Department of Civil Engineering

B.Tech. curriculum (W.E.F. 2018-2019)

Vision

[1]. To impart knowledge, advanced skills, excellence in scientific and technical education and research with global perspectives in infrastructural developments with modern trends.

[2]. To encourage students to imbibe the engineering ethics to serve India and World.

[3]. To serve as a valuable resource for societal needs and economic growth of the country.

Mission

[1]. To provide quality education with ethical values in commensuration with balanced curriculum

[2]. To provide advanced skills and knowledge in design, construction, consultancy and develop the state-of-the-art research facilities

[3]. To serve as a knowledge base and create professional expertise for the community

[4]. To promote innovative and original thinking in the minds of civil engineering graduates

PEOs (Program Educational Objectives) for B. Tech Program of Civil Engineering Department:

PEO #1: Knowledge of Basic Science and Engineering

To establish confidence in basic/fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities for a successful civil engineering career.

PEO #2: Engineering Design and Skills

To impart knowledge and skills necessary for identifying and assessing Civil Engineering design solutions and the related social, economic and public safety impacts.

PEO #3: Encouraging Lifelong Learning

To encourage engineering graduates for obtaining professional license, assuming leadership roles, engaging in life-long learning.

PEO #4: Incubating Professional and Ethical Attitude

To nurture students' ability to deal effectively with ethical and professional issues, taking into account the broader societal implications of Civil Engineering.

Program Outcomes (POs):

Undergraduate engineering programmes are designed to prepare graduates to attain the following program outcomes:

PO	PO Description	
PO #1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering	
	fundamentals, and an engineering specialization to the solution of complex engineering	
	problems.	
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PO #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.
PO #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.
PO #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.
PO #5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO #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.
PO #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.
PO #7 PO #8	 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. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO #7 PO #8 PO #9	 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. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO #7 PO #8 PO #9 PO#10	 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. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. 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.
PO #7 PO #8 PO #9 PO#10 PO#11	 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. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. 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. 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.

Program Specific Outcomes (PSOs):

PSO #1: Develop the ability to plan, analyze, design and prepare cost estimates of various civil engineering projects.

PSO #2: Apply computer aided skill and tools, execute various civil engineering projects.

PSO #3: Implement various codal provisions/guidelines as applicable to design and civil engineering profession.

NB.: COs will be as per the Faculty concerned... and the Correlation Level of Co vs PO as below

"1" – Slight (Low) Correlation

"2" – Moderate (Medium) Correlation

"3" - Substantial (High) Correlation

Total Course Credit points: 164

	SEMESTER - I									
Sl No.	Code	Subject	L	Т	S	С	Η			
1	MAC01	Mathematics - I	2	1	0	3	3			
2	PHC01	Physics	2	1	0	3	3			
3	CYC01	Chemistry	2	1	0	3	3			
4	XEC01	Engineering Mechanics	2	1	0	3	3			
5	ESC01	Environmental Science	2	0	0	2	2			
6	BTC01	Life Science	2	0	0	2	2			
7	PHS01	Physics Laboratory	0	0	2	1	2			
8	CYS01	Chemistry Laboratory	0	0	2	1	2			
9	WSS01	Workshop Practice	0	0	2	1	2			
10	XES01	Co-curricular Activities - I	0	0	2	0	2			
11	HSC01	Values and Ethics	0	0	0	0	0			
		TOTAL	12	4	8	19	24			

	SEMESTER - II										
Sl No.	Code	Subject	L	Т	S	С	н				
1	MAC02	Mathematics - II	2	1	0	3	3				
2	CSC01	Introduction to Computing	2	1	0	3	3				
3	ECC01	Basic Electronics	2	1	0	3	3				
4	EEC01	Electrical Technology	2	1	0	3	3				
5	MES01	Engineering Graphics	1	0	2	2	3				
6	CSS01	Computing Laboratory	0	0	2	1	2				
7	ECS01	Basic Electronics Laboratory	0	0	2	1	2				
8	EES01	Electrical Technology Laboratory	0	0	2	1	2				
9	HSS01	Professional Communication	1	0	2	2	3				
10	XES02	Co-curricular Activities - II	0	0	2	0	2				
		TOTAL	10	4	12	19	26				
SOME FIRS C	SOME OF THE SUBJECTS ABOVE ARE GROUPED FOR INTERCHANGE BETWEEN FIRST AND SECOND SEMESTER FOR HALF OF THE STUDENT HAVING TOTAL CREDIT UNIT 38 IN FIRST YEAR (1ST AND 2ND SEMESTER COMBINED)										

2017-18 (1st Year Credit = 38)

Total Course Credit points: 170

	SEMESTER - I											
Sl No.	Code	Subject	L	Т	S	С	Н					
1	MAC01	Mathematics - I	3	1	0	4.0	4					
2	PHC01	Engineering Physics	2	1	0	3.0	3					
3	CYC01	Engineering Chemistry	2	1	0	3.0	3					
4	XEC01	Engineering Mechanics	2	1	0	3.0	3					
5	ESC01	Environmental Science	2	0	0	2.0	2					
6	XES51	Engineering Graphics	1	0	3	2.5	4					
7	HSS51	Professional Communication Laboratory	1	0	2	2.0	3					
8	PHS51	Physics Laboratory	0	0	2	1.0	2					
9	CYS51	Chemistry Laboratory	0	0	2	1.0	2					
10	WSS51	Workshop Practice	0	0	3	1.5	3					
11	XXS51	Co-curricular Activities - I	0	0	2	1.0	2					
		TOTAL	13	4	14	24.0	31					

	SEMESTER - II									
Sl No.	Code	Subject	L	Т	S	С	Н			
1	MAC02	Mathematics - II	3	1	0	4.0	4			
2	CSC01	Introduction to Computing	2	1	0	3.0	3			
3	ECC01	Basic Electronics	2	1	0	3.0	3			
4	EEC01	Electrical Technology	2	1	0	3.0	3			
5	BTC01	Life Science	2	0	0	2.0	2			
6	XES52	Graphical Analysis using CAD	0	0	2	1.0	2			
7	CSS51	Computing Laboratory	0	0	2	1.0	2			
8	ECS51	Basic Electronics Laboratory	0	0	2	1.0	2			
9	EES51	Electrical Technology Laboratory	0	0	2	1.0	2			
10	XXS52	Co-curricular Activities - II	0	0	2	1.0	2			
		TOTAL	11	4	10	20.0	25			

2018-19 (1st Year Credit = 44)

	SEMESTER - III										
Sl No.	Code	Subject	L	Т	S	С	Н				
1	MAC331	Mathematics - III	3	1	0	4	4				
2	CEC301	Solid Mechanics	3	1	0	4	4				
3	CEC302	Fluid Mechanics	3	0	0	3	3				
4	CEC303	Building Construction & Concrete Technology	3	1	0	4	4				
5	ESC331	Engineering Geology for Civil Engineering	3	0	0	3	3				
6	ESS381	Engineering Geology Laboratory for Civil Engineering	0	0	3	1.5	3				
7	CES351	Fluid Mechanics & Strength of Material Laboratory	0	0	3	1.5	3				
8	XXS381	Co-curricular Activities - III (Optional)	0	0	0	0	0				
		TOTAL	15	3	6	21	24				

N.B.: Although XXS381 is non-credit, participation will enrich individual grade card.

SEMESTER - IV									
Sl No.	Code	Subject	L	Т	S	С	Η		
1	CEC401	Structural Analysis-I	3	1	0	4	4		
2	CEC402	Design of Concrete Structures	3	1	0	4	4		
3	CEC403	Surveying	3	0	0	3	3		
4	CSC432	Data Structure	3	0	0	3	3		
5	CEO44* HSC431	Open Elective - I Psychology	3	0	0	3	3		
6	CES451	Structural Analysis Sessional-I	0	0	3	1.5	3		
7	CES452	Design of concrete Structures Sessional	0	0	3	1.5	3		
8	CSC482	Data Structure Sessional	0	0	3	1.5	3		
9	XXS481	Co-curricular Activities - IV (Optional)	0	0	0	0	0		
		TOTAL	15	2	9	21.5	26		

N.B.: Although XXS481 is non-credit, participation will enrich individual grade card.

	SEMESTER - V									
Sl No.	Code	Subject	L	Т	S	С	Н			
1	CEC501	Structural Analysis-II	3	1	0	4	4			
2	CEC502	Design of Steel Structures	3	1	0	4	4			
3	CEC503	Soil Mechanics	3	0	0	3	3			
4	CEC504	Transportation Engineering	3	1	0	4	4			
5	CEO54*	Open Elective - 2	3	0	0	3	3			
6	CES551	Structural Analysis Sessional-II	0	0	3	1.5	3			
7	CES552	Design of Steel Structures Sessional	0	0	3	1.5	3			
8	CES553	Transportation Engineering & Soil Mechanics Laboratory	0	0	3	1.5	3			
9	CES554	Surveying Laboratory & Estimation Sessional	1	0	3	2.5	4			
10	XXS581	Co-curricular Activities - V (Optional)	0	0	0	0	0			
		TOTAL	16	3	12	25	31			

N.B.: Although XXS581 is non-credit, participation will enrich individual grade card.

SEMESTER - VI									
Sl No.	Code	Subject	L	Т	S	С	Н		
1	HSC631	Economics and Management Accountancy	3	0	0	3	3		
2	CEC601	Water Resource Engineering	3	1	0	4	4		
3	CEC602	Foundation Engineering	3	0	0	3	3		
4	CEC603	Environmental Engineering	3	1	0	4	4		
5	CEE610-619	Depth Elective - 1	3	0	0	3	3		
6	CEE620-629	Depth Elective - 2	3	0	0	3	3		
7	CES651	Environmental Engineering Laboratory & Computational Laboratory- I	0	0	3	1.5	3		
8	CES652	Concrete Technology Laboratory	0	0	3	1.5	3		
9	XXS681	Co-curricular Activities - VI (Optional)	0	0	0	0	0		
		TOTAL	18	2	6	23	26		

N.B.: Although XXS681 is non-credit, participation will enrich individual grade card.

	SEMESTER - VII										
Sl No.	Code	Subject	L	Т	S	С	Η				
1	MSC731	Principles of Management	3	0	0	3	3				
2	CEE710-719	Depth Elective - 3	3	0	0	3	3				
3	CEE720 -729	Depth Elective - 4	3	0	0	3	3				
4	CEE730 -739	Depth Elective - 5	3	0	0	3	3				
5	CEO74*	Open Elective - 3	3	0	0	3	3				
6	CES751	Project - I	0	0	4	2	4				
8	CES752	Structural Engineering Laboratory & Computational Laboratory -II	0	0	3	1.5	3				
9	CES753	Vocational Training / Summer Internship and Seminar	0	0	2	1	2				
		TOTAL	15	0	9	19.5	24				

	SEMESTER - VIII									
Sl No.	Code	Subject	L	Т	S	С	H			
1	CEE810-819	Depth Elective - 6	3	0	0	3	3			
2	CEO84*	Open Elective - 4	3	0	0	3	3			
3	CEO85*	Open Elective - 5	3	0	0	3	3			
4	CES851	Project - II	0	0	15	5	15			
5	CES852	Project Seminar	0	0	0	1	0			
6	CES853	Viva Voce	0	0	0	1	0			
		TOTAL	9	0	15	16	24			

OPEN ELECTIVES

The students can opt from elective subject(s) that are offered in a particular semester, except the subjects with his /her own department code.

	OPEN ELECTIVE – 1 : SEMESTER-IV										
Sl No.	Code	Subject	L	Т	S	С	H				
1	CEO440	Introduction to Earthquake Engineering	3	0	0	3	3				
2	CEO441	Elementary Civil Engineering	3	0	0	3	3				
3	CEO442	Experimental Methods & Analysis	3	0	0	3	3				

OPEN ELECTIVE – 2 : SEMESTER-V										
Sl No.	Code	Subject	L	Т	S	С	Н			
1	CEO540	Numerical Methods in Engineering	3	0	0	3	3			
2	CEO541	Engineering Computing and Simulation with Scilab	3	0	0	3	3			
3	CEO542	Introduction to Random Vibrations	3	0	0	3	3			

	OPEN ELECTIVE – 3 : SEMESTER-VII										
Sl No.	Code	Subject	L	Т	S	С	Η				
1	CEO740	Mechanics of Composite	3	0	0	3	3				
2	CEO741	Optimization in Engineering Design	3	0	0	3	3				
3	CEO742	Theory of Elasticity and Plasticity	3	0	0	3	3				

OPEN ELECTIVE – 4 : SEMESTER-VIII										
Sl No.	Code	Subject	L	Т	S	С	Н			
1	CEO840	Finite Element Analysis and Applications	3	0	0	3	3			
2	CEO841	Disaster Management and Mitigation	3	0	0	3	3			
3	CEO842	Experimental Methods in Engineering	3	0	0	3	3			

OPEN ELECTIVE – 5: SEMESTER-VIII										
Sl No.	Code	Subject	L	Т	S	С	Н			
1	CEO850	Watershed Planning and Management	3	0	0	3	3			
2	CEO851	Elementary Structural Design	3	0	0	3	3			
3	CEO852	Reliability Engineering	3	0	0	3	3			

DEPTH ELECTIVES

The students primarily will opt from elective subject(s) that are offered in a particular semester by his /her own department. However, a student can opt for elective subject(s) that are offered by other department in a particular semester, with the permission/ consent from his/her Head of the Department and the concerned teacher of that subject.

DEPTH ELECTIVE – 1 : SEMESTER-VI										
Sl No.	Code	L	Т	S	С	H				
1	CEE610	Advanced Design of Concrete Structures	3	0	0	3	3			
2	CEE611	Advanced Structural Analysis	3	0	0	3	3			
3	CEE612	Mechanics of Composite Structures	3	0	0	3	3			
4	CEE613	Material Technology	3	0	0	3	3			
5	CEE614	Applied Numerical Methods	3	0	0	3	3			
6	CEE615	Bridge Engineering	3	0	0	3	3			

	DEPTH ELECTIVE – 2 : SEMESTER-VI										
Sl No.	Code	Subject	L	Т	S	С	Н				
1	CEE620	Analysis and Design of Pavement	3	0	0	3	3				
2	CEE621	Finite Element Method	3	0	0	3	3				
3	CEE622	Ground Improvement	3	0	0	3	3				
4	CEE623	Remote sensing and GIS	3	0	0	3	3				
5	CEE624	Traffic Engineering and Management	3	0	0	3	3				
6	CEE625	System Approach to Civil Engineering	3	0	0	3	3				

	DEPTH ELECTIVE – 3 : SEMESTER-VII										
Sl No.	Code	Subject	L	Т	S	С	Н				
1	CEE710	Structural Dynamics	3	0	0	3	3				
2	CEE711	Advanced Design of Steel Structures	3	0	0	3	3				
3	CEE712	Theory of Plates and Shells	3	0	0	3	3				
4	CEE713	Theory of Elasticity and Plasticity	3	0	0	3	3				
5	CEE714	Structural Health Monitoring	3	0	0	3	3				

	DEPTH ELECTIVE – 4 : SEMESTER-VII										
Sl No.	Code	Subject	L	Т	S	С	Н				
1	CEE720	Soil Dynamics	3	0	0	3	3				
2	CEE721	Environmental Pollution and control	3	0	0	3	3				
3	CEE722	Construction Planning and Management	3	0	0	3	3				
4	CEE723	Open Channel Hydraulics	3	0	0	3	3				
5	CEE724	Ground Water	3	0	0	3	3				
6	CEE725	Hydrology & Irrigation Engineering	3	0	0	3	3				

DEPTH ELECTIVE – 5 : SEMESTER-VII										
Sl No.	Code	Subject	L	Т	S	С	Н			
1	CEE730	Principles of Reliability	3	0	0	3	3			
2	CEE731	Offshore Structural Dynamics	3	0	0	3	3			
3	CEE732	Pre-stressed Concrete	3	0	0	3	3			
4	CEE733	Advanced Concrete Technology	3	0	0	3	3			
5	CEE734	Advanced Structural Mechanics	3	0	0	3	3			

DEPTH ELECTIVE – 6 : SEMESTER-VIII											
Sl No.	Code	Subject	L	Т	S	С	Η				
1	CEE810	Sediment Transport	3	0	0	3	3				
2	CEE811	Slope Stability and Reinforced Earth	3	0	0	3	3				
3	CEE812	Soil Structure Interaction	3	0	0	3	3				
4	CEE813	Industrial Waste	3	0	0	3	3				
5	CEE814	Water Resources System Planning & Management	3	0	0	3	3				
6	CEE815	Machine Foundation	3	0	0	3	3				

Course	Title of the	Program Core	Total N	umber o	f contact l	iours			
Code	course	(PCR) / Electives	Lecture	Tutorial	Practical	Total	Credit		
		(PEL)	(L)	(T)	(P)	Hours			
CEC-301	Solid Mechanics	PCR	3	1	0	4	4		
Pı	re-requisite(s)		Course .	Assessme	nt method	S			
Knowle	dge of Engineering	Continuo	ous (CT) an	d end ass	essment (E	EA). CT+	-EA		
Mechani	cs and Mathematics								
C	• CO1: Development	of skills for predictin	ng structura	l behavio	ur of solid	s under d	lifferent loads		
Course	• CO2: Knowledge o	f basics of analysis a	and design	of structu	iral compo	onents ma	ade of variety		
Outcomes	of materials								
(COs):	• CO3: Developing th	e requisite skill that helps in studying the advanced courses							
	Concept of stress and	and strain: Normal and shear stresses and strains in axially loaded mem							
	Elastic moduli and the	ir inter-relationships,	, strain ener	gy due to	direct stre	esses, imp	pact loads. (4)		
	Beam Statics: Definitions, support types and support reactions, concepts of redund force and bending moment diagrams for beams (8)						ndancy, shear		
	force and bending moment diagrams for beams. (8)								
	Symmetric Beam Be	atical assun	nptions, n	noment of	inertia, e	elastic flexure			
	formulae and its applic	cation, moment carry	ing capacit	y. (3)					
	Bending stress and S	hear stress distribu	tions in be	am sectio	ns, Combi	ned bend	ing and direct		
Topics	stresses. (8)								
Covered	Strain energy: Due to	pure bending and sh	learing stres	ss. (2)					
(Hrs)	Deflection of beams	: Moment-curvature	relationshi	ip, detern	nination o	f deflect	ion by direct		
(1113)	integration method, me	oment area method a	nd energy r	nethod. (6)				
	Torsion: Pure torsion	h, Torsion of circula	r solid sha	aft, closed	d coil heli	cal sprin	ig. Combined		
	bending and torsion. (4	1)			1				
	Two dimensional str	ess problems: Princ	ipal stresse	s, maxim	um shear	stresses,	Mohr's circle		
	of stresses, constructio	of stresses, construction of Mohr's circle. (4)							
	Thin pressure vessels	: Hoop stress and me	eridional str	ess, volu	metric chai	nges (2)			
	Columns: Fundament	als, different types of	of equilibriu	um, colur	nn bucklin	g theory	, Euler's load		
	for columns, limitatic	ons of Euler's theor	y – proble	ems, ecce	ntric load	and sec	ant formulae,		
	empirical column form	ulae & IS code form	ulae. (4)						
	Text Books:								
Text	Text 1. Elements of Strength of Material by S. P. Timoshenko & D. H. Young								
Books, 2. Strength of Materials by S SBhavikatti									
and/or	3. Engineering Mechai	nics of Solids by E. F	P. Popov						
reference	Reference Books:								
material 4. Strength of Material by Singer & Pytel									
(s)	5. A Text Book of Str	ength of Materials by	y Ghosh &	Datta, No	ew Age In	ternation	al Publication		
Manaina	Pvt. Ltd, New Delhi								

mu	pping '					100									
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management $\&$ finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO2	-	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	3	-	2	-	-	-	-	-	-	-	-	3	2	3

Cou	irco	Tit	le of t	ho	Pro	ogram	Core	[Fotal N	lumber	of con	tact ho	urs		
Col	ode	(course		(PC)	R) / E (PEI	lective L)	s Lo	ecture (L)	Tutori (T)	al Pra	ctical P)	Total Hours	Cre	dit
CEC	-302	Fluid	Mech	anics		PCI	ł		3	0		0	3	3	
	Pr	e-requi	isite(s)						Cours	e Asses	sment r	nethods	3		
		Mecha	nics				Cont	inuous	s (CT) :	and end	lassessi	ment (E	EA). CT	+EA	
Cou	ırse	• CC)1: De	velopn	nent of	f skills	for pre	edictin	g fluid	behavi	our				
Outco	omes	• CC	02: Kn	owledg	ge of b	asics o	of fluid	l flow	measui	rement	and mo	del dev	elopme	nt	
(CC) s):	• CC	03: De	velopiı	ng the	requis	ite skil	1 that 1	helps in	n studyi	ng the a	advance	ed cours	ses	
		Fluid	Prope	rties:	Equati	ions of	State,	Units	and D	imensic	ons, Flu	id Press	sure, Pr	essure G	auges,
		Result	ant Pr	essure	on Pla	ane an	d Curv	ved Im	merse	d Surfa	ces, Cei	ntre of	Pressur	e, Equil	ibrium
		of Floa	ating E	Bodies,	Buoy	ancy a	nd Me	ta Cer	tre. (9))					
		Types	of F	low: D	Definit	ions, (Continu	uity E	quatior	n, Equa	tion of	Flow	along a	Stream	Line,
		Energ	y Equa	ation,	Mome	ntum	Equati	on, Fl	uid Ac	celerati	on, Flo	w in a	Curved	d Path, I	Forced
Top	pics	and Fr	ee Vo	rtex. (7	7)										
Cov	ered	Dime	nsiona	l Anal	ysis: S	Similit	ude of	fluid f	low, no	on-dime	ensional	numbe	ers. (3)		
(H	rs)	Incom	press	ible fl	ow in	close	d con	duits:	Lamin	ar and	Turbul	ent Flo	w, Crit	ical Rey	ynold's
		Numb	er, Pip	pe Fric	ction I	Law, I	Lamina	r Flov	w in P	ipes, F	riction	Loss in	n Smoo	th and	Rough
		Pipes,	Minor	: Losse	es in Pi	ipes, H	IGL an	d EGI	_, Emp	irical F	ormula	for Pip	e flow.	(6)	
		Flow	measu	remen	nt: Ori	fice co	pefficie	ent, Ex	cternal	and Re	entrant	Mouth	pieces,	Measu	rement
		of Ve	locity	and D	ischar	ge in	Closed	l Cono	luits, V	√enturii	neter, (Drificer	neter a	nd Pitot	Tube,
		Flow t	hroug	h Recta	angula	r Wei	rs and $\sum_{n=1}^{\infty}$	V-Not	ch, Tin	ne of Ei	nptying	g Tanks	and Re	servoirs	. (7)
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CO2	-	2	3	1	-	-	-	-	-	-	-	-		2	1
CO3	-	3	-	2	-	-	-	-	-	-	-	-	-	3	2

Соц	rse				P	rogram	Core	Tota	al Num	ber of	contac	t hours		
Co	de	Title	e of the cou	irse	El	(PCR) ectives ()/ PEL)	Lect	ure Tut	torial	Practical	Total		edit
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		Pre-requ	uisite(s)					Cou	rse Asse	essment	methods	8		
		No pre-r	equisites			C	ontinuo	ous (CT) and en	nd asses	sment (E	EA). CT	+EA	
Cou	ırse	• CO1: .	Acquire kn	owledge	e of s	election	and ap	plicati	on of b	uilding	g materi	als		
Outco	omes	• CO2:	Understand	the build	ling c	omponen	ts and j	plannin	g					
	JS):	• CO3: •	Gain an int	egrative	e idea	on mate	erials, p	orepara	tion an	d mix	design o	of conc	rete	
		A). Buil	ding planr	ning an	d con	istructio	n: Pla	nning	and ori	entatio	n of bui	ldings,	Introd	uction
		to differe	ent compor	ients an	d fun	ctions of	t a buil	lding 11	n detail	s: Fou	ndation,	Wall,	Beam,	Floor,
		R001, St	air & Stairc ding Motor	case, Do	oor, v	vindow,	and et	C. (10) + huild	in a mad	tomiolo	(2)			
		B). Bull	ung Mate	riais: B		uea on u	maaha	t Dulla	ng mai	lerials	(2)	of find	and	200*20
		Aggrega	iles: Class	rd tog	n, sai	Inping, Iolotorio		unical,	physic All	ai pro	perues	or nine	e and (coarse
		aggregat	es, staliua	of agar	us, u	(A)	is sui	JStance	-s, All	kan-ag	gregate	Teacti	on, u	lermai
		Cement	• Introduc	of aggre	egale. Shemi	. (4) ical cor	nnositi	on n	naior (romno	unde k	vdrati	on nh	vsical
		nronertie	s testing	finenes	s cor	nsistency	settir	ng time	sound	dness	strength	heat	of hydi	ration
		specific	oravity tyr	nes of ce	ement	t (8)	, 5000	ig till	, 50uii	uness,	strength	, neut	or iryai	ution,
Тор	pics	Water:	Source. au	ality, im	nurit	ies and e	effect o	of on co	oncrete.	. sea w	ater (2)			
Cov	ered	Admixt	ure: Introd	uction.	classi	fication.	specif	ication	ns and f	unctio	ns of ad	mixture	es. (2)	
(H	rs)	Other m	naterials: E	Brick, T	imber	r. Lime,	Cemer	nt mort	ar, Tim	ber, St	teel and	Paint.	(8)	
		C). Co	ncrete Te	chnolo	gy:	Introduc	tion,	classif	ication,	prop	erties,	grades.	adva	ntage,
		disadvan	tages and c	quality o	contro	ol of con	crete.	(2)						0
		Fresh c	oncrete: Ir	ntroduct	tion,	workabi	lity, fa	ctors,	measur	ement	, segreg	ation,	bleedin	g and
		manufac	ture of con	ncrete –	batcl	hing, mi	xing, t	ranspo	rting, p	olacing	, compa	ction, 1	finishir	ng and
		curing. (6)											
		Harden	ed concret	e: Intro	ducti	on, stren	igth, st	ress-st	train ch	aracter	ristics, c	lestruct	ive and	l non-
		destructi	ve test, s	shrinkag	ge, c	reep, p	ermeat	oility,	durabi	lity, a	attack of	of sulp	ohates,	acid,
		effloresc	ence, thern	nal prop	perties	s and fire	e resist	ance. ((4)	a 1				
		Concret	e mix desig	gn: Fac	tors a	and mix $($	design	using	Indian S	Standa	rd code.	(4)	• •	1
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		Tort Poo	concrete a	na Ferro	o cem	ient. (4)								
		1 Engin	ks: leering Mate	erials by	S C	Rangwal	a K S	Ranov	vala and	IPSE	Ranowala	Charc	tar	
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Boo	oks,	2. Build	ing Constru	ction by	S. C.	Rangwal	a, Char	otar Pu	blishing	g House	, Anand			
and	l/or	3. Conce	rete Technol	logy by l	M.S. 5	Shetty, S.	Chand	Publis	her, Nev	w Delhi	i			
refer	rence	4. IS 102	262: 2009, 0	Concrete	Mix	Proportio	ning-G	uidelin	es $(1^{st}R)$	evision), BIS, N	lew Del	hi.	
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		Revis	ion) BIS, No	ew Delh	i.									
		<i>Referenc</i>	e Books:	or hr	мт	Combhi	. Total	MaCro		and www	uu nntal i	in		
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						Pro	gram	Core	Tot	al Nu	mber of	contact	hours		
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	oue					Elec	etives (PEL)	Lectur	e (L)	(T)	(P)	Hours	5	
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		Pre-re	quisite	(S)					Coi	irse A	ssessmei	nt metho	ds		
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Cou	urse	• CO	1: Cor	nduct e	experir	nents t	for the	deteri	nining	the p	roperties	of hard	en conc	crete and	d mild
Outc	omes	stee	l, and	other of	constru	uction	materi	als.	-	-	-				
(CC	():	• CO	2: Per	form d	ifferer	nt expe	riment	ts on f	luid m	echani	cs relate	d proble	ms for	determi	nation
		of p	ropert	ies of	flow th	irough	pipes	and ca	librati	on of f	few flow	rate mea	asuring	instrum	nents.
		• CO	3: Use	mode	rn inst	rumen	its and	tools	to dete	rmine	the prop	perties of	harder	n concre	te and
		oth	er civi	l engin	eering	mater	ials an	d worl	k in a g	group.	1 1				
		• CO	4: Pre	pare th	e repo	rt on e	xperin	nental	results						
Top	oics	Deterr	ninatio	on of c	ompre	ssive s	strengtl	h, split	tensil	e stren	gth & fl	exural st	rength	of conci	ete.
Cov	ered	To ob	serve t	he beh	avior	of a m	ild stee	el spec	imen v	vhile b	being tes	ted and t	o deter	mine (i)	upper
(H	rs)	and lo	wer yi	eld po	ints, (i	i) ultir	nate st	rength	, (iii) t	reakir	ig streng	th, (iv) p	ercenta	ige elon	gation
	·	of leng	gth, (v) perce	ntage	reduct	ion of	cross-s	section	l .	0 0			C	0
		To ap	ply tor	sional	load o	on circ	ular ro	ds and	l to de	termin	e the va	lue of m	odulus	of rigid	lity by
		measu	ring th	ne angl	e of tv	vist.									
		Exper	iment	on Roc	ckwell	Hardn	less Te	est.							
		Deterr	ninatio	on of c	oeffici	ent of	bend l	oss in	flow th	nrough	pipes.				
		Exper	iment	on fric	tion lo	ss in f	low the	rough	pipes.						
		Calibr	ation of	of Ven	turime	ter.									
		Calibr	ation of	of V-no	otch.										
		Calibr	ation of	of Orif	ice me	ter.									
		Exper	iment	on imp	pact of	jet.									
		Text E	Books:								~				
		1. C	oncret	e Tech	nolog	y by N	I. S. Sł	netty, S	S. Chai	nd & C	<u>)</u> 0				
	ext	2. C	oncret	e Tech	nolog	y by N	I. L. G	ambhi	r, Tata	McGi	aw Hill			CC11 4	1
BOG	OKS,	3. E	lement	ts of S	trengti	1 OF M	aterial	by S.	P. Iim	iosnen	ko, and	D. H. YO	oung, A	ITIliated	1 East-
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Course Code Title of the course (PCR) / Electives (PEL) Lecture Tutorial Practical Total Credit CEC-401 Structural Analysis-I PCR 3 1 0 4 4 Pre-requisite(s) Course Assessment methods Course Assessment (CA). CT+EA 4 Course CO1: Acquire the knowledge of structural systems, elements, joints, loads, stability, equilibrium, compatibility and indeterminacy CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames CO0: CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames • CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames • CO3: Achieved the idea to apply geometric methods to obtain slope and deflections • CO3: Evaluate & draw the influence lines for reactions, shears, & bending moments in beams & girders due to moving load. Throduction: Structural system, support condition different load and system (2) Shear force and bending moment: Recapitulation of bending moment and shear force of determinate structures. (4) Slopes and deflections: Slopes and deflections: Slopes and deflections in beams and frames, elastic curve, application of clastic beam theory with Maculay's notation, moment area method, conjugate beam method. (14) Energy methods: Structural Analysis by C. S. Reddy,	C		Program Cor	re	Total	Numb	oer of	contact l	nours		
Could Electives (PEL) (L) (T) (P) Hours CEC-401 Structural Analysis-I PCR 3 1 0 4 4 Pre-requisite(s) Course Assessment methods Course Assessment (EA). CT+EA 0 4 4 Course COI: Acquire the knowledge of structural systems, elements, joints, loads, stability, equilibrium, compatibility and indeterminacy 0 CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames (COs): • CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames • CO3: Achieved the idea to apply geometric methods to obtain slope and deflections • CO5: Evaluate & draw the influence lines for reactions, shears, & bending moments in beams & girders due to moving load. Introduction: Structural system, support condition different load and system (2) Shear force and bending moment: Recapitulation of bending moment and shear force of determinate structures. (4) Shear force and bending moment: Recapitulation of bending moment area method, conjugate beam method. (14) Energy methods: Strain energy, complementary energy, real work, virtual work, application of Castigliano's Theorems & virtual work methods to beams, frames, trusses, Maxwell's Reciprocal theorem, Betti's Law (18) Static and kinematic indeterminacy: Application on different type of structures (4) Influence	Course	Title of the course	(PCR) /]	Lectur	e Tut	orial	Practical	Total	Cr	edit
CEC-401 Structural Analysis-I PCR 3 1 0 4 4 Pre-requisite(s) Course Assessment methods Engineering & Solid Mechanics Continuous (CT) and end assessment (EA). CT+EA Outcomes • CO1: Acquire the knowledge of structural systems, elements, joints, loads, stability, equilibrium, compatibility and indeterminacy Outcomes • CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames (COs): • CO3: Achieved the idea to apply geometric methods to obtain slope and deflections • CO4: Gain the idea to apply Energy methods to obtain slope and deflections • • CO5: Evaluate & draw the influence lines for reactions, shears, & bending moments in beams & girders due to moving load. Topics Slopes and deflections: Slopes and deflections in beams and frames, elastic curve, application of elastic beam theory with Maculay's notation, moment area method, conjugate beam method. (14) Energy methods: Strain energy, complementary energy, real work, virtual work, application of Castigliano's Theorems & virtual work methods to beams, frames, trusses, Maxwell's Reciprocal theorem, Betti's Law (18) Static and kinematic indeterminacy: Application on different type of structures (4) Influence Lines: Application of influence lines & rolling loads for determinate beams / girders (10) Te	Code		Electives (PE)	L)	(L)	(Γ)	(P)	Hours		
Pre-requisite(s) Course Assessment methods Engineering & Solid Mechanics Continuous (CT) and end assessment (EA). CT+EA Course • CO1: Acquire the knowledge of structural systems, elements, joints, loads, stability, equilibrium, compatibility and indeterminacy Outcomes • CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames (CO8): • CO3: Achieved the idea to apply geometric methods to obtain slope and deflections • CO4: Gain the idea to apply Energy methods to obtain slope and deflections • CO5: Evaluate & draw the influence lines for reactions, shears, & bending moments in beams & girders due to moving load. Topics Topics Slopes and deflections: Slopes and deflections in beams and frames, elastic curve, application of elastic beam theory with Maculay's notation, moment area method, conjugate beam method. (14) Energy methods: Strain energy, complementary energy, real work, virtual work, application of Castigliano's Theorems & virtual work methods to beams, frames, trusses, Maxwell's Reciprocal theorem, Bett's Law (18) Static and kinematic indeterminacy: Application on different type of structures (4) Influence Lines: Application of influence lines & rolling loads for determinate beams / girders (10) Text Books: 1 Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill 2 Elementary Structural Analysis by N. C. Sinha, New Central book agency pvt. Ltd. reference Books: <th>CEC-401</th> <th>Structural Analysis-I</th> <th>PCR</th> <th></th> <th>3</th> <th>1</th> <th>L</th> <th>0</th> <th>4</th> <th>4</th> <th>4</th>	CEC-401	Structural Analysis-I	PCR		3	1	L	0	4	4	4
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 COI: Acquire the knowledge of structural systems, elements, joints, loads, stability, equilibrium, compatibility and indeterminacy CO2: Able to compute the internal forces in cable, arch, trusses, beams and frames CO3: Achieved the idea to apply geometric methods to obtain slope and deflections CO4: Gain the idea to apply Energy methods to obtain slope and deflections CO5: Evaluate & draw the influence lines for reactions, shears, & bending moments in beams & girders due to moving load. Introduction: Structural system, support condition different load and system (2) Shear force and bending moment: Recapitulation of bending moment and shear force of determinate structures. (4) Slopes and deflections: Slopes and deflections in beams and frames, elastic curve, application of elastic beam theory with Maculay's notation, moment area method, conjugate beam method. (14) Energy methods: Strain energy, complementary energy, real work, virtual work, application of Castigliano's Theorems & virtual work methods to beams, frames, trusses, Maxwell's Reciprocal theorem, Betti's Law (18) Static and kinematic indeterminacy: Application on different type of structures (4) Influence Lines: Application of influence lines & rolling loads for determinate beams / girders (10) Text Books: Elementary Structural Analysis by C. S. Reddy, Tata McGraw Hill Elementary Structural Analysis by N. C. Sinha, New Central book agency pvt. Ltd. Structural Analysis by R. C. Hibbeler, Pearson Education material S. Structural Analysis by G. S. Pandit & S. P. Gupta, Tata McGraw Hill Theory of structures by S. P. Timoshenko and D. H. Young, Mc. Graw Hill book Co 	Enginee	ring & Solid Mechanics	Contin	nuous	s (CT)	and en	d asse	essment (l	EA). C	Γ+EA	
Topics Introduction: Structural system, support condition different load and system (2) Shear force and bending moment: Recapitulation of bending moment and shear force of determinate structures. (4) Slopes and deflections: Slopes and deflections in beams and frames, elastic curve, application of elastic beam theory with Maculay's notation, moment area method, conjugate beam method. (14) Energy methods: Strain energy, complementary energy, real work, virtual work, application of Castigliano's Theorems & virtual work methods to beams, frames, trusses, Maxwell's Reciprocal theorem, Betti's Law (18) Static and kinematic indeterminacy: Application on different type of structures (4) Influence Lines: Application of influence lines & rolling loads for determinate beams / girders (10) Text Books, and/or (s) 5. Structural Analysis by R. C. Hibbeler, Pearson Education material (s) (s) 5. Structural Analysis by G. S. Pandit & S. P. Gupta, Tata McGraw Hill 6. Theory of structures by S. P. Timoshenko and D. H. Young, Mc. Graw Hill book Co Mapping of Course Outcomes COs→POs→PSOs	Course Outcomes (COs) :	 CO1: Acquire the k equilibrium, compatible CO2: Able to compute CO3: Achieved the id CO4: Gain the idea to CO5: Evaluate & drawner 	nowledge of st pility and indeter e the internal for ea to apply geon apply Energy m aw the influence	tructo rmina rces i metrio netho e lino	ural sy acy in cable c meth ods to c es for	ystems e, arch ods to obtain s reactio	, elen , truss obtain slope a ons, sl	nents, joi es, beams n slope an and deflec nears, &	ints, lo s and fr d defle ctions bendin	ads, sta ames ctions g mome	ability, ents in
Text Books: Text 1. Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill Books, 2. Elementary Structural Analysis by Wilbur & Norris, Mcgraw-Hill College and/or 3. Elements of structural analysis by N. C. Sinha, New Central book agency pvt. Ltd. reference 4. Structural Analysis by R. C. Hibbeler, Pearson Education material <i>Reference Books:</i> (s) 5. Structural Analysis by G. S. Pandit & S. P. Gupta, Tata McGraw Hill 6. Theory of structures by S. P. Timoshenko and D. H. Young, Mc. Graw Hill book Co Mapping of Course Outcomes COs⇒POs⇒PSOs	Topics Covered (Hrs)	Introduction: Structura Shear force and bendi determinate structures. (Slopes and deflection application of elastic bea beam method. (14) Energy methods: Strain of Castigliano's Theore Reciprocal theorem, Bet Static and kinematic in Influence Lines: Appli girders (10)	an energy, completermina & virtual w ti's Law (18) ication of influe	rt con decap Macu emen vork Appl ence	ndition pitulation lection ulay's ntary en metho lication lines	differe on of b s in b notatio hergy, ds to n on dif & roll	ent loa bendin beams on, mo real w beams fferent ling lo	ad and sys ag momen and fra oment are vork, virtu s, frames, t type of s bads for	stem (2) nt and mes, e a methe al work trusse structure determ) shear fo od, conj k, applio s, Max es (4) inate bo	orce of curve, jugate cation well's eams /
Mapping of Course Outcomes COs→POs→PSOs	Text Books, and/or reference material (s)	<i>Text Books:</i> 1. Basic Structural Analy 2. Elementary Structural 3. Elements of structural 4. Structural Analysis by <i>Reference Books:</i> 5. Structural Analysis by 6. Theory of structures b	ysis by C. S. Rec Analysis by Wi l analysis by N. R. C. Hibbeler, G. S. Pandit & by S. P. Timoshe	ddy, ilbur C. S , Pea S. P enko	Tata N & Nor Sinha, N rson E C Gupta and D.	IcGrav ris, Mo New Co ducatio a, Tata H. Yo	v Hill cgraw entral on McG oung, l	-Hill Col book age raw Hill Mc. Graw	lege ncy pvt [,] Hill be	. Ltd.	
	Mapping of	t Course Outcomes COs-	→POs→PSOs					<u> </u>			

