									
Unit V	double acting pu	umps								
	(C) Centrifugal	l Pum	p: Compo	onent parts	s; Working principle	; Static and mano	metric Heads;			
	losses & efficien	encies;	; Vertical	Turbine Pu	ump					
Text Boo	ks									
T.1	"Hydraulics and Fl	Fluid n	nechanics '	", authored	by Modi & Seth,Stand	ard Book House, De	elhi,2017.			
T.2	"Fluid Mechanics A 1998.	And I	Fluid Powe	er Engineeri	ing " authored by Kun	nar D.S., S.K.Katar	ia And Sons,			
T.3	"Flow in open char	annels'	", authored	l by Subram	nanya K, Tata McGraw	Hill Publication,, 2	2009.			
T.4	"Fluid Mechanics Publishers,2009.	es: Incl	luding Hyd	draulic Mac	hines" authored by Jai	n,A.K. ,INT Khanna	L			

Reference Books								
R.1	"Open channel hydraulics", authored by VenTeChow , International Student Edition. McGraw Hill, 2009.							
R.2	'Engineering Fluid Mechanics" authored by Garde, Mirajgaonkar, Scitech Publication, 2010.							
R.3	"Flow through open channels", authored by K.G.RangaRaju, Tata McGraw Hill Publications, 1998.							
R.4	"Fluid Mechanics, Hydraulics And Hydraulic Machines" authored by Arora K.R.,NT Standard Publishers Distributors, 2005.							
Useful L	inks							
1	https://nptel.ac.in/courses/105/101/105101082/							
2	https://nptel.ac.in/courses/112/105/112105206/							

	Course Outcomes	CL	Class Sessions
BCE3601.1	Determine the losses in pipe network using Darcy-Weisbach and Hazen William's equation.	3	8
BCE3601.2	Analyze the pipe network system and its components including water hammer pressure.	4	10
BCE3601.3	Analyze the uniform and critical flow through open channels including efficient channel sections.	4	9
BCE3601.4	Analyze energy concepts in the open channel flow and undertake Rapidly Varied flow.	4	8
BCE3601.5	Apply the concept of hydraulic machines in performance of Power plant.	3	10

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3			NAAC Accr	edited (A+ Grade)						
D	(A	An Autonomous	s Institute Affilia	ited to RTM Nagpur Unive	ersity, Nagpur)				
Program: B.Tech. Civil Engineering										
Semester	Semester-VI BCE3602: Design of Steel Structures									
Tea	ching	Scheme		_	Examination	on Scheme				
Theor	y	3 Hrs/week		_	CT-I	15 Marks				
Tutori	al				CT-II	15 Marks				
Total Cr	edits	3			CA	10 Marks				
Duration of	of ESE	: 3Hrs			ESE	60 Marks				
Pre-Requi	isites: I	Mechanics of Sol	d		Total Marks	100 Marks				
			Cour	rse Contents						
	Steel	as a Structural	Material: Physic	al and mechanical propertie	s of Structural	Steel, Merits				
Unit I	and	Demerits of Ste	el as a Structura	l Material, Grades of Struc	tural Steel, Sh	ape factor of				
	vario	various Structural Steel Sections, IS 800:2007, Introduction to Limit State Method.								
T T 1 / T T	Struc	ctural Fasteners:								
Unit II	Beha	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 wel						connections.				
	Tension Member: Types of Tension Member, Stresses, Design of Tension Member									
Unit III	Com	Compression Member: Effective length Slenderness ratio Design of Compression Member								
	Desi	Design of connection: Beam to beam. beam to column.								
		6								
TT:4 TX7	Desi	Design of simple and built-up beams: Laterally restrained and un-restrained, (symmetrical as								
Unit IV	well as unsymmetrical section). Design of welded plate girder and Curtailment of plates.									
	Colu	Column: Design of Axially loaded columns, Design of Laced and Battened Columns (Design								
Unit V	of B	of Built-up Columns) with Bolted and Welded End Connection. Column Bases: Types of								
	Colu	Column Bases, Slab Base, Gusset Base, Design of Slab Base and Gusseted Base.								
Text Boo	ks									
T.1	"Fund 2013	amentals of Stru	ctural Steel Desig	n", authored by M. L. Gaml	bhir, McGraw H	Hill Education,				
T.2	"Desig 2008	gn of Steel Struct	ures", authored by	N. Subramanian, OXFORD	University Press	, First Edition,				
Т.3	"Limit	t State Design of	Steel Structures",	authored by S. K. Duggal, M	lcGraw Hill Edu	acation Private				
	Limite	ed, 2011								
T.4	1986.	gn of steel structu	re authored by L	.5. megi, 1 ata Mic Graw hills	rublisher Co. Li	ia, new Delhi,				
Referenc	e Book	ζS								
R.1	"Stabi Educa	lity Analysis an tion, 2004.	d Design of Stee	l Structure", authored By M	I. L. Gambhir,	McGraw Hill				
R.2	"Desig	gn of steel structu	re "authored by S.	S. Bhavikatti, dreamtech, distri	ibuted by Willey	v, 2009.				

R.3	"Design of steel structure" authored by A. S. Arya and J.L. Ajmani, Nem chand bros, Roorkee, 2011.						
R.4	"Design of steel structure" authored by P Dayaratnam, S. Chand of Co. Delhi 2003 edition,2012.						
Useful Links							
1	https://nptel.ac.in/courses/105/105/105162/						
2	https://nptel.ac.in/courses/105/104/105104030/						

	Course Outcomes	CL	Class Sessio ns
BCE3602.1	Use the knowledge of IS code of practice (IS 800) for the design of steel structural elements.	3	10
BCE3602.2	Design structural fasteners (Bolted and welded connections) used in steel construction.	6	9
BCE3602.3	Design the Tension and Compression members.	6	8
BCE3602.4	Evaluate simple & built-up beams and built-up columns.	6	8
BCE3602.5	Develop Axially loaded columns	6	10

