

# ERODE SENGUNTHAR ENGINEERING COLLEGE



(An Autonomous Institution, Affiliated to Anna University) PERUNDURAI, ERODE - 638 057

## PG Curriculum and Syllabus

(1 to 4 Semesters)

### M.E. ENVIRONMENTAL ENGINEERING

Choice Based Credit System (CBCS)

**REGULATION 2019** 



### ERODE SENGUNTHAR ENGINEERING COLLEGE

(Approved by AICTE, New Delhi, Permanently Affiliated to Anna University - Chennai & Accredited by NAAC & National Board of Accreditation (NBA), New Delhi.) **PERUNDURAI, ERODE 638 057** 



### INSTITUTION VISION & MISSION

#### VISION

Erode Sengunthar Engineering College strives with determination and commitment to provide and promote world-class Technical Education, in particular to the students of backward rural areas, transforming them into holistic personalities embedded with discipline, skill and responsibility that make them patriotic, successful, and self-developed professionals ready to accomplish any job in their career and life.

#### MISSION

- Provide an idyllic study atmosphere, fine infrastructure, qualified and dedicated faculty and standardized systems for a strong career foundation.
- Aid and motivate the students and faculty alike for maximum utilization of facilities, making them
  innovative and creative in thinking and research, in order to provide technical service to industry and
  society.
- Develop multi-skilled personalities to make ESEC, a world leader in Technical Education.

#### DEPARTMENT OF CIVIL ENGINEERING

#### VISION

 Department of Civil Engineering of Erode Sengunthar Engineering College are committed to provide students latest learning techniques and full-fledged knowledge base in related sectors to make them globally recognizable Civil Engineers.

#### MISSION

- To inculcate knowledge through laboratory and field study, apart from effective teaching learning process.
- > To utilize the infrastructure of the college to a maximum extent.
- To synergize the efforts of both students and staff to meet the ever growing construction the needs of the industry.
- To expose the faculty and students in research and consultancy works.

#### PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

**PEOs1:PREPARATION AND CORE COMPETENCE:** To prepare the students with strong fundamental knowledge in mathematics, science and engineering, communication, to identify the design concept, analyze and to execute a project.

**PEOs2:BREADTH**: Providing opportunities to work with related fields of engineering viz computer science and engineering, electrical engineering and mechanical engineering, so that the students can able to understand the different industrial environments.

**PEOs3:PROFESSIONALISM**: To develop high proficiency in computer-based engineering knowledge, developing soft skills, design and development, and the use of computational tools.

**PEOs4:LEARNING ENVIRONMENT:** To promote continuous learning, research and social development activities among the students with strong, professional, moral and ethical values. Thereby they can achieve successful carriers to meet the needs of Indian and multinational organizations.

### ERODE SENGUNTHAR ENGINEERING COLLEGE, ERODE DEPARTMENT OF CIVIL ENGINEERING

#### **REGULATIONS - 2019**

#### CHOICE BASED CREDIT SYSTEM

#### I TO IV SEMESTERS CURRICULUM

#### M.E. ENVIRONMENTAL ENGINEERING Minimum credits to be earned : 69

				SEMEST	ER I							
				THEOP	RY							
Cade Na	Courses	Object	ive & Out	tcomes	L	т	Р	с	Ma	ximum l	Marks	Catalan
Code No	Course	PEOs	POs	PSOs	L	1	F	C	CA	ES	Total	Category
19EV101	Probability and Statistics for Environmental Engineers	1,111	1,2,10 ,11	1	3	1	0	4	40	60	100	BS
19EV102	Environmental Chemistry	1,111	1,2,3	1	3	0	0	3	40	60	100	PC
19EV103	Environmental Microbiology	1,111	1,2,3	1	3	0	0	3	40	60	100	PC
19EV104	Physico-Chemical Treatment of Water and Wastewater	ш	1,2,10 ,11	1	3	0	0	3	40	60	100	PC
19EV105	Air Pollution and Control Technologies	1,111	1,2,10 ,11	1	3	0	0	3	40	60	100	PC
19EV106	Transport of Water and Wastewater	1,11	1,2,10 ,11	1	3	0	0	3	40	60	100	PC
			1	PRACTIC	AL							
19EV107	Environmental Chemistry & Microbiology Laboratory	Ш	1,2,3, 5,	2	0	0	4	2	60	40	100	PC
	TOTAL				18	2	4	21	300	400	700	-

			:	SEMESTE	RI							
	A DATE A CONTRACT		4	THEOR	Y							
Code No	Course	Object	ive & Ou	tcomes		-	Р	с	Max	imum M	larks	Catagory
Code No	Course	PEOs	POs	PSOs	L	Ľ	P	C	CA	ES	Total	Category
19EV201	Design of Biological Treatment Systems	1,111	2,10, 11	1	3	1	0	3	40	60	100	PC
19EV202	Environmental Auditing and New	1,111	1,2,3	1	3	0	0	3	40	60	100	PC