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	1	-	-	1	1	1
CO2	3	-	-	-	-	-	1	-	-	-	-	-	3	2	1
CO3	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO4	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO5	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1

C						P	rogra	m Cor	e To	tal N	umber o	f contac	t hours		
	rse de	Tit	tle of th	ie co	urse	_	(PC	CR) /	Le	ecture	Tutorial	Practical	Total	Cr	edit
				<u> </u>		E.	lective	s (PE	_)	(L)	(1)	(P)	Hours		
CEC	402	Des	sign of Struct	Cono tures	crete		PC	CR		3	1	0	1	4	4
		Pre-re	equisite(s)					(Course	Assessme	ent metho	ds		
		Solid I	Mechani	ics				Contin	nuous	CT) ar	nd end ass	sessment	(EA). C	Г+ЕА	
Cour Outcon (COs	rse mes 5) :	 CO1 CO2 CO3 struct 	: Apply 2: Unders 3: Formu ctures.	know stand llate, a	vledge basic d analyze	of solic lesign j e, and c	l mecha philoso lesign b	anics fo phies a pasic co	or design pplical ompone	gn solu ole to c ents of	tions. concrete st Civil Eng	tructures.	Reinford	ced Con	crete
Topio Cover (Hrs	cs red s)	Proper Shrink Design Analys and do Behavy reinfor Servic Design Isolate Design	rties of age and a philos sis and ubly rei iour of cement, eability a of colu a of one ed and o	conc l cree sophi desig inford bear , Det y, Lin umns e-way comb	rete an p pher es – w gn of s ced sec ns in s ailing o nit stat s: Shor v and t bined f	id rein orking ection ctions, hear a of rein es of c t and l wo-wa cooting	forcing on, I.S s stress s in fle T and born forcen leflection ong co ay slat gs (6)	g steel, s speci s metho exure b L sect ad, Des nent. (4 ion and blumns bs, Sta	, Char fication of and by wor ions (% iign fo iign fo iign fo iign fo iign fo iign fo iign fo iign fo iign fo iign fo	acteris n (4) limit king s 3) r shea cing, C ntrica s. (6)	tic streng state met tress and r, Ancho Calculatic Ily loade	gths, Stre hod of d limit sta rage and on of def d columr	esign. (te meth curtaili lections as (8)	n curve 8) lod, Sin ment of . (4)	s, gle
Tex Book and/o referen materi) Mappi	at cs, or nce al(s	Text B 1. Rei Tat. 2. IS 4. WW Refere 5. Rei Pub 6. Rei Pub f Cours	nforced a McGr 456: 20 vision), 16, Des w.nptel <i>nce Boo</i> nforced blishing nforced <u>blishing</u>	l Cor caw-H DOO, BIS, sign A l.iitm oks: l Con Co. 1 l Con <u>Com</u>	ncrete Hill Pul Indian New I Aids fc .ac.in/c ncrete, Pvt. Lt ncrete pany. COs	Design blishir Stand Delhi. or Rein course 6th I d. New Desig New I	n, 2nd ng Con lard P aforced s/ Editior w Delh gn, 1st Delhi, PSOS	Edition npany lain an l Conc n, by ni, 1990 t Revi 1990.	on, by Limite nd Re rete to S. K. 5. sed E	S. U: ed, Ne inforce IS: 45 Malli dition	nnikrishr w Delhi, ed Conc 56 – 1978 ck and , by S.N	na Pillai 2003. rete – C 8, BIS, N A.P. Gu N. Sinha	and De ode of ew Del pta, O , Tata	evdas M Practic hi xford & McGra	Aenon, ce (4th & IBH w-Hill
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines

	Engine	Prc	Desig	Conduc com	Moo	The en	Ers		I	Co	Projec	Life	Plan, a	Compu	coq
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	2	-	-	-	3	-	2
CO2	3	-	3	-	-	-	1	-	-	2	-	2	-	2	-
CO3	-	-	3	-	-	-	-	2	-	2	1	3	2	1	3

Co	urse	Ti	tle of t	he Pi	rogran	ı Core	e (PCR))/	Total	Numbe	er of c	o <mark>ntact</mark> h	ours	Cr	edit
C	ode		course	1	Elect	tives (l	PEL)	Ι	Lecture	e Tuto	orial P	ractical	Total		
									(L)	(T)	(P)	Hours		
CE	EC 403	B Su	ırveyiı	ng		PCR			3	()	0	3		3
	Pre-	requisi	tes				~ .	(Course .	Assessm	ent me	thods	~ ~ ~ ·		
		None					Contin	nuous (CT) an	d end as	sessme	nt (EA).	CT+EA		
Car	•	• CO1	l: Learr	i basic p	rinciple	s of su	rveying	and ha	andling	of vario	us surv	eying in	struments	8.	
Outer	irse •	CO_2	2: Learr	to conc	luct eng	gineerin	ig surve	ys.							
Oute			5: Data	entry in	mena bo	oks an	a level i	DOOKS.							
			F. Make	vite area	and w	lumes									
		Introd	uction:	Definit	ion pri	mary d	ivision	classif	fication	and Pri	ncinles	of surve	ving Ba	sic meas	urements
		(2)	uction.	Denni	ion, pri	inary a	11151011,	ciussii	lication	und I II	neipies	or surve	ying, Du	sie meas	urements.
	l	Linear	measu	rement	s: Instru	iments.	, Rangin	ng, Cha	aining, "	Гаре со	rectior	is. (3)			
	•	Chain	survey	ing: Prin	nciples,	Basic of	definitio	ons, Eq	uipmen	nt, Field	work,	Obstacles	s, Plotting	g & accu	racy. (3)
	•	Compa	ass sui	rveying	: Instru	iments,	Traver	rse, B	earings	and t	heir d	esignatio	ns, Mag	netic de	clination,
	1	Magnet	tic & tr	ue beari	ngs, Fie	ld wor	k, Plotti	ng & a	djustm	ent of a	closed	traverse.	(3)		
]	Levelli	ng: Ba	isic defi	nitions.	Instru	iments	and th	eir adj	ustment	s, Prin	ciples of	f levellin	g, Field	work and
	1	writing	(4)	books,	Profile	levelli	ng & c	ross-se	ectionin	ig, Reci	procal	levelling	g, Diffici	ilties in	levelling,
		Contor	(4) iring:	Basic de	efinitio	ns Met	thods of	f locat	ing cor	ntours (haract	eristic of	f contour	s Use o	f contour
	1	naps. (2)	Duble a	crimition	15, 1010		1000		100015, 0	maraot		contour	5, 050 0	i contour
]	Plane '	Table s	surveyir	ng: Intr	oductio	on and b	oasic d	efinitio	ns, Instr	uments	and the	ir uses, H	Principles	s of plane
	t	abling	, Meth	ods of j	plane ta	abling,	Three	point	problen	ns and	its solu	utions, T	wo-poin	t problei	n and its
Top	pics s	solution	n, Error	s in plar	ne tablii	ıg, Adv	antages	and d	isadvan	itages. (3)				
Cove	ered	Theod	olite:	Differen	it part	s, Ten	nporary	adju	stments	, Fund	amenta	l lines,	Permai	nent adj	ustments,
П	18)	Theod	olite T	of horizo raversir	oniai an 10• Intr	oductic	on and h	es. (4)	lefinitic	ns Fiel	d worl	- Angul	ar measu	rements	Traverse
		comput	tations.	Balanci	ng of th	e trave	rse. Acc	curacy	of trave	erse surv	veving.	(5)	ai measu	irements,	Traverse
	I	Measu	rement	t of are	as: Are	a of a	tract w	ith irre	egular l	ooundari	ies, Di	fferent m	nethods, 1	Planimet	er and its
	ι	uses. (5	5)						•						
	1	Measu	rement	t of vol	umes:	Compu	tation o	of area	of cros	ss sectio	ons for	differen	t section	s, Comp	utation of
	1	volume	s by di	fferent 1	method	s, Volu	me fron	n conte	our map	o, Capac	city of	reservoir	, Volume	e from sp	ot levels,
	1	viass-r Flectro	1au1 u1a	igram – : atic dist	nts char		ics and	uses. (4 Worki	4) Ing prin	ciple of	FDM	equinme	nt Llees	Range	Accuracy
		Correct	tions to	be appli	ied to h	orizont	al distar	nces. (4	ing prin 1)	lepic of	LDIVI	equipine	in, Oses,	Range, I	Accuracy,
Те	ext	Text B	Books:	oc uppi		01120110	ui uistui	1005. (•)						
Boo	oks, 1	1. Surv	veying	and Lev	velling	Part I	& II b	y T. I	P. Kan	etkar an	d S. V	7. Kulka	rni, Puno	e Vidyar	thi Griha
and	l/or	Prak	ashan l	Pune – 3	80, 1979)									
refer	rence 2	2. Surv	veying	Vol. I &	z II. by	B. C.	Punmia	ı, A. K	L. Jain a	and A. I	K. Jain	A.K., L	axmi Put	olications	(P) Ltd.,
mate	erial	200: Defense) naa Da	Jac											
		Aejerei 3 Sur	veving	vol I <i>k</i>	& II by	KRA	rora St	andard	Book	House	P R -10	74 Delh	i		
		4. Sur	veying	courses	availab	le in ht	tp://npte	el.iitm.	ac.in/	1100050, 1	D . 10	, i, Dein	1		
Ν	Mappi	ng of C	Course	Outcon	nes CC	s→PC	Ds→PS	Os							
			at		0						ıt	50	L.	Π	
	50 0	ysis	s	s of lems	sage	and	t & ty		3	ion	mer	ning	lesig e	l ski) suo
	erin edg(anal	elop tion	luct tion	ol u	neer ety	nen abili	cs	ual . vork	nicat	nage ance	lear	se, c	uideo ools	visio
	gine owl	em :	/dev solu	Conc tiga ex p	m tc	ngir socie	ronı tainâ	Ethi	ivid am v	mur	mai fina	guc	naly. d pre	ter and to	providel
	En	robl	sign of	C Tves Inpl	oder	he e	Envi		Ind te:	Com	ject &	fe-l	n, ai ane	ndu	gu
		Р	Dei	C II.	М	Т	I			0	Pro	Ľ	Pla	Col	3
	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO8	POQ	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-		-	-	2	1012	3	-	
CO^{1}	-	-	-	-	-	-	-	-	-	-	3		3	-	-
CO3	-	-	-	-	-	-	_	-	-	_	3	_	3	-	_
CO4	-	-	-	-	-	-	-	-	-	-	3	-	3	-	_
CO5	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-

Correct		Program Core	Tota	al Number of	f contact h	ours	
Course	Title of the course	(PCR) / Electives (PEL)	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credit
CEC-451	Structural Analysis Sessional-I	PS	0	0	3	3	1.5
Р	Pre-requisite(s)		Course	e Assessment	methods		
Engineer	ing & Solid Mechanics	Continuou	is (CT) a	and end asses	sment (EA)). CT+E	A
Course Outcomes (COs) :	 CO1: Acquire the kr equilibrium, compatibi CO2: Able to compute CO3: Achieved the ide 	nowledge of struct lity and indetermina the internal forces a to apply geometri	ural sys acy in cable, c metho	stems, eleme arch, trusses ds to obtain s	ents, joints, s, beams and slope and de	, loads, d frames eflectior	stability, s ns
	 CO4: Gain the idea to a CO5: Evaluate & drav beams / girders due to 	apply Energy metho w the influence lin moving load.	ods to ot es for r	eactions, she	ars, & ben	ns ding m	oments in
Topics Covered (Hrs)	Introduction: Structura Shear force and bending determinate structures. (Slopes and deflection application of elastic be beam method. (12) Energy methods: Stru- application of Castiglia Maxwell's Reciprocal the Static and kinematic in Influence Lines: Appli girders (9)	al system, support co ing moment: Reca (2) as: Slopes and det am theory with Mac rain energy, comp no's Theorems & y heorem, Betti's Law ndeterminacy: App ication of influence	ondition pitulation flections culay's f plementa virtual v virtual v (12) plication e lines	different loa on of bending s in beams notation, mor ary energy, vork methods n on different & rolling loa	d and syste g moment a and frame nent area m real work s to beams, type of stru ads for dete	m (1) and shea s, elasti- nethod, c c, virtua , frames actures (erminate	ar force of ic curve, conjugate al work, s, trusses, (3) e beams /
Text Books, and/or reference material (s)	<i>Text Books:</i> 1. Basic Structural Anal 2. Elementary Structural 3. Elements of structural 4. Structural Analysis by <i>Reference Books:</i> 5. Structural Analysis by 6. Theory of structures by	ysis by C. S. Reddy l Analysis by Wilbu l analysis by N. C. S y R. C. Hibbeler, Pe y G. S. Pandit & S. by S. P. Timoshenk	y, Tata M nr & Nor Sinha, N earson E P. Gupt o and D	AcGraw Hill rris, Mcgraw- lew Central b ducation a, Tata McGr H. Young, 1	-Hill Colleg oook agency aw Hill Mc. Graw H	ge 7 pvt. Lt Hill boo	d. k Co
apping of C		80617 60		<u> </u>			

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	1	-	-	1	1	1
CO2	3	-	-	-	-	-	1	-	-	-	-	-	3	2	1
CO3	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO4	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO5	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1

C		Program Core	Total N	lumber o	f contact	hours		
Course	Title of the course	(PCR) /	Lecture	Tutorial	Practical	Total	Cr	edit
	Design of Compute	Electives (PEL)	(L)	(1)	(P)	Hours		
CES452	Structures sessional	PS	0	0	3	3	1	.5
	Pre-requisite(s)		Course	Assessme	ent metho	ds		
	Solid Mechanics	Continue	ous (CT) a	and end ass	sessment (EA). C	Г+ЕА	
Course Outcomes (COs) :	 CO1: Apply knowledge CO2: Understand basic CO3: Formulate, analyz Concrete structures. 	of solid mechanics design philosophie ze, and design basi	for desig s applica c compo	gn solutio ble to cor nents of	ns. hcrete stru Civil Eng	ictures. gineerir	ng Rein	forced
Topics Covered (Hrs)	 Properties of concrete and Shrinkage and creep pheno Design philosophies – wo Analysis and design of se and doubly reinforced sect Behaviour of beams in sh reinforcement, Detailing o Serviceability, Limit state Design of columns: Short Design of one-way and tw Isolated and combined for Design of cantilever type 	a reinforcing steel, omenon, I.S. specif rking stress method ctions in flexure by ions, T and L section ear and bond, Desi f reinforcement. (4 s of deflection and and long columns, vo-way slabs, Stain potings (6) retaining walls (6	Characte ication (4 1 and lim 7 working ons (8) gn for sh) cracking eccentric rcases. (6	ristic stre it state m g stress an ear, Anch , Calculat cally load b)	ngths, Sti ethod of ad limit st norage an- tion of de ed colum	ress stra design. tate met d curtai flectior ns (8)	(8) thod, Si ilment ons. (4)	ingle of
Text Books, and/or reference material(s)	 <i>Text Books:</i> 1. Reinforced Concrete D Tata McGraw-Hill Pub 2. IS 456: 2000, Indian S Revision), BIS, New D 3. SP-16, Design Aids for 4. www.nptel.iitm.ac.in/concrete <i>Reference Books:</i> 5. Reinforced Concrete, Publishing Co. Pvt. Ltd 6. Reinforced Concrete I Publishing Company. N 	Design, 2nd Editior lishing Company L Standard Plain and elhi. Reinforced Concre ourses/ 6th Edition, by S I. New Delhi, 1996 Design, 1st Revise New Delhi, 1990.	a, by S. U imited, N Reinfor ete to IS: K. Mal K. Mal	Jnnikrish Jew Delh ced Cond 456 – 19 lick and n, by S.I	na Pillai i, 2003. crete – C 78, BIS, 1 A.P. Gu N. Sinha	and De ode of New De pta, O , Tata	evdas M Practic elhi xford & McGra	Aenon, ce (4th & IBH w-Hill
Mapping o	f Course Outcomes $COs \rightarrow Point Poin$	Os→PSOs						
vledge	sis ent of ions of sms age	society & /	. E	ent &	ing	gn and	ill and	uidelines

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations c complex problems	Modern tool usage	The engineer and societ	Environment & sustainability	Ethics	Individual & team work	Communication	Project management $\&$ finance	Life-long learning	Plan, analyse, design an prepare	Computer aided skill an tools	codal provisions / guidelii
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	2	-	-	-	3	-	2
CO2	3	-	3	-	-	-	1	-	-	2	-	2	-	2	-
CO3	-	-	3	-	-	-	-	2	-	2	1	3	2	1	3

G		Program Core	Total	Number o	of contact	hours		
Course	Title of the course	(PCR) /	Lecture	Tutorial	Practical	Total	Cre	edit
Code		Electives (PEL)	(L)	(T)	(P)	Hours		
CEC-501	Structural Analysis-II	PCR	3	1	0	4	4	4
	Pre-requisite(s)		Cours	e Assessm	nent metho	ds		
Solid N	Aechanics & Structural	Continuou	is (CT) a	and end as	sessment (EA). C	T+EA	
	Analysis-I		. ,					
	• CO1: Analyse indeterm	inate beams and fr	ames by	/ displacer	nent meth	ods (Slo	ope def	lection
Course	method, Moment distril	oution method, Kar	ne's met	hod)				
Outcomes	• CO2: Analyse indeterm	inate beams and fr	ames by	force met	thods (Thr	ee mon	nent Equ	uation,
(COs) :	column Analogy metho	d, consistent defor	mation r	nethod)				
	• CO3: Apply matrix a	nalysis using stif	fness a	nd flexibi	lity metho	ods- co	mputer	-based
	analysis of structure.							
	• CO4: Evaluate and drav	w the influence lin	es for re	eactions, sl	hears, and	bendin	g mom	ents in
	indeterminate beams / g	girders and frames.	1	г		. 1	1	
	• CO5: Apply approxim	nate methods (Su	bstitute	Frame n	nethod, P	ortal a	nd can	tilever
	Displacement methoda	-storeyed building	irames	lastion N	fomant di		~~ P~ L	Zani'a
	method to indeterminate be	Application of Sig	ope der. Hals (16)	ioment di	suibuuo		vann s
	Force methods: Applicati	on of Three mom	$\frac{10}{2}$) ations to c	ontinuous	heam	evecut	ion of
т ·	Column analogy & Consist	tent deformation m	ethod to	heams &	frames (1)	2)	CACCUL	
Topics	Influence lines: Indeterr	ninate structures.	Muller	Breslau	principle	-) with a	pplicati	on to
(Urg)	redundant beams (8)				p		PP	011 00
(1115)	Matrix Method: Matrix	formulation of	flexibili	ty & stif	ffness me	thods of	of stru	ctures-
	application for simple load	ing cases (10)		•				
	Approximate methods: S	Substitute frames,	Portal &	& Cantile	ver metho	ds on r	nulti-st	oreyed
	building frames (6)							
Text	Text Books:							
Books,	1. Basic Structural Analys	is by C. S. Reddy,	Tata Mo	Graw Hil	1			
and/or	2. Elementary Structural A	Analysis by Wilbur	& Norr	is, Mcgrav	v-Hill Coll	lege		
reference	3. Structural Analysis L. S	S. Negi & R. S. Jan	gid, Tata	a McGraw	' Hill			
material	4. Structural Analysis by I	R. C. Hibbeler, Pea	rson Ed	ucation				
(S)	<i>Keference Books:</i> 5 Structurel Analysis by (C Dondit & C D	Cunto	Toto Ma	Teory I L'11			
	5. Structural Analysis by C	J. S. Panull & S. P	. Gupta,	Tata MCC Graw Hill	Jraw Hill			
Manning o	f Course Outcomes $CO_{2} \rightarrow 1$	$\frac{11}{2} \frac{11}{2} \frac$	ing MC.					
ledge	ais ent of tions ems age	pu a		n ent &	ng n	sign	skill	s /

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management $\&$ finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	-	-	-	3	-	3	2	1
CO2	3	-	-	-	2	-	-	-	-	-	3	-	3	2	1
CO3	3	-	-	-	2	-	-	-	-	1	3	-	3	3	1
CO4	3	-	-	-	2	-	-	-	-	-	3	-	3	2	1
CO5	3	-	1	-	-	-	-	-	-	-	3	-	3	1	1

Co	Irco						Progra	am Co	re To	tal Nu	mber of	contac	t hours	;		
C	ode		Fitle o	f the c	ourse		(P (CR) /	L	ecture	Tutorial	Practica	l Total	Cro	edit	
							lectiv	es (PE	L)	(L)	(T)	(P)	Hours	3		
CEC	C 502	Desi	gn of (Steel S	Struct	ures	P	CR		3	1	0	4	4	1	
		Pre-	requisi	te(s)					(Course A	ssessme	nt metho	ds			
		Solic	l Mech	anics				Conti	nuous ((CT) and	l end ass	essment	(EA). C	T+EA		
Cou	ırse	• CC	D1: Ap	ply kno	wledge	e of sol	lid mec	hanics f	for desi	ign solut	ions.					
Cuico (CC	Onles ()s) :	• C()2: Un)3: Eor	derstan	d basic	design	1 philos	ophy aj	ompon	ole to ste	el structu	ires.	Stool et	ructuras		
(Intro	ductio	n. Prop	erties o	of struc	tural st	eel. I.S	rolled	sections	s. I.S. sp	ecificatio	$\frac{31001}{100}$ since $\frac{1}{2}$	luctures	•	
Top Cov (H	pics ered rs)	Desig Desig Section Desig Desig and w Desig Connee Desig Lacin Desig	m philo m of T m of B ons /cor m of G m of G m of P /elded. m of ections. m of S m of S m of C	osophy ension Geams (npounc antry g late gin (2) Simple (6) Struts oattens, olumn	of Lin memb (lateral l beam girders rders, o e Com and co Colum bases	nit Stat ers, Co ly supj s (6) s (4) Connection nection olumn an splic – slab	e metho ompress ported / ctions, s ns: Riv s includ cing. (6 base G	od for S sion me /unsupp Stiffene /eted, I ding bu	Steel St embers ported) ers and Bolted hilt-up	ructures in truss : Simple curtailm and we column	(6) (6) e beam u nent of fl elded co s under	using roli ange plat onnection axial an	led sect tes, Spli as, mon d eccen	ions, Bu cing – ri nent res ntric load	iilt up iveted isting dings,	
Te Boc anc	ext oks, l/or	<i>Text</i> 1. D 2. IS	Books esign c 800-2	 a of Struts and columns including built-up columns under axial and eccentric loadings, and battens, Column splicing. (6) a of Column bases – slab base, Gusseted base. (4) Books: sign of steel Structures by N. Subrhamanium (Oxford publications) 800-2007: General Construction in Steel-Code of Practice 808-1989: Dimensions of Hot Rolled Steel beam, column, channel and angle sections 												
refer	ence	4. w	ww.np	tel.iitn	n.ac.in	/cours	es/	Ronea	Steer	ocum, c	orunni,	enumer	und un	gie seet	10115	
mater	nal(s)	Refe	rence	Books:	•											
		5. Li	mit St	ate De	sign o	f Steel	Struct	ures by	y S.K.	Duggal	(McGr	aw Hill	publica	tions)		
		6. Li	mit S	tate D	Design	of S	teel st	tructur	es by	Virenc	lra Geł	nlot &	Dr. Ra	am Ch	andra	
		() 7 D	cientii	ic pub of steel	Struc	tures h	ws s	Bhavi	ikatti (IK Intl	Publish	ing Hou	se N D	elhi)		
Mapr	oing of	Cours	se Out	comes		POs-	\rightarrow PSOs	S Dilavi	IKatti (1 4011511		<u>50, 11 D</u>	(chin)		
	zineering knowledge	Problem analysis	sign/development of solutions	duct investigations of omplex problems	Modern tool usage	engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	ject management & finance	Life-long learning	ı, analyse, design and prepare	nputer aided skill and tools	codal provisions / guidelines	
	Eng	DOC	De	Con		The	DOT	DOG	DOG	DOIO	Prc		Plar	Con		
	P()]	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2		
COL	2								2				2		PSO3	
CO1	$\frac{2}{3}$	-	-	-	-	-	-	-	2	- 2	-	- 2	3	- 2	PSO3 2	