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1.1		NAAC Accredited (A+ Grade)						
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)								
Program	1: B. '	Гес <mark>h.</mark> Civil E	ngineering					
Semester-	VI	BCE3603: Geo	technical Engineering					
Tea	ching	Scheme		Examination	on Scheme			
Theory	y	3 Hrs/week		CT-I	15 Marks			
Tutoria	ની			CT-II	15 Marks			
Total Cre	dits	3		CA	10 Marks			
Duration o	f ESE	: 3Hrs		ESE	60 Marks			
Pre-Requis	sites: (Concrete Technol	ogy	Total Marks	100 Marks			
	-		Course Contents					
	Intro	duction: Forma	tion of soil, residual & transported soil, ma	ijor deposits fo	und in India,			
T T 1 / T	soils	generally used	in practice such as sand, gravel, organic soil,	clay, Betonies	, black cotton			
Unit I	SOIL C	etc. Introduction	to clay mineralogy.	Dansity index	, mathada af			
	deter	Phases of soil: Various soil weight & volume inter-relationship. Density index, methods of determining in situ density.						
	Inde	x Properties &	Their Determination Water content spec	ific gravity si	eve analysis			
	narti	cle size distrib	ution curve sedimentation analysis Differe	ential and free	swell value			
Unit II	Cons	sistency of soil.	Atterberge's limits. Classification of Soil:	Particle size	classification,			
	Text	ual classification	n, Unified & I.S. classification system, field	lidentification	of Expansive			
	soil,	Swelling pressu	re.					
	Perm	neability: Darcy	's law & its validity, Discharge & seepag	e 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,							
	Preliminary problems of discharge estimation in homogeneous soils, Effective, Neutral and							
	iotal	stresses in soil i	llass.					
	Stres	s Distribution:	Stress distribution in soil Mass, Boussinesq	ue equation, p	oint load and			
T T . •4 TT 7	uniformly distributed load over rectangular & circular areas, Use of Newmarks charts.							
Unit IV	Shear Strength: Introduction, Mohr Coulomb's theory, Drainage condition, Measurement of							
	and s	sensitivity.	eet shear test, triaxiar test, uncommed comp		ine shear test,			
	Cons	solidation: Com	pression of laterally confined soil Terzagh	is 1-D consoli	dation theory			
	(forn	nation of Different	ential equation) Determination of coefficient	t of consolidation	on. Degree of			
	cons	olidation. Deter	mination of preconsolidation pressure, Settler	ment, Rate of so	ettlement.			
Unit V	Com	paction: Mecha	nism of compaction, factors affecting comp	action, standard	d & modified			
	proc	tor Tests, field c	compaction equipment, quality control, Adva	nce compaction	n Techniques,			
	Nucl	ear density mete	er.					
Text Book	KS							
T.1	Soil M	lechanics & Foun	dation Engg. – K.R. Arora, Standard. Publisher,	2020 edition				

L

T.2	Soil Mechanics & Foundations – B.C.Punmia, Laxmi Publication, 16th edition 2017
T.3	Basic & Applied Soil Mechanics – Gopal Ranjan & Rao, Newage International Publication, 3 rd edition 2016
T.4	Geotechnical Engg. – T.N.Ramamurthy & T.G. Sitharam, S. Chand Publishing, 2005 edition
Reference	ze Books
R.1	Soil Mechanics & Foundation Engg – P.N. Modi, Standard Book House, 5th edition 2019
R.2	Soil Mechanics & Foundation Engg – V.N.S. Murthy, CBS Publisher, 2018 edition
R.3	Geotechnical Engg. – P.Purushothama Raj, McGraw-Hill Education, 1995 edition
R.4	Soil Mechanics & Foundation Engg – P.Purushothama Raj, Pearson Education India, 1 st edition 2007
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	Class Session s
BCE3603. 1	Elustrate the knowledge about origin and classification of soils	4	8
BCE3603. 2	Distinguish index and engineering properties of the soil and develop a proficiency in handling experimental data	4	8
BCE3603. 3	Estimate the influence of water flow on the engineering behavior of soils	4	10
BCE3603. 4	Evaluate the concept of effective stress and its influence on soil behavior	5	9
BCE3603. 5	Analyze and compute principles of permeability, compaction, consolidation and shear strength parameters of soil	4	10

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Program	n: B .'	Tech. Civil E	ngineering			·
Semester	-VI	BCE3604: Des	gn of Hydraulic S	tructure (PE-III)		
Tea	ching	Scheme			Examinati	on Scheme
Theor	у	3 Hrs/week			CT-I	15 Marks
Tutoria	al				CT-II	15 Marks
Total Cre	dits	3			CA	10 Marks
Duration o	f ESE	: 3Hrs			ESE	60 Marks
Pre-Requi	sites:	Hydrology and W	ater Resources Engi	neering	Total Marks	100 Marks
			Course	e Contents		
Unit I	General: Irrigation, necessity, importance, benefits of irrigation, types.Water requirement for crops : Crop seasons and major crops of India, crop rotation, soils and their irrigation requirement, field capacity, wilting point, available moisture in soils for crops / plants, depth & frequency of irrigation, GCA, CCA, kor period, kor water depth, duty – delta relation, base period.					
Unit II	Reservoir Planning : Selection of site for reservoirs, engineering surveys, geological and Hydrological investigations, fixing of LWL, FTL/FRL, HFL, TBL, dead storage, live storage, different storage zones in reservoirs, reservoir sedimentation and its removal. Statistical Methods: Statistics in hydrological analysis, probability and probability distribution. Floods: Causes and effects, Factors affecting peak flows and its estimation, frequency analysis					
Unit III	Water Logging: Causes, effect, Preventive measure of water logging.Canal Irrigation : types of canal system, stable canal, unstable canal, grading, lined, canal network Canals In Alluvial Soils : Kennedy's silt theory–Design procedure, silt supporting capacity, drawbacks, Lacey's silt theory–definition of initial final and permanent regime channels, Lacey's Regime equations, channel design procedure, limitations.Lined Canals: design procedure, types of lining, relative merits and demerits of canal lining, economics of canal lining.					
Unit IV	Dam gove dam earth and Failu Stab	ns: General Class erning selection ; stability requir ; Galleries.Earth nen dams-founda chipping, turfin ure of earthen d ility of foundation	sification of dams of dams. Instrume ements; Theoretic en Dams: Types tion, cut off trench g; seepage throug ams; Plotting of p on against shear. (C	s as per use, hydraulic de entation in damGravity Da cal & practical profile of of earthen dam; Descrip h, rock toe, hearting, centr gh body of earthen dam ohreatic line for earthen de DMC and ODD tests for he	esign and mate m: Forces acti- gravity dam; tion of compo- al impervious and drainage a lams with hori- earting and casi	rials; Factors ng on gravity Low & High nent parts of core, pitching arrangements; zontal filters; ng zones)
Unit V	Spill verti	lways: Types of cal lift, radial, re	spillway, General lling and drum; G	principle of design of oge ate O.S. Energy dissipation	e spillway; Spi n methods.	llway gates –

	Diversion Head Works: Component parts of diversion headworks - Fish ladder, guide wall,
	divide wall, silt excluder and silt ejector; Causes of failure of weirs on permeable foundation;
	Bligh's Creep theory; Dr. Khosla's theory for design of weirs on permeable foundation
Text Boo	ks
T.1	"Design of Hydraulic Structure and Hydraulic Structures" authored by Santosh Kumar Garg, Khanna Publisher, 1999.
T.2	"Design of Hydraulic Structure and Water Power Engineering" authored by B.C. Punmia, Laxmi Publication, 1992.
Т.3	"Design of Hydraulic Structure" authored by Asawa G. L., New age International, New delhi, 1 January 2005.
T.4	"Design of Hydraulic Structure" authored by S. R Sahasrabudhe, S. K. Kataria and Sons, 2013.
Reference	e Books
R.1	"Design of Hydraulic Structure" authored by N N Basak, Mc Graw Hill Education, 2017.
R.2	"Design of Hydraulic Structure" authored by Dr. N, P. Singh, T Banerjee, Charotar Publishing house, 2015
R.3	"Irrigation Water Resources and Water Power Engineering" authored by P N modi, Rajsons Publication Pvt. Ltd, 9 th Edition 2014.
R.4	"Design of Hydraulic Structures" Dr. R. P. Rethaliya, Atul Prakashan Ahmedabad, 1st edition, 2021
Useful Li	inks
1	https://nptel.ac.in/courses/105/105/105105110/
2	https://nptel.ac.in/courses/105/104/105104030/