						Pro	gram	Core	Total	Num	ber o	f contact	hours		
	urse	Tit	le of t	he cou	rse		(PCR)	/	Lecture	e Tu	torial	Practical	Total	Cr	edit
	Jue					Elec	tives (PEL)	(L)	((T)	(P)	Hours		
CEC	C-503	S	oil Me	chani	CS		PCR		3		0	0	3		3
]	Pre-req	uisite(s)					Cours	e Ass	essme	ent method	ls		
Eng	ineeri	ng and	Fluid	Mecha	anics		Co	ntinuo	us (CT)	and e	nd ass	essment (EA). C	Γ+EA	
Cou	urse	• CC	01: Acc	quire k	nowle	dge of	classi	fying t	he soil f	rom (Civil E	Engg. Asp	ect		
Outco	omes	• CC	2: Abi	ility to	condu	ict Exp	perime	nt and	Analyze	the c	lata w	ith interpr	retation		
(CO	s):	• CC	3: Abi	ility to	analy	ze Soil	l for S	oil-Stru	ucture li	ke Da	ms (E	arthen/Rig	gid)		
		• CC	4: Abi	ility to	Desig	n Soil	relate	d Civil	Engg. S	tructu	ıre				
		• CC	5: Un	derstar	nding 1	need of	f the P	rofessi	onal Eth	ics &	futur	e studies			
		Introd	luction	n: Typ	e of s	oil, M	ineral	ogical	composi	tion,	Basic	definition	ns of so	il parar	neters,
		Inter-p	hase r	elatior	nships,	Probl	ems (4)							
		Index	prop	erties:	Index	k prop	erties	of soil	s and th	eir de	etermi	nation, cl	assifica	tion ba	sed on
		index	proper	ties. P	roblen	ns (4)									
		Classi	ficatio	on: Va	rious	classif	icatio	n syste	ems, IS,	MIT	, US	bureau ar	nd soil	classifi	cation,
		PRA, 1	Plastic	ity cha	art. Gr	oup In	dex. P	roblem	is. (3)						
		Soil-V	Vater	Press	ure: 7	Total,	effecti	ve, an	d pore	pressu	ire in	soil. Cap	pillary 1	rise, eff	fect of
Tor	pics	seepag	ge on p	ore pr	essure	, Quic	k cond	ition. I	Problem	s. (3)		. 1		• .	·
Cove	ered	Perme		y: Pe	rmeab	ility a	and se	epage	throug	h soi	I, Da	rcy's lav	v, Dete	erminati	ion of
(H	rs)	perme	ability	by la	borato	ry me	thods	and fie	eld meth	ods. I	Factor	s affectin	g perm	eability	. Flow
(11	,	throug	h strat	ified s	011. Pr	oblem;	s. (4)	с т		0	• ,	1	F1		
		Seepa	ge ana		Lapia	ice's e	quatio	n Ior I	sotropic	æ ar	1-1SOU	opic solls	, Flow-	nets, So	eepage
		throug	n sub-	soii, ea	arthen	embar	ikmen	t & pip	ng failt	ire, Pi	robier	ns (4)		1	
		footing		oulor f	I: Sue	ss aisi	itrory	footing	Dirs, poir	ii inaa	18, III 's oat	e loads, si	np ioac	is, recta rda' aqu	Ingular
		Noum	gs, cho		ion S	gs, alt	nnary	onth r	zs. Dous	bulb	Nov	morte's in	fluono	lus equ	uation,
		stross	due to	linear	1011.	ing lo	ade D	cpiii, j roblam	s (5)	oulo,	, INCM		muence		cients,
		Conso	lidati	$n \cdot \Omega$	ne_dir	nensio	aus. 11 nal - C	onsoli	.s. (<i>s)</i> dation t	heory		dometer	test e		curve
		settlen	nent &	r ite ti	me rec	mired	deter	minati	a = 0	meory	, ОС	Definition	of Nor	nally <i>&</i>	$\frac{1}{2}$ Over
		consol	idated	soils	Proble	ameu,) ()	minau		, IIIv,	Cc. L			many o	
		Comp	action	• Corr	nactic	n Sta) ndard	Procto	r Test N	Aodifi	ied Pr	octor Test	VAVS	o curve	Field
		comp	ction t	tests at	nd Fiel	ld com	nactio	n Proł	olems (?	100111 1)			, yu vs		. 1 1010
Τe	ext	Text B	ooks:				paerio			<u> </u>					
Boo	oks,	1. Soi	l Mech	anics a	nd Fou	Indatio	n Engi	neering	by V N S	S Mur	thy.CE	3S publishe	er and D	istributo	r
and	/or	2. Soi	l Mech	anics a	nd Fou	indatio	n Engii	neering	by S.K.	Garg,	Khann	a Publishe	rs		
refer	ence	3. Bas	sic and	Applie	d Soil	Mecha	nics by	Gopal	Ranjan &	& A.S.	R. Rad	o, New Age	e Interna	tional	
mate	erial	Refere	nce Bo	oks:											
(9	s)	$\frac{4}{6}$ Adv	vanced	Soil M	lechani	ics by I	3.M. D	as, Mc	Graw Hi	lls Put	olisher	S			
Mapp	oing o	t Cours	se Outo	comes	CUS	≠PUs-	7 PSU	S			<u> </u>				
	dge		t of	suc	e	_					t &	50	u	II	
	wle	lysis	men	gatic	Isag	. and	it &		& <u>~</u>	tion	meni	ning	desi <u>j</u> e	d sk	s s
	č kno	anal	elopi tions	vesti. x pro	ool t	ineer iety	ımen ıabili	nics	dual worl	inica	lagei	g lear	yse, (repar	aide tools	ovisio

	Engineering kn	Problem and	Design/develop solution	Conduct invest of complex pr	Modern tool	The enginee society	Environme sustainabil	Ethics	Individual team woi	Communics	Project manage finance	Life-long lea	Plan, analyse, and prepa	Computer aide and tool	codal provis guideline
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	-	-	-	-	-	-	-	-	-	-	1	2	-
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	-	2
CO3	1	3	3	-	-	-	-	-	-	-	1	-	2	-	2
CO4	-	2	3	2	-	-	-	-	-	-	-	-	-	2	2
CO5	-	-	-	-	-	-	-	-	3	-	-	2	-	2	2

Correct	T:41 f 41	Program Core	Total	Number o	f contact h	ours					
Course	The of the	(PCR) /	Lecture	Tutorial	Practical	Total	Credit				
Code	course	Electives (PEL)	(L)	(T)	(P)	Hours					
CEC504	Transportation Engineering	PCR	3	1	0	4	4				
Pre	e-requisite(s)		Cours	e Assessme	ent methods		•				
	None	Contin	uous (CT)	and end ass	sessment (E	A). CT+F	EA				
	• CO1: Apply kno	owledge of transport	rtation engi	ineering for	planning &	z design s	solutions.				
Course	• CO2: Understan	nd basic design pl	nilosophy a	applicable	to compone	ents of tr	ansportation				
Outcomes	engineering.				_		_				
(COs) :	• CO3: Formulate	e, analyze, & desigr	n basic con	ponents of	transportati	on engin	eering.				
Topics Covered (Hrs)	 Highway planning, Geometric Design of elements. (6) Highway construction: Materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements; Environmental impact, Highway maintenance. (12) Principle of Transportation, Different modes of transportation and their characteristics, Scope and limitations. Traffic Engineering, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads. (12) Airport planning, Site selection, Obstructions and zoning laws, Geometric standards of landing area, Runway orientations, Airport runway length, taxiway and exit taxiway design, Visual aids, Introduction to air-traffic control. (10) Development of railways in India, Track components and materials, Geometric design elements, Tractive resistances, Layout of points and crossings, High speed track, Marshalling yards, Signaling and interlocking, Track materials and maintenance. (10) Requirements of good docks and harbours, Types of docks, Whaff-walls, Lock-gates, Wave action, Littoral drift, Breakwaters, Jetties, Dredging. (6) 										
Tovt	Text Books:	vay Airport and Uar	hour Enga	WKP Sube	amanian So	itech Dubl	ication				
Books.	2. Airport Engine	ering by Rangwala (Chrotar Pub	ishing	amaman, SC		ication				
and/or	3. Railway Engine	eering by Saxena and	l Arora, Dha	anapat Rai P	ublication						
reference	Reference Books:	•••		•							
material(s)	4. Highway Engin Bros.	neering by S. K. Kl	nanna, C.E.	G. Justo an	d A. Veerar	aghavan,	Nemchand &				
	5. Harbour, Dock	and Tunnel Engineer	ring by R. S	rinivasan, C	harotar Publi	ishing					
Mapping of	t Course Outcomes	CUs→POs→PSOs	<u> </u>								

P		Court		comes	000.	100		, ,							
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management $\&$ finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	2	-	-	-	3	-	2
CO2	3	-	3	-	-	-	1	-	-	2	-	2	-	-	2
CO3	-	-	3	-	-	-	-	2	-	2	1	3	-	1	2

						Pr	ogram	Core	Tot	al I	Number	of contac	t hours		
	urse de	Ti	tle of t	the co	urse		(PCR)/	Lect	ure	Tutorial	Practica	l Total	Cr	edit
	Jue					Ele	ctives	(PEL)	(L)	(T)	(P)	Hours	5	
СЕС	C-551	Str	uctura Sessi	al Ana onal-I	alysis I		PS		0		0	3	3	1	.5
		Pre-ree	quisite	e(s)					Co	urse	e Assessn	nent meth	ods		
S	olid M	lechan	ics &	Struct	ural		Co	ontinuo	us (C	Г) а	and end as	ssessment	(EA). C	CT+EA	
		Ana	lysis-l	. 1	• 1	<u> </u>	· 1		1	<u>c</u>	1	1' 1		.1 1	(01
Co	11700	• C	OI: A	Analys	e inde	termi	nate b	bution	and	trar	nes by	displacer	nent m	ethods	(Slope
Outo	comes		$\Omega^{2} \cdot \Lambda$	on mei	nou, w	tormi	n aistri	DULIOI	metho and f	Ju, . ram	Kane S II.	orce met	hode (7	'hroo n	oment
(CC	Os):	• C E	onatio	n. coli	ımn Ar	alogy	methc	od con	sistent	t de	formation	method		mee n	loment
	,	• C	O3: A	n, con	matrix	analy	vsis us	ing st	ffness	ar	nd flexib	ility met	hods- c	omputer	·-based
		ar	nalysis	of str	ucture.	••••••	,	8						P	
		• C	04: Ev	valuate	e and d	raw th	ne influ	ience li	nes fo	or re	eactions, s	shears, an	d bendi	ng mom	ents in
		in	detern	ninate	beams	/ gird	ers and	l frame	s.						
		• CO	5: Ap	oply a	approxi	mate	metho	ods (S	ubstitu	ite	Frame 1	nethod,	Portal a	and car	ntilever
		me	thods)	to sol	ve mul	ti-stor	reyed t	ouildin	g fran	nes					
		Disp		ent m	ethods	: App	plicatio	on of S	Slope	def	lection, N	Moment of	listribut	ion & 1	Kani's
		meth	od to 1	ndeter	minate	beam	is, fran	ies & p	ortals		2)	aantinua	ha haam	avaaut	ion of
_		Colu	e meu	alogy	Applic & Con	ation	of Thr defor	nation	metho	equa ad ta	ations to	continuot & frames	(0)	, execut	1011 01
	pics	Influ	inn and ience	lines:	Indete	ermina	ate stri	ictures	Mul	ler	Breslau	principle	with a	nnlicati	ion to
	verea	redur	ndant b	beams	(6)				, 10100	101	Diesiaa	principie	, , , , , , , , , , , , , , , , , , ,	ppnout	ion to
(1)	118)	Matı	rix M	ethod	: Mati	rix fo	rmulat	ion of	flexi	bili	ity & sti	iffness n	ethods	of stru	ctures-
		appli	cation	for sin	nple lo	ading	cases	(6)							
		Аррі	roxim	ate m	ethods	: Sub	stitute	frames	, Port	al &	& Cantile	ever meth	ods on	multi-st	oreyed
		build	ing fr	ames	(6)										
- T		Text I	Books:		1 4 1	• •		11 7		C	TT'11				
I Bo	ext	1. B	asic Sti	ructura	I Analy uctural	SIS DY Analys	C. S. K sie by V	eaay, 1 Vilbur 2	ata Morr	cGra ic N	aw Hill Megraw-H	ill Colleg	`		
an	d/or	2. E	ructura	al y Su al Anal	vsis L.	S. Neg	sis Uy v ri & R.	S. Jang	id. Tat	15, 1 a M	cGraw Hi	lli Conego 11			
refe	rence	4. St	ructura	al Anal	ysis by	R. C. 1	Hibbele	er, Pear	son Ed	ucat	tion				
mate	rial(s)	Refer	ence B	ooks:											
		5. St	ructura	al Anal	ysis by	G. S. I	Pandit &	& S. P.	Gupta,	Tat	ta McGrav	w Hill			
Monr	ving of	6. In	termed	liate sti		analysi	IS by C	K wan	g Mc.	Gra	IW H111				
wiapp	mg of	Cours				rUST	1208								
	dge	20	it of	ns of us	ē	ciety					it &	ас	1 and	l and	_
	nowle	alysi	opmer ns	igatio oblem	ıl usag	nd so	ent & ility	s	al & ork		cation	e	lesigr ce	d skil	sions nes

	Engineering know	Problem analy	Design/developn solutions	Conduct investiga complex probl	Modern tool u	The engineer and	Environment sustainabili	Ethics	Individual d team work	Communicati	Project managen finance	Life-long lear	Plan, analyse, des prepare	Computer aided s tools	codal provisio guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO2	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO3	3	-	-	-	2	-	-	-	-	1	-	-	3	3	1
CO4	3	-	-	-	2	-	-	-	-	-	-	-	3	2	1
CO5	3	-	1	-	-	-	-	-	-	-	-	-	3	1	1

Cor							Progra	am Co	re T	otal Nu	imber of	f contact	hours	•	
	ode	1	litle of	the c	ourse		(P (CR) /	I	ecture	Tutorial	Practical	Total	Cı	edit
		Der		141 6	14		Electiv	es (PE	L)	(L)	(T)	(P)	Hours	3	
CES	8552	Desi	gn of S Se	steel S	al	res]	PS		0	0	3	3	1	1.5
		Pre-	requisit	e(s)						Course	Assessm	ent metho	ods		
		Solid	l Mecha	anics				Cont	inuous	(CT) a	nd end as	sessment	(EA). (CT+EA	
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Top Cove (Hi	oics ered rs)	Intro Desig Desig Built Desig Desig rivete Desig conne Desig loadin Desig	ductio gn phil gn of T gn of T up sect gn of G gn of P ed and gn of S ections. gn of gn of gn of	on, Pro osoph 'ensio Beam tions fantry Plate g welde Simple . (6) Strut acing a Colum	pperties ny of Lis n members (later /compose y girders, girders, ed. (2) e Conne ts and and batt in bases	of st mit S bers ally und I s (4) Cor ectio ens, a – sl	ructura State m , Comp suppor beams () nnection ons: Riv imns i Colum ab base	al steel, ethod f pression rted /u (6) ns, Stif veted, includi n splic e, Guss	, I.S. 1 for Ste n men nsupp ffener: Boltee ng bu ing. ((eted b	olled so cel Stru obers in orted): s and co d and v uilt-up base. (4	ections, I ctures (6 truss (6 Simple urtailmen velded co columns	(.S. speci)) beam u nt of flam onnection s under	ficatio sing ro age plan ns, mo axial	ns (2) olled se tes, Spl ment re and ec	ections, icing – esisting centric
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Mapp	ing of	Cours	se Outc	omes	COs→	POs	→PSOs	S							
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines

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CO2	-	-	-	3	1	-	-	-	-	-	-	-	-	-	3
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Con		• C(O1: let	arn the	basic	surve	ying te	chniqu	es and	the us	se of basi	ic surve	ing ins	trumen	ts.
Outo	irse	• C	O2: le	arn th	e art o	f quai	ntity e	stimati	on, pi	reparati	on of B	ill of Q	uantitie	s, and	writing
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		5) C_{01}	ntouri	ng hy	anv me	thod (Ontion	al sub	iect to	availa	bility of	time)	•		
		6). Stu	idv of	theod	olite. fi	unctio	n of it	s diffe	rent p	arts. M	easurem	ent of h	orizont	al and y	vertical
Top	oics	angle (7 labo	orator	v class	ses)			r r						
Cove	ered	B). Es	timati	ion	v	,									
		Introdu	uction	to qu	antity	surve	ying, N	Method	ls of a	measur	ement a	nd units	of me	asurem	ent for
		variou	s item	s of w	ork, Pr	ocedu	res of o	compu	tation	, Use o	f proform	na. (2)			
		Types	of esti	imates	, Data	requir	ed for	estima	tion. (2)					
		Prepar	ing de	etailed	estima	tes fo	or vario	ous typ	es of	Civil 1	Engineer	ing wor	ks. (7)	+ 5 ses	ssional
		classes	5) 	C 1			c	1 (1				``			
		Specif:	ication	ns of d	ifferen	t item	s of wo	ork. (I	hr. th	eory c	lass lect	ures)	C	1 0	1 1
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refer	ence	5. Esti	imating	g. costi	ng and	specif	ication	in civi	l engi	neering.	6 th editio	on by M.	Chakra	ıbortv. k	Kolkata.
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		Referen	nce Bo	ooks:											
		6. Tex	t book	of esti	mating	and co	osting (civil en	gineer	ing) by	G. S. Bir	die, Dha	ipat Rai	& Sons	, Delhi,
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Correct		Program Core	Total N	umber o	f contact	hours								
Code	Title of the course	(PCR) /	Lecture	Tutorial	Practical	Total	Credit							
Coue		Electives (PEL)	(L)	(T)	(P)	Hours								
CEC601	Water Resource Engineering	PCR	3	1	0	4	4							
	Pre-requisite(s)		Course	e Assessm	ent metho	ods								
	Fluid mechanics	Continuo	ous (CT) a	and end as	sessment	(EA). C	T+EA							
	• CO1: Understanding of occu	rrence, distributio	n, storag	e & tran	smission	of wate	er in different							
C	form in the space, on the surf	ace and below the	surface of	of the ear	th.									
Course	• CO2: Understanding of te	empo-spatial coll	ection of	of data	and pre	paratio	n of hydro-							
$(CO_{\rm s})$	 meteorological information system. CO3: learning importance, requirement, method & infrastructure for imparting irrigation water to crop, development & conservation of water for its economic & efficient use Hydrology: Hydrologic cycle & system model, Hydro-meteorological Information System and its Definition, need, generation, maintenance, validation, calibration of data sets, estimation of missing data, retrieval of data (5) Precipitation: Forms, types & measurement, Recording & non-recording gauges, Network, Analysis & Adjustment of data, Average depth, depth-area-duration analysis, Surface retention, Detention, Overland flow, Interception, Depression storage. (6) Evaporation & Transpiration: Factors, Measurement, formula consumptive use (2) Stream flow: Stage, discharge & relations interpretation of stream flow records. Factors 													
(COS).	• CO3: learning importance, re	quirement, metho	d & infra	structure	for impa	rting in	rigation water							
	to crop, development & conse	ervation of water f	or its eco	onomic &	z efficien	t use								
	Hydrology: Hydrologic cycle	& system model,	Hydro-m	neteorolo	gical Info	ormatio	n System and							
	its Definition, need, generation	n, maintenance, va	illidation,	calibrati	on of da	ta sets,	estimation of							
	Procinitation: Forms types	5) Remansurament	Docordin	a & non	rocordir		na Natwork							
	Analysis & Adjustment of data	Average depth	denth_are	g & non a-duratio	on analys	is Surf	ace retention							
	Detention Overland flow Inter	ception Depressi	on storag	ze. (6)	Jii anaiys	13, Duii	dee retention,							
	Evaporation & Transpiration	: Factors. Measur	ement. fo	ormula co	onsumpti	ve use ((2)							
	Stream flow: Stage, discharge	ge & relations, in	nterpreta	tion of s	stream fl	ow rec	ords. Factors							
	affecting the run off, yield, flow	v duration & mass	curve (4)										
	Infiltration: Process, Capacity	, Measurement, Es	stimation	(3)										
	Run-off: Factors, Yield, Flow-	-duration curve, F	low mass	s curve. (3)									
	Hydrograph: Base flow separa	ation, Unit hydrog	raph, Syr	nthetic hy	drograpł	n (3)								
Topics	Irrigation: Necessity, Advar	ntages, Disadvant	ages, T	ypes, W	ater dist	ribution	n techniques,							
Covered	Quality of water, Duty, Delta,	Base period, Inc	lian crop	seasons	, Irrigatio	on effic	eiencies, Soil-							
(HIS)	moisture –irrigation relationshi	ps, Estimating dep	oth and fr	requency	of irrigat	10n. (5)	ined e stable							
	channels Sediment transport	conomics of cana	$\frac{1}{1}$	Cross dra	ion of un	nneu, 1 orks (3)	$\operatorname{Ined} \alpha \operatorname{stable}$							
	Water-logging and control: (auses Control R	eclamatic	on of sali	ne and al	kaline l	ands Surface							
	& Sub-surface drainage (3)		conumation	JII OI Sull	ne une u	Runne I	unus, Burrace							
	Diversion head-works: Defin	ition of weirs, ba	rrages &	their cla	assificatio	on, Lav	out of typical							
	diversion head-works & function	on of its component	nts. (2)			, ,	51							
	Reservoirs: Types, selection of	f site, Storage zon	es, Fixati	ion of cap	pacity, re	gulatior	n. (3)							
	Dam: Earthen and concrete dar	n, selection criteri	la, design	n (4)										
	Spillways and energy dissi	paters: Location	, types,	energy	dissipatio	on, still	ling basin &							
	spillway gate (4)			~										
	Flood Forecasting: Estimation	i, forecasting & m	itigation,	flood la	nd manag	gement	(4)							
	Flood routing: Reservoir & Cl	nannel routing (hy	drologica	al method	d only) (2	2)								
Text Books	1 Engineering Hydrology by K	Subramanya Fourth	Edition	McGraw 1	Hills Educ	eation (I	ndia)							
and/or	2. Irrigation Engineering and Hvd	raulic Structures by	S. K. Ga	rg. Khann	a Publishe	ers. New	/ Delhi							
reference	Reference Books:			- 6,		,								
material(s)	3. Irrigation and Water Power En	gineering by B. C.	Punmia,	B. B. Par	nde, A. K	. Jain, A	A. Kumar,, 16 th							
	Edition, Laxmi Publications (P)	Limited, New Delh	i											
Mapping of	of Course Outcomes $COs \rightarrow POs$ -	→PSOs			- <u> </u>		I							
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	Engineering knowledge	Problem analysis	Design/deve lopment of	investigatio ns of	Modern tool usage	The engineer	Environmen t & sustainabilit	Ethics	Individual & team work	Communica tion	Project managemen t & finance	Life-long learning	Plan, analyse, design and	Computer aided skill and tools	codal provisions / guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3		3		-	3	-	-	-	-	-	2	-	-
CO3	-	-	3	-	3	3	-	3	3	2	3	3	2	-	1

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			.		F	Electiv	es (PE	L)	(L)	(]	Γ)	(P)	Hour	s	
CE	C602		Found Engine	eering		P	CR		3	0		0	3		3
Pre-	-requisi	ite(s)			(Course	Assess	ment r	nethods				1		
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Co Outc	urse comes	• C(D1: Ca D2: De	lculate s termine	shear s the ea	trengt orth pro	h of so essures	il on fo	oundatio	ons and	retaini	ng struct	ures		
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		of pi	les, Pro	oblem. (6)	_									
		Well	found	ation: I	Elemei	nts of	wells,	Гурез	. (2)						
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and	d/or	2. Ba	asic and	d Applie	ed Soil	Mech	, anics b	by G.	Ranjan	and A.	S. Rao)			
mate	rial(s)	Refe	rence l	Books:											
mate	1141(3)	3. Fo	oundation	on analy	ysis an	d Des	ign by	J. E. 1	Bowles						
		4. Sc	oil Mec	hanics a	and Fo	undati	on Eng	gineer	ing by S	S.K. Ga	rg, Kh	anna Pul	olishers		
		5. A	dvance	d Soil N	1echar	nics by	<u>B.M.</u>	Das,	McGra	w Hills	Publis	hers			
Map	ping of	r Cou	rse Out	comes (PUS	*P50s								
	nowledge	laysis	pment of ns	igations of oblems	l usage	nd society	ent & ility		al & ork	cation	cement & e	arning	lesign and e	d skill and	sions / ies
	ineering kı	Problem an	ign/develo solutior	luct investi omplex pro	fodern tool	engineer ai	Environme sustainab	Ethics	Individua team wo	Communic	ject manag financ	ife-long le	, analyse, c	puter aidec tools	odal provis guidelin
	Eng	ł	Des	Cond	N	The				-	Pro	Γ	Plan	Com	°
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	-	-	-	-	-	-	-	3	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO4	3	2	-	1	-	-	-	-	-	-	-	-	-	2	3

Course					Prog	ram Co	re	Total	Numb	er of	contact]	hours		
Code	Title	of the	cours	e	(P	PCR) /		Lecture	Tuto	rial I	Practical	Total	Cre	edit
couc					Electi	ves (PE	L)	(L)	(T)	(P)	Hours		
CEC603	Env	vironn nginee	nental ering		I	PCR		3	1	L	0	4	4	4
	Pre-requ	isite(s)					Cour	se Asse	essme	nt metho	ods		
	No	ne				Cont	inuo	us (CT)) and er	nd ass	essment	(EA). C	T+EA	
	• CO1:	Apply	know	ledge	of wate	er suppl	y & y	wastew	ater en	gineeı	ring for c	lesign so	olutions.	
Course	• CO2:	Under	rstand	basic	design	philoso	ophie	es appli	cable to	o con	veyance	and trea	atment i	inits of
Outcome	water	& was	stewate	er.							_		_	
(COs):	• CO3:	Form	ulate,	analy	ze, an	d desig	gn ba	asic co	mpone	nts of	f water	supply	& was	tewater
(005).	dispos	sal.	Pr noo	uinom	ont. S	0117000	0110	ntity (molity	mitari	o Intoleo	a Pr tran	anortati	on (0)
	Conver	– uses stional	a reg	or tr	ent: S	ources,	Qua	niny, Q	Veration		a, make	$s \propto trantion C$	'oagulat	$\frac{1}{100} \frac{9}{8}$
	floccula	ntion	i wai Filtrati	on D	isinfec	-	inclu	iding d	esion d	n, se	its Othe	r misce	llaneous	water
	treatme	nt proc	cesses.	(13)	isiiiice	lion	mere	ading d	051511	JI UIII		i misee	nuncou	, water
	Water	storag	e & di	stribu	tion s	vstems,	Desi	ign of p	oipe net	works	s. (3)			
	Introdu	iction	to plu	mbing	g syste	ms in b	uildi	ngs. (2)	1					
Topics	Estima	tion of	f quan	tities (of sani	tary was	stewa	ater & s	torm w	vater r	unoff. (3)		
Covered	Sewera	ge sys	tem, D	Design	of sew	vers, Sev	wer a	appurter	nances,	Mate	rials of s	ewer co	nstructi	on. (5)
(Hrs)	Quality	7 & ch	aracto	erisati	on of	domest	tic w	vastewa	ter: di	fferen	nt parame	eters inc	luding	oxygen
	demand Dringin	verage system, Design of sewers, Sewer appurtenances, Materials of sewer construction. (5) ality & characterisation of domestic wastewater: different parameters including oxygen hands, Standards of sewage disposal. (4) nciples of wastewater treatment, Physical, chemical & biological treatment methods,												
	Primary	ality & characterisation of domestic wastewater: different parameters including oxygen nands, Standards of sewage disposal. (4) nciples of wastewater treatment, Physical, chemical & biological treatment methods, nary & secondary treatment, Bio-filter, Activated sludge process, Stabilisation pond, Septic												
	tank. (1	nands, Standards of sewage disposal. (4) nciples of wastewater treatment, Physical, chemical & biological treatment methods, nary & secondary treatment, Bio-filter, Activated sludge process, Stabilisation pond, Septic (12)												
	Introdu	iction	to oth	er tre	atmen	t proces	sses i	includiı	ng dige	stion	& dispos	al of slu	dge. (3)	
	Princip	les of	strean	n sani	tation.	. (2)					-			
	Text Bo	ook:												
Text	1. Envi	ironme	ental E	Ingine	ering (Vol. I	& II)) by Pu	nmia, .	Jain &	& Jain, I	.axmi P	ublication	ons (P)
Books,	Ltd,	New I	Delhi		• (1		TT \ 1	a v	C	T71	DU	1 D	11 ·	
and/or	2. Envi	ironme	ental E	nginee	ering (V01. I &	: II) t	ру 5. К.	Garg,	Knan	na Publis	shers, D	elhi	
reference	3 Envi	ironme	ental E	nginee	ering h	v H. S. I	Peav	v. D. R	Rowe	& G	Tchoba	noglous	McGra	w Hill
material	Edu	cation	(India)) Priva	te Lim	ited, Ne	ew D), 2. 10 Oelhi			1 011000			
(8)	4. Was	tewate	r Engi	neerin	g, Trea	atment a	& Re	use (4tl	h Ed) b	y Met	tcalf & E	ddy, Inc	. (Revis	sed by
	G. T	choba	noglou	ıs, F. L	. Burt	on & H	. D. S	Stensel,	Tata M	1cGra	w Hill E	ducation	n Private	e
	Lim	ited, N	lew De	elhi										
Mappin	g of Cours	se Out	comes	COs-	POs-	≯ POs								
	e	Ŧ	of		ty	ility				ance		put	hud	
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	now	opme ns	igati	l usa	s pu	usta	s	al & ork	catio	ent é	arni	desi re	d sk	sion
	ng k m ai	evelc	vest x pr	1 too	eer a	& s	thic	vidu m w	iuni	geme	ng le	se, epa	aide ools	rovi deli
	oble	n/de sol	ct in nple	derr	Igine	ment	щ	Indiv tea	umo	anag	e-lo	naly pr	ter	lal p gui
	Pr)esig	cor	Mo	le er	ironı			Ũ	ct m	Lif	n, a	ndu	cod
	ш	П	Ŭ		I	Env				Proje		Pla	Co	
P	01 PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	1 PO12	PS01	PSO2	PSO3
CO1	2 -	-	-	-	-	-	-	2	-	-	-	2	-	-
CO2	3 -	3	-	-	-	1	-	-	2	-	2	2	-	-
CO3		3	-	-	-	-	2	-	2	1	3	2	-	3