	Course Outcomes	CL	Class Sessions
BCE3604.1	Calculate water requirement for crop patterns.	3	9
BCE3604.2	Analysis of flood occurrence in reservoir planning	4	8
BCE3604.3	Design of water conveyance canal system for structure.	6	9
BCE3604.4	Illustrate the planning, design and operation of storage reservoir.	3	10
BCE3604.5	Analyze the basic profile of dams for checking stability of Gravity Dams and Earth dams.	4	9

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Tulsiramji Gaikwad-Patil College of Engineering and Technology								
-	Wardha Road, Nagpur-441 108							
		NAAC Accredited (A+ Grade)						
D	(An Autonom	mous I	Institute A	millated to	o KIM Nag	gpur Univ	ersity, Nagpur)
Program	n: B.Tech. Civi	n En	gineering	5				
Semester	-VI BCE3605:	: Hydr	aulic Mode	lling (PE-	·III)		Γ	
Tea	aching Scheme						Examinati	on Scheme
Theor	y 3 Hrs/weel	ek					CT-I	15 Marks
Tutor	ial						CT-II	15 Marks
Total Cr	edits 3						CA	10 Marks
Duration	of ESE: 3Hrs						ESE	60 Marks
Pre-Requ	isites: Fluid Mechan	nics					Total Marks	100 Marks
	1		(Course Co	ontents			
	Dimensional an	nalysis	s: Units, d	limensions	s of physic	cal quanti	ities, different	methods of
Unit I	Obtaining dimen	nsion 1	less parame	eters viz., 1	Rayleigh's n	nethod, m	ethod of repeat	ing variables,
	Buckingham π the Weber number	theorer	m, Reynolds	s number,	Froude num	nber, Mach	n number, Eule	r Number and
	weber number.							
TT:4 TT	Determination of	of scale	es for mode	els, Neces	sity of disto	ortion of so	cales, scale effe	ects. Movable
Unit II	bed models. Co	onstru model	s3D	operation	of hydraul	ic models	. Wind tunnel	s, flumes2D,
		mouch	SJD.					
Unit III	Measuring Equi	uipmer	nts: Flume	s, Weirs,	, flow met	ters, press	sure transduce	rs, hot film
	anemometer, Cur	arrent i	meter, Lase	r doppler,	pointer gau	ges		
	Application to c	coastal	l and tidal t	problems	Design of I	Regular &	Random (3D	and2D) wave
Unit IV	modelling techni	Application to coastal and tidal problems. Design of Regular & Random (3D and 2D) wave modelling techniques, stability of coastal structures. Simulation of littoral drift Design of						
	sand trap, Distort	rted sc	cale tidal modelling technique(rigid/movable) for Estuarine Ports,					
	_							
	Rigid bed models and movable bed models, bank protection works, barrages and weirs, canal							
Unit V	off takes, power intakes, gates, bridges and intakes. Applications for structures in hilly							
Cint v	& processes related to various hydraulic structures Dams spillways and energy dissipaters							
	combination of ri	rigid a	and movable	e bed mod	els, sedimen	tation and	flushing of res	ervoirs.
Text Boo	ks							
	"Dimensional A	m 01!	a and 41		1 ~? ~~41 ~ ~	d II	anahaan V.	on Dul C 1
T.1	June 1980.	naiysis	s and theory	y of mode	eis" authored	u Henry L	angnaar, Krieg	er Pub Co, I
	"Horbour and Co		Enginaciin	", outh	d hy Nama'	ahon and C	Vothing! V.	1 LOUI Occor
T.2	and Coastal Engin	ineerin	Engineering	g authored	Chennai 20	002.	o. Kaunironi, Vo	1 I&II, Ocean
	"Flow through or	nen ol	hannel" aut	hored by	Rajesh Shri	$\frac{1}{\sqrt{2}}$	ford Universit	v Press New
T.3	Delhi, 2008.		numer aut	nored by	rajeon onn	, asiav, O2		y 11000, 110W
т 4	"Fluid Mechanics	s and	Machinerie	s" authore	ed by Modi	and seth, S	Standard book	House, Delhi,
1.4	2002.				-			
Reference	e Books							
R.1	"Fluid Mechanics	s", aut	thored by D	r. R. J. Ga	arde,New Ag	ge Publicat	tions, 2011.	

R 2	"Hydraulic Modeling" authored by Victor Lyatkher and Alexander Proudovsky, Scrivoner
N. 2	Publishing, 2016.
R 3	"Hydraulic Modelling- An introduction Principles, Methods and Applications" authored by
K .5	Pavel Novak and Vincent Gunot, CRC press, 2010.
R /	"Development in Hydraulic Engineering" authored by P Novak, Taylor & Francis Publication,
К.4	2018.
Useful L	inks
1	https://nptel.ac.in/courses/105/105/105105110/
2	https://nptel.ac.in/courses/105/104/105104030/

	Course Outcomes	CL	Class Session s
BCE3605.1	Use the concept of Dimensional analysis in model making.	3	9
BCE3605.2	Determination of types of scales for model making.	3	9
BCE3605.3	Calculate vacuum and gauge pressure using measuring equipments.	3	8
BCE3605.4	Design hydraulic models using dimensionless number	6	9
BCE3605.5	Illustrate the concept of model making in hydraulic structures.	3	10