C							Prog	ram C	ore	Total N	umber	of cont	act ho	urs	
Cou	irse]	Fitle o	f the c	ourse		(I	PCR) /]	Lecture	Tutorial	Practi	cal T	otal	Credit
CO	ue						Electi	ves (P	EL)	(L)	(T)	(P)	H	ours	
		Envir	onme	ntal E	nginee	ering									
CEC	C651	Labor	atory	& Cor	nputa	tional]	PCR		0	0	3		3	1.5
			Lab	orator	y- I										
		Pre-	requis	ite(s)					(Course A	Assessme	ent meth	nods		
	En	vironm	ental I	Engine	ering		(Contin	uous ((CT) and	d end ass	sessmen	nt (EA)	. CT+l	EA
Cou	ırse	• CO1	: Achi	eve K	nowled	dge of	design	h & dev	velopr	nent of o	experim	ental sk	ills		
Outco	omes	• CO2	2: Und	erstand	l the pi	rincipl	es of d	lesign	of exp	eriment	s.				
(CC) s):	• CO3	B: To	learn	step l	by ste	p pro	cedure	for	modelli	ng tech	nique &	& ana	lysis c	of civil
		engi	neerin	g prob	lems b	y finit	e elem	ent bas	sed so	ftware					
		• CO4	: Ana	lyse &	solve	for fo	orces a	nd def	lection	n in trus	ses, bea	ms and	frame	s unde	r static
		load	ing												
		• CO5	5: Anal	yse &	solve	for res	ponses	s in tru	sses, l	beams a	nd frame	es under	r dynai	nic loa	ding
		A). Er	iviron	menta	l Engi	ineeri	ng								
		1. pH	and te	empera	ture.										
		2. Tu	rbidity												
		3. Co	nducti	vity.											
		4. Tot	tal soli	ids, Se	ttle abl	le solio	ds and	susper	nded s	olids.					
Top	pics	5. Ch	loride.												
Cov	ered	6. Ac	idity.												
(H	rs)	7. All	kalinit	y.											
		8. Res	sidual	chlorn	ne.										
		9. Dis	solve	1 oxyg	en.										
		10. Co	olony c	count o	of bacte	eria.									
		B). Co	omput	ationa	l Labo	orator	y- I								
		Introd	uction	of co	mpute	r aideo	d desig	gn and	draft	ing, Sol	lution of	fstructu	ıral pr	oblem	s using
		comm	ercial	softwa	re										
Te	ext	Text B	Book:												
Boo	oks,	1. Ch	emistr	y for E	Enviroi	nmenta	al Engi	ineerin	g and	Science	e, 5th ed	ition by	v C. N	Sawye	r, P. L.
and	l/or	Mc	cCarty	and G	.F. Per	kin, N	IcGrav	v-Hill	Inc., 2	2002					
refer	ence	2. Nu	merica	al Metl	nods fo	or Scie	entists a	and En	ginee	rs by R.	W. Han	nming, l	Dover	Public	ations
mate	erial	Refere	ence B	ook:											
(8	5)	3. Sta	indard	metho	ods for	r the e	examir	nation	of wa	ater and	wastew	vater. (2	2012).	21st E	Edition,
		Wa	ashingi	ton: A	PHA.	1.14	.1 1	с т		TT	·	.1 1	1.0.1		1 / т
		4. C - 1	Appl	1ed N		cal M	ethods	for I	engine	eers Us	ing Ma	tlab an	d C	by Ro	bert J.
Monr	aing o	SCI f Cours	nilling.	, Sandi	$\frac{1}{COc}$	$\mathbf{PO}_{\mathbf{s}}$	Nelsor	n Engir	ieerin	g; Har/C	ar eaiti	on			
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		sis	ment	of	age	nud	8,		2	uc	nent	ing	s, Dare	ed s	/ St
	ring dge	naly	lopi	ons	ol us	er a ty	ient vility	s	al & ork	cati	agei ice	earn	ulyse preț	aid tool	ision
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	Eng. kno	oble	gn/c of sc	CC Vesti	dern	e en sc	nvira usta	Щ	Indiv tear	umc	ect 1 & f	e-loi	lan, ign (sill	lal p gui
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	DO1	DO2		DO 4	DOS	DOC	D07	DOQ	DOO	DO10		DO12	DCO1		
CO1	PUI	PO2	PU3	r 04	r05	PU0	1 PU/	ruð	209	P010	PUII	rui2	r201	PSU	2 PSU3
CO1	-	-	-	- 3	-	-	1	-	3	-	-	-	-	-	-
CO_2	- 2	-	3	-	2	-	-	_	-	-	-	-	- 2	- 3	-
CO4	3	-	3	-	3	-	-	-	-	1	-	1	3	-	-

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CO5

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Com							Progra	m Cor	e 7	Fotal N	Number (of conta	ct hou	rs	
Code	e	Ti	tle of t	the co	urse	E	(PC) Elective	CR) / es (PEI	L)	ecture (L)	Tutorial (T)	Practica (P)	l Tot Hoi	al ırs	Credit
CES6	52	Con	crete ' Labo	Techn ratory	ology y		P	S		0	0	3	3		1.5
		Pre-re	equisite	e(s)	, 				C	ourse .	Assessme	ent meth	ods		
Buil	ding	g Const	ruction	1 & Co	oncrete		C	Continu	ous (CT) an	d end as	sessment	(EA).	CT+	EA
	Ū	Tec	hnolog	şу						,					
Cours	se	• CO	1: Co	nduct	exper	imen	ts for	deterr	ninin	g the	properti	es of c	lifferer	nt en	gineering
Outcon	nes	mat	terials	like ce	ement,	fine &	k coars	e aggre	egate	s, conc	rete etc.	and worl	x in a g	roup.	
(COs	()	• CO	2: Des	ign coi	ncrete n	nix pro	oportio	n based	on th	e prope	rties of co	ncrete in	gredien	ts.	
		• CO	3: Use	e mode	ern inst	rumen	its & to	ools for	conc	lucting	the expe	riment of	n diffei	ent en	ngineering
		mat	erials.							U	1				0 0
		• CO	4: Prep	pare th	e repor	rt on o	experir	nental	result	s.					
		To det	ermine	e the (a	a) finei	ness o	of ceme	ent by s	ievin	g, (b) s	standard o	consister	cy of	cemer	nt and (c)
		setting	g time of	of cem	ent. (6)		2		0, , ,			•		
		To det	ermine	e the (a	a) spec	ific g	ravity o	of ceme	ent (b) comp	pressive s	trength	of cem	ent ar	nd (c)
		sound	ness of	f ceme	nt. (6)										
		To det	ermine	e the (a	a) parti	cle si	ze dist	ribution	n, (b)	specifi	ic gravity	and wa	er abs	orptic	on and (c)
Topic	cs	bulk d	ensity	and vo	oids in	coars	e aggre	egate. (6)						
Covere	ed	To det	termine	e the (a	a) parti	cle si	ze dist	ribution	n, (b)	specifi	ic gravity	and wa	ter abs	orptic	on and (c)
(Hrs))	bulk d	ensity	and vo	oids in	fine a	aggrega	ate. (6)							
		Concr	ete miz	x desig	gn by I	S Me	ethod. ((6)							
		(a) Pre	eparati	on of c	concret	e spe	cimens	to dete	ermin	e the c	ompressi	ve stren	gth flex	kural	strength
		and sp	olit tens	sile str	ength o	of con	crete c	of a giv	en m	ix prop	ortions.	(6)			
		(i) Co	mpress	sive str	rength	at 07	days -	3 nos c	ube -	- 3 nos	cylinder				
		(ii) Co	ompres	sive st	rength	at 28	days -	3 nos o	cube	+3 nos	s cylinde	r			
		(111) S	plit tei	nsile st	trength	at 28	days -	3 nos	cylin	der					
		(1V) F	lexura	l stren	gth at ∠	28 day	ys - 3 n	os pris	m		1 (7 1	1 0	0.1		
		(b) Te	st abov	ve spec	cimen a	accore	ling to	the pro	oper t	esting	day (7 da	$\frac{1}{2}$ and $\frac{1}{2}$	8 days) (3)	
		(c) 1	l'o dete	rmine	the co	nsiste	ncy an	d work	abilit	y of fre	eshly mix	ked conc	rete by	7	
		1) 5	lump t	est and	1 11) CC	mpac	ting fa	ctor tes	st						
Toyt		1 ext B	OOKS:	Taalaa	- 1 I	A	M Na		. J.T.	I Dues	Ira Daama	on Edu	D., 1, 1, .		
Books	s	1. Cor	ncrete	Techn	ology I)у А.	NI. Ne	ville ar	10 J.	J. Broo	isotion	on Eau.	Public	ation	
and/o	or	2. COL			ology	<i>y</i> w.	5.516	etty, S.	Chan	a Publ	ication.				
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	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management $\&$ finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	3	-	-	-	-	2	-	-	-	-	-	-
CO2	-	-	3	2	-	-	-	-	2	-	-	-	3	-	-
CO3	-	-	-	2	3	-	-	-	1	-	-	-	-	3	-
CO4	-	-	2	1	-	-	-	-	1	2	-	-	_	_	1

Con						P	rogran	n Core	Tot	al Nu	nber o	f contact	hours				
	de	Ti	tle of	the co	urse		(PC	R) /	Lect	ture Tu	itorial	Practical	Total	Cr	edit		
						El	ectives	s (PEL) (1	_)	(T)	(P)	Hours				
CES	5751	Proje	ct I				P	5	0		0	4	4		2		
		Pre-re-	equisit	e(s)					Co	ourse A	ssessn	nent meth	ods				
Des	sign of	f Conci	rete Stu	ructure	es alon	g	C	Continu	ous (C	CT) and	l end a	ssessment	t (EA).	CT+EA			
with	Conc	rete Te	chnolo	ogy La	borato	ry											
Сог	ırse	• C(D1: De	monst	rate a s	sound	techni	cal kno	wledg	e of th	eir sele	ected proj	ect topi	с.			
Outc	omes	• C(D2: Un	 Definition and solution. Design engineering solutions to complex problems utilising a systems approach. Conduct an engineering project. pe of Civil Engineering problem either experimentally, analytically, and Numerically. 													
(CC	() (s):	• C(D3: De	 Undertake problem identification, formulation and solution. Design engineering solutions to complex problems utilising a systems approach. Conduct an engineering project. e of Civil Engineering problem either experimentally, analytically, and Numerically. 													
,	,	• C(D4: Co	 Design engineering solutions to complex problems utilising a systems approach. Conduct an engineering project. e of Civil Engineering problem either experimentally, analytically, and Numerically. 													
				Design engineering solutions to complex problems utilising a systems approach. Conduct an engineering project. of Civil Engineering problem either experimentally, analytically, and Numerically.													
Top	oics	Any ty	pe of	Or Civil Engineering problem either experimentally, analytically, and Numerically.													
Cov	ered	5.5	1	: Conduct an engineering project. e of Civil Engineering problem either experimentally, analytically, and Numerically.													
(H	rs)			e of Civil Engineering problem either experimentally, analytically, and Numerically.													
Te	ext	Text B	ooks:	e of Civil Engineering problem either experimentally, analytically, and Numerically.													
Boo	oks,	Refere	nce Bo	e of Civil Engineering problem either experimentally, analytically, and Numerically.													
and	l/or																
mater	vial(s)																
Mapr	oing o	f Cours	se Out	comes	COs	>POs-	→PSOs	S									
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	ing]	em a	leve] oluti	nves ex p	n to	leer	ıt &	Ethi	ividı un v	unu	nana] guo	yse, rep	aid tool	sion		
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	ingii	P	Desi	ondi	Ň	hee	iron			0	roje	Li	an,	duuo	al p		
	Щ			Ŭ		F	Env						Ы	Ŭ	cod		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	l PO12	PSO1	PSO2	PSO3		
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		

Code Title of the course (PCR) / Electives (PEL) Lecture Tutorial Practical Pre-requisite(s) Total Course Credit Hours CES752 Structural & computational Lab-II PS 0 0 3 3 1.5 Design of Concrete Structures along with Concrete Course Assessment methods Course Assessment (EA). CT+EA Outcomes (COs) : CO1: Design concrete mix proportion based on the properties of concrete ingredients and design and detailing of reinforced concrete beam under given conditions and work in a group. CO2: Use modern instruments and tools for experimenting on different engineering materials in a group. CO3: Prepare the report on experimental results. CO4: Ability to apply computational software to analyse and design of different civil engineering problems and apply in industries Topics Covered (Hrs) 1. Concrete mix design for different grades of concrete (as per Indian Standard guidelines). 2. Design, detailing and bar bending schedule for R.C. beam. . Application of commercial software for solving Civil Engineering problems Text Books; and/or reference material(s) Text Books: . Concrete Technology by M. S. Shetty, S. Chand Publication. . Concrete Technology by M. S. Shetty, S. Chand Publication. . Soncrete Technology M. L. Gambhir, Tata McGraw Hill. 4. So code of practice: 383-2016, 10262-2019, 456-2000 etc.	Cou	rso					P	rogran	n Core	Tot	al Nu	nber o	f contact	t hours			
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PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 PS02 PS03		En		De	Cor	-	The					Pr		Pla	Coi		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	CO1	1	-	3	3	-	-	-	-	2	-	-	-	3	-	-	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	CO2	-	-	<u> </u>	2	-	-	-	-		- 2	-	-	-	<u> </u>	-	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	CO4	-	1	2	-	3	-	-	-	-	-	-	-	3	3	1	

Course		I	Program Co	e Tota	l Nu	mber o	of contact	hours		
Code	Title of the cour	rse	(PCR) /	Lectu	ire T	utorial	Practical	Total	Cre	dit
Coue		E	Clectives (PE	L) (L))	(T)	(P)	Hours		
	Vocational Train	ing /								
CES753	Summer Internshi	ip and	PS	0		0	3	3	1.	5
	Seminar						1	1		
	Pre-requisite(s)	1	~ .	Cou	rse A	ssessm	ent metho	as		
Design of	Concrete Structures a	along	Continu	ious (CT	') and	l end as	sessment	(EA). C	CT+EA	
Course Outcomes (COs) :	 CO1: Able to constructure, product her organization CO2: For his / her Weaknesses, Opp CO3: Able to do organization in particular du constructure, product asks assigned du CO4: Able to test tasks assigned du CO5: Able to approximation organization. CO6: Able to ana for improvement 	nstruct the ts / servic of interns er organiz portunitie etermine articular a st the the iring the i oply vario skills d	e company p ces offered, k ship. zation of inte s and Threats the challeng and the sector coretical lear internship per bus soft skills uring perfor	rofile by ey achie rnship, t (SWOT res and in gene ning in p iod. such as mance f interns	comp veme (he st (). future ral. practi s time of t hip o	piling t nts and udent i e poter cal situ e mana the tas rganiza	the brief h market p s able to a ntial for h nations by gement, p sks assig	istory, a erformation assess i nis / he accom- oositive ned ir recomm	manage ance for ts Stren er intern plishin attitude n intern eend cha	ement his / ngths, nship g the e and nship anges
Topics Covered (Hrs) Text Books, and/or reference material(s)	Text Books: Reference Books:	•								
Mapping of	Course Outcomes C	Os→POs	→PSOs							
gineering knowledge	Problem analysis sign/development of solutions duct investigations of complex problems	Modern tool usage • engineer and society	Environment & sustainability Ethics	Individual & team work	Communication	jject management & finance	Life-long learning	1, analyse, design and prepare	nputer aided skill and tools	provisions / guidelines

	Engine	Prol	Design	Conduct comj	Mod	The eng	En		E t	Col	Project	Life	Plan, an	Comput	codal pro
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Co							Program Core (PCR) / Electives (PEL)		Tot	Total Number of contact hours							
Code		Title of the course							Lect	ure Tu	itorial	Practical	Total	ours Credit			
) (1	_)	(T)	(P)	Hours				
CES851		Project II					PS	5	0		0	15	5	1	.5		
Pre-requisite(s)						Course Assessment methods											
Des	sign of	Conci	oncrete Structures along				Continuous (CT) and end assessment (EA). CT+EA										
with Concrete Technology Laboratory																	
Co	ourse	• CO1: Demonstrate a sound technical knowledge of their selected project topic.															
Outo	comes	• CO2: Undertake problem identification, formulation and solution.															
(COs): • CO3: Design engineering solutions to complex problems utilising a systems approach.												ch.					
CO4: Conduct an engineering project.																	
	pics	A	ny ty	pe of	Civi	l Eng	ineerii	ng pro	blem	either	expe	erimentall	y, ana	lytically	, and		
	vered	N	umerio	cally.													
1) т	irs)	Toret	Dook														
	oks	I EXI Rofo	DUUKS ronco	s. Rooks	•												
an	d/or	Rejerence Dooks.															
refe	rence																
material(s)																	
Map	oing of	Cours	se Out	comes	COs	>POs-	PSOs	5									
	owledge	lysis	ment of	ations of dems	Isage	l society	it & ity		& k	tion	ment &	ming	sign and	skill and	guidelines		
	knc	ana	elop	stig prob	ool ۱	r and	men abil	iics	hual wor	nica	lage]	lear	e, de oare	ded	us / su		
	sring	lem	deve solut	in ve olex	ern t	ineeı	'iron stain	Eth	divic eam	nuu	man fina	long	alyse prej	er aid too	'isio		
	inee	Prob	ign/	duct omp	Jode	eng	Env su:		te	Con	ject	-ife-	, an	iputo	prov		
	Eng		Des	Cone	A	The					Prc	Ι	Plan	Con	odal		
				-											č		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO12	PSO1	PSO2	PSO3		
CO1	2	3	3	3	3	3	3	3	2	3	3	3	3	3	2		
000	2	5	2	2	2	2	<u>`</u>	2	-	-	-	2	2	2	ר ר		
CO2	3 3	3	3	3	3	3	3	3	2	3	3	3	3	3	3		
Co	urco					P	rogran	n Core	Tot	al Nu	nber o	f contact	hours				
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C	ode	Т	itle of	the co	urse		(PCl	R) /	Lect	ture T	utorial	Practical	Total	Credi	t		
						El	ectives	s (PEL) (1	_)	(T)	(P)	Hours				
CE	S852	J	Projec	t Semi	inar		PS	5	0		0	0	0	1			
		Pre-re	equisit	e(s)					Cours	se Ass	essmen	t method	S				
Des	sign of	Conci	rete Stu	ructure	es alon	g	Con	tinuous	s (CT)	and er	nd asse	ssment (E	EA). CT	+EA			
with	Concr	ete Te	chnolo	ogy La	borato	ry											
Co	urse	• (CO1: E	xpress	ed a so	ound to	echnica	al knov	vledge	of the	ir seleo	cted proje	ct topic	•			
Outo	comes	• (CO2: P	resent	the pr	oblem	identi	fication	n, form	nulatio	n and s	olution.					
(CC	Os):	• (CO3: 1	llustra	te des	sign e	nginee	ering s	olutio	ns to	compl	ex probl	ems uti	lising	a		
		S	ystems	s appro	oach.												
		• C	04: Co	4: Conduct an engineering project seminar.													
To	pics			: Conduct an engineering project seminar.													
	vered																
(Г	irs)		Rooks														
Т	ext	Text	et Books:														
Bo	oks,	Refe	rence	Books	:												
an	d/or																
rete	rence																
mate	erial(s)				CO_{2}]		
Mapp	oing of	Cours	se Out	comes	CUS	PUS-	7 P208	\$									
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management &	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	l PO12	PSO1	PSO2	PSO3		
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO4	5	5	3	5	3	3	3	3	3	5	5	5	5	3	5		

C						P	rogran	n Core	e Tot	al Nu	mber o	of contact	hours			
	Jurse Jodo]	Fitle of	f the c	ourse		(PCl	R) /	Lect	ure T	utorial	Practical	Total	Cr	edit	
	Jue					El	ectives	s (PEL) (I	_)	(T)	(P)	Hours			
CE	ES853		Vi	va Voo	ce		PS	8	0		0	0	0		1	
		Pre-re	equisit	e(s)					Co	ourse A	Assessr	nent meth	ods			
Des	ign of	Conci	ete Sti	ructure	es alon	g	C	Continu	ous (C	CT) and	d end a	ssessmen	t (EA).	CT+EA		
with	Concr	ete Te	chnolo	ogy La	borato	ry			,	,						
C	ourse	• (CO1 D	emons	strate k	nowle	dge in	the pr	ogram	doma	in.					
Out	comes	• (CO2 P	resent	his vie	ews co	gently	and pro	ecisely							
(C	COS):	′ • (CO3 E	xhibit	profes	sional	etique	ette sui	table fo	or care	eer prog	gression				
To	opics															
Co	vered															
(]	Hrs)		· n · 1													
Text	Books	s, Tex	xt Books:													
ar	nd/or	Ref	ference	e Book	s:											
refe	erence															
mat	erial(s))														
Mapp	oing of	Cours	se Out	comes	COs	POs-	→PSO	S						[
	sering knowledge	blem analysis	n/development of solutions	t investigations of plex problems	lern tool usage	gineer and society	nent & sustainability	Ethics	ndividual & team work	mmunication	unagement & finance	-long learning	nalyse, design and prepare	aided skill and tools	visions / guidelines	
	Engin€	Pro	Desigr	Conduc com	Moc	The en _l	Environn		I	Co	Project ma	Life	Plan, aı	Computer	codal prc	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0) PO 1	1 PO12	PSO1	PSO2	PSO3	
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	

Cou	irse]	Title of	f the c	ourse		Progr	am Co	ore T	otal Nu	mber o	f conta	ct hour	s Cı	edit	
Co	de					(PCR)	/ Elect	ives I	Lecture	Tutoria	Practic	ca Tota	al		
							(PEL)		(L)	(T)	1 (P)	Hou	rs		
CEO)440		Introd	luctio	n to]	PEL		3	0	0	3		3	
		Eart	hquak	e Eng	ineeri	ng										
		Pre-	requisi	tes:					С	ourse A	ssessme	nt meth	ods			
		No pi	e-requ	isites			(Continu	lous (CT) and	end ass	essmen	t (EA).	CT+EA	L	
Cou	irse	• C	01: A	pplyin	g Engi	neerin	g math	nematio	es in so	olving v	ibration	proble	m			
Outco	omes	• C	02: A	bility t	o desig	gn a bi	uilding	earthc	juake i	resistive	•					
		• C	03: Le	earn ba	sic of	Earth	quake e	engine	ering							
		• C	<u>04: A</u>	bility t	o man	age di	saster					~ .				
Тор	Dics	Seism	ology:	Engi	neering	g geol	ogy of	f earth	quake	s, plate	tectoni	cs, Seis	micity	of the	world,	
Cove	ered	Seism	ic wa	ves, fa	aults,	plate	bound	aries,	Intens	ity, Str	ong gro	ound m	otion,	Measur	ing of	
		Earthc	juake,	Earth	quake	Magı	nitude-	Local	(Rich	ter) ma	agnitude	, surfa	ce way	ve mag	nitude,	
		Mome	ent m	agnitu	de. S	pectra	ıl Par	ameter	rs: Po	eak Ao	ccelerati	on, Pe	eak V	elocity,	Peak	
		Displa	cemer	nt, Free	quency	Conte	ent and	l durati	ion. (1	2)						
		Eleme	entary	Vibr	ation:	Vibr	ation	of ele	menta	ry syste	em, Sin	gle deg	gree ar	nd two-	degree	
		freedo	m svst	tems. I	Earthou	iake a	nalvsis	. Resp	onse s	pectrum	n concer	ot (10)			U	
		Earth	rthquake Resistant Design: Philosophy, Code based methods for seismic design for RC Idings Behaviour of masonry structure during earthquake bands & reinforcement in													
		buildi	thquake Resistant Design: Philosophy, Code based methods for seismic design for RC dings. Behaviour of masonry structure during earthquake, bands & reinforcement in													
		masor	ldings. Behaviour of masonry structure during earthquake, bands & reinforcement in sonry (10)													
		Conor) Idalin	oci E	fficier	t agiar	nia ra	istant	nlonnin		otion of	aitaa	importo	noo of	
		archite	al Gu	featur	es. E	eartha	ii seisi uake r	nic tex esistan	t build	lings c	ng, seled		siles,	on pro	lice of	
		specia	l const	tructio	n featu	ures lik	te nom	ndino	floatir	ings, c og colun	on soft	storev	stair ca	se etc	role of	
		engine	ers in	the ear	rth aua	ike mi	tigatio	ns & d	isaster	manag	ement (1	10)	stan ea	.se etc.,		
		Text H	Books:		<u>, , , , , , , , , , , , , , , , , , , </u>											
Те	xt	1. Ea	rthqua	ke resi	stant d	esign	of stru	ctures	by Par	nkaj Ag	arwal ar	id Mani	sh Shri	khande		
Boo	oks,	2. Ba	sics of	Struct	ural dy	ynami	cs and	aseism	nic Des	sign by	S. R. Da	modara	asamy a	nd S. K	avitha	
and	/or	Refere	nce Bo	oks:	•								•			
refere	ence	3. Ele	ements	of E	arthqu	ake E	Engine	ering	by Jai	Krish	na, A.R	. Chan	drasekl	naran, I	Brijesh	
mate	ertai	Ch	andra													
Mapp	oing o	of Cours	se Out	comes	COs	POs-	→PSO	S		1	1					
	ge		of	s of		ety					જ		pun	put		
	vled	'sis	lent	tions	sage	soci	8		2	uo	lent	ing	ign ;	aill a	/ su	
	knov	naly	ndo	tigal robl	su lo	and	nent bilit	SS	aal & ork	icati	gem ce	earr	desi	ed sl	isio	
	ing]	em a	eve] oluti	nves ex p	n to	leer	ronn aina	Ethi	ividı um v	unu	nana inan	gue	yse, repi	· aid tool	prov idel	
		- Te	p/ s	i i i	der	ngir	Envi		Ind	Jomi	ect n f	fe-lc	anal P	outer	lal gu	
	neer	rot	5	2 8	0					0					· S	
	Engineer	Proł	Design	onduc	Mc	he e					Proj	Г	lan,	duno	coc	
	Engineer	Prot	Design	Conduc	Mc	The e					Proj	Г	Plan,	Comp	coc	
	Engineer	PO2	Design	Conduc Conduc FO4	°W PO5	The e	PO7	PO8	PO9	PO10	PO11	- РО12	Plan, IOSA	Com PSO2	PSO3	
C01	Engineer	PO2 -	- Design	Conduc Conduc -	PO5 -	DOG -	PO7 -	PO8 -	PO9 -	PO10	PO11 -	PO12 -	PSO1 -	PSO2 -	PSO3	
CO1 CO2 CO3	Engineer 1 1	PO2 - -	PO3 - 3	Conduc -	о W PO5 - -	2	PO7 - -	PO8 - -	PO9 - -	PO10 - -	PO11 -	PO12 - -	Plan, - -	PSO2 - -	PSO3 - -	

Course	Title of the course	Program Core	Total N	umber of	f contact	hours	C	redit					
Code		(PCR) / Elective	Lecture	Tutorial	Practica	Total							
		(PEL)	(L)	(T)	1 (P)	Hours	3						
CEO 441	Elementary Civil	PEL	3	0	0	3		3					
	Engineering												
	Pre-requisites:		Course A	ssessme	nt metho	ds							
	No pre-requisites	Continuou	s (CT) and	l end ass	essment ((EA). C	CT+EA	1					
Course	• CO1: Gain knowledge at	out elementary le	el civil e	ngineerin	g								
Outcomes	• CO2: To learn the use of	survey instrument	s										
	• CO3: To learn about con	struction materials	and techr	ology									
Topics	Measurement: Measurement	t of lengths, hei	ghts, and	angles	using su	rveying	g equi	pment,					
Covered	chain, tape, Dumpy level, stat	ffs, Theodolites. (1	0)	•	-			-					
	Survey: Different mapping r	nethods, elements	of chain	surveyin	g, compa	lss surv	veying,	, plane					
	able surveying, theodolite surveying, leveling and contouring. (10)												
	Building Materials: Commo	n building materia	ls, stone,	brick, tin	nbers, cei	nent, c	oncret	e, lime					
	concrete, their strength, chara	cteristics and diffe	rent types	of each	material.	(10)							
	Construction: Elements of	residential build	ings, met	hod of	construct	tion, n	niscella	aneous					
	temporary constructions, forn	n work, timbering	etc. (12)										
	Text Books:												
Text	1. Surveying and Levelling P	art I by T. P. Kane	tkar, and	S. V. Ku	lkarni, P	une Vio	dyarthi	i Griha					
Books,	Prakashan Pune – 30, 197	9											
and/or	2. Engineering Materials by S	5. C. Rangwala, Cł	arotar Pu	b. House	, Anand								
material	3. Building Construction by S	5. C. Rangwala, Cł	arotar Pu	b. House	, Anand								
material	Reference Books:												
	4. Building Construction by	B. C. Punmia, A.	K. Jain an	d A. K.	Jain, Lax	mi Puł	olicatio	ons (P)					
	Ltd.												
Mapping of	of Course Outcomes $COs \rightarrow PO$	s→PSOs		1									
edge	is it of ans of as ge			nt &	හ ස	n and	ll and	/					