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			NAAC Accredited (A+ Grade)	NT.				
Prograi	Program: B Tech Civil Engineering							
Somostor		BCE3606: Urb	an Hydrology and Hydraulics (PF-III)					
Semester	-vi	Schome	an Hydrology and Hydraunes (I E-III)	Evominoti	on Sohomo			
	icining	2 Una /magala			15 Marka			
Tratan	y	3 Hrs/week			15 Marks			
Tutor		2			15 Marks			
Total Cr	edits	3		CA	10 Marks			
Duration	of ESE	: 3Hrs		ESE	60 Marks			
Pre-Requ	isites		Correct Constants	Total Marks	100 Marks			
	Γ		Course Contents					
	Urba	anisation: Proces	ss of urbanization, Trends of urbanization a	nd industrializat	ion, influence			
Unit I	on ł	nydrologic cycle	e, effects and consequences for drainage	, Rainfall analy	ysis in urban			
	envi	ronment, design	storm					
	Urba	an Runoff comp	utations: Empirical, Time-area and unit hydr	ograph approac	hes.			
Unit II	Urba	an storm water	runoff : overland flow, Kinematic wave	theory approact	h, infiltrating			
	catch	nments			_			
Unit III	Desi	gn of drainage	e system elements: Hydraulic fundament	als, infiltration	and on-site			
	road	detention of storm water, design of sewerage and drainage channels, design of appurtenances,						
	Toud		n or pumping stations					
	Urba	an water supply	: Estimate of demand, sources in surface	and groundwate	er, Reservoir,			
Unit IV	capa	capacity estimation. Introduction to urban watershed software - Hydrologic Cistern, water						
	conservation and ecological aspects, Water harvesting							
	Cont	trol of storm wa	ter pollution: Pollution build-up and wash	off process with	n reference to			
TT:4 X7	urba	urban drainage systems. Source control in commercial and industrial complexes, storage						
Unit v	optic	options - dry and wet ponds, biological treatment of wastewater, chemical treatment of storm						
	wate	er						
Text Boo	ks							
T.1	"Арр Т, Мо	lied Hydrology: cGraw Hill, Nev	A Compendium of Water resources technology York, 1964	ology" authored	by Chow V			
Т.2	"Hyd	rology and Hyd	raulic Systems" authored by Gupta R S, P	rentice Hall Pul	blishers, New			
1.2	Jersey	y, 1989.						
Т.3	"Urban Hydrology, Hydraulics and storm water quality" authored by A Osman and Robert J Houghtalen, Wiley Publication, 2003.							
T.4	"Engi 2017.	"Engineering hydrology" authored by K Subramanya , Mc Graw Hill Education ,4th edition, 2017.						
Reference	e Bool	ks						
R.1	"Drai J, UN	nage in Urban A NESCO, Paris, 1	Areas- 2 Volumes" authored by Geiger W 1 987	F, Marsalek J Z,	and Rawls G			

R.2	"Urban Hydrology" authored by Hall M J, Elsevier Applied Science Publishers, New York,
	1984.
R 3	"Stormwater Detention for Drainage, water quality and CSO Management" authored by Stahre
К.5	P, and Urbonas B, Prentice Hall Publishers, New Jersey, 1983.
R.4	"Urban Hydrology" authored by Timothy R. Lazaro, Revised edition, CRC Press, 1990.
Useful L	inks
1	https://nptel.ac.in/courses/105/101/105101002/
2	https://nptel.ac.in/courses/105/104/105104029/

	Course Outcomes	CL	Class Sessio ns
BCE3606.1	Relate the process of urbanization and its influence on the processes and storages associated with hydrological cycle.	3	8
BCE3606.2	Analyze computational approaches for urban water supply, flooding by conceptual and physical techniques	4	9
BCE3606.3	Design of drainage system elements.	6	10
BCE3606.4	Evaluate capacity of reservoirs & demand of reservoir.	5	9
BCE3606.5	Apply the knowledge to control storm water pollution	3	9

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3) (A	n Autonomous	NAAC Accredited (A+ Grade) s Institute Affiliated to RTM Nagpur Unive	ersity, Nagnur							
Program: B.Tech. Civil Engineering											
Semester	Semester-VI BCE3607: River Engineering (PE-III)										
Tea	Teaching Scheme Examination Scheme										
Theor	y	3 Hrs/week		CT-I	15 Marks						
Tutori	al			CT-II	15 Marks						
Total Cr	edits	3		СА	10 Marks						
Duration of	of ESE:	3Hrs		ESE	60 Marks						
Pre-Requ	isites:			Total Marks	100 Marks						
			Course Contents								
Unit I	Introd flood	duction, classif	ication of Rivers, Mechanics of alluvial rives, Sediment transport and budgets, River	vers including morphology	channel and and various						
	classi	ification scheme	es.								
	Beha	vior of Rivers:	Introduction, River Channel patterns, Straig	ght River chan	nels, Causes,						
Unit II	chara	characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms,									
	Instal	bility of rivers,	Hydraulic geometry, Delta formation and con	trol.							
	Mech	nanics of Alluvi	al Rivers. Rivers and restoration structures. S	ocio-cultural i	nfluences and						
Unit III	ethics	s of stream resto	pration.								
Unit IV	Bio-e Serie	engineering Tec s Analysis of fl	chniques, Classification review, Natural Char ow, Sediment and channel geometry data.	nnel Design A	nalysis, Time						
		j									
	River Training and Protection Works: Introduction, Classification of River Training, Types of										
Unit V	training works, Protection for Bridges with reduced waterway, Design of Guide Band,										
	embankment and spurs/dampners and other river/ flood protection works.										
Text Boo	ks										
T.1	"River	Engineering" au	thored by Margeret Peterson, Prentice hall public	ation, 1986.							
T.2	"Princi 1994.	iples of River Er	ngineering (the non tidel alluvial)" authored by P	H Jameen, VSS	D Publication,						
т 2	"River	"River Behaviour Management and Training (Vol. I & II)" authored by Varma, C. V. J. Saxena, K.									
1.5	T.3 R. (Koushal Raj); Rao, M. K. ,CBI&P, New Delhi, 1989.										
T.4	"River	Engineering" au	thored by Santosh Kumar, Khanna Publication, 20	019.							
Referenc	e Book	S		1 0 1 0 0							
R.1	"Irriga Publica	tion & Water P ation, 2021.	ower Engineering" authored by B. C. Punmia	and Pande B.	B. Lal, Laxmi						
R.2	"Mech Ranga	anics of sedimen Raju, Wiley Eas	it transportation and Alluvial stream problems" au tern limited, 1977	thored by R.J. C	Garde and K.G.						
R.3	"River	Engineering" au	thored by K. D. Gupta, Vayu education of India,	2019.							
R.4	"Applied Fluivial Geomorphology for River Engineering and Management" authored by Colin R.										

	Thorne and R. Hey ,Wiley Publication, 1997.				
Useful L	Useful Links				
1	https://nptel.ac.in/courses/105/103/105103204/				
2	https://nptel.ac.in/courses/105/106/105106145/				

	Course Outcomes	CL	Class Sessio ns
BCE3607.1	Illustrate river morphology & its classification schemes.	3	9
BCE3607.2	Analyze river flow hydraulics and its behavior.	4	9
BCE3607.3	Relate mechanics of alluvial rivers & restoration structures	3	9
BCE3607.4	Analyze hydraulic parameters related to river training works.	4	9
BCE3607.5	Apply the knowledge of river training & protection works for river training phenomena.	3	9