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-

						P	rogra	m Cor	e T	otal N	umber o	of conta	ct hour	S	
Cou	irse	Ti	tle of t	the co	urse		(PC	R) /	L	ecture	Tutorial	Practica	l Total	C	redit
	Jue					E	lective	s (PEI)	(L)	(T)	(P)	Hou	s	
CEO	442	Expe	erimer	ıtal m	ethods	5	PI	EL		3	0	0	3		3
			and A	nalys	is										
		Pre-re	equisite	e(s)					Co	ourse A	ssessme	nt meth	ods		
B	Basic 1	Engine	ering,	statisti	cs &		C	ontinu	ous (C	CT) and	l end ass	essment	(EA).	CT+EA	
		pro	babilit	у											
Cou	irse	• CO	1: Dev	elopm	ent of	skills	for pre	dicting	g engir	neering	system	behavio	ur		
Outco	omes	• CO2	2: Kno	wledg	e of ba	asics o	f data :	analysi	s for f	urther	applicati	ions.			
(CC) s):	• CO2	3: De	velopi	ng th	e requ	iisite	skill t	hat h	elps i	n the a	dvanced	l cours	es rela	ted to
		exp	erimer	ntal stu	ıdy	-				-					
		Types	of n	neasui	remen	ts and	d erro	ors: In	ternal	& ex	ternal e	stimates	s of er	rors, R	elative
		freque	ncy di	stribut	ion, H	istogra	am, Tr	ue valu	le, Pre	cision	of measu	urement,	Best e	stimate	of true
		value	& prec	cision,	Metho	ods of o	calcula	ting be	est esti	mate c	of true va	lue & st	andard	deviati	on (7)
Tor	nics	Comb	inatio	n of	measu	ireme	nts: A	ccurac	y of	mean,	Signific	cant dig	its. Me	ethod o	f least
	ered	square	s & its	s appli	cation	for cal	lculatio	on of b	est est	imate	of true va	alue, cui	ve fitti	ng, (8)	
(H1	rs)	Gener	al line	ear re	gressi	on: Co	mparis	son &	combi	nation	of meas	urement	s. Exte	nsions o	of least
(11	15)	square	meth	nod. T	heory	of er	rors, 1	Binom	ial &	Gaus	sian dist	tribution	, Conf	idence	limits,
		Signifi	icance	test, p	rincip	le of m	naximu	ım like	lihood	l & goo	odness of	f fit, Chi	i-square	e test. (9)
		Displa	Displacement measurement : Dial Gauge, Microcator, Optical Method, Pneumatic												
		Transc	Fransducer, Strain Gauges, Variable Inductance & Capacitance Transducer, Piezo-Electric,												
		Electro	Electro-Kinetic, Photo-Electric, Ionization, Vibrating Wire & Vacuum Tube Transducer.												
		Force	& To	rque:	Elastic	: Type	, Fluid	Load	Cell, I	Dynam	ometers.				
		Temp	eratur	e: B	i-Mate	rials,	Pressu	ıre &	Resi	stance	Therm	ometers	, Ther	mocoup	les &
		Pyrom	eters.												
		Pressi	ire: N	/IcLeo	d Gau	ge, Pi	rani C	Bauge,	Ioniz	ation (Gauge, I	Manome	eters, B	ourdon	Tube,
		Resist	ance G	Jauges	•										
		Fluid	Veloc	ity: P	itot tul	be & H	Hot W	ire An	emom	eter, L	DA. Flo	w Meas	suremen	nt in Co	onfined
		Passag	ges & (Open (Channe	els. Mi	scellar	neous r	neasui	rement	s (10)				
		Dynai	nic R	espon	se of a	a Mea	suring	Instru	ment,	Respo	nse to T	ransien	t & Per	riodic S	ignals,
		First 8	z Seco	nd ord	ler syst	tems a	s well	as their	r Dyna	amic R	esponse	Charact	eristics	. (8)	
		Text B	ooks:												
Te	xt	1. Inst	trumen	tation,	Measu	rement	and A	nalysis	by B C	C Nakra	and K K	Chaudh	ary, Tat	a McGra	w Hill,
Boo	oks,	198	35. · 1	634				г	1 77	.1.1		1 4 1 1		1 10	
and	/or	2. Prii B eferre	nciples	of Me	asurem	ent, Pro	ecision	, Error a	and Tr	uth by I	N C Barfo	ord, Addi	son We	sley, 196	57.
refere	ence rial	3 Dh	nce Bo wical N	OKS: Aggeitr	amont (and An	alveie k	W N N	Cook	nd E D	abinowic	z Addie	on West	av 1063	2
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		Interp	iterpolation and approximation : Newton's, Lagrange and Hermite interpolating												
		polyno	omials	, cubic	spline	s; leas	st squa	re and	minim	ax app	proximat	tions. (6))		
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		stabili	ty and	their	conver	rgence	. Boui	ndary v	alue j	proble	ms: func	ctional a	pproxir	nation,	finite
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and	/or	2. Nu	merical	l Meth	ods: Pr	oblems	and S	olutions	s by M	lahinde	er Kumar	Jain (Au	thor), S	.R.K. Iy	vengar
refere	ence	(Aı	uthor),	R. K. J	ain, Ne	w age	publish	ners							
mater	ial(s)	3. Nu:	merical	l Metho	ods for	Engine	ers by	Chapra	, S. C.,	and C	anale, R.	P., McG	raw Hill	, Inc., 20	007.
		<i>Refere</i>	nce Bo plied N	oks:	ool Mot	hode f	or Eng	incore I	Ising I	Matlah	and C h	v Dobort	I Sobil	ling (Au	uthor)
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		5. Nu	merical	l Analy	sis for	Scient	ists an	d Engin	eers: 7	Theory	and C P	rograms	by Madl	humanga	al Pal,
		Alp	oha Sci	ence In	tl Ltd;	1 edition	on	Ũ				0	-		
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C						P	rogra	m Core	e T	otal N	umber o	of contac	t hour	'S	
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		Pre-re	equisit	e(s)					Co	ourse A	Assessme	ent metho	ods		
	Engi	neerir	ng Mat	hemati	ics		C	Continu	ous (C	CT) an	d end ass	sessment	(EA).	CT+EA	
Co	urse	• C	01: Ui	ndersta	nd the	basic	eleme	nts of s	cilab I	langua	ige.				
Outc	comes	• C(02: Co	ompute	e differ	ent m	athema	atic ope	ration	s like	scalars,	vectors, r	natrix,	statistic	es and
(CC	Os):	pr	obabil	ity, or	linary	differe	ential e	equation	ns by	using	scilab.				
		• C	03: Us	se mod	ern so	ftware	tools	scilab.	•	•					
		• C	04: Us	se scila	b to si	mulate	e the d	ifferent	engir	neering	g probler	ns.			
To	pics	Intro	oducti	on: Int	roduct	ion to	scilab	, scilab	envir	onmer	it, works	space, wo	rking	director	y. (2)
Cov	vered	Basi	c elem	ents o	f the la	angua	ge: Ba	sic elei	ments	of the	scilab la	inguage.	(2)	·	• • • •
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		Plot	nary differential equations, statistics, probability functions using scilab. (10) ting with scilab: Plotting 2D and 3D graphs using scilab. (4) ulation techniques: Monte Carlo method, Latin Hypercube simulation, Variation												
		Simu	ting with scilab: Plotting 2D and 3D graphs using scilab. (4) ulation techniques: Monte Carlo method, Latin Hypercube simulation, Variation ction techniques (10)												
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		Text	Books	5:											
Te	ext	1. E	nginee	ering a	ind Sc	ientifi	c Con	nputing	with	Scila	b by C.	Bunks,	J. P	Chancel	lier, F.
Bo	oks,	D	elebec	cque, C	C. Gom	ez, M	. Gour	sat, R.	Nikou	khah,	and S. S	teer., Bir	khäuse	er; 1999	•
and	d/or	2. N	Iodelli	ng an	d Sim	ulatio	n in l	Scilab/S	Scicos	by S	Stephen	L. Cam	pbell,	Jean-P	hilippe
refe	rence	C	hance	lier, an	d Ram	ine N	ikoukh	nah, Spr	ringer	. 2010					
mate	rial(s)	3. A	Pract	ical In	troduc	tion t	o Prog	grammi	ng an	d Proł	olem Sol	lving by	Tejas	Sheth,	Scilab,
		C	reate S	Space 1	Indepe	ndent	Publis	hing Pl	atforn	n, 201	6.				
		Refe	rence	Books	:										
		4. S	cilab b	y Exa	mple b	у М. А	Allouf,	, Create	Spac	e Inde	pendent	Publishir	ng Plat	form, 20	012.
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CO3	-	-	-	-	3	-	-	_	-	-	-	_	-	3	-
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		integ	gration, Poisson, Gaussian processes. (10) dom vibration of linear structures Unit-impulse and frequency-response functions												
		Ran	dom vibration of linear structures Unit-impulse and frequency-response functions e- and frequency-domain analysis Single- and multi-degree-of-freedom systems												
		Tim	e- and frequency-domain analysis Single- and multi-degree-of-freedom systems ionary and nonstationary responses State-space formulation Modal cross-correlations												
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and	d/or	N	VY, 19	967 Kı	rieger F	, ub., I	Huntin	gton, N	IY, 19	76.		,		,	,
refe	rence	2. P	Probab	ilistic	Struct	ıral D	ynami	ics: Ad	vance	d The	ory and A	Applicati	ons by	Y. K. I	in and
mate	rial(s)	0	G.Q. C	ai, Mo	cGraw-	Hill,	New Y	ork, N	Y, 19	95.	-				
		Refe	erence	Book	ts:										
		3. A	An Inti	roduct	tion to	Rand	om Vi	bration	s, Spe	ctral	& Wave	let Analy	sis: Th	ird Edit	tion by
		L	D.E. N	ewlan	id, Dov	er Pu	blication	ons, M	ineola	, NY,	2005.				
		4. I	ntrodu	iction	to Ran	dom '	Vibrati	ons by	N. C.	Niga	m, MIT I	Press, Ca	nbridg	e, MA,	1983.
		5. A	Applic	ations	of Ra	ndom	Vibra	ations	by N.	$C. N_1$	gam and	S. Nara	yanan,	Narosa	a Pub.,
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CO2	3	-	3	-	-	-	1	-	-	2	-	2	2	2	-
CO3	-	-	3	-	-	-	-	2	-	2	1	3	-	-	-

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		C	Compo	osite											
	Р	re-requi	isite(s))					Cou	irse Asse	ssment m	ethods			
Kn S	iowledg tructur	ge of So al Analy	lid Me ysis &	echanio Design	cs, n		Co	ontinuo	ous (C	Γ) and end	d assessm	ent (EA). CT+	EA	
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To Cov (H	pics vered Hrs)	Introduce reinfor Co-ord Comp Brief of Micro criteria Analy Finite	ntroduction, Types of composite materials, Lamina and Laminate, Matrix and Fibre, Fibre- einforced Composites, Comparison of strengths between bulk material and fibres. (6) Co-ordinate systems, Effect of orientation of fibres on the strength and stiffness of Composites. (6) Brief outline of manufacturing processes. (4) Micromechanics and Macro mechanics, Constitutive relations, Stresses and Strains, Failure eriteria of composites. (8) Analysis of Composites: beams and plates (12) Finite Element Method in analysis of Composite Structures (6)												
Т	ext	Text E	Books.	:											
Bo	oks,	1. Me	echani	ics of	Compo	osite N	lateria	ls by F	Robert	M. Jone	s: Taylo	r and Fr	ancis	(2015)	
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mate	rial(s)	Kefere	e nce E Achani	BOOKS.	: Comn	osite N	Nataria	le and	Struc	tures by	Madhuii	t Mukh	anadh	Waw	
	(~)	J. MC	iversi	tv Pre	comp ss (20)	(0.5110 fr)	aten	iis and	Struc	tures by	Madifuji	t WIUKII	Jpaun	iyay,	
Mapp	oing of	Course	e Outc	comes	$\frac{COs}{COs}$	POs-	→PSOs	3							
	و		f	of		ty					2		pr	pr	
	Engineering knowledg	Problem analysis	Design/development o solutions	Conduct investigations complex problems	Modern tool usage	The engineer and socie	Environment & sustainability	Ethics	Individual & team work	Communication	Project management δ finance	Life-long learning	Plan, analyse, design aı prepare	Computer aided skill ar tools	codal provisions / guidelines

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		Intro	ductio	n to	optim	izatio	n moo	lel fo	rmulat	ion in	engine	ering (design:	Object	tive &
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		Solut	ion T	echni	ques:	Linea	ur pro	gramn	ning: 1	Linear	Program	mming	Proble	m, Gra	phical
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Top	pics	Varia	bles U	nrestri	icted in	ı Sign,	Basic	Defin	itions i	n LP, C	Canonic	al reduc	tion, Pr	inciples	of the
Cov	ered	Simpl	lex M	ethod,	Simp	lex M	ethod	in TA	BLEA	U Forn	n, Com	putatior	nal Prob	olems, i	Big M
		Simp	lex N	lethod	l, Tw	o-Phas	se Si	mplex	Meth	od. R	evised	Simple	ex Met	thod,	Integer
		Progr	ammir	ıg, Fix	ed Cha	arge Pi	roblem	Form	ulation	l. (8)					
		Nonli	inear j	progra	ammin	ıg – 1:	Single	e varia	ble und	constrai	ned mir	nimizati	on, Basi	ic Defir	itions,
		Optin	nality (Criteri	a, Intro	oductio	on to li	ne sea	rch tec	hniques	. (4)				
		Nonli	Nonlinear programming – 2: Multivariable unconstrained optimization, Optimality Criteria, Introduction to various Algorithms for Minimization. (4)												
		Introc	Introduction to various Algorithms for Minimization. (4) Nonlinear programming – 3: Multivariable constrained optimization Equality Type												
		Const	rointe	progr	rango	ng – Muli	J: IV	Iuitiva	mality	type	Const	pumza	001, E	quanty	Type Tritoria
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		& M	lultiple	e obje	ective	optim	izatior	n, Sof	t com	puting	technie	ques -	Geneti	c Algo	orithm,
		Simu	lated A	nneali	ing Te	chniqu	le, Fuz	zy log	ic, Arti	ficial N	leural N	letwork	s. (8)	U	
		Text E	Books:												
		1. En	gineeri	ng Hyd	lrology	by R.	S. Vars	hney, l	Nem Ch	and & E	Bros. Ro	orkee (U	J.P.) 198	6.	and
		2. Op	eration	s Research	arch –	Princip	les and	l Practi	ce by A	A. Ravin	dran, D.	J. Philip	ps and J.	J. Solb	erg, 2 nd
Te	ext	3 En	oineeri	ng Ont	imizati	n = T	heory :	and Pre	o7. actice h	v S S	Rao 3rd	Edition	New A	ae Int (P) I td
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mate	erial	4. No	nlinear	Progra	amming	g – The	ory and	d Algo	rithms ł	by M. S.	Bazaraa	a & C. M	I. Shetty	, John V	Viley &
		So	ns, Nev	v York	, 1990.			~ .		~					1.9
		5. Inti	roducti	on to C)ptimui	m Desi	gn by J	. S. Ar	ora, Mc	Graw H	ill Int. E	ditions,	McGraw	Hill Bo	ook Co.
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Cou	arse	Title	Title of the courseProgram CoreTotal Number of contact hoursCredit(BCB) /LeatureTutorialPracticalTotal													
Co	ode					(P	CR) /]	Lecture	Tuto	rial P	ractical	Tota	1		
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Outco	omes	• C	02: To	o defin	e the s	stress a	nd stra	an beh	aviour	of stru	ctural e	lements	•			
		• C	03: To	o apply	theor	y of el	asticity	y in be	nding a	and tors	sion pro	blems.				
		• C	04: To	o apply	theor	y of pl	asticit	y in fa	ilures o	of differ	ent mat	terials a	nd struc	tures.		
		Stres	s & S	Strain:	Stres	s equi	libriur	n equ	ations,	rectang	gular, c	ylindric	al and	spheric	al co-	
		ordina	ates, C	deneral	lized I	looke [*]	's Law	y, Stres	ss and	strain c	compati	bility ed	quation	s. Plane	stress	
		and p	plane s	strain j	proble	ms, A	iry's s	stress	functio	n, Prin	cipal S	tresses	and str	ains, sti	ess &	
_		strain	invari	ants, n	umeri	cal pro	blems	. (15)				~				
Тор	oics	Torsi	on: St	nafts of	f circu	lar and	l non-o	circula	r prisn	natic see	ctions, S	Saint Ve	enant th	eory, w	arping	
Cove	ered	functi	on, str	ess fui	nction.	. (7)										
		Theo	heories of Failure: Basic concepts and Yield Criteria, Different Theories of Failure, Yield ocus and Yield Surfaces. Equations of Plasticity. (8)													
		Locus	ocus and Yield Surfaces. Equations of Plasticity. (8) asticity: hydrostatic stresses, deviatoric stresses, invariants of deviatoric stresses, yield													
		Plasti	asticity: hydrostatic stresses, deviatoric stresses, invariants of deviatoric stresses, yield													
		criteri	ia, vor	n Miss	es, Tre	esca y	ield cr	iteria,	theorie	es of pl	astic flo	ow, plar	ne stres	s, plane	strain	
		proble	ems in	plasti	city, th	nick cy	linders	s, thick	sphere	es. (12)						
Te	xt	Text E	Books:													
Boo	oks,	1. The	eory of	f Elast	icity a	nd Pla	sticity	by S.	Fimosh	ienko, I	MC Gra	w Hill I	Book co	ompany.		
and	/or	2. The	eory of	f Elast	icity a	nd Pla	sticity	by Sac	dhu Sir	igh, Kh	anna Pu	ublishers	S.			
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mate	11111	3. Ad	vance	d Stren	igth of	mater	ials by	Papo	v, MC	Graw H	IIII BOO	k Comp	any.	T 7 1	N 7	
		4. Pla	sticity	for st	ructur	al Eng	gineers	by W	/. F. C	then an	d D. J.	Han, S	pringer	-Verlag	, New	
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		Spring	pring Element: General, Implementation in FEA, Applications, Problems. (5) ar Elements : Definition, Property Matrix using Direct and Energy Approach, Engineering													
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Tex	ĸt	I. Fin Mc	ite eler Graw I	ment a Hill Ed	nalysis: ucation	theor	y and p	progran	nming	by C S	S Krishna	amurthy	(2001).	Publishe	er: Tata	
B001	ks, 'or	2. Fin	ite Ele	ement A	Analysi	s Theo	ory and	l Appli	cation	with A	NSYS b	y Moave	eni. Put	olisher: I	Pearson	
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		4. Fin	ite Ele	ment P	rocedu	es by]	Klaus-J	lurgen l	Bathe.	Publish	er: Prent	ice-Hall ((2009)			
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CO2	1	-	-	-	-	3	-	2	-	-	3	-	1	-	-
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		Displa	Displacement measurement : Dial Gauge, Microcator, Optical Method, Pneumatic													
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and	l/or	3. Wa	tershed	l Mana	gement-	Gu	idelines	for Inc	lian	Cone	dition	s by E.	M. Tide	man, (1	.999), C	Imega
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		Text B	Column base foundation (19) <i>Lext Books:</i> Reinforced Concrete Design by S. U Pillai and Devdas Menon. Tata McGraw-Hill													
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and	l/or	4. IS 8	300-20	07: Ge	eneral (Constr	uction	in Ste	el-Co	de of Pra	actice					
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		7. Rei	nforce	d Cono	crete D)esign	by S.N	J. Sinh	a, Tat	a McGr	aw-Hill	Publishi	ng:			
M	•	8. Lim	nt Stat	e Desi	$\frac{gn \text{ of } S}{CO}$	Steel S	tructu	res by	S.K. I	Juggal,	McGraw	/ Hill pt	blicati	ons		
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		Basic	Basic reliability analysis: Introduction, Definition of reliability, Different classical reliability analysis methods: First Order Reliability Method, Second Order Reliability Method, Engineering applications (10)													
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and	d∕or	2. Pr	obabili	ity, rel	iability	y and s	statistic	cal me	thods	in engin	neering	design	by A. H	Ialder a	nd S.	
refer	rence	M	ahadev	an, Jo	hn Wi	lev and	d Sons.	New	York.	0	0	0				
mater	rial(s)	3. Pr	obabili	ity, ran	dom v	ariable	es and	stocha	stic pi	ocesses	by A. I	Papoulis	s, McGr	aw Hill	New	
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		4. Pr	actical	Relial	oility I	Engine	ering b	by Pat	rick O	'Connor	r, Andr	e Kleyr	ner, Joh	n Wile	y and	
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Outc	comes	•	CO2: .	Ability	to ana	alyze t	he Uti	lity Str	ucture	s: Bun	ker, Silo	, Water	Tank, S	Shell etc	;
(C	Os)	•	CO3: .	Ability	for u	ndersta	anding	the ne	ed of	future s	tudies				
		Com	bined	footir	ng: Ty	pes, de	esign o	f recta	ngular	[·] slab, t	apezoid	al, strip	and raf	t type (6)
		Port	al an	d mu	lti-sto	ried	buildi	ng fra	ame:	Design	of co	ntinuou	s bear	n, eartl	nquake
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т		Shel	l and f	folded	plate:	Desig	gn of sl	hell an	d fold	ed plate	: (4)				
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		Deep	o and	curve	Beam	: Desig	gn of d	leep &	curve	beam (4)				
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CO2	3	-	3	-	-	-	1	-	-	2	-	2	3	1	1	
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		• CC	D3: W1	rite alg	gorithm	for t	he num	erical n	netho	ds for	efficient	coding of	of prog	ram	
		• CC	D4:Uno	derstar	nd the r	nathe	ematics	concep	ts un	derlyin	g the nu	nerical 1	nethod	s	
		Fund	ament	als of	' nume	rical	metho	ods: Ne	ed fo	or Nun	nerical m	nethods	in Civi	il Engir	eering,
		Sourc	es of	Errors	s, Abs	olute	, Relat	ive and	d Pe	rcentag	e, round	l off er	ror, ar	nd stabi	ility of
Top	pics	algori	thms.	(04)											
Cov	ered	Linea	r sys	tem o	of alge	ebrai	c equa	ations:	Gaus	s elim	ination	method	LU	decomp	osition
(H	rs)	metho	od; iter	ative	method	s, ill	condit	ioned s	ysten	ns. Jaco	obi, Gau	ss Seide	l meth	od, Rel	axation
		metho	od. (08	)											
		Nonli	near	equati	ions: B	isecti	ion me	thod, F	Regul	a Falsi	method	l, Newt	on Raj	phson r	nethod,
		Modif	fied No	ewton-	Raphs	on m	ethod, ]	Higher	order	Newto	on's met	hod Bai	stow n	nethod,	system
		of nor	1-linea	r equa	tions. (	8)	•					1			
		Inter	polatio	on ar	id ap	prox	imatio	n: Nev	wton	's, La	grange	and H	ermite	ınterp	olating
		polyn	omials	s, cubic	c spline	s; lea	ist squa	tre and i	minir	nax ap	proximat	1000000000000000000000000000000000000	) ·		1 /
		Nume	erical	allier	entiati	on a	na int	egratio	<b>n:</b> N	ewton-	Cotes ai	nd Gaus	sian ty	/pe qua	drature
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		stabili	ity and	their		quai	$\frac{10115}{20}$	indary	uue j value	problem	is. single	e siep ai	approv	imation	finite
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		Text 1	Rooks		. (00)										
Те	ext	1. Ni	imeric	al Met	hods fo	or Sc	ientists	and Er	ngine	ers by	R. W. H	amming	. Dove	r Public	cations:
Boo	oks.	2 €	dition						-8	-15 e j			, 2010	1 1 0/011	,
and	l/or	2. Nu	imeric	al Me	thods:	Probl	lems ar	nd Solu	tions	by M	ahinder	Kumar J	ain (A	uthor),	S.R.K.
refer	ence	Iye	engar (	Autho	or), R. F	K. Jai	n, New	age pu	blish	ers					
mater	rial(s)	3. Nu	imeric	al Met	hods fo	or En	gineers	by Cha	apra,	S. C.,	and Can	ale, R. F	., McC	Braw Hi	ll, Inc.,
		20	07.												
		Refer	ence B	Books:											
		4. Ap	oplied	Nume	rical N	letho	ods for	Engine	ers I	Using 1	Matlab a	ind C by	y Robe	ert J. So	chilling
		(A	uthor)	, Sand	ra L. H	arris,	Nelson	n Engin	eerin	g; Har/	Cdr edit	ion			
		5. Nu	imeric	al Ar	nalysis	for	Scien	tists a	nd l	Engine	ers: The	eory an	d C	Program	ms by
		Ma	adhum	angal	$\frac{Pal, Al}{CO}$	pha S	Science	Intl Lto	1; 1 e	dition					
Mapp	oing of	f Cours	se Out	comes	COs→	POs	$\rightarrow PSO$	S				<u>г</u>		1	1 1
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	neer	robl	gn/c st	uct i mpl	oder	ngi	Envi		Ind te:	Com	ect r f	fe-lo	anal F	outer	bdal gu
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	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	PO7	PO8	<b>PO</b> 9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	3	-	3	-	-	-	-	-	-	-	-	3	-
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Cor							Progra	m Cor	e	Total N	Number o	of contac	t hour	'S	
	irse	Т	itle of	the c	ourse		( <b>P</b> C	C <b>R</b> ) /	]	Lecture	Tutorial	Practica	l Tota	al C	redit
	ue					•	Electiv	es (PEl	L)	(L)	(T)	(P)	Hou	rs	
CEF	E615	Br	ridge l	Engin	eering		P	CL		3	0	0	3		3
		Pre-r	equisi	te(s)						Course	Assessm	nent meth	ods		
Sur	vey, W	/ater R	lesour	ce Eng	gineerin	g,	(	Continu	lous	(CT) a	nd end as	ssessmen	(EA)	CT+E	A
a	nalysi	s and c	lesign	of stru	ictures										
Co	urse	• C(	01: Ac	quire	knowle	dge	to select	t differe	nt ty	pe bridg	ges by ass	essing the	r mate	rial, cap	acity,
Outc	comes	qu	ality &	z suitał	oility										
(C	Os)	• C(	02: At	oility to	o make	a bri	dge plan	and de	sign	followi	ng requisi	te criteria			
		• C(	03: Su	pervise	e the con	struc	ction pro	cedure	of di	ifferent	componen	its of a bri	lge		
		• C(	D4: As	sess th	e quality	⁷ and	roles of	various	s cor	nponent	s of bridg	e			<b>.</b>
То	pics	Hydr	aulic	desig	gn: Su	rvey	i, Cate	hment,	S	ite sel	ection, I	Hydraulic	geor	metry,	Linear
Cov	vered	water	ways,	Econo	omic sp	an, <i>i</i>	Afflux a	ind Sco	ur. (	(4)	1 1	•.1		1 (6)	
(H	Irs)	Load	ls on b	oridge	: Differ	ent t	ypes of	load a	cting	g on bri	dge alon	g with nu	merica	ul (6)	1 1
		Slad		DOX C	cuivert:	Ar	alysis	of decl	K SI	ab - e	ffective	width &	lengt	n meth	od and
		nume	rical e	examp	le with		erent typ		/e IC	bad. (4)	Theer	. huidaa			
		K.C.	Deam	I-SIAD	and si		compos a matha	site pr	lage	es: K.C	. I-Dean	n bridge	and s	leef cor	nposite
		Dung	ynamic response of bridge deck: General features, factor affecting vibration, practical												
		appro	ynamic response of bridge deck: General features, factor affecting vibration, practical												
		<b>Prest</b>	resser	d conc	rete hr	id ga	• Gener	ral feat	ures	advan	s. (2) tage of P	SC Brid	lae de	esion de	tails of
		nre_te	nsion	ed and	l nost_te	nsi	ned bri	doe an	d nu	merica	1 ( <b>6</b> )	. <b>b</b> . <b>c</b> . <b>b</b> ii	ige, u	sign ut	
		Bride	oe hes	aring.	Introdu	letic	n type	s of he	arin	ng desi	on princi	inles of d	iffere	nt heari	ng and
		nume	rical e	vamn	les ( <b>4</b> )		in, type	5 01 00	ann	ig, ucsi	511 prine			n bean	ing and
		Subs	tructu	ire: Ii	ntroduc:	tion	type	of nier	's f	forces :	acting or	n niers	stabili	v anal	vsis of
		abutn	nent t	vnes o	of wing	wall	and nu	merical	exa	amples	of Pier a	nd Abutm	ent (4	l)	<i>y</i> 515 01
		Bride	ge fou	indati	on: Ge	nera	l aspec	t. types	s of	founda	ations. de	esign asp	ect of	pile ar	nd well
		found	lations	and n	umeric	al ex	amples	of pile	and	l well fo	oundation	18. ( <b>4</b> )		P	
-		Text	Books	•			<b>I</b>	r r							
	ext	1. Bi	ridge H	Engine	ering b	vS.	Ponnus	wamv.	Tat	a McG	raw-Hill	Publishin	g Con	npany L	imited.
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and	d/or	2. IR	C: 6-2	2017 S	standard	l Spe	ecificati	ons and	1 Co	ode of F	Practice for	or Road E	ridges	5	
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mate	rial(s)	Refer	ence	Rooks	•										
		4 D	esign a	and co	nstructi	on c	of Highy	vav Bri	døe	s by K	S. Raksł	nit. New (	Central	Book	
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	Engineering kn	Problem and	Design/develog solution	Conduct invest of complex pr	Modern tool	The engineer an	Environme sustainabi	Ethics	Individua team wo	Communic	Project manage finance	Life-long les	Plan, analyse, d prepare	Computer aided tools	codal provis guidelin
	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	3	3
CO2	-	3	2	-	3	-	1	-	-	-	-	-	3	3	3
CO3	-	-	-	-	-	-	-	-	3	2	-	1	-	-	1
CO4	-	-	-	-	-	-	-	-	-	-	-	3	1	-	1

Co			Program Core Total Number of contact hours													
	ode	1	<b>Fitle of</b>	f the c	ourse		( <b>P</b> (	C <b>R</b> ) /	L	ecture	Tutorial	Practica	l Total	l Cr	edit	
			<u> </u>			E	Electiv	es (PEI	L)	(L)	(T)	(P)	Hour	s		
CE	E620	An	alysis -	and D	esign o	f	P	EL		3	0	0	3		3	
		Dro_1	Pav	te(s)	ts					ourse A	ssessme	nt meth	ode			
	Tran	norta	tion Fr	ic(s)	ring			Continu		CT and	l end as	essment	(FA)	CT+F4	1	
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Co	ourse	• C(	) 2. U	nderst	anding	of me	chanic	enaraeu	nsfer	of vehi	cular loa	nd to nav	ement			
Out	comes	• C(	D 3: D	evelor	ment of	f abili	ity to u	indersta	and ve	bi vein	avement	interact	ion			
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		• C0	D 5: 1	Develo	pment	of e	xpertis	e in de	esign	of pay	vement of	of diffe	rent ty	pes of	roads,	
		hi	ghway	, airpo	rt pave	ment	•		0	*				-		
To	opics	Cha	racter	izatior	ı of Su	b-Gr	ade S	oil and	Min	eral Ag	ggregate	es: Intro	duction	n, partic	le size	
Co	vered	analy	ysis,	gradati	ion, m	oistu	re co	ntent,	consi	stency,	test,	classific	ation,	compo	osition,	
(H	Hrs)	com	pactior	n, stren	igth det	ermin	nation,	strengt	h prop	perties of	of miner	al aggre	gates (	<b>8</b> )		
		Bitu	minou	s Mat	terials:	Intro	ductio	on, desii	rable	propert	ies, tests	s, other	binder	s, engin	leering	
		prop Dosi	erties a	and mi	x design	n (ð)	to Mi	vos for	· Dox	omont	s. Intro	duction	como	nt nror	ortion	
		mine	eral ac	oregat	tes wa	iter	admixt	tures r	roper	ties of	fresh	concrete	test	on ha	rdened	
		conc	rete. fa	actors	for dura	ability	v. desig	n of ce	ment	by BS	(10262).	IRC (44	4). Dry	^v Lean C	Cement	
		Cond	crete (I	MORT	H 201)	, Mix	Desig	n for R	ural R	Roads (I	RC :SP:	62) <b>(8</b> )	,, J			
		Fact	ors A	ffectir	ng Pav	emen	t Des	ign: T	ypes	of pav	ements,	factors	affect	ing des	ign of	
		pave	pavements (4) Analysis and Design of Flexible Pavements: Stress analysis, design methods, benefits of													
		Ana	<b>.nalysis and Design of Flexible Pavements:</b> Stress analysis, design methods, benefits of I-E method, test roads (4)													
		M-E	<i>Analysis and Design of Flexible Pavements:</i> Stress analysis, design methods, benefits of <i>I</i> -E method, test roads (4)													
		Stru		Evalu	iation (	of Pa	vemen	ing sta	pose,	types, a	And meth	nods of s	structu	ral eval	uation,	
		Mod	els of	Fallin	uon Uy a Weia	stati oht D	eflect	illig, ste ometer	FWI	- state	vibrato.	tion of	IIIg, II Laver	Modul	i from	
		FWI	) Test	data.	uses of	Back	k-calcu	ilated P	Pavem	ent Lav	ver Mod	uli. Stru	ictural	Evaluat	tion of	
		Rigio	d Pave	ment u	using FV	WD.(	<b>6</b> )				) •1 1.100					
		Stru	ctural	Eval	uation	of U	nboun	d Gra	nular	and S	ub-Gra	de Lay	ers: U	sing Dy	vnamic	
		Cone	e Pene	tromet	er (DC	<b>P</b> ) – 1	Develo	opment	of D	CP Tes	t, The E	<b>)</b> ynamic	Cone	Penetro	meter,	
		mate	rial te	sting v	with DC	CP, d	etermi	nation of	of DC	CP inde	x values	s, factor	s affec	ting DC	CP test	
		resul	ts, cor	relatio	n of D	CP in	dex va	alues wi	ith oth	ner stan	dard tes	t values	, appli	cation o	f DCP	
Toyt	Doole	test c	$\mathbf{D}_{\mathbf{D}}$	mitatio	on of D	CP (6	)									
1 ext	DOOKS	1 exi	DUUKS Iighwa	v Engi	ineering	thy F	Srini	ivas Ku	mar							
refe	erence	Refe	rence	Books	:	5091	C. DIIII	Ivas Ita	inan.							
mate	erial(s)	2. P	rincipl	es of F	Paveme	nt En	gineeri	ing by I	Nick 7	Гот						
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	ing	em 2	leve] oluti	in ve olex	n to	ngin socie	ronr taina	Ethi	ividı v ma	unu	nana	guo	alys d pre	ter a nd tc	prov iidel	
	ineer	robl	ign/c s(	duct	lodei	he e	Envi sust		Ind teć	Com	ect r f	ife-l	ın, aı anc	upu aı	odal gı	
	Engi	д	Desi	Con of (	M	L				Ŭ	Proj	Ë	Pla	Co	ö	
	<b>PO</b> 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	-	-	-	-	-	-	-	3	-	-	3	-	-	
CO2	-	-	3	4	-	-	-	-	-	-	-	-	2	1	1	
CO3	-	-	-	-	3	-	-	-	2	-	-	-	1	3	1	
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
CO5	-	-	-	-	-	-	-	3	-	-	3	3	1	3	3	