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7 - 7		W	Wardha Road, Nagpur-441 108							
			Ν	NAAC Accredited (A+ Grade)						
	(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)									
Program	1: B.'	Fech. Civil E	Engine	ering						
Semester-	VI	BCE3608: Bui	ilding C	Construction	Practice (PE-IV)	1				
Tea	ching	Scheme				Examinati	on Scheme			
Theory	y	3 Hrs/week				CT-I	15 Marks			
Tutoria	al					CT-II	15 Marks			
Total Cre	dits	3				CA	10 Marks			
Duration o	f ESE	: 3Hrs				ESE	60 Marks			
Pre-Requis	sites:	Concrete Techno	ology, B	Building Con	struction Material	Total Marks	100 Marks			
				Course	e Contents					
	Fou	ndations: Nece	essity a	nd types of	R.C.C. foundations, De	tail of Deep for	oundation and			
	preca	ast foundation is	in gener	ral, Details	shallow foundations. Bea	ring capacity o	f soils and its			
	asses	ssment. Presum	ptive b	earing capac	city values from codes. L	oads on founda	tions. Causes			
Unit I	of fa	ulures of found	lations	and remedia	al measures, Foundation	on black cotton	soils Setting			
	out f	oundation trenc	ches, ex	cavation tim	bering of foundation tren	ches.				
	Job layout Site: Clearance, layout for Load bearing and framed structures - Marking -									
	Eartl	hwork								
	Bric	kwork: Qualitie	ies of g	ood bricks,	classification of bricks te	sts on bricks as	per as codes.			
	Tern	ns used in bric	ckwork,	commonly	used types of bonds in	h brickwork suc	ch as header,			
	stret	cher, English an	nd Flem	nish bonds, p	principles of construction.	Reinforced brid	ckwork, brick			
Unit II	knog	gging. Parapets,	coping	s, sills and c	corbels, brief introduction	to cavity walls	, load bearing			
Unit II	and	partition walls.	Mason	ry construct	ion using cement concret	e blocks and cla	ay walls, load			
	bear	bearing and partition walls. Masonry construction using cement concrete blocks and clay								
	bloc	blocks. Precest Construction: Introduction to method and materials. Precast elements likes								
	poles, cover, jallies, steps corbets, truss element etc.									
	Ston	e Work Stone	es cutt	ting and dre	essing selection of stone	es types of sto	ne masonary			
	nrina	ciples of constru	uction i	oints in ma	sonary Lifting heavy stor	nes common bi	uilding stones			
	in India Arches and Lintels: Terminology in contraction types chaijas and canopies pre-									
Unit III	cast Lintels & Arches, Damp Proofing : Causes and effect of dampness. Various methods of									
	damp proofing Damp proofing in plinth protection New Techniques of Damp Proofing									
	Dam	p Proofing in Pl	linth Pr	otection, Ne	ew Techniques of Damp p	proofing. Epoxy	etc.			
	SUP	STRUCTUPE	E CON	STRUCTIO						
	Tech	niques of Box i	iacking	- Pipe Jack	ring _under water constru	ction of diaphra	om walls and			
	hase	ment-Tunneling	jacking a techni	j – Tipe Jaek Jaues – Pilin	ang -under water constru	ction of utaphia	g cofferdam -			
	cable	anchoring and	5 teenni I orontii	ng-driving d	ianhragm walls sheet nil	es - shoring for	deen cutting -			
Unit IV	well	noints -Dewater	ring an	d stand by P	lant equipment for under	pround open exc	avation			
	SUP	ER STRUCTU		ONSTRUC'	FION	Si suna open ext				
	Laur	ching girders h	bridge	decks. off sl	hore platforms – special	forms for shells	– techniques			
	for 1	neavy decks – i	in-situ	pre-stressing	in high rise structures	Material handli	ng – erecting			
Cint I V	well SUP Laur	points -Dewater ER STRUCTU aching girders, b	U RE CO bridge	d stand by P ONSTRUC decks, off sl	Tant equipment for undergeneration of the second se	ground open exc forms for shells	cavation - techniques			
	10r f	1eavy decks - 1	in-situ j	pre-stressing	g in mgn rise structures,	waterial handli	ng – erecting			

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	light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.					
	Floors : General principles, types and method of construction, floors finished quality, testing floor tiles, synthetic & Ceramic Tiles.					
Unit V	Roofs : Flat and pitches roofs, roof coverings, types AND their constructional features.					
Unit v	Plastering and Pointing : Necessity, types and methods					
	Painting : White washing, colour washing and distempering new materials & Techniques					
	Temporary Timbering : Centering and formwork shoring, underpining and scaffolding					
Text Boo	ks					
T.1	"Building Construction, Planning Techniques and Method of Construction" author by Arora S.P. and Bindra, Dhanpat Rai and Sons Publication, 2010.					
T.2	"Building construction" author by Varghese P.C., 2 nd edition, Prentice Hall of India Pvt. Ltd, New Delhi Publication, 2007.					
Т.3	"Building Construction" author by B.C. Punmia, Arun Kumar Jain, Ashook Kumar Jain, 11th Edition Laxmi Publications, 2005					
T.4	"Building Construction" author by Rangwala, , 33th Edition, Charotar Publishing House Pvt. Ltd.2017.					
Reference	e Books					
R.1	"Building Materials & Construction" author by Soni,S. 1 st edition REPRINT, S. K. Kataria And Sons publication.					
R.2	"Building Materials" author by Bhavikatti S.S, Vikas Publication					
R.3	"Building Construction," author by Sushil Kumar, 19th Edition, Standard Publisher Distributors New Delhi, 2001.					
R.4	"Construction Technology," Author by Sankar, S.K. and Saraswati, S., 3 rd Oxford University Press, New Delhi, 2008					
Useful L	inks					
1	https://nptel.ac.in/courses/105/102/105102088/					

	Course Outcomes	CL	Class Sessions
BCE3608.1	Illustrate the foundation and job site layout of Building.	3	9
BCE3608.2	Analyze various materials and precast construction techniques for building construction.	3	9
BCE3608.3	Identify the concept of stonework, lintel arches, damp proofing.	4	8
BCE3608.4	Analyze construction technique for substructure and superstructure.	4	10
BCE3608.5	Apply the knowledge of timbering, floors, roofs, painting and plastering for building construction.	3	9

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1	Tulsiramji Gaikwad-Patil College of Engineering and Technology									
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	(An Autonomou	NAAC Accredited (A+ Grade)	worsity Nagnur							
Program	n• R Tech Civil F	'ngineering	iversity, nagpur)						
Consister VI DCE2(00: A law and Deciding Constantial Mathematics Westerney)										
Teaching Scheme										
	2 Urs/wesh			15 Marka						
Tutor	el			15 Marks						
Total Cr	al adite 3	-		10 Marks						
Duration	of ESE: 3Hrs	-	ESE	10 Marks						
Duration (isites: Concrete Techno		Total Marks	100 Marks						
TTe-Kequ	isites. Concrete rechnic	Course Contents	I otal Marks	100 Marks						
T T •4 T			1 10							
Unit I	Types of foundation	is and construction methods; Basics of Forn	iwork and Stagin	g						
	Common building c	construction methods (conventional walls a	nd slabs; conven	tional framed						
Unit II	structure with block	-work walls); Modular construction method	Is for repetitive w	vorks;						
	Precast concrete con	Istruction methods; Basics of Slip forming I	or tall structures.	- f D - 1						
	Identification of cu	tting_edge sustainable construction materi	als technologies	s for Bridges;						
Unit III	management strateg	Identification of cutting-edge sustainable construction materials, technologies, and project								
	reduce the negative environmental impacts of construction activity.									
	Topographic mappi	Topographic mapping with LiDAP Technology characteristics of LiDAP instruments and								
	platforms used fo	lopographic mapping with LiDAR lechnology: - characteristics of LiDAR instruments and								
Unit IV	weaknesses of various LiDAR platforms and instruments for a broad range of application									
	scenarios, LiDAR uses & applications									
	Examination of the	e current LEED for New Construction ra	ating system, an	d case study						
	analysis of highly	analysis of highly successful recent "green construction projects" through student team								
Unit V	assignments and presentations. Preparation for the LEED Green Associate professional									
	licensing exam.									
Text Boo	ks									
T.1	"Building Construction Bindra, Dhanpat Rai ar	n, Planning Techniques and Method of Construct ad Sons Publication, 2010.	ction" author by A	rora S.P. and						
T.2	"Building construction" Delhi Publication, 2007	" author by Varghese P.C., 2 nd edition, Prentice 7.	Hall of India Pvt.	Ltd, New						
T.3	Project Planning & Con Laxmi Publications, Ne	Project Planning & Control with PERT&CPM" author by Punmia B.C. & Khandelwal K.K., ,7 th edition Laxmi Publications, New Delhi, 2016.								
T.4	"Building Construction	a" author by Kumar, S., 20 th "Building Construc	tion", Standard Pu	blishers. 2014						
Referenc	e Books									
R.1	"Soil Mechanics And F Publishers Distributors	Foundation Engineering" author by Arora K.R.	, 7 th edition REPI	RINT Standard						
R.2	"Design Of Foundation Narosa Publishing Hou	n Systems : Principles And Practices" author by use	Kurian Nainan P.	, 3 rd edition						
R.3	"Alternative building M Reddy, 5 th edition New	Materials and Technologies" author by K. S. Ja age international Publishers, 2007	gdish& B. V. Venl	katarama						

R.4	"Sustainable Building Design Manual- Volume I & II" author by TERI, 2 nd edition, Tata Energy Research Institute, 2009.						
Useful L	Useful Links						
1	https://nptel.ac.in/courses/105/102/105102195/						
2	https://nptel.ac.in/courses/105/105/10515157/						

	Course Outcomes	CL	Class Session s
BCE3609.1	Explain the types of foundation provided in building construction	3	7
BCE3609.2	Determine common building construction methods in civil engineering field.	3	9
BCE3609.3	Illustrate basic construction methods used for steel structures, bridges and their technologies.	3	10
BCE3609.4	Analyze the concept of LiDAR technologies and their applications.	4	10
BCE3609.5	Implement green construction project case studies and LEED rating system	3	9

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Program	Program: B.Tech. Civil Engineering									
Semester	Semester-VI BCE3610: Structural Audit & Retrofitting of Structures (PE-IV)									
Tea	ching Scheme						Examinati	on Scheme		
Theor	y 3 Hrs/w	eek					CT-I	15 Marks		
Tutoria	al						CT-II	15 Marks		
Total Cre	edits 3						СА	10 Marks		
Duration o	f ESE: 3Hrs						ESE	60 Marks		
Pre-Requi	sites: Concrete te	chnolo	ogy, Struct	tural Analy	sis		Total Marks	100 Marks		
				Course	e Contents	5				
Unit I	Introduction: earthquake, fir corrosion: corr corrosion indu introduction to retrofitting	Cau re, dar rosior iced t retro	nses of mage to se n induced by leaching of tting of	structural teel structu l by carbo ng of con structures	damages ures due to onation of acrete. Intra- t, its neces	: mechanical corrosion, dar concrete, chlo coduction to st sity, repairs, di	actions, chem nage to RC stru oride induced of ructural audit, fference betwee	actures due to corrosion and its necessity, en repairs and		
Unit II	Structural Audit: Structural audit, assessment of health of structure, study of structural drawings, visual observations, nature of distress, collapse and investigation, limitations on investigator, tools for investigation, various NDT methods for assessing strength of distressed materials, concrete endoscopy. Investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, role of client, architect, consulting engineer and contractor.									
Unit III	Structural Health Monitoring (SHM): Introduction to SHM, Local and Global techniques for SHM, short and long-term monitoring, active and passive monitoring, remote and wireless SHM Techniques. Instrumentation, data acquisition, data processing for SHM, Artificial Intelligence in SHM.									
Unit IV	Retrofitting of Structures: Methods of retrofitting: moisture barrier systems, mass reduction technique, jacketing, shortcreting, Ferro cement mesh, inserting new member, base isolation. Suitability of various retrofitting techniques for RC structures, steel structures and masonry structures and introduction to retrofitting of Historical Structures									
Unit V	FRP & Retrofitting of RC Columns and Beams: Fiber Reinforced Polymer (FRP), Types of FRP and their properties, advantages of FRP retrofitting, FRP retrofitting using FRP plates, FRP wrapping, FRP bars, National and International code provisions. Retrofitting of RC columns using FRP for axial confinement as per provisions of ACI 440. Analysis and design of RC beam using FRP, Retrofitting of RC Beams using FRP for flexural strengthening, shear strengthening, Provisions of ACI 440.									

Text Boo	bks			
T.1	"Concrete repair and maintenance", Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001.			
T.2	"Building: Structural Audit, Repairs and Restoration", Arun Kelkar, Majestic Publishing House			
Т.3	"Repair and protection of concrete structures", Noel P. Mailvaganam, CRC Press,1991 1 st edition (18 December 1991)			
T.4	A Handy Guide to Repairs, Rehabilitation and Waterproofing of RCC Building (Structures), Jayakumar J. Shah			
Reference Books				
R.1	ACI 440.2R-08, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures, American Concrete Institute.			
R.2	Maintenance, Repair & Rehabilitation & Minor Works of Building, by P C Varghese, PHI			
R.3	Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.			
R.4	Management of Deteriorating Concrete Structures, George Somerville, Taylor and Francis, Publication.			
R.5	"Retrofitting Design of Building Structures", Xilin lu, Science Press, New York (2010)			
Useful L	inks			
1	https://nptel.ac.in/courses/105/106/105106202/			

	Course Outcomes	CL	Class Sessio ns
BCE3610.1	Identify causes of deterioration in RC and steel structures	3	9
BCE3610.2	Explore entire process of structural audit.	4	9
BCE3610.3	Explore necessity and methods of structural health monitoring.	4	8
BCE3610.4	Explain method of retrofitting for RC, steel and historical structures	3	9
BCE3610.5	Design retrofitting using FRP for RC column and RC beam.	6	10