Commo						P	rogra	m Cor	e T	otal Nu	mber o	f contae	et hour	5	
Course		Titl	e of th	le cou	rse		(PC	CR) /	L	ecture	Tutorial	Practic	al Tota	1 <b>Cr</b>	edit
						E	lective	es (PEI	L)	(L)	(T)	(P)	Hou	'S	
<b>CEE621</b>	Fi	nite	Elem		lethoo	1	PI	<u>E</u> L	3		0		3	3	
a 1: 1 ) A		Pre-rec	juisite(	s)	•	0		<b>a</b>	C	ourse As	sessmen	t method			
Solid M	lechan Ei	ncs, Sti ngg. M	uctural athema	l Engin atics	eering a	&		Contin	uous (C	$\mathcal{I}$ ) and	end asse	ssment (	EA). CI	+EA	
	• (	CO1: 1	Unders	standir	ng the a	advant	tage of	f FEM	over	classica	l metho	ds and	use it fo	or mod	elling
	á	and an	alysis	of real	life en	ginee	ring st	ructure	es.						U
	• (	CO2: \$	Skill to	simul	late sim	nple ei	nginee	ring st	ructure	es throu	gh FE n	nodellliı	ng and i	nterpre	t data
Course	t a	from t	he FE	anal	ysis to	ascer	rtain t	heir re	eliabili	ty and	applica	bility i	n light	of phy	ysical
(COs) :	s (	constra	unts of	t the sy	ystem a	ind co	mmon	engine	eering	sense.	Incinoo	ina nro	bloma		
()		CO3. I	Skill c	of usir	o adva	anced	FEA	softwa	re nac	chages :	and dev	ring pro velonme	nt of F	E code	es for
	1	modell	ing, ar	alysis	and in	vestig	ation of	of prob	olems r	elated t	o indust	ry and i	research	L 0000	5 101
	Int	roduc	tion: 1	Engine	ering l	Proble	ems, D	oifferen	t num	erical n	nethods	, Histor	y of Fi	nite Ele	ement
	Me	ethod (	FEM),	, Steps	in FE	M, Ar	eas of	Appli	cation,	, Verific	cation p	roblems	, imple	mentati	on of
	Eng	gineeri	ing Pro	oblems	s in FEI	M. (10	<b>)</b> )								
	Sol	lution	of Eng	gineer	ing Pr	oblen	ıs usir	ng Mat	t <mark>rix</mark> op	peration	<b>ı</b> : Impor	tance, N	Aatrix N	Manipu	lation
Topics	Tee	chniqu	es, So	olutior	n of S	Simult	taneou	s Line	ear E	quations	s, Inve	rse of	Matrix	, Com	puter
(Hrs)	Im	plemei	ntation	. (6)											
(1113)	Sp	<b>pring Element:</b> General, Implementation in FEM, Applications in civil engineering,													
	Pro	Problems. (6)													
	Ba	r Ele	ements	s: De	finitior	n, Sti	iffness	Mat	rix, I	Load v	ector a	and di	splacem	ent v	ector,
	Im	plemei	ntation	in FE	M, Pro	blems	s and V	/alidati	ion. ( <b>6</b>	)					
	FE	Mode	elling	of Eng	gineeri	ng Pr	oblem	s: Trus	sses, b	eams, F	rames e	tc. (14)			
	Co	mpute	er Pro	grams	s/ SOF1	ГWAI	RES ba	ased or	ı FEM	: Use in	i solutio	n of En	gineerii	ng Prob	lems.
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Books,		Educat	tion				r <i>c</i>	,	-8 - 1				.,		
reference	2.	An Int	roducti	on to t	he Finit	e Elen	nent Me	ethod b	y Redd	ly, J. N.,	2005.		<b>T</b> (	M	TT'11
material(s	s) ³ .	Funda	mentals	s of F vate L	inite E	lemen 2005)	t Anal	ysis b	y Davi	1d V. F	lutton P	ublisher	: Tata	Mcgraw	/ H1ll
	Ref	ference	Books		innica (	2003)									
	4.	Finite	Elemer	nt Proc	edures b	oy Kla	us-Jurg	en Batl	he Pub	lisher: P	rentice-H	Iall (200	9)		
Mappi	ing of	Cours	se Outo	comes	COs→	POs	>PSO:	S							
	lge		of	s of	0	iety					જ		and	and	
	wled	lysis	ment	ation lems	Isage	l soc	t & ity		& K	tion	nent	ning	sign	skill	snc /
	g knc	ana	elopi tions	estig	ool t	r and	umen Iabili	nics	dual worl	nica	nagen unce	; lear	e, de pare	ded	ovisio
	ering	blem	/dev solu	t inve plex	ern t	ginee	viror Istair	Etł	ndivi eam	nuuu	t mai fine	-long	alyse	to to	al pro guide
	gine	Prol	ssign	nduct	poM	e eng	En su		Ir t	Col	oject	Life	n, an	mput	codi
	En		Ď	Cor		The					Pr		Pla	Col	
	<b>PO</b> 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-	3	-	-
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	urse ode	Ti	tle of 1	the cou	urse	( <b>P</b> (	CR) / E	Electiv	es L	ecture	Tutorial	Practica	al Tota	Cred	it
							(PE	<b>L</b> )		(L)	(T)	(P)	Hour	s	
CE	C622	Gro	und Ir	nprov	ement	;	PE	L		3	0	0	3	3	
		Pre-re	quisite	e(s)	-	Co	ourse A	ssessn	nent m	ethods					
S	oil Me	echanie	cs & F	oundat	tion	Co	ontinuo	ous (CT	$\mathbf{C}$ ) and $\mathbf{C}$	end ass	essment	(EA). C	CT+EA		
		Engi	neerin	g									•• •		
Co	urse	• C(	O1: un	dersta	nd hov	v to in	prove	the ge	otechn	ical pro	perties of	of soft s	oil by d	ifferent	-
	comes	te	chniqu	les.			. , •	1		.1 1	c ·				
	JS).	• 0	02:100	entify	ground		itions a	and sug	ggest n	nethod (	of impro	wement			
		• 0	03: un	dersta	nd the	princi	ples of	soll re	einforc	ement a	ind conf	inement	in eng	ineering	5
		Intr	nsuuc	$\mathbf{n}$	ormati	on of	soil	maior	soil t	vne co	llancibl	e soil	evnanci	ve coil	
		oroii	nd imr	on. rovem	orman nents: d	on or objecti	ve no	tential	( <b>8</b> )	ype, ee	mapsion	5011,	слраны	ve som	,
		Grou	und Ir	nprov	ement	in G	anula	r Soil:	In pla	ce dens	sification	n by (i)	Vibrofl	oatatio	1
To	pics	(ii) C	Compa	ction r	oile (iii	) Vibr	o Com	pactio	n Piles	(iv) Dy	vnamic (	Compac	tion. ( <b>1</b>	2)	-
Cov	vered	Grou	und Ir	nprov	ement	in Co	ohesiv	e Soil:	Preloa	ding w	ith and	without	vertica	drains	,
(H	Irs)	Com	pressil	bility,	vertic	al and	d radi	al con	solida	tion, p	reloadin	g meth	ods. T	ypes o	f
		Drain	ns, De	sign c	of vert	ical D	rains,	constr	uction	technic	ques. St	one Col	lumn: H	Function	ı
		Desi	gn prii	nciples	, load	carryi	ng cap	pacity,	constr	uction	techniqu	ies, settl	ement	of stone	e
		colui	olumn foundation. (22) <i>Ext Books:</i>												
		Text	ext Books: . Ground Improvement by M.P. Moseley and K. Krisch, (2006)–II edition, Taylor and												
Text	Books	1. U	Ground Improvement by M.P. Moseley and K. Krisch, (2006)–II edition, Taylor and Francis												
and	d/or	2. D	esignir	ng with	Geosy	nthetic	s by Ko	berner,	R. M (	1994), P	rentice H	Iall, New	Jersey		
refe	rence	3. E	nginee	ring Pri	inciples	s of Gr	ound M	Iodifica	tions b	y Hausi	nann, M	. R. (199	0), McC	iraw Hil	1
mat	erial	р	ublicati	ions											
(	s)	Refer	rence E	Books:		1 ''		1	т <i>(</i>	~	(1007)	D ()	(1 T	1	
		4. E	arth Ke	Contro	ement a	ind soll	structi	ares by v Viant	Jones (	J. J. F. f. Abreim	2. (1985). son and l	, Butterw Bruce	orths, L	ondon.	
		6. G	round	Contro	and I and I	mprove	ement	bv K.	Krisch	& F.Kr	isch $(20)$	10). Johr	n Wilev	& Sons	
		19	994.			r		- )			(	,			,
		7. F	oundati	ion De	sign p	rinciple	es and	Practic	es by	Donald	P Codut	to, 2nd	edition,	Pearson	l <b>,</b>
		Ir	ndian eo	dition,	2012										
Mapp	oing of	Cours	se Out	comes	COs	POs-	→PSO9	S		I	<u> </u>				
				<u>ب</u>			ity				Jce			ols	es
	dge		t of	o su s	e	iety	abili				fina	50	and	d to	elin
	wle	lysis	men	ation	Isag	l soc	stain		& <u>~</u>	tion	t & :	ming	sign	ll an	guid
	knc	anal	lopi	stig prob	ool t	and	sns 2	ics	lual worl	nica	men	lear	e, de oare	l ski	/ su
	ring	lem	deve	inve lex j	in ti	neei	nt &	Eth	divić sam	nmt	lagei	long	alyse preț	nidec	isio
	inee	Prob	ign/	luct omp	lode	engi	nme		te	Con	mar	-ife-	, ana	ter a	prov
	Eng	Ι	Des	Conc	N	The	viro				ject	I	Plan	ndu	dal
						L .	En				Pro		-	Col	co
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	<b>PO11</b>	PO12	PSO1	PSO2	PSO3
CO1	-	3	-	2	-	-	-	-	-	-	-	-	3		1
CO2	-	2	3	2	-	-	1	-	-	-	-	-	-	3	1
CO3	-	3	2	-	-	-	-	-	-	-	-	-	3		1

C						P	rogran	n Core	e T	otal Nu	mber of	f contac	t hour	S	
Cou	rse	Tit	le of tl	he cou	rse	( <b>P</b> (	CR) / F	Electiv	es L	ecture	Tutorial	Practica	l Tota	d Ci	redit
CO	ue						(PE	<b>L</b> )		(L)	(T)	(P)	Hou	rs	
CEC	623	Remo	te Sen	sing &	<b>&amp; GIS</b>		PE	L		3	0	0	3		3
		Pre-re	quisite	(s)					С	ourse As	ssessmen	t method	S		
		<u> </u>	lone					Contin	uous (O	CT) and	end asses	ssment (H	EA). CI	Γ+EA	
Co	urse	CO1	: Leari	1 abou	t basic	items	, paran	neters	& con	cepts re	lated wit	th remot	e sensi	ing.	
Outo	comes	CO2	: Appl	y techi	niques	of vis	ual im	age int	erpreta	ation an	d digital	image p	process	sing.	
(C(	<b>J</b> s):		: Use (	JS an	d its c	ompor	$\frac{1}{1}$	or basi	c appli	cations	in civil	engineer	ring.	1 01	
		Rem	ote So	ensing	: Hist	ory, P	hysica	l basis	s, Elec	tromag	netic sp	ectrum,	Specti	al refle	ctance
		curve	es, spe	(12)	signati	ires, F	cesolut	lons, I	assive	e & act	ive remo	ote sens	ing, K	emote s	ensing
То	niac	platio Song	orins. (	(1 <i>2)</i> );fforo:	at trunc	Sot	allita k	and d	aciona	tions P	neinain	al annli	ontion	FCC	Aprial
	pics	phot	urs. L		n type intor	s, sau rotati	$c_{1111}c_{11}$	Janu u	esigna	uons a	, princip	ai appin	cations	, FCC,	Aeriai
	(cicu Irc)	Digit	igraph tol im	$\mathbf{y} \propto \mathbf{n}$		nciali ing D	$\operatorname{Vir}(\mathbf{y})$	₽ DN	value	Digit	al image	format	e Ima	a proc	Accina
(1	115)	funct	ions _	Image	enhai	ing. 1 Iceme	nt Im	a DIN	nsform	s, Digit	mage cl	assificat	$\sin k$	analysis	(10)
		Geog	oranhi	c Info	rmati	on Sv	stem:	Introd	luction	GIS G	compone	ents – h	ardwar	e. softv	vare &
		infra	structu	re. Gl	S data	tvne	s. Dat	a inpu	t & p	rocessir	ng. DEM	l genera	ation.	Preparat	tion of
		them	atic m	ap froi	m RS o	lata. (	6) 6)		• •• P			- 8		p	
		Integ	gration of RS & GIS techniques and its applications in the field of Civil Engineering.												
		(5)	egration of RS & GIS techniques and its applications in the field of Civil Engineering.												
		Text	) ext Books:												
		1. R	emote	Sensi	ng & C	HS (21	nd Ed.	) by B.	Bhatt	a (Oxfo	rd Unive	ersity Pr	ess. Ne	ew Delh	i)
Т	ext	2. T	extboo	ok of F	Remote	Sensi	ing &	Geogra	aphica	1 Inform	nation S	vstems (	3rd E	d.) by N	1. Anji
Bo	oks,	R	eddy (	BS Pu	blicati	ons, H	[yderal	oad)	1						5
an	d/or	Refe	erence	Books	5:			,							
refe	rence	3. R	emote	sensir	ng & Ii	mage 1	Interpr	etation	i (6th 1	Ed.) by	T.M. Li	llesand,	R.W.	Kiefer a	& J.W.
mat	erial	C	hipma	n (Wil	ey Ind	ia (P)	Ltd., N	New De	elhi)	-					
(	s)	4. G	eograp	ohical	Inform	nation	Syste	ms (2	nd Ed	.) by P	A. Lon	gley, M	1.F. G	oodchile	d, D.J.
		N	laguire	e & D.	W. Rh	ind (Jo	ohn W	iley &	Sons,	Inc.)					
Mapp	oing of	f Cours	se Outo	comes	COs	POs-	→PSO	S		I	1 1			1	
				f		y	lity						ы	ъ	les
	edge	s	nt of	ons c as	ge	ciet	nabi			_	nt &	8	n an	l an	deliı
	owle	ılysi	s	gatic blen	usag	d so	staiı		k k	atior	amer	rnin	esign	skil	guio
	g kn	ans	elop tion	estig prol	looi	r an	k su	nics	dual woi	inica	nage ance	g lea	e, de pare	ded ols	/ su
	sring	lem	/dev solu	inv olex	em 1	inee	ent d	Etl	divi eam	nmu	mai fina	long	alys pre	er ai to	/isic
	jine	Proł	sign	duct omj	Iod	eng	um		t, t	Cor	ject	-ife-	, an	Iput	prov
	Eng		Des	Cone	N	The	wiro				Prc	Ι	Plan	Con	dal
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	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PO8	PO9	<b>PO10</b>	<b>PO11</b>	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	1	-	-	-	-	-	-
CO2	3	$\frac{2}{2}$	-	2	2	-	1	-	1	1	-	3	-	-	-
CO3	3	2	3	-	2	-	1	-	1		-	3	-	-	-

Co	1860					P	rogra	m Cor	e T	otal Nu	mber of	f contact	t hour	'S		
Col	ode	Т	itle of	the co	ourse	E	(PC) lective	CR) / es (PEI	L)	ecture (L)	Tutorial (T)	Practica (P)	l Tota Hou	մl rs	redit	
CEE	2-624	Traf	fic En	gineer	ring ar	ıd	Pl	EL		3	0	0	3		3	
			Man	agem	ent											
		Pre-r	equisite	e(s)					C	Course A	ssessmer	it method	S			
	Tran	sporta	tion En	gineeri	ng			Conti	nuous (	CT) and	l end asse	essment (	EA). C	T+EA		
Co	urse	• C(	D1: Ap	ply kr	nowled	lge of	traffic	study	& anal	ysis for	design s	solutions	5. 			
Outc	comes	• C(	J2: Ur	idersta	ind bas	sic desi	ign ph	ilosopł	iy app	licable	to traffic	flow &	highw	yay		
(C)	Os):	• C(	$33 \cdot F_0$	rmulat	e ana	lvze a	nd des	ion ha	sic cor	nnonen	ts of hig	hway int	ersect	ions		
	•	Traf	fic ch	aracte	eristics	s. Traf	ffic en	gineer	ing st	udies a	nd analy	vsis: Vo	lume.	speed.	delay.	
	pics vered	origi	n and o	destina	ation. (	(18)		0	0		-	, ,	,	1 /		
(F	(refea	High	<b>hway intersections</b> , Traffic flow theory, Traffic capacity, Traffic operations and control, nal systems, Parking and terminal facilities, Traffic safety. (20)													
(		Sign	nal systems, Parking and terminal facilities, Traffic safety. (20) <b>Dat of highway traffic</b> on environment. (4)													
		Impa	apact of highway traffic on environment. (4)													
Т	ext	Text	Books	: Engine	oring	hy D		ee W	P Ma	Shana a	ndES	Draceae	Dronti	ce Hall		
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an	d/or	2. T	ranspo	rtation	1 Engii	neering	g and I	Plannir	ng, C. S	S. Papa	costas, a	nd P. D.	Preve	douros,		
mate	rial(s)	P	rentice	Hall	India		-		-	-						
linate	11u1(5)	3. P	rincipl	es of 7	Fransp	ortatio	n Engi	ineerin	g, P. C	Chakrob	orty and	A. Das,	Prent	ice Hall	India.	
Mapp	oing of	Cours	se Out	comes	COs	>POs−	→PSO:	S			1					
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	knor	analy	lopn ions	stiga probl	ol u	and	ment abilit	ics	ual ¿ work	nicati	agen nce	learı	, des are	led s ls	visio lines	
	ring	lem	deve solut	inve lex l	ern to	neer	iron	Eth	divid am	Inut	man fina	long	ulyse prep	er aid too	l pro uide	
	ginee	Prob	sign/sign/s	duct	Aode	engi	Env sus		Inc	Con	oject	-ife-	ı, anz	apute	g	
	Εnξ		Det	Cone	N	The					Prc		Plan	Con		
	<b>PO</b> 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	<b>PO11</b>	PO12	PSO1	PSO2	PSO3	
CO1	2	-	-	-	-	-	-	-	2	-	-	-	3	3	1	
CO2	3	-	3	-	-	-	1	-	-	2	-	2	3	2	1	
CO3	-	-	3	-	-	-	-	2	-	2	1	3	1	2	3	

Cou	rse	Γ	Title of	the co	ourse	]	Progra	am Cor	re	Total N	Number	of contac	t hour	s Cree	lit
Co	de						( <b>P</b> (	CR) /	]	Lecture	Tutorial	Practica	l Tota	ıl	
						I	Electiv	es (PEl	L)	(L)	(T)	(P)	Hou	rs	
CEE	625	Syste	ms apj	proacl	ı to Civ	il	P	EL		3	0	0	3		3
		E	nginee	ring d	esign										
		Pre-1	requisi	tes:					(	Course .	Assessm	ent metho	ods		
		No pr	e-requ	isites			C	ontinuo	ous	(CT) an	d end as	sessment	(EA). <b>(</b>	CT+EA	A
Cou	irse	• C	01: De	evelop	system	appı	roach b	ased m	node	ls of Ci	vil Engii	neering sy	stems.		
Outco	omes	• C	O2: So	olve op	timizati	on p	roblem	ns.							
		• C	03: Le	arn de	cision the	heor	y and i	ts appli	icati	on to C	E proble	ms			
		Introd	luction	n: Sy	stem co	once	pt for	engin	leeri	ng des	sign, Sy	stem cla	ssificat	ion, s	ystem
		model	ing, M	ethodo	ology of	syst	em des	sign. ( <b>4</b>	)						
		Optin	nizatio	n Tec	hniques	s: L	inear I	Progran	nmi	ng- Sin	nplex M	ethod Du	ality T	heory,	Dual
		Simple	ex, Ser	nsitivit	y analys	sus, l	Integer	progra	mm	ing ( <b>8</b> )					
Тор	oics	Netwo	ork an	alysis	: Transp	oorta	tion pr	oblems	s, A	ssignm	ent probl	ems, Ma	ximal f	low, F	Project
Cove	ered	manag	gement	(8)											
		Non-L	Linear	prog	rammin	<b>ig:</b> ]	Basic of	concept	t, Ir	troduct	tion to I	Lagrange	multip	liers,	Kuhn-
		Tucke	r condi	itions	(4)										
		Comn	<b>Common Probabilistic models (8)</b> Decision theory: Decision problems, Decision criteria, Maximax, Equally likely, Minimax,												
		Decisi	<b>Decision theory:</b> Decision problems, Decision criteria, Maximax, Equally likely, Minimax,												
		Maxin	num li	keliho	od, Bay	s' de	ecision	rule, A	App	lication	to civil	engineer	ing sys	tems d	esign.
		$\frac{(10)}{T}$	1												
		1 End	ooks: vineerir	ng Hyd	rology by	v R	S Vars	hnev N	lem (	Chand &	Bros R	oorkee (U	P) 198	6	
		2. Op	erations	s Resea	arch by A	A. Ra	vindrai	1. D. J.	Phil	ips, and	J. J. Solt	erg. Princ	iples an	d Pract	tice 2 nd
		Edi	ition, Jo	ohn We	eley & So	ons, l	New Yo	ork, 198	7.	1		0,	1		
Те	xt	3. Eng	gineerir	ng Opti	mization	n - T	heory a	nd Prac	ctice	by S. S	. Rao, 3 rd	Edition, 1	New Ag	e Int. (1	P) Ltd.
Boo	oks,	Put	olishers	, New	Delhi, 20	)01.									
and	/or	4. Intr	roductio	on to (	Operation	ns R	esearch	$\int_{-\infty}^{\infty} A c$	comp	outer or	iented Al	gorithmic	Appro	ach by	B. E.
refere	ence	Gil Defene	lett, TN	IH Edi	tion, Nev	w De	elhi 198	5.							
mate	erial	5 Not	nce Do nlinear	OKS: Progra	mming _	_ The	ory and	d Algori	ithm	s by M	S Bazar	a & C N	1 Shett	v Iohn	Wiley
		5. No.	Sons. N	ew Yo	rk. 1990.		cory un	a mgon	111111	5 UY 141.	D. Duzur	ία, α c. 1	1. Shett	y, <b>J</b> 01111	whey
		6. Intr	roductio	on to C	<b>D</b> ptimum	Des	ign by	J. S. Ar	ora,	McGra	w Hill In	. Editions	, McGr	aw Hil	l Book
		Co.	. Singap	pore, 19	989.										
		7. Eng	gineerir	ng Opti	mization	1 – n	nethods	and Ap	oplic	ations b	y G. V. I	Reklaitis,	A. Ravi	ndran,	and K.
		<u>M.</u>	Ragsde	ell, Joh	n Wiley	& So	ons, Nev	w York,	198	3.					
Mapp	ong o	of Cours	se Outo	comes	COs→I	POs-	→PSO	S		1	1	1			
	e)		Ŀ	of		ý	llity						р	q	nes
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	lwo	alysi	pme: us	gatic blen	usa	ıd sc	ıstai		۱ <i>&amp;</i>	rk ation	eme	arnir	esig	l ski	, gui
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	Engineer	Probl	Design/c sc	Conduct i compl	Moder	The engi	Environmen		Ind te:	Com	Project 1 f	Life-l	Plan, anal I	Computer	codal provi
	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	PO12	PSO1	PSO2	PSO3
CO1	-	3	3	-	-	-	-	2	2	-	-	-	3	-	-
CO2	-	3	3	-	-	-	1	-	-	3	-	2	3	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	3	-	-

C						D	C			Total I	Numbe	r of co	ontact	hours		
	irse	Titl	e of th	e cour	se	Progr	am Co	ore (P)	$(\mathbf{R})$	Lecture	Tuto	rial Pi	actical	Total	Credit	
CO	ue						lective	S (PEI	_)	(L)	(T)	)	(P)	Hours		
CEE	710	Struc	tural	Dynar	nics		PF	EL		3	0		0	3	3	
		Pre-rec	quisite(	(s)					Co	urse Ass	essment	metho	ds			
		Solid M	Iechan	ics			(	Continu	ous (C	T) and e	nd asses	sment	(EA). (	CT+EA		
		• CO1	: Deve	elop &	analyz	ze dam	ped &	un-da	mped	SDOF s	ystems	for fre	e & fo	orced vi	bration.	
C		• CO2	: Deve	elop an	d anal	yze the	e MDC	OF syst	ems fo	or free &	z forced	l vibra	tion.			
Outco	rse	• CO3	: Mod	el civil	engin	eering	struct	ures &	deriv	e the dy	namic p	roper	ies of	structur	es	
(COs	s).	• CO4	: Calc	ulate n	atural	freque	ncies,	mode	shapes	s & struc	ctural re	spons	es num	nerically	/	
(00)	.,.	• CO5	: Appl	y the c	oncep	ts & p	rincipl	es of s	tructui	ral dyna	mics for	r earth	quake	analysi	s of civil	
		engiı	neering	g struc	tures &	k evalı	late th	eir seis	smic p	erforma	nce					
		Introd	luction	n: D'A	Alembe	ert's pi	rincipl	e, dyna	amic lo	oads, de	finition	of deg	grees o	f freedo	om (1)	
		SDOF	syste	e <b>m:</b> E	quatio	ons of	moti	on, un	damp	ed and	dampe	ed SD	OF sy	ystems,	viscous	
		dampi	ng, cri	itically	damp	ped, o	ver-da	mped	and u	nder-da	mped s	system	, dam	ping co	oefficient	
		determ	inatio	n, dyna	amic n	nagnifi	ication	factor	and tr	ansmiss	sibility.	(7)				
		Force	d vibr	ation	of SD	OF sy	stems	: Vibr	ation 1	under si	nusoida	al load	s, resp	onse to	general	
		dynam	ic load	ding - I	Duham	nel's ir	ntegral	: impu	lse, ree	ctangula	r, triang	gular l	oading	proble	ms. (5)	
Top	ics	Fourie	er ana	lysis a	nd res	ponse	in the	e frequ	ency	domain	theory,	probl	$\frac{1}{2}$	)		
Cove	ered		f Syste ibroti	em: De		ment a	ina soi	ution c	or equa	ations of	motion	i, prot	lems (	2) cicc.cn	dmadaa	
(Hr	s)	rree v	apolit	on of	mode	r sysu	ems: E	agen v	alues	and vec	tors, na	lural I	requen	cies and	a modes,	
		norma	Unancy 1/gener	y UI ralized	coord	inates	nrobl	Lation ome (5	)	moues,	moua		Jansioi	i, con	cept of	
		Free v	ree vibration response: Free vibration of un-damped systems, modal analysis. (3)													
		Force	orced vibration of MDOF systems: Modal expansion of excitation vector, modal analysis,													
		modal	orced vibration of MDOF systems: Modal expansion of excitation vector, modal analysis, nodal contribution factors. (3)													
		Force	nodal contribution factors. (3) Forced vibration response: Modal analysis, forced vibration for un-damped systems													
		subject	ted to	sinusoi	idal lo	ading	and arl	bitrary	loadir	ng. (5)				I	5	
		Damp	ing iı	n stru	ctures	s: Cla	ssical,	non-o	classic	al dam	ping, r	nass	propor	tional,	stiffness	
		propor	tional,	Rayle	eigh, C	Caughe	ey dan	nping,	Moda	l analys	sis for	classic	ally d	amped	free and	
		forced	vibrat	ion sys	stems	(4)										
		Earth	quake	analy	vsis of	fstru	ctures	: Equa	ations	of mot	ion for	un-da	imped	and cl	assically	
		dampe	d syst	ems si	ngle a	nd mu	ltiple	degree	of fre	edom s	ystems,	moda	l parti	cipatior	n factors,	
		modal	analys	sis, res	ponse	spectr	um ana	alysis,	modal	combin	ation ru	iles (4	)			
Tar		Text Bo	ooks:	of Char		h.,			TT							
Bool	XI ks	1. Dyr 2 Far	iamics thouak	ol Stru e Resis	clures	by Ani	I <b>K.</b> Uf f structi	iopra, P ure by l	'HI Pankai	Agarwal	and Ma	nich S	hrikhar	nde		
and/	/or	3. Stru	ictural	Dvnam	ics: Th	neorv a	nd Con	nputatio	on by N	Aario Paz	z. Kluwe	er Aca	lemic F	ublisher	s	
refere	ence	Referen	nce Bo	oks:		,		-r			_,,				~	
materi	ial(s)	4. Ele	ments of	of Earth	nquake	Engine	eering,	Jai Kris	shna, A	A.R. Cha	ndraseka	aran, B	. Char	ndra. So	uth Asian	
		Pub	lishers													
		5. The	eory of	Vibrati	on wit	h Appli	ication	s, W.T.	Thom	son, PHI						
Mappi	ng of	t Cours	e Outc	comes	COs→	POs→	PSOs			1		1				
	50	'SiS	bm ns	of	Ι	pur	82			uo	&	ing	0	ed ed		
	sring dge	naly	velo utio	uct ions	too e	eer ; ty	hilit	SS	ial b 'ork	icati	sct tent	earr	alyse	r aid	isio	
	ginee	em a	1/de f sol	ondi igat	dern usag	ngin ocie	onn aina	Ethio	vidt m w	unu	roje igen inan	ng ]	, an	reps outer	prov prov	
	Eng kno	oble	esign nt of	C Vest	Mod	ie er s	invir susta	I	Indi tea	omr	F nana fi	fe-lo	Plan	d fino	dal J gu	
		Pr	° Ď	in G		Ţ	щ			0	ц	Ľi		0,	ć O	
	<b>PO</b> 1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	<b>PO10</b>	<b>PO</b> 11	PO12	PSC	1 PSC	D2 PSO3	
CO1	2	3	3	-	-	-	-	-	-	-	-	-	2	-		
CO2	2	3	3	-	-	-	-	-	-	-	-	-	2	-		
CO3	3	2	2	-	1	-	-	-	-	-	-	2	-	1	2	
CO4	3	3	3	3	2	-	-	-	-	-	1	2	-	1	1	
CO5	3	2	-	2	1	1	-	1	-	-	1	2				

						Pr	ogran	ı Core	Το	tal Nu	mber of	[°] contact	hours	5	
Co	ode	Tit	tle of t	he cou	irse	Ele	(PCF ectives	<b>R) /</b> ( <b>PEL</b> ]	Le	ecture (L)	Tutorial (T)	Practical (P)	l Tota Hour	l Cr	edit
СЕ	<b>E711</b>	Adv S	vanced teel St	l Desiş tructu	gn of res		PE	L		3	0	0	3		3
		Pre-re	quisite	(s)					С	ourse A	ssessmer	nt method	S		
	Desi	gn of S	steel St	ructure	S			Contin	uous (	CT) and	end asse	essment (l	EA). C	Г+ЕА	
Con Outc (CC	urse omes Ds) :	<ul> <li>C0</li> <li>C0</li> <li>stu</li> <li>C0</li> </ul>	D1: Un D2: Ap ructure. D3: For	derstan ply bas rmulate	d the d ic know	esign a wledge ze, and	of stee	, princij el design n of var	ples of n of con ious Ci	few stee mponen vil Eng	el structu ts for des ineering	res as a w sign solut Steel stru	hole. ions of ctures.	whole	
Toj Cov (H	pics rered [rs]	Desig Desig Desig Desig Brid railw Intro (8)	gn of I gn of T n, Colu gn of w gn of C ges: D ay. (10 oductio	ndustr Fruss n umns D ater ta astella esign 1 ) n to P	ial Sh nember esign, nk:Sta ted be oads f lastic	ed: De s, Purl Base P ging, C ams an or high Design	scriptio in, Top late and Column d open hway / : Plasti	on of E o Chord d Ancho s brace web st railwa ic hingo	Different d and l or Bolt d type ructure by brid e, Plast	it comp Bottom s Design staging. s. (4) ges, De ic-Colla	onents, I Chord E n. ( <b>10</b> ) ( <b>10</b> ) esign of apse met	Loads Ca Diagonals truss bri hod, Plas	lculatio , Shoe dges fo tic Ana	n, Analy Plate an or highv llysis of	vsis and ad Bolts vay and Frames
Te Boo and refer mater	ext oks, d/or rence rial(s)	<ul> <li>(8)</li> <li>Text Books:         <ol> <li>Design of steel Structures by N. Subrhamanium (Oxford publications)</li> <li>IS 800-2007: General Construction in Steel-Code of Practice</li> <li>IS 808-1989: Dimensions of Hot Rolled Steel beam, column, channel and angle sections</li> <li>SP 6(1)-1964: Handbook for Structural Engineers.</li> <li>IS 3370-1965 code for concrete structures for he storage of liquids</li> <li>IS 805: 1968 Code of Practice for Use of Steel in Gravity Water Tanks</li> <li>IRC:6-2017 Standard Specifications and Code of Practice for Road Bridges</li> <li>www.nptel.iitm.ac.in/courses/</li> </ol> </li> <li>Reference Books:         <ol> <li>Limit State Design of Steel Structures by S.K. Duggal (McGraw Hill publications)</li> <li>Design of steel Structures by S. S. Bhavikatti (IK Intl Publishing House, N Delhi)</li> </ol> </li> </ul>													
Mapp	51ng 01	Cours	se Out	comes	COs-	≯POs−	>PSO	S			e e			s	
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & financ	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tool	codal provisions / guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	<b>PO11</b>	PO12	PSO1	PSO2	PSO3
CO1	1	-	3	-	-	-	-	2	2	-	-	-	3	-	2
CO2	3 -	- 3	3 3	-	-	-	-	- 2	-	2	- 1	3	- 2	2 1	- 3
		-					1			· · · · ·	1	-			-

Со	urse					Pro	ogram (PCR	Core	T	otal N	umbe hou	r of co rs	nta	ct	Credit	
C	ode	1	itle of	the co	ourse		Èlecti (PEI	ves L)	Lect (L	ure Tu	torial (T)	Practica (P)	l To Ho	otal ours	Crea	lit
CE	E712	Th	eory o S	of Plato hells	es and		PEI		3		0	0		3	3	
		Pre-re	quisite	(s)					Co	ourse A	ssessr	nent me	thoc	ls		
Sol	id Mec	hanics	, Struct	ural A	nalysis			Contin	uous (C	CT) and	l end a	ssessme	ent (	EA). C1	$\Gamma + EA$	
Co Out (C	ourse tcomes COs):		CO1: 1 subject CO2: A Methoo CO3: A CO4: I	Derive ted to b Analys ds. Analys Design	the expending e the section of the s	xpress g mon simply hin she linder	ions o nents, t suppo ell stru shell a	f the c twistin orted pl ctures and rev	curvatu g mom ates ar using u view th	re and ients a id solv membr e IS co	displ nd she ve ther cane the odal p	lacement ear forc m by us neory. rovisio	nt ro e. sing	elations 5 Navies of it.	ships of	plates Levy's
Te Co (1	opics overed Hrs)	Bas twi Pla Lev Pla Des Sho rela Me (Sy Des Ap	<ul> <li>Basic curvature and displacement relationships. Expressions for bending, moment, twisting moments, shear forces. (4)</li> <li>Plate equation, Edge conditions. Solution of simply supported plates by Navier's and Levy's methods. Introduction to anisotropic plates. (10)</li> <li>Plate subjected to in plane forces, Buckling of plates. Numerical analysis of plates. Design of plates. (6)</li> <li>Shell structures Classification, Differential geometry, Curvature, Strain, Displacement relations. (4)</li> <li>Membrane theory of thin shells and design of cylindrical shells of double curvature (Synclastic and anticlastic), Shells of revolution, North light shell. (10)</li> <li>Design of shell and review of IS code provisions, Introduction to bending theories:</li> </ul>													
T Bo ar refe mate	Fext boks, nd/or erence erial(s)	<i>Tes</i> 1. 2. <i>Rej</i> 3.	t Book Theor Theor Prent ference Desig & Dis	k (s): ry of P ry and ice Ha e Book gn and stribute	lates a Analy Il Inc. Const ors (20	nd Sho ysis of New J ructior 105)	ells by Plate ersey	Timos s by C oncrete	shenko Classic Shell	and K and N Roofs	riegen lumer by G	r, McG ical M .S. Ran	caw ethc	Hill ods, Ru wamy, (	dolph S CBS Pu	zilard, blisher
Mapp	oing of	Cours	se Out	comes	COs	POs-	<b>→</b> PSOs	5								
	Engineering knowledge	<b>Problem</b> analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management &	finance		Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
T	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	PO	11 PO	12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-		3	1	-
CO2 CO3	2 -	3 3 1	- - 3	-	-	-	-	-	-	-	-	-		3 3 3	1 1 2	- - 3

							Program Core Total Number of contact hou							urs		
Cou	rse de	T	Title of	f the c	ourse	1	(P) Electiv	CR) / /es (PI	615	Lecture (L)	Tutoria	l Pract	ical T	otal	Cı	edit
		The	ory of	Flacti	city a	nd 1	Liccu			(L)	(1)	(1)	, 11	ours		
CEE	713	Inc	Pla	asticit	v	lu	F	PEL		3	0	0		3		3
		Pre-1	requisit	te(s)	/					Course A	ssessme	nt meth	ods			
	Engir	neering	& Soli	d Mech	nanics			Cont	inuous	(CT) and	l end asse	essment	(EA).	CT	+EA	
		• CO	01: To	develo	op basi	c unde	rstand	ing of	the be	haviour	of mater	ials.				
Cour	rse	• CO	02: To	define	the str	ess an	d strai	n beha	viour	of struct	ural elei	nents.				
Outco	mes	• CO	03: To	apply	theory	of ela	sticity	in ben	ding a	nd torsio	on probl	ems.				
		• CC	04: To	apply	theory	of pla	sticity	in fail	ures o	f differe	nt mater	ials and	l struc	cture	es.	
		Stress	8 & S	train:	Stress	s equi	libriun	n equa	ations,	rectang	gular, cy	lindric	al an	d sp	oheric	al co-
		ordinates, Generalized Hooke's Law, Stress and strain compatibility equations. Plane s												stress		
and plane strain problems, Airy's stress function, Principal Stresses and strains,											, str	ess &	strain			
		invaria	ants, n	ts, numerical problems. (15)												
TopicsTorsion: Shafts of circular and non-circular prismatic sections, Saint Venant theoryCoveredfunction, stress function. (7)											ory, w	arping				
		Theor	ries of	Failu	re: Ba	sic co	ncepts	and Y	ield (	Criteria,	Differen	t Theo	ries o	f Fa	uilure,	Yield
		Locus	and Y	ield S	urfaces	s. Equ	ations	of Plas	sticity.	(8)						
		Plasti	city: ł	iydros	tatic s	tresses	s, devi	atoric	stress	ses, inva	riants o	of devi	atoric	str	esses,	yield
		criteri	a, von	Misse	es, Tre	sca yı	eld cri	iteria,	theori	es of pla	astic flo	w, plar	e stre	ess,	plane	strain
Tar	-+	proble	ems in	plastic	city, thi	іск суі	inders	, thick	spher	es. (12)						
Bool	si ks	1 exi D 1 The	ouks:	f Elact	icity ar	nd Play	sticity	hy S '	Fimos	henko N	AC Grav	7 Hill F	Rook	om	nany	
and/	or	1. Th	eory of	f Elast	icity ar	nd Pla	sticity	by S. by Sad	i nnos. ihu Si	ngh Kh	anna Pul	v 11111 1 Nichera	JUOK	Join	pany.	
refere	ence	2. In Refere	nce Ro	ooks:	ieity ai	iu i iu	sticity	by Dat		11 <u>5</u> 11, 1 <b>X</b> 110	unia i u	manere	•			
mater	rial	3. Ad	vanceo	1 Strer	igth of	mater	ials bv	Papoy	. MC	Graw H	ill Book	Comp	anv.			
		4. Pla	sticity	for s	tructur	al En	gineers	s by C	Then.	W.F. an	d Han,	D.J. S	pring	er-V	⁷ erlag	. New
		Yo	rk.			· · ·		5	,		,	,	1 0		0	,
Mappi	ing of	f Cours	se Outo	comes	COs->	POs	<b>&gt;</b> PSOs	5								
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	edge	s	nt of	ons c as	e	ciet				-	nt &	50	n an	1 000		<b>\</b>
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	g kn	1 ani	velol ition	'esti; pro	tool	er an	nme nabi	hics	idua 1 wo	unic	ance	g le;	se, d spare	1000 1000	ols	ovis lelin
	erin	blen	/dev solu	t inv plex	em	jinec	viro	Etl	ndivi eam	mmt	fin	-lon	alys pre		tc tc	al pr guid
	gine	Prol	sign	duct	Mod	eng	En [.] su		t.	Coi	) ject	Life	ı, an		ındu	s f
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C							Program Core         Total Number of contact hours								
Course	Title	of the co	urse	( <b>P</b>	<b>CR</b> ) / <b>E</b>	lectiv	ves I	ecture	Tutorial	Practical	Tota	l Ci	redit		
Couc					(PE)	L)		(L)	(T)	(P)	Hour	s			
<b>CEE-71</b>	4 Struc	tural He	alth -		PE	L		3	0	0	3		3		
	Pre-requi	site(s)	5				(	Course A	Assessmer	t methods	<u> </u>				
Knou	ledge of Solid	l Mechani	ice and			Contir	1110115	(CT) and	d end asse	ssment (F	$(\mathbf{A})$	Γ±FΔ			
KIIOW	Structural	Design				contin	luous					-			
Course	• CO1: K	nowledg	ge of ass	essm	nent and	l mon	itorin	g of ex	isting str	uctures a	is well	as for	newly		
Outcome	constru	cted struc	ctures.	.:11 <b>↓</b>	0 1100		nt N		innant	for roco	anah	nd in	luctui ol		
(COs) :	• CO2. I	ions	anu sk	.111 l	o use i		uni in	DI equ	upment	IOI IESE		uiu iii	iusuiai		
	• CO3: K	nowledg	e on ins	trum	entatior	ns in s	structi	res. the	eir use an	d interpr	et the	collecte	ed data		
	from in	strument	ations.				,			<i>•</i>					
	• CO4: H	CO4: Based on the above, the students are expected to suggest remedial measures for													
	distress	distressed structures.													
Topics	Preamble	Preamble: Definition of structure, different types of structures, behaviour of structures under													
Covered	variety of loading conditions, deterioration and failure of structures, structural materials. (4)														
(Hrs)	<b>Introduction:</b> What is structural health and SHM, importance, application and present														
	Types of S	SHM: Pe	eriodic a	nd co	ontinuoi	us me	ethods	for im	plementa	tion of e	• ( <b>-</b> ) ach. ( <b>f</b>	9			
	Measurer	nent tecl	niques:	Des	structive	e and	non-d	estructi	ve ( <b>6</b> )		uem. (t	)			
	Equipme	nt: For n	on-destr	uctiv	ve testin	g, wo	rking	princip	les of thi	s equipm	ent an	d use (	8)		
	Health r	nonitori	ng in	dyn	amic d	condi	tion:	Basics	s of str	uctural	dynan	nics, s	ensing		
	technolog	es, data	collectio	n an	d analy	sis, b	asic c	oncept	of signal	processi	ng, ide	entifica	tion of		
	structural	health us	ing mod	al pa	arameter	rs. ( <b>1</b> 4	<b>4</b> )				1.				
	Field visit	<b>2</b> )	o the site	(s) o	f old str	ructur	e(s) for	or asses	sing them	r existing	g condi	tion to	r SHM		
	Text Bool	5) ····													
Text	1. Structu	.s. Iral Healt	th Monit	orin	g by Via	ctor C	Hurgi	ıtiu							
Books,	2. New tr	ends in S	Structura	l He	alth Mo	nitori	ng by	Ostach	owich, V	Vitslaw, (	Gueme	es, Alfr	edo.		
and/or	3. Dynam	nics of str	ructures	by A	K Cho	pra, F	Pearso	n/Prent	ice Hall.	,		,			
materia	Reference	e Books:													
(s)	4. Non-d	estructiv	e Testii	ng c	of Mate	rials	and	structur	res by E	Buyukozt	urk a	nd Tas	demir:		
	Spring	ger													
Mapping	of Course O	utcomes	COs→F	'Os-	<b>→</b> PSOs										
2	t of	ns of s	e	iety					t &	ъл   ·	and	and			
	lysis men	s ation	usag	d soc	nt & ity		જ્ર સ્	tion	men	rnin .	Sign	skill	ions . S		
	ana elop	estig prot	tool	r and	ımeı ıabil	nics	dual wor	inica	nage ince	g lea	e, d£ pare	ided ols	ovisi eline		
	blen.	solu x inv	dern 1	ginee	nviroi ustair	Ed	ndivi team	Junur	t mai fine	, long	nalys pre	ter al	lal pr guide		

	Engineeri	Proble	Design/d	Conduct ir comple	Moder	The engin	Envir sust	Ι	Indi tea	Comr	Project m fi	Life-lo	Plan, analy P	Computer	codal J gu
	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	PO7	PO8	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	-	-	-	3	2	-	-	-	-	-	-	-	-	2	3
CO3	-	-	-	2	3	-	-	-	-	-	-	-	-	3	1
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-

•				Progra	am Co	ore	Total	Numb	er of co	ontact l	nours		
Course	Title of th	e cours	se	(P	CR) /		Lecture	e Tut	ori P	ractic	Total	Cr	edit
				lectiv	es (PE	EL)	(L)	al (	T) 8	al (P)	Hours		
<b>CEE720</b>	Soil Dyr	namics		<u>P</u>	EL		3	0		0	3		3
Pre-requ	isite(s)		(	Course	Asses	sment	metho	ds					
Soil Me	chanics		(	Contin	uous (	CT) ar	nd end	assessm	ent (EA	A). CT+	EA		
Course Outcomes	<ul> <li>CO1: devisitatic equisitatic equi</li></ul>	velop a uilibriuu lerstand sign of s unalysir the adj	mecha n conc d the c founda ng the acent f	inism t litions lassica ttions i vibrati counda	o designof stru of stru l geote n large ng way tions.	gn the actures echnica e struc ves wh	founda al failu tures li ich car	ttions fo res due ke powe n be iso	or resist to lique er plant lated an	ing vib efaction s, other d meas	and mi industrures for	nd achi tigate th ial builc achievi	eve ne lings ng
Topics Covered (Hrs)	Vibration of elementary system, Single degree and two-degree freedom systems, Wave propagation in an elastic, homogeneous, isotropic medium. (10) Propagation of waves in saturated media, Behaviour of dynamically loaded soils, Evaluation of dynamic properties of soil. (10) Theories for vibration of foundations in elastic media, Design procedures for dynamically loaded foundations for vertical and rocking vibrations. (14) Foundations under reciprocating engines, Foundations for forge hammers, motor generators, turbo-generators and crushers. (10)												
Text Books, and/or reference material (s)	<ul> <li>Text Books</li> <li>1. Soil Dyn</li> <li>2. Vibration</li> <li>Wheeler</li> <li>3. Fundame</li> <li>Reference I</li> <li>4. Vibration</li> <li>5. Foundation</li> <li>6. Analysis</li> <li>7. Dynamic</li> </ul>	<ul> <li>turbo-generators and crushers. (10)</li> <li><i>Text Books:</i> <ol> <li>Soil Dynamics and Machine Foundation by Swami Saran, Galgotia Publicaions</li> <li>Vibrations Vibration Analysis and Foundation Dynamics by NSV Kameswara Rao, Wheeler Publishing, New Delhi.</li> <li>Fundamentals of Soil Dynamics by B M Das</li> </ol> </li> <li><i>Reference Books:</i> <ol> <li>Vibrations of Soils and Foundations by Richart Hall and Woods</li> <li>Foundations of Machines-Analysis and Design by Prakash and Puri.</li> <li>Analysis and design of Foundations for Vibrations by P J Moore</li> </ol> </li> </ul>											
Mapping	of Course Ou	tcomes	COs	>POs-	→PSO	S							
Engineering knowledge	Problem analysis Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management $\&$ finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions / guidelines
DOI		DO 4	DOC	DOC	D07	DOO	DOO	DO10	DO11	DO 10	DCO1	DCOO	DCOO

	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PO8	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2
CO1	2	-	3	2	-	-	-	-	-	1	-	-	2	-
CO2	-	3	-	-	-	-	1	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	2	-	-	-	1	-	3	-

Cor							Program Core Total Number of contact hours								
	irse ide	I	<b>Fitle of</b>	the c	ourse	(	PCR)	/ Elect	ives	Lecture	Tutorial	Practica	l Tota	ıl C	redit
	uc						(]	PEL)		(L)	(T)	(P)	Hou	rs	
CEC	C <b>721</b>	Envi	ironm	ental l	Pollution		I	PEL		3	0	0	3		3
			& C	Contro	<b>bl</b>					0	•	·	1		
		Pre-1	None	te(s)				Cont		Course A	Assessme	nt metho	$\frac{ds}{(EA)}$		
		- CO		1 1		F 13			inuous		u enu ass		<u>EA).</u> (		1:60
Cou	irco	• CO	1: App		olid wood		meren	t types	or en		ental alle	cung the	e comi	nunity	lille
Outor		pon	iutants	(air, s	ond was	es a		se) for	desig	n soluu	ons.	1 1	C. 1:		
	$(a) \cdot$	• CO	2: Unc	ierstan	d basic d	esig	gn phile	osopni 11tont	es app	plicable	to contro	of and sa	te aisp	osal of	
	(5).		erent t	ypes o		me	ntar po		.s.		1		. 6 . 1: 6	· · · · · · · · · · ·	
		• CO	3: Fori	nulate	, analyze	, an	a aesig	gn basi	c con	trol and	disposal	systems	OI 011	terent t	ypes
		or e			i polluta	us.	~ ~ <b>f</b> ~~ ~	114: ~	- 4	a af mal	11	()			
			<b>Air pollution</b> : Its effects, measurement, methods of control, air pollution control equipment.												
Tom	iaa	Alf p	(16) Air pollution: its effects, measurement, methods of control, air pollution control equipment.												
	ones	(10) Community Solid wastes – quantity & characteristics methods of collection disposal $k$													
		reuse. (16)													
(п	15)	Noise nollution - Its effects noise measurement methods of control of environmental noise													
		<b>Noise pollution</b> - Its effects, noise measurement, methods of control of environmental noise.													
		(U) Iena I	asnac	ts of e	nvironma	nta	l nollu	tion &	contr	al(2)					
		Lugai	aspec			ma	i ponu	uon a	conti	01. (2)					
_		Text I	Books.		- ·			<b>-</b> .							
Te	xt	I. In	troduc	tion t	o Envire	onm	iental	Engine	eering	by M	.L. Dav	18 & D	.A. C	ornwell	(Tata
Boc	oks,	M	lcGrav	v-H1ll	Educatio	n Pr	ivate I	_imited	1, Nev	v Delhi)	)	~ ~ 1			a
and	/or	2. Ei	nviron	menta	l Engine	erin	g by F	I.S. Pe	avy,	D. R. R	owe & C	J. Tcho	banogl	ous [M	cGraw
refer	ence	H	ill Edu		(India)	riv	ate Lir	nited, I	New I	Jelhi					
mate	erial	<i>Refer</i>	ence E	Sooks:				р ·		1	1 4 7	N 0.	0		· ·
(S	5)	3. El	nviron	menta.	Engine	erin	g – A	Desig	gn Ap	proach	by A. F	. Sincei	0 & 0	G. A. S	Sincero
Mann	ving o	(P f Cours		e - Ha	$\frac{11}{CO_{c} \rightarrow P}$				a, ne	w Deim	)				
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	irse	• COI	: Lear	n preli	minari	es of (	constru	iction p	planni	ng and	manage	ment.			
	Onies Del	• CO2	: Lear	n cons	truction	n sale	aty aspe	ects.	hood	40 400		d contro			
	55)	• CO3	: Lear	n conti	ract ma	inagei	ment.	Get ex	posed	to tend	lering ar	id contra	icting.		
		• CO4	E Lea	rn ado	out tine	e run	ning c	x oper	ration &	or go	overnme of constr	nt-run-	uinmer	ring de	epart.,
		Const	ructio	n nla	nning.	Intro	, projec ductio	n to r	lannir	$rac{1}{5}$	ages of	nlanning	Worl	n. z break	down
		structi	ire Sc	heduli	ing Pr	enara	tion of	f scher	lules	for iol	n mater	ials lab	our ea	uinmen	t and
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		Organ	nizing	cons	tructio	on: I	Princip	les of	forg	anizati	on. Tv	pes of	organi	zation.	Site
		organi	sation	Tem	orary s	servic	es, Job	layou	t. (6)		, -j	r	8		
		Safety	y in co	nstruc	ction: I	mpor	tance o	of safet	y & it	s meas	ures in c	onstruct	ion acti	vities.(3	3)
Top	oics	Const	ructio	n labo	our: W	elfare	facilit	ies, La	bour l	aws. (	3)				
Cov	ered	Contr	act n	nanage	ement:	Diff	erent	types	of co	ntracts	s, Notic	e invitir	ng tend	ler, Co	ntract
		docum	nents,	Condit	ion of	contra	act, Ea	rnest r	noney	, Secu	rity mon	ey, Terr	ninatior	n of con	tract,
		Arbitr	ation,	Specif	ication	– dif	ferent t	ypes. (	(8)						
		Public	e wor	ks ac	counts	: Mu	ister r	oll, M	leasure	ement	book,	Cash bo	ok, Ma	aterial-a	it-site
		accour	nt, Imj	prest,	Tempo	rary a	advanc	e, Mo	de of	payme	ent, Bill,	Vouche	er, Run	ning ac	count
		Dill, Fi		ll, Adv	ance p	ayme	nt to co	ontract	or, Se	cured a	advance,	Stock,	l ools ar	id plant	s. (7)
		Const	rucuo	n pra	cuces:	vari	lous co	onstruc	Cimo y	equipi	ient, Fa	clors al.	mont o	selection	on of
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		Text B	ooks:	iation.	(1)										
		1. Est	imating	g and c	osting i	n civil	engine	ering b	y B. N	. Dutta	, theory a	nd practi	ce		
		2. Est	imating	g, costi	ng and	specifi	ication	in civil	engine	ering b	y M. Ch	akraborty	,		
		3. Tex	kt book	of esti	mating	and co	osting (	civil en	gineer	ing) by	G. S. Bi	rdie, Dha	npat Rai	& Sons	
		4. Civ	vil engi	neering	g Contra	acts an	d Estin	hates by	/ B. S.	Patil, (	Drient Lo	ngman, N	lew Dell	hi, 1981.	
Te	ext	5. PE	KI & C	PM pi	anagem	s and a	applicat	lions by	L. S.	Srinain N V	, Allillau azirani	and S I	Vest Pres	ss Pvi. dola – K	hanna
Boo	oks,	Puł	olishers	. Delhi	i-6, 197	8.		ounts	0y <b>v</b> .	14. 4	azıram,	and D. I	. Chan	uoia, ix	nanna
and	l/or	Refere	nce Bo	oks:	-,										
mate	erial	7. Ma	nagem	ent in	Constru	iction	Industr	y by P.	P. Dł	narwad	ker, Oxfo	ord & IB	H Publis	shing Co	o. Pvt.
mut	onui	Ltd	l. New	Delhi,	1992.		D	1		<b>D</b> 1	G 11 A	1 100			
		8. Bu	Ilding (	Constru	iction by	y S. C	. Ranga	iwala, (	Charota	ar Book	Stall, Ai	nand, 198	80. nomolitor	hoole	( <b>n</b> )
		9. Col	l New	Delhi	1979	and 1	ts plain	ing a	appric	ation D	y IVI. Vel	ma, met	ropontai		:0. (þ)
Map	oing o	f Cours	se Out	comes	$COs \rightarrow$	POs-	→PSOs	S							
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	<b>PO</b> 9	PO10	) PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	-	-	3	-	3	-	-

Co					]	Progra	am Cor	e To	<u>tal Nu</u>	mber of	contact	t hours		
	odo	Title o	of the c	ourse		( <b>P</b> (	C <b>R</b> ) /	Le	ecture	Tutorial	Practical	l Total	Cr	edit
	oue				I	Electiv	es (PE	L)	(L)	(T)	(P)	Hours		
CE	E723	Open char	nnel Hy	ydraulic	S	P	EL		3	0	0	3		3
		Pre-requis	ite(s)					(	Course	Assessm	ent meth	ods		
		Fluid Mech	nanics				Conti	nuous	(CT) a	nd end as	sessment	t (EA). C	CT+EA	
Cou	urse	• <b>CO1:</b> U	ndersta	nding m	echa	anics of	f flow,	energy	y & m	omentun	n in an o	pen cha	nnel	
Outc	omes	• CO2: C	omputa	tion of d	iffe	rent co	mpone	nts of	flow in	n an oper	n stream	l <b>.</b>		
(CC	<b>Ds</b> ):	• CO3: C	apabili	ty for d	esig	n of d	lifferent	type	of op	en chan	nel for	operati	onalizat	ion of
		water-re	sources	systems										
		Introductio	on: De	scription	s, ty	pes of	flow, s	tate of	f flow,	regime	of flow	(2)		
		<b>Open-Cha</b>	nnels a	and thei	r p	ropert	ies: 7	'ypes,	geom	etry, ge	ometric	elemen	ts of c	hannel
		sections, v	elocity	distribu	tior	n, wid	e oper	cha	nnel,	measure	ment o	f veloc	ity, ve	locity-
		distribution	coeffic	cients and	d de	termin	ation, p	ressu	re dist	ribution	in a cha	nnel sec	ction, ef	fect of
		slope on pro	essure d	listributi	on.	(8)								
		Energy an	d Mom	nentum 1	Prir	iciples	: Energ	gy, spe	ecific (	energy, o	criterion	for a c	ritical s	tate of
		flow, interp	pretatio	n of loc	al p	phenon	nena, e	nergy	in no	n-prism	atic cha	nnels, 1	moment	um in
		open-chann	el flow	, specific	tor	ce, mo	mentur	n prın	ciple a	pplied to	o non-pr	1smatic	channe	ls. (6)
		Critical flo	ow con	nputatio	ns a	and A	pplicat	ions:	Criti	cal flow	, factor	s, flow	compu	itation,
Та		nyaraulic ez	kponent	t for flov	/ CO		10n, co	tiona	x meas	ichmont	t ( <b>0</b> )	aina tha	valaai	try of o
	pics	uniform fl	ow m	open en draulie	ann	liont	Equation	uons,	establ	rm flor	, express	sing the	c veloci	hozy's
	(re)	resistance	factor	Manr	ina	r r r r r r r r r r r r r r r r r r r	nula:	Man	nining	$r_{\rm out}$	w, Clicz nhness	coeffic	ient f	actors
(11	13)	Mannining'	s rough	ness coe	ffic	ient tal	ble $(6)$	Ivian	mmg	5 104	Sincess	coeffic	ient, i	actors,
		Computati	ons of	Uniforn	n Flo	ow: Th	ne conv	evanc	e of a	channel	section.	the sec	tion fac	tor for
		uniform-flo	w com	putation.	the	e hvdra	ulic ex	poner	nt for	uniform	-flow co	mputat	ion. flo	w in a
		channel sec	tion wi	th comp	osite	e rougl	hness. I	Detern	ninatic	n of the	Norma	l Depth	and Ve	locity,
		determinati	on of t	the Norr	nal	and C	ritical	Slope	s, prol	olems of	f unifor	m flow	compu	tation,
		computation	n of flo	od disch	arge	, unifo	rm surf	ace fl	ow (6)				-	
		Design of (	Channe	ls for U	nifo	rm Flo	<b>w:</b> (6)							
		(a) Non-ero	odible o	channels	: N	on-ero	dible cł	annel	, non-e	erodible	material	and lin	ing, mi	nimum
		permissible	veloci	ity, char	nel	slope	s, freel	ooard,	best	hydraul	ic section	on, det	erminat	ion of
		section dim	ensions	5										
		(b) Erodib	le cha	nnels w	ith	scour	not si	ilt: M	lethod	of appr	oach, n	naximui	n perm	issible
		velocity, n	lethod	of perm	iissi	ble ve	elocity,	tracti	ve fo	rce, trac	tive-for	ce ratio	o, perm	issible
		tractive for	e, meth	nod of tra	activ	ve force	e, stable	e hydr	aulic s	ection	1		•1.1	1 •
		(c) Grasse	d chai	nnel: G	ass(	ed cha	innel, 1	retarda	ance c	oefficiei	nt, the	permiss	sible ve	elocity,
T	ovt	Text Dooka	grass,	procedui	e oi	desigi	1.							
Boo	oks	1 Open Ch	annel F	Hydraulic	s hv	K Su	ıbraman	va Fo	urth E	dition N	IcGraw	Hills Ed	ucation	(India)
and	d/or	Private L	imited.	New Dell	ni.	11. 50	lorumun	<i>yu</i> , 10		union, n			ucution	(maia)
refer	rence	Reference B	ooks:											
mater	rial(s)	2. Open-Ch	annel H	ydraulics	by '	V. T. C	how, M	cGraw	-Hill B	ook Com	pany, In	c., New	York	
Map	ping of	f Course Ou	tcomes	COs→F	Os-	→PSO	S				1			
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	ing lge	aly lop	P iii c									y T	o ai	sions / les
	neering wledge	n analy levelop	nduct gations	tool	gine	nmo	thic	idu: w	unia	ojec seme	lg le	analy nd pr	uter ai ind to	rovisions / lelines
	Engineering knowledge	blem analy gn/develop	Conduct estigations	lern tool	engine society	lvironme ustainab	Ethics	ndividua team wo	mmuni	Projec anageme financ	-long le	lan, analy gn and pr	mputer ai cill and to	al provisions / guidelines
	Engineering knowledge	Problem analy Design/develop	Conduct investigations	Modern tool	The engined society	Environme sustainab	Ethics	Individua team we	Communie	Projec manageme financ	Life-long le	Plan, analy design and pr	Computer ai skill and to	codal provisions / guidelines
	Engineering knowledge	Problem analy Design/develop	Conduct investigations	Modern tool	The engine society	Environme	Ethics	Individuation team we	Communic	Projec manageme financ	Life-long le	Plan, analy design and pr	Computer ai skill and to	codal provisions / guidelines
<u>CO1</u>	c Engineering knowledge	Problem analy Problem analy Design/develop	Conduct Envestigations	Modern tool	OO The engined society	Environme sustainab	Ethics	Individua team we	Communic O PO10	Projec manageme financ	PO12	- Plan, analy design and pr	Computer ai skill and to	<ul> <li>codal provisions / guidelines</li> </ul>
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	P	re-requ	isite(s)	)					Cou	rse Asse	ssment	methods			
Flu	uid Me	echani	cs and	Water	•		С	ontinuc	ous (CT	) and en	d asses	sment (E	A). CT+1	EA	
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		<u> </u>	rouna	water	of ar	aund	watar	• Inte	oducti	010	Charac	toristio	of Gro	und w	otor
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Code         Title of the course         (PCR) / Electives (PEL)         Lecture (L)         Tutorial (T)         Practical (P)         Total Hours         Credit           CEE725         Hydrology and Irrigation Engineering         PEL         3         0         0         3         3           Pre-requisite(s)         Course Assessment methods         Course Assessment (EA). CT+EA           Course         • CO1: Understanding of occurrence, distribution, storage & transmission of water in different form in space, over & below surface of earth, data collection & processing           (COS):         • CO2: Understanding flow generation, occurrence of flood, drought, environmental flow requirement.         • CO3: Realizing need for food sufficiency, crop water, irrigation requirement, method & design of infrastructures for irrigation requirements.         • CO3: Realizing need for food sufficiency, crop water, irrigation system (7)           Diversion head-works: Definition of weirs and barrages and their classification, Layout of typical diversion head-works and function of its components. (3)         Concrete gravity dams: Forces acting, Elementary profile, Design of gravity dams (3)           Earthen dams: Types, Causes of failure, Seepage control, Slope protection (3)         Hydraulic power: Thermal-water power, systems, arrangement, equipment, operation (2)           River navigation: Requirements of navigable waterways, Methods of achieving navigablity, Open channel methods, Navigation dams, Navigation locks, Financing river navigation projects. (4)           Topics         Gr
Conc         Electives (PEL)         (L)         (T)         (P)         Hours           CEE725         Hydrology and Irrigation Engineering         PEL         3         0         0         3         3           Pre-requisite(s)         Course Assessment methods         Physics and Fluid Mechanics         Continuous (CT) and end assessment (EA). CT+EA           Course         • CO1: Understanding of occurrence, distribution, storage & transmission of water in different form in space, over & below surface of earth, data collection & processing         • CO2: Understanding flow generation, occurrence of flood, drought, environmental flow requirement.           • CO3: Realizing need for food sufficiency, crop water, irrigation requirement, method & design of infrastructures for irrigation requirement.         • Introduction: Brief introduction to Hydrology and Irrigation system (7)           Diversion head-works: Definition of wirs and barrages and their classification, Layout of typical diversion head-works and function of its components. (3)         • Concrete gravity dams: Forces acting, Elementary profile, Design of gravity dams (3)           Earthen dams: Types, Causes of failure, Seepage control, Slope protection (3)         • Hydraulic power: Thermal-water power, systems, arrangement, equipment, operation (2)           River navigation: Requirements of navigable waterways, Methods of achieving navigability, Open channel methods, Navigation dams, Navigation locks, Financing river navigation projects. (4)           Topics         Ground water: Occurrence, Well hydraulics, Regional aquifer hydrau
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		1. 0	ffshor	e Stru	ctural l	Engine	ering	by The	omas H	I Dawso	on, Pren	tice Ha	11, 1983		
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		speci	al case	of soli	d shaft	; thick	spheric	al shell	s. ( <b>4</b> )						
		Curv	ved Bea	ams: In	troduc	tion; st	tresses i	in curve	ed bea	ams; ecce	entricity; 1	rings und	er loads	; distri	bution
		of str	esses a	nd ben	ding m	oments	s in ring	gs. ( <b>4</b> )							
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	n Su	B	eve lut:	ive X F	1 tc	eer	t &	3th:	vid		gei	ng	/se rep	led	101