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Program		ing meeting					
Semester	-VI BCE3611: Con	nstruction Equipment and Automation (PE-I)	V)				
Tea	aching Scheme		Examination	on Scheme			
Theor	y 3 Hrs/week		CT-I	15 Marks			
Tutori	al		CT-II	15 Marks			
Total Cr	edits 3		CA	10 Marks			
Duration	of ESE: 3Hrs		ESE	60 Marks			
Pre-Requ	isites: Concrete Techno	ology, Surveying	Total Marks	100 Marks			
		Course Contents					
Unit I	Introduction: Uniq past history. Constr Productivity of Diff jacks and grouting e	ue features of construction equipment, Need uction Equipment: Capacity, Feasibility, ov Ferent Equipment: Excavators, Pavers, Plaste quipment; Cranes and Hoists, Concrete Batch	l of construction whing and opera- ring machines; hing Plants, etc.	n equipment, ating cost and Pre-stressing			
Unit II	Automation in Construction Industry: Need and Benefit of automation, Automation in Canal lining, Automation in Construction of Highway, Automation in concrete technology						
Unit III	Drones: Photogrammetry, Project Monitoring- real time data, aerial mapping, land survey, quantity survey, quality survey, structural health monitoring survey, underwater survey.						
Unit IV	Robotics in Construction: Introduction, Benefits of robots in construction industry with respect to time, cost, quality, safety. Use of robots for construction activities like Brick laying, Demolition, Material Handling, Structural steel cutting, Rebar tying/bending, Form work mould making, 3D printing- print complex, layered, parts and objects of homes, buildings, bridges and roads 3D Scanner for surveying and project management						
Unit V	Introduction to A Information Modelin	dvanced Technologies: Virtual Reality, A ng (BIM).	ugmented Real	ity, Building			
Text Boo	ks						
T.1	"Construction Planning	, Methods and Equipment", R L Peurifoy, McGra	aw Hill, 2011.				
T.2	"Construction Project 1 2011	nanagement, Theory & Practice", Kumar Neeraj	Jha, Pearson Edu	cation India,			
Reference Books							
R .1	"Construction Equipment and its Planning and Application" author by Dr. Mahesh Varma, 1 st edition, Metropolitan Book Company, New Delhi-, 1983						
R.2	"BIM and Construction Management: Proven Tools, Methods, and Workflows", By Brad Hardin, Dave McCool, John Wiley & Sons, 2 nd Edition. 2015						
R.3	"Automation in Constr RFID Technology", Jay	"Automation in Construction Management: Automated management of Construction Materials Using RFID Technology", Javad Mairouhi Sardroud, Scholars' Press, 2014					
R.4	"Enhancing BIM Meth	odology with VR Technology", Open access peer	[
R.5	"Robotics and Automation in Construction", Open access peer- reviewed edited volume						

Useful L	Useful Links				
1	https://nptel.ac.in/courses/105/102/105102088/				
2	https://nptel.ac.in/courses/105/106/105106053/				
3	https://nptel.ac.in/courses/105103206				

	Course Outcomes	CL	Class Sessio ns
BCE3611 .1	Derive feasibility of specific equipment in construction project conditions	3	8
BCE3611 .2	Selection of Automation techniques in construction industry		10
BCE3611 .3	Select suitable Drone technology for surveying and project management		8
BCE3611 .4	Analyze benefits of robotics versus conventional construction equipment		14
BCE3611 .5	Classify application of Virtual Reality, Augmented Reality, BIM in construction industry		5

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G

Progra	m: B. ′	Fech. Civil E	gineering			
Semester	r-VI	BCE3616: Geo	echnical Engineering Lab			
Te	aching	Scheme			Examination Schen	
Practi	cal	2 Hrs/week			CT-I	
					CT-II	
Total Ci	redits	1			СА	25 Marks
					ESE	25 Marks
Pre-Requ	isites: '	Transportation E	gineering		Total Marks	50 Marks
			Course Contents			CO
1	1 To determine the moisture content (water content) of a given soil sample.		CO1			
2	To det	ermine the speci	ic gravity of the soil sampl	le.		CO1
3	To cla	ssify the coarse-	rained soils			CO1
4	To det	ermine liquid lii	it and plastic limit of soil.			CO2
5	To det	ermine the shrin	age limit of soil and calcul	late shrinkage fac	ctors.	CO2
6	To det	ermine coefficie	nt of permeability of given	soil sample at de	sired density b	y CO3
U	a suitable method.			0.05		
7	To determine the mass density of soils by Sand replacement method.			CO1		
8	To determine the mass density of soils by Core Cutter method.			CO1		
9	Proctors' compaction Test and Proctor needle test.			CO4		
10	To determine the unconfined compressive strength of cohesive soil sample.		CO4			
11	To det	termine shear st	ength parameters of the gi	iven soil sample	by Direct Shea	r CO4
	Test.					
12	To det	ermine CBR val	e of the given soil sample			CO4
Text Boo	oks					
T.1	Soil M	Iechanics & Foun	ation Engineering - K.R. Arc	ora, Standard Publis	sher	
T.2	Soil M	Iechanics & Foun	ation Engineering - B.C.Pun	mia, Laxmi Publica	ation	
T.3	Basic	& Applied Soil M	echanics - Gopal Rajan & Ra	o, Newage Internat	ional Publication	l
T.4	Geote	chnical Engineeri	g - P. Raj, Dorling Kindersle	y Pvt. Ltd		
Reference	ence Books					
R .1	Soil M	Soil Mechanics & Foundation Engineering - Modi, Std. Publisher				
R.2	R.2 Soil Mechanics & Foundation Engineering - V.N.S. Murthy, CBS Publisher					
Useful L	inks					
1	https:/	/nptel.ac.in/cours	<u>s/105/101/105101201/</u>			
2	https:/	/nptel.ac.in/cours	<u>s/105/105/105105168/</u>			
3	https:/	/nptel.ac.in/cours	\$/105/106/105106142/			

	Course Outcomes	CL	Lab Sessions
BCE3616.1	Illustrate the index and engineering properties of the soil	4	6
BCE3616.2	Examine properties & interaction between water and soil	5	4
BCE3616.3	Compute principles of compaction and consolidation settlement of soil	5	4
BCE3616.4	Analyze bearing capacity, earth pressure and foundation settlement of soil	4	4

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Program:	B.Tech. Civil E	ngineering			
Semester-VI	BCE3617: Ste	el Structures Lab			
Teachi	ing Scheme		Examinat	ion Scheme	
Practical	2 Hrs/week		CT-I		
			CT-II		
Total Credit	s 1		CA	25 Marks	
			ESE	25 Marks	
Pre-Requisite	es: Mechanics of Sol	id	Total Marks	50 Marks	
		Course Contents			
	a) Design of Con	nection (Beam to Beam)			
1	b) Design of Cor	nection (Beam to Column)		CO3	
		· · ·			
_	a) Design of Lac	eed and Battened Columns			
2	b) Design of Bo	Ited and Welded End Connection	CO5		
	a) Design of Slat	Base Column			
3	b) Design of Gusseted Base Column			CO5	
	0) 2 001gii 01 000				
4 Design of Plate C		Girder		CO4	
	Design of Trate C	Jildel		0.04	
_				CO1, CO2,	
5	Minimum One S	e Site visit to Steel Structures		CO3, CO4,	
Tort Doole				C05	
1 ext Books	4F 1 4 1 6 6		11: 110		
T.1	2013	structural Steel Design", authored by M. L. Gai	mbhir, McGraw	Hill Education,	
T.2	"Design of Steel S Edition, 2008	Structures", authored by N. Subramanian, OX	KFORD Univers	sity Press, First	
Т.3	"Limit State Desig Private Limited, 20	n of Steel Structures", authored by S. K. Du	ıggal, McGraw	Hill Education	
T.4	"Design of steel structure" authored by L.S. Negi, Tata Mc Graw hills Publisher Co. Ltd, New Delhi, 1986.			r Co. Ltd, New	
Reference Books					
R.1	"Stability Analysis and Design of Steel Structure", authored By M. L. Gambhir, McGraw Hill Education, 2004.				
R.2	"Design of steel str	ucture "authored by S. S. Bhavikatti, dreamtech,	distributed by W	Villey, 2009.	
R.3	"Design of steel structure" authored by A. S. Arya and J.L. Ajmani, Nem chand bros, Roorkee, 2011.				
R.4	"Design of steel structure" authored by P Dayaratnam, S. Chand of Co. Delhi 2003 edition,2012.				