	Engineerin	Problen	Design/dev solt	Conduct inv complex	modern	The engine	Environment	Et	Indiv tean	Сотт	Project manag	Life-lon	Plan, analys pre	Computer aide	codal provisi
	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	3	2	-	-	-	-	-	-	-	-	2	-	-
CO3	3	-	3	2	2	-	-	-	-	-	-	-	2	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-

Program Core Total Number of contact hours										rs							
	irse		Title o	of the c	course		(F	<b>PCR</b> ) /		Lecture	Tutorial	Practic	al Tota	d Cı	edit		
	uc						Electi	ves (P	EL)	(L)	(T)	(P)	Hou	rs			
CEF	<b>E810</b>	S	edime	nt Tra	nspor	't		PEL		3	0	0	3		3		
		Pre	-requis	ite(s)						Course	Assessm	ent meth	ods				
		CEC 3	02, CE	C 601.				Cont	inuou	s (CT) ar	nd end as	sessmen	t (EA).	CT+EA			
Co	urse	• C	01: U	nderst	anding	g of the	e origir	n and n	nechai	nism of	sedimen	it transp	ort				
Outc	comes	• C	02: D	evelop	ment	of capa	abilitie	s to an	alyze	sedimer	nt load.						
(CC	Os):	• C	O3: A	bility t	o deve	elop m	odel to	o predio	ct sedi	ment lo	ad.						
``````````````````````````````````````		• C	04: C	apabili	ity to c	lesign	stable	channe	el to c	arry the	predicte	ed sedin	nent loa	d			
		Intro	oducti	on: (2)	)								•				
		Sedi	ment	prope	rties:	particl	e size	shape	and c	lensity,	fall velo	ocity, vi	scosity	, colloi	ds and		
		Three	Threshold of particle motion. (4)														
		Sand	Sand transport by air: Surface creep, effects of sand movement on wind, instability of a														
		flat s	lat sand surface, ridges and dunes. (4)														
		Sedi	ediment movement in water: bed features and meanders, analytical models, stresses in														
T	•	flow	ow of fluid-solid mixtures. (4)														
	pics	Char	hannel roughness and resistance to flow. (2)														
	refeu	Sedi	<b>diment load:</b> Bed Load, Bed Forms; Effective bed roughness; Armouring, suspended diment diffusion approach energy approach statistical approach suspended adiment														
(1)	113)	sedin	diment, diffusion approach, energy approach, statistical approach, suspended sediment														
		load,	oad, total Load. (8)														
		Stab	le Ch	annei	Desig	$\mathbf{n}: 1 \mathbf{n}$	e empi	irical s	table	rogisto	design	- Traci	Ive Ioi	ce met	nod of		
		houn	dary s	hear - '	The st	- Diag	nss-se	ction -	Desig	n by tra	nce to i	rce met	- Desi	gli values for			
		Cohe	esive s	edime	nts: $(2$	2)	055 50	cuon	Desig	, n oy ut		ree met	100 (0)				
		Erosi	ion, de	positio	on, sco	our, loc	al sco	ur at di	fferen	t structi	ures. (2)						
		Dime	ension	al Ana	lysis a	nd Sin	nilitud	e (2)									
Te	ext	Text	Books	s:													
Boo	oks,	1. N	Iechan	ics of	Sedim	nent Ti	anspo	rtation	and A	Alluvial	Stream	Problen	ns by R	L. J. Gai	de, K.		
and	l/or	G	Ran	ga Ra	ju, Re	evised	Third	Editic	on, Ne	ew Age	Interna	tional l	Publish	ers, and	l New		
refer	rence		elhi.	oundo	m, h,d	monling	hr. A	I Do	. مارز	Ond ad	itian Da						
mater	Tal(s)	Z. L	oose b		гу пуа	rauncs	S DY A.	. J. Kal	IGKIVI	, 2nd ed	nuon Pe	rgamon	press				
		Kejel	rence . edime	DUUKS. nt Trat	snort	hy V	T Cho	w Mo	Graw	-Hill Be	ook Com	nany I	nc Ne	w Vork			
Mapp	oing of	Cours	se Out	comes	$\frac{15port}{COs}$	POs-	>PSO	s	Juw	TIIII DC		ipany, i	<u>iic., i (c</u>	W IOIK			
1110pp		00000		f	0051	>							71	-			
	edge	s	nt of	ons c ns	ge	ciet				_	nt &	50	n and	l and	<u>\</u>		
	owl	alysi	omei Is	gatic blen	fesn	os pi	nt & lity		rk &	atior	eme	arnir	esig	skil	ions es		
	g kn	n an	velo] utior	/esti; t pro	tool	er ar	nme nabi	hics	idua 1 wo	unic	mage	g le;	se, d spare	iided ools	ovis lelin		
	erin	blen	n/der solt	t inv plex	lern	gine	lviro ustai	Ē	ndiv tean	mm	t ma fin	-lon	nalys pre	ter a to	al pı guic		
	Igine	Prc	esigı	nduc	Mod	e en	En		Ţ	ů	ojec	Life	n, aı	nduu	cod		
	Er		Ď	Coi		Th					Pt		Pla	Co			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3		
CO1	3	-	-	-	-	-	-	-	3	-	-	-	2	-	-		
CO2	-	3	-	-	-	-	-	-	3	-	-	-	2	-	-		
CO3	-	-	-	-	3	-	-	3	-	-	-	-	2	-	-		
CO4	-	-	-	-	-	-	-	-	-	3	3	3	2	-	-		

						Program Core				Numb	ours	<b>i</b>				
	irse ide	Title	of the	e cours	se	(P	C <b>R</b> ) /		Lecture	e Tut	ori P	ractic	Total	Cr	edit	
	Juc				I	Electiv	es (PE	EL)	(L)	al (	T) a	al (P)	Hours			
CEF	<b>E811</b>	Slope Rein	e Stabi forced	lity ar l Eart	nd h	Р	EL		3	0		0	3		3	
	I	Pre-requ	isite(s)	)					Cou	rse Asse	ssment 1	nethods				
	Foun	dation I	Engine	ering			C	ontinuo	ous (CT	) and en	d assess	ment (E	A). CT+	EA		
Cou	ırse	• CO	l: learn	basic	mechai	nism of	reinfo	rced ea	rth.							
Outco	omes	• CO2	2: desig	gn wall	with re	einforce	ed back	cfill								
		• CO:	b: anary	n. Basi	ic mec	hanisn	n of rei	inforce	ed eartl	1 Pract	ical ann	lication	(6)			
		Basic		onents	of rei	nforce	ed soil	: Soil	or fill r	natrix, l	Reinfor	cements	, facing	elemen	nts. (6)	
		Streng	Strength characteristics of reinforced soil: Basic concept, Sigma and Tau models, laboratory studies, sliding shear test, pull-out tests (8)													
Top	pics	studies	studies, sliding shear test, pull-out tests. (8)													
Cov	ered	Wall	<b>Vall with reinforced backfill</b> : Pressure intensity on the wall, Stability against sliding, verturning and bearing failure. Increase of earth pressure due to a line load on the backfill.													
(H	rs)	overtu	verturning and bearing failure, Increase of earth pressure due to a line load on the backfill, esign procedure. (10)													
		Metho	esign procedure. (10) <b>Iethods of Slope Stability</b> : Taylor Charts, Method of Slices. Effect of Tension Cracks.													
		Vertic	<b>Iethods of Slope Stability</b> : Taylor Charts, Method of Slices, Effect of Tension Cracks, 'ertical Cuts. Bishop's Analysis. Non-circular Failure Surfaces, Stabilization of slopes:													
		Draina	'ertical Cuts. Bishop's Analysis. Non-circular Failure Surfaces, Stabilization of slopes: Drainage measures, Soil reinforcement (geosynthetics/soil nailing etc). (15)													
		Text <b>B</b>	Drainage measures, Soil reinforcement (geosynthetics/soil nailing etc). (15) Text Books:													
т		1. Reinforced Earth & Geotextiles by Koerner														
Boo	ext	2. Rein	nforce	d Earth	1 & Ge	eotexti	les by	G.V.	Rao	mand C	V	i and C	1	n Tahn	Wilson	
and	l/or	5. Earl	in and Sons 1	Earth- 963	-KOCK	Dams	by Sn	erara,	wood	ward, C	JIZIENSK	and C	levenge	er. John	wney	
refer	ence	4. Ear	th and	Rock	Fill Da	ams by	Bhara	at Sing	h and ]	H. D. SI	harma,	1999				
mater	rial(s	Refere	ence B	ooks:				C								
	)	5. Slop	pe Stal	bility a	nd Sta	bilisat	ion me	ethods	by L. Y	W. Abra	amson,	T. S. Le	ee, and S	S. Sharn	na,	
		John G The	n Wile	y & so	ons. $(2)$	002)	EN	Drom	haad (	1002)	Diodric	aada	mia and	nrofac	cional	
		0. The	don	my or	Stope	es by	E. IN.	DIOIII	neau, (	1992),	DIACKIE		inic and	i profes	sional,	
		7. Ear	th &	Rockf	ill Da	ms, P	rincipl	es of	Design	n and	Constru	ction b	y Chris	stian, K	Lutzner	
		Pub	lished	Oxfor	d and	IBH.	-		-				-			
		8. Han	ldbook	c of Slo	ope Sta	abiliza	tion by	/ J. A.	R. Ort	iago, an	d A. S.	F. J. Sa	yao, 20	04.		
Mapp	oing o	f Cours	se Out	comes	COs	>POs−	→PSO8	S								
	ge		of	s of		ety					ઝ		pur	pur	lines	
	wled	sis	nent	tions ems	sage	soci	y X		2	ion	nent	ing	ign a	kill a	uide	
	knoʻ	anal	lopn ions	stiga orobl	ool u	and	ment abilit	ICS	ual e vork	nicat	agen 1ce	learı	, des are	led s Is	ls / g	
	uring	lem	deve solut	inve lex l	em to	neer	iron stain	Eth	divid sam	inuic	man fina	long	alyse prep	er aic toc	ision	
	ginee	Prob     Prob       ginee     sign/sign/sign/sign/sign/sign/sign/sign/											prov			
	Eng		Des	Cone	A	The					Pro	П	Plan	Con	odal	
															õ	
001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
$\frac{COI}{CO2}$	-	- 2	- 3	-	_	-	-	-	-	-	-	-	1	-	-	
CO2 CO3	-	3	-	2	-	-	-	-	-	-	-	-	2	1	1	

		Program Total Number of contact hours															
Co	urse ode	Title	e of the	e cours	se C	ore (P Electi (PE	CR) / ives L)	Lec (1	cture L)	Tutoria (T)	l Pra	ctical (P)	Total Hours	Cro	edit		
CE	E812	So I	il Stru nterac	icture ction		PE	L	3	3	0		0	3		3		
			Pre-ree	quisite	(s)					Cour	se Asse	essment	method	s			
	Structu	iral A	nalysis	s, Soil	Mecha	anics a	nd	Co	ontinuo	ous (CT)	and en	d asses	sment (l	EA). CT	T+EA		
		Four	ndatior	n Engir	neering	g								,			
		•	CO1: 1	Unders	tand t	he basi	is of sc	oil-stru	cture i	nteractio	on.						
Co	urse	•	$CO2 \cdot 1$	Unders	tand v	various	soil in	nteracti	ion mo	dels like	e heams	s on ela	stic four	ndation			
Outc	comes		(Wink	ler bea	m mo	del), in	finite	beam.	finite	beam m	odels.		000	luulion			
(CC	Os):	•	$CO3 \cdot $	Annly	soil-st	ructure	inters	action	model	s to diffe	erent tv	ne of fo	undatio	ns like i	nile		
	/		sheet r	nile wa	lls (ca	ntileve	r and a	anchor	ed she	et nile v	valls)		undatio	iis iike j	JIIC,		
			CO4	Analys	o the f	founda	tion of	differ	ent cix	vil struct	ures wi	th cons	idering	oil_etru	oture		
			interac	stion in	e uie i static		ll as di	unamic	condi	itions	uies wi	ui cons		5011-5110	icture		
		Intr	aduati	1000000000000000000000000000000000000	noratr	as we	found	otion i	ntoroot	ion An	lytical	formul	otions (	4)			
		Intro	raction	on, su n nroh	lome	of shall	llow fo	auon n	ion co	mbined	footing	Digid	method	and Fi	lavibla		
		meth	action	) U bron	lems	or sha		Junuar		momeu	looting	, Rigiu	memou	, and r			
To	nice	Roor	<b>institute foundation</b> , Infinite beam, Finite beam, Modulus of subgrade reaction and pating parameters (8)														
	vered	effec	ins on elastic foundation, infinite beam, Finite beam, Modulus of subgrade reaction and acting parameters. (8)														
	Irc)	Shee	ecting parameters. (8) eet pile wall, Cantilever and anchored sheet pile wall, Fixed earth support, Free earth														
(1)	113)	sunn	et pile wall, Cantilever and anchored sheet pile wall, Fixed earth support, Free earth port. (6)														
		Reta	pport. (6) etaining walls. Conduits. Load on different types of conduits. Design charts. (5)														
		Brad	red ex	cavati	on P	ressure	e distr	ibution	in h	raced w	alls E	stimatio	on of st	trut loa	d etc		
		Stab	ility of	$\frac{1}{2}$ bottor	n of e	xcavati	ion (4)	)	i m o	iuceu vi	uns, L	Stimuti		141 104	u ete.,		
		Piles	under	r diffe	rent lo	ading	condit	ions	Analys	sis unde	r latera	l load	Differer	nt annro	aches		
		Mec	hanism	1 of fai	lure. I	Ultima	te load	l. Defl	ection	s. Elasti	c contir	nuum ar	pproach.	Analys	sis and		
		desig	zn. (8)					, 2	•••••	., 210.50	•••••••		· · · · · · · · · · · · · · · · · · ·	j.			
		Text	Books	5:													
Те	ext	1.Ge	otechi	nical E	Engine	ering:	Princ	ipal a	nd Pra	actices (	of Soil	Mecha	anics ar	nd foun	dation		
Boo	oks,	En	gineer	ing by	VN.S	S. Mur	thy,	1									
and	l/or	2.Fo	undati	on ana	lysis a	and De	sign by	y J. E.	Bowle	es.							
refer	ence	3. Ba	sic and	d Appl	ied Sc	oil Mec	hanics	by G.	Ranja	an and A	. S. Ra	0					
mater	rial(s)	Refe	rence	Books	:			•	Ŭ								
		4. Ac	lvance	d Geot	echni	cal Eng	gineeri	ng soi	l-struc	ture Inte	raction	using (	Compute	er and			
		M	aterial	Model	s by C	C. S. D	esai, ai	nd M.	Zamar	1		-	-				
		5. Ad	lvance	d Soil	Mech	anics b	y B. M	1. Das	, McG	raw Hill	s Publi	shers					
Mapp	oing of	Cours	se Out	comes	COs	>POs-	<b>≻</b> PSOs	3									
	e		f	×.		ty					2		pu	pu			
	ledg	is	ent c	tion ems	lge	ocie	x			Ę	ent &	gu	çn aı	II aı	s /		
	MOI	alys	pme	tiga robl	nse	s pu	ent & ility		ıl & ırk	atio	eme	arni	lesig e	l ski	sion es		
	g kr	n an	/elo	ives x p	tool	er ai	nme nab	hics	idua 1 wc	unic	nag anc	g le	se, d spar	idec	ovis lelin		
	erin	blen	√dev solι	ct ir nple	lem	gine	viro ıstai	Ē	ndiv ean	um	t ma fin	-lon	pre	ter a tc	al pı guić		
	gine	Pro	sign	ndu	Mod	eng	En st		Ir	Co	ojeci	Life	ı, an	nput	cod		
	En		De	of Co		The					Pro		Plaı	Cor			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	<b>PO10</b>	<b>PO</b> 11	PO12	PSO1	PSO2	PSO3		
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-		
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-		
CO3	2	-	2	-	-	-	-	-	-	-	-	-	2	1	1		
CO4	1	2	-	1	-	-	-	-	-	-	-	-	2	1	1		

C						Program Core				Total Number of contact hours					5	
	ode	Titl	e of th	e cour	se	(PCR	() / Ele	ectives	Le	ecture	Tutorial	Practica (P)	l Tota	ul Cu	redit	
CEC	7813	Ind	uctria	Wast	05			,		(L) 3			3	15	3	
CLA	2013	Pre-real	uisite(s	)					Cor	urse Ass	essment i	nethods	3		5	
	Enviro	nmenta	ıl Engii	, neering			C	Continu	ous (C	$\Gamma$ ) and er	nd assess	ment (EA	A). CT+	-EA		
Con Outc (CC	urse omes Ds) :	<ul> <li>CC wa</li> <li>CC dif</li> <li>CC of</li> </ul>	D1: A _I stewat D2: Ur ferent D3: For indust	pply k ter) for idersta types rmulat rial po	nowled desig nd ba of indu e, anal llutant	dge of n solut sic des ustrial lyze, a s.	diffen tions. sign p polluta nd des	rent ty hilosoj ants. sign ba	pes of phies a sic con	indust indust applicat	rial poll ble for c d dispos	utants ( control a al system	air, so and sa ms of e	lid was fe dispo differen	te and osal of t types	
Toj Cov (H	pics ered (rs)	Indu Air p Solid Wast	ustrial sources of pollution, types of pollutants. (5) pollution – Its effects, measurement, methods & equipment of control. (15) d wastes – quantity & characteristics, methods of collection, disposal & reuse. (12) stewater – characteristics, methods of collection, treatment & disposal. (10) <i>et Books:</i>													
Te Boo and refer mat	ext oks, l/or rence erial s)	<i>Text</i> 1. E H 2. In <i>N</i> <i>Refe</i> 3. E P 4. In E	Books nviron fill Edu atroduc IcGrav rence nviron rentice adustri ducatio	s: imenta ication ction t v-Hill <b>Books</b> imenta e – Hal al Wa on)	l Engi i (India to Env Educa : l Engi l of In tter Po	neerin a) Priv vironm tion Pri ineerin dia Pri ollution	g by H ate Lin rental rivate I rivate L n Con	H.S. Pe mited, Engin Limite A Desi imited trol b	eavy, I New I eering d, New gn Ap , New y W.V	D. R. R Delhi by M v Delhi Delhi W. Eck	owe & .L. Dav by A.H enfelder	G. Tcho is & E P. Since r, Jr. (N	banog D.A. C ro & AcGrav	lous, M ornwell G.A. S w-Hill	cGraw , Tata incero, Higher	
Mapp	oing of	t Cours	se Outo	comes	COs	>POs-	→PSOs	S								
	Engineering knowledge	Problem analysis	Problem analysis         Design/development of solutions         Design/development of solutions         Solutions         Conduct investigations of complex problems         Modern tool usage         Modern tool usage         Ethics         Ethics         Ethics         Project management & finance         Individual & team work         Individual & finance         Individual & finance         Computer aided skill and prepare         Computer aided skill and tools         Codal provisions / guidelines													
	<b>PO1</b>	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3	
CO1	2	-	-	-	-	-	-	-	2	-	-	-	1	-	-	
CO2	3	-	3	-	-	-	1	-	-	2	-	2	3	1	1	
CO3	-	-	3	-	-	-	-	2	-	2	1	3	3	2	2	

C	Program Core Total Number of contact hours														
Cou	rse do	1	litle of t	the co	ourse		(I	<b>PCR</b> ) /		Lecture	Tutorial	Practical	Total	C	redit
	le						Electi	ves (P	EL)	(L)	(T)	(P)	Hours	5	
CEE	814	Wa Plann	ter reso ling and	ource d Ma	Syste nagen	m 1ent		PEL		3	0	0	3		3
		Pre-	requisit	e(s)						Course .	Assessm	ent meth	ods		
Fluid	Mec	chanics,	Irrigati	on Er	nginee	ring,		Contin	nuous	(CT) an	nd end as	sessment	(EA).	CT+E	A
	Wate	er Reso	urces Er	ngine	ering,										
Econ	nomi	cs and (	Comput	er Ap	plicati	ions									
Cour	rse	• CO	1: Under	rstanc	ling of	f diffe	rent as	pects o	of sys	tems of	water res	sources			
Outco	mes	• CO2	2: Learn	ing o	f optir	nizati	on tecł	nniques	s, line	ar and d	ynamic I	Programr	ning.		
(COs	s):	• CO3	3: Abili	ty to	form	ulate	models	s of re	servo	ir syste	ms, size,	, operatio	on and	hydro	power
		Introd	luction:	Ove	erview	and F	Role of	engine	eers (	2)					
		Fngin	eering	econ	omic	anal	veie I	Princin	les o	-) I engin	eering e	conomic	e Ma	themat	tics of
		econor	nic ana	lysis	Price	theor	rv and	resour	rces s	allocatio	n Cond	itions of	nroie	nt onti	nes or mality
		Benefi	t-cost a	nalvsi	is Dis	count	rate (	5)		inocuno	in, cond	1110115 01	proje	n opu	maney,
		Identi	fication	and	evalu	ation	of wa	e, ter ma	nage	ment p	lans: Svs	stem con	cent. S	vstem	design
		metho	dology,	Opti	mal de	esign.	Introc	luction	to c	lassical	optimisa	tion tech	niques	with	simple
		numer	ical exa	mples	s, Sim	ulatio	n analy	vsis. (5)	)		1		1		1
		Plann	ing for :	flood	contr	ol: Pl	anning	g conte	xt, De	evelopin	g the sup	oply, Esti	mating	g the de	emand,
		Projec	t feasibi	lity. (	(5)		-			-					
Topi	ics	Plann	ing for	drai	nage:	Plan	ning co	ontext,	Dev	eloping	the supp	oly, Estir	nating	the de	emand,
Cove	red	Projec	t feasibi	lity. (	(5)										
(Hrs	s)	Plann	ing for	wate	er sup	ply: I	Plannir	ng cont	ext, l	Develop	ing the s	supply, E	stimat	ing irri	igation
		deman	d, Estin	nating	g urbai	n dem	and an	d Proje	ect fea	asibility.	. (5)				
		Planni	ing for	hydr	oelect	ric po	ower:	Planniı	ng co	ntext, D	evelopin	g the sup	oply, E	stimati	ing the
		deman	d, Proje	ect fea	sibilit	y. (5)			P						
		Planni	ing for	navi	gation	e: Plai	nning	context	, Dev	veloping	the sup	ply, Estin	nating	the de	emand,
		Projec	t feasibi	lity. (	(5)		- <b>4.</b>	D1 *			· · · · 1 · · · ! ·		1 т		
		domon	d Droio	innin at for	g and	oper	ation:	Planni	ng co	ontext, L	evelopin	ig the sup	opiy, E	sumau	ing the
		Tort B	a, Fioje		15101111	y. (3)									
Tex	xt	1  W	ater Res	source	s Syst	tems -	- Mod	elling '	Techn	iques ai	nd Analv	sis by S	Vedi	ila and	РР
Book	κs,	M	ujumdar,	Tata	McGra	aw-Hil	l Publis	shing C	ompai	ny Limite	ed, New I	Delhi.		and und	
and/	or	Refere	nce Bool	ks:				U	1	5	,				
materi	al(s)	2. Irri	gation S	System	n Desi	gn –	An En	gineeri	ng Aj	pproach	by H. C	luenca, R	ichard,	Prenti	e Hall,
materi	ui(5)	Eng	glewood	Cliffs	, New	Jersey	07632	р ·	1 1		-	1		· •	1
Monri	naa	$\frac{3}{100000000000000000000000000000000000$	ter Dema	and M		ment b	y Butle	er, Davi	d and	Memon,	Fayyaz A	AII, IWA I	ublish	ing, Lo	ndon
wiappi	ing 0			mes		rus-	1120	> 			<u>г г</u>	l	Г		[]
	dge		t of	s of	a)	iety					k k	-	and	and	
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	Engineering knov	Problem analy	Design/developn solutions	Conduct investiga complex probl	Modern tool u	The engineer and	Environment sustainabili	Ethics	Individual d team work	Communicati	Project managen finance	Life-long lear	Plan, analyse, des prepare	Computer aided si tools	codal provisio guidelines
	<b>PO</b> 1	PO2	PO3	PO4	PO5	<b>PO6</b>	PO7	<b>PO8</b>	PO9	<b>PO10</b>	<b>PO11</b>	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-	-

		Program Core Total Number of contact hours													
Course	Title of the course	( <b>PCR</b> ) /	Lecture	Tutorial	Practical	Total	Credit								
Coue		<b>Electives (PEL)</b>	(L)	(T)	(P)	Hours									
<b>CEE815</b>	Machine Foundation	PEL	3	0	0	3	3								
	Pre-requisite(s)		Course .	Assessme	ent metho	ods									
Me	echanics of structures	Continuou	s (CT) an	d end as	sessment	(EA). C	CT+EA								
	• CO1: Acquire knowledge	of Machines and i	its Found	ation: Ty	pes and I	Forces a	acting upon,								
~	dynamic analysis														
Course	• CO2: Ability to conduct	Field-Experiment	and Ana	lyze the	data wit	h interp	pretation for								
Outcomes	determining dynamic prop	erties of Soil													
(COs) :	• CO3: Ability to Design S	uitable Foundatio	ns based	on Soil	as a Spr	ing, and	d as a Half-								
	Space continuum														
	• CO4: Ability for understanding the need of future studies <b>Single Degree freedom system:</b> Free vibration of Single Degree freedom system, natural														
	<b>Single Degree freedom system:</b> Free vibration of Single Degree freedom system, natural frequency and time period damping Amplitude. Forced vibration, dynamic magnification														
	frequency and time period, damping, Amplitude, Forced vibration, dynamic magnification														
- ·	factor (5)														
Topics	Two Degree Freedom System	<b>m:</b> Free and Force	ed Vibrat	10n  of  Tv	vo Degre	e Freed	om System,								
Covered	Natural frequencies and the	ieir arrangement,	Eigen	value a	and Eige	en vect	tor, normal								
(Hrs)	coordinates, Effect of dampin	g, generalized ma	ss and sti	iness m	atrices. (	/) Seil S	tiffnaga and								
	damping (2)	Experimental	Procedur	e for fin	ang out	2011 2	unness and								
	Machine Vibration: Type	of Machines n	armissihl	e amplit	ude ve	time r	period Soil								
	modeling as linear un-damped	l springs Soil as I	Half-Snad	e inclus	ion of da	mning	embedment								
	effect. (6)	springs. Son us i	iun opu	ee, merus	ion or uu	mping,	ennoeument								
	<b>Foundation design:</b> Foundat	ion analysis and d	lesign as	linear sp	ring, vert	tical vib	pration. pure								
	sliding and rocking vibration.	(6)		~P	8,		, <b>F</b>								
	Couple vibration of sliding a	and rocking. (6)													
	Elastic half-space approach	of analysis and d	lesign (8)	)											
Toyt	Text Books:														
Books	1. Hand book of Machine Fo	oundations by P. S	Srinivasu	lu and C	.V. Vaid	yanatha	n, Tata-Mc-								
and/or	Graw-Hill Publishing Com	npany ltd.													
reference	Reference Books:														
material(s)	2. Design Aids in Soil Mechanics and Foundation Engineering by S.R. Kaniraj, Tata-Mc-														
	Graw-Hill Publishing Com	npany ltd.													
Mapping of	Course Outcomes COs→POs-	→PSOs		<u> </u>	I										

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment & sustainability	Ethics	Individual & team work	Communication	Project management & finance	Life-long learning	Plan, analyse, design and prepare	Computer aided skill and tools	codal provisions/guidelines
	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	<b>PO10</b>	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	3	-	-	-	-	-	-	-	1	-	-
CO2	-	3	-	-	2	-	-	-	-	-	-	-	1	1	1
CO3	-	-	3	-	-	2	-	1	-	-	-	-	2	1	1
CO4	-	-	-	-	-	2	-	1	-	-	-	3	1	1	1