Useful Links				
1	https://nptel.ac.in/courses/105/105/105105162/			
2	https://nptel.ac.in/courses/105/104/105104030/			
3	https://nptel.ac.in/courses/105/101/105101082/			

	Course Outcomes		Lab Sessio ns
BCE3617.1	Use the knowledge of IS code of practice (IS 800) for the design of steel structural elements.		2
BCE3617.2	Design structural fasteners (Bolted and welded connections) used in steel construction.		2
BCE3617.3 Design the Tension and Compression members.		6	6
BCE3617.4	Design simple & built-up beams and built-up columns.	6	4
BCE3617.5 Design Axially loaded columns		6	10

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Program: B.Tech. Civil Engineering					
Semester-VI BCE3618: Advanced Fluid Mechanics Lab					
Tea	ching S	Scheme		Examinat	ion Scheme
Practic	al	2 Hrs/week		CT-I	
				CT-II	
Total Cr	edits	1	1 CA		25 Marks
				ESE	25 Marks
Pre-Requisites: Fluid Mechanics I, Engineering mechanics Total Mark			Total Marks	50 Marks	
			Course Contents		
1	Study	of flow around	d immersed bodies.		CO1
2	Detern	mination of Da	rcy-Weisbach friction factor for given pipe	es.	CO1
3	Detern	mination of Ma	anning's or Chezy's Constant and for an op	en channel.	CO3
4	Devel	oping specific	energy diagram for a rectangular channel.		CO4
5	Study	of GVF profil	es.		CO3
6	Study	of hydraulic ju	Imp in a horizontal rectangular channel.		CO4
7	Study	and performation	nce of Francis turbine.		CO5
8	Study	and performat	nce of Pelton Wheel turbine.		CO5
9	Study and performance of Centrifugal pump CO5			CO5	
10	Study	and performan	nce of Reciprocating pump		CO5
11	Proble	em on pipe net	work analysis manually and using applicati	on software.	CO2
12	Establ chann	lishment of sub el.	o critical, critical and super critical flow in o	open	CO3
Text Boo	ks				
T.1	" Hydra	aulics and Fluid	mechanics ", authored by Modi& Seth, Standa	rd Book House, D	elhi,2017.
Т.2	"Fluid Mechanics And Fluid Power Engineering" authored by Kumar D.S., S.K.Kataria And Sons, 1998.			aria And Sons,	
Т.3	"Flow i	in open channels	", authored by Subramanya K, Tata McGraw H	Hill Publication, 2	009.
T.4	"Fluid Mechanics: Including Hydraulic Machines" authored by Jain, A.K. , INT Khanna Publishers, 2009.				
Referenc	e Books	5			
R.1	R.1 "Open channel hydraulics", authored by VenTeChow , International Student Edition. McGraw Hill, 2009.				
R.2	"Engine	eering Fluid Me	chanics" authored by Garde, Mirajgaonkar, Sci	tech Publication,	2010.
R.3	"Flow t	hrough open ch	annels", authored by K.G.RangaRaju,Tata McC	Graw Hill Publicat	ions, 1998.

R.4	"Fluid Mechanics, Hydraulics And Hydraulic Machines" authored by Arora K.R.,NT Standard Publishers Distributors, 2005.
Useful L	inks
1	https://fmc-nitk.vlabs.ac.in/fluid-machinery/
2	http://eerc03-iiith.vlabs.ac.in/
3	https://nptel.ac.in/courses/105/101/105101082/

	Course Outcomes	CL	Lab Session s
BCE3618.1	Determine the losses in pipe network using Darcy-Weisbach and Hazen William's equation.	3	4
BCE3618.2	Design the pipe network system and its components including water hammer pressure.	6	2
BCE3618.3	Apply the concepts of uniform and critical flow through open channels including efficient channel sections.	3	6
BCE3618.4	Analyze energy concepts in the open channel flow and undertake Rapidly Varied flow.	4	4
BCE3618.5	Apply the concept hydraulic machine in performance of Power plant.	3	8

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r rogram: D. rech. Civil Engineering								
Semester-VI BCEXX08: Metro Systems & Engineering (Open Elective-II)								
Teaching Scheme			Examinati	Examination Scheme				
Theory	3 Hrs/week		CT-I	15 Marks				
Tutorial			CT-II	15 Marks				
Total Credi	ts 3		CA	10 Marks				
Duration of I	ESE: 3Hrs		ESE	60 Marks				
Pre-Requisit	es: Transportation Er	gineering, Surveying	Total Marks	100 Marks				
Course Contents								
Unit I	General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials.							
Unit II	Civil Engineering- Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management							
Unit III	Electronics and Communication Engineering- Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.							
Unit IV	Mechanical & TVS, AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators.							
Unit V	ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.							
Text Books	1							
T.1	Paul E. Garbutt, "W	Vorld Metro Systems Paperback", 1 April	1997.					
T.2	S.Ponnuswamy, (Late) Dr. David Johnson Victor," Urban Transportation: Planning, Operation and Management", 2012, McGraw Hill.							
T.3	M. M. Agarwal, Sudhir Chandra, K. K. Miglani "Metro Rail in India for Urban Mobility", 2021, Prabha & co.							
T.4	"A systems approach to developing a new metro for megalopoleis" September 19, 2016,							
Reference Books								
R.1	Handbook of Research on Emerging Innovations in Rail Transportation Engineering by B. Umesh Rai (Chennai Metro Rail Limited, India)							

Useful Links				
1	https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_48.pdf			
2	https://nptel.ac.in/courses/117/101/117101050/			

	Course Outcomes	CL	Class Sessio ns
BCEXX08.1	Use the knowledge of metro systems in its planning and construction	3	9
BCEXX08.2	Apply the Knowledge of survey investigation for the construction planning and management	3	9
BCEXX08.3	Illustrate electronic signaling systems and Automatic fare collection.	3	9
BCEXX08.4	Construct the Tunnel Ventilation, Station Air conditioning and all Mechanical Devices	3	9
BCEXX08.5	Apply the knowledge of Traction power, TSS and ASS power for Metro.	3	9

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