	Total				18	1	4	20	300	400	700	-
19EV204	Unit Operations and Processes Laboratory	ļI	1,2,3,5	2	0	0	4	2	60	40	100	PC
	Mar Maria		Р	RACTI	CAL		111					
	Professional Elective III	11	1,2,3,7 ,9	1	3	0	0	3	40	60	100	OE
	Professional Elective II	11	1,2,3,5 ,8,9,10 ,	1	3	0	0	3	40	60	100	PE
	Professional Elective I	Ш	1,2,10, 11	1	3	0	0	3	40	60	100	PE
19EV203	Industrial Wastewater Management	1,111	1,6,7,8	1	3	0	0	3	40	60	100	PC
	Product Management								1			1

				SEMEST	ER II	l.						1. 1.
				THEO	RY							
	0	Objective & Outcomes			-	Р	6	Maximum Ma		larks	Catalan	
Code No	Course	PEOs	POs	PSOs	L	Т	Р	С	CA	ES	Total	Category
19EV301	Solid and Hazardous Waste Management	1,111	2,10, 11	1	3	0	0	3	40	60	100	PC
+	Professional Elective IV	1, 111	1,2,3, 6,12	1	3	0	0	3	40	60	100	PE
	Professional Elective V	I, III	1,2,3, 6,12	1	3	0	0	3	40	60	100	PE
Service .				PRACTI	CAL			14		1.2		
19EV302	Industrial Training	I,IV	1,2,3, 5,6	3	0	0	0	1	60	40	100	EEC
19EV303	Project Work (Phase - I)	I ,II, IV	1,2,3, 5,6	3	0	0	12	6	60	40	100	EEC
241	Total				9	0	12	16	240	260	500	

64 C.			S	EMESTE	R IV					1.0		
				THEOR	Y							
Code No	Course	Object	ive & Ou	tcomes		T	P	с	Max	kimum	Marks	Category
Code No	Course	PEOs	POs	PSOs			F	C	CA	ES	Total	Category
19EV401	Project Work (Phase II)	1 ,111	2,10, 11	1	0	0	24	12	60	40	100	EEC
	Tot	al			0	0	24	12	60	60	100	-

K m Chairman - Bo3 Dept. of Civil Engg. - E--

Chairman - 805 Dept. of Civit English Ester

#### **PROFESSIONAL ELECTIVES**

	1			IVES	1	1		
Code No.	Course	0	bjective & Outco	omes	L	т	Р	с
obuo no.	oouroe	PEOs	POs	PSOs	-			
		PROFES	SIONAL ELECTI	VE - I				
19EVX01	Instrumentation, Selection and Management of Environmental Engineering Equipment	1	1,2,3,6,7	1	3	0	0	3
19EVX02	Remote Sensing and GIS Applications in Environmental Engineering	1,111	1,2,3,4,5,6	1	3	0	0	3
19EVX03	Ecology and Environmental Quality Management	1,111	1,2,3,4,5,6	2	3	0	0	3
19EVX04	Urban and Rural Sanitation	1	1,2,4,5,6,7	1	3	0	0	3
19EVX05	Computing Techniques in Environmental Engineering	1.00	7,8,10,12	1	3	0	0	3
		PROFESS	SIONAL ELECTIV	/E - II				
19EVX06	Environmental Impact Assessment	1	1,6,9,10,11	1	3	0	0	3
19EVX07	Environmental Policies and Legislations	I	1,6,9,10,11	1	3	0	0	3
19EVX08	Environmental Bio- Technology	1	1,2,3,5,7	1,2	3	0	0	3
19EVX09	Environmental Structures	I	1,5,7	1	3	0	0	3
19EVX10	Environmental Reaction Engineering	1	1,5,6,7,8	1	3	0	0	3
- 205 br#sec	Dept. of Civit Er	PROFESS	IONAL ELECTIV	E - III				
19EVX11	Environmental System Analysis	1	1,2,3,4,5,6	1	3	0	0	3
19EVX12	Role of Environmental Legislations in Industries	1,111	1,6,7,8,9	1	3	0	0	3
19EVX13	Cleaner Production and Sustainable Development	1,11	1,2,3,5,7	1	3	0	0	3
19EVX14	Solar Energy Technologies	-1	1,2,3	1	3	0	0	3
	F	ROFESS	IONAL ELECTIV	E - IV				
19EVX15	Environment, Health and Safety in Industries	1,11	1,2,3,4,5,6	1	3	0	0	3
19EVX16	Climate Change and Adaptation	1	1,2,3,4,5,6	1	3	0	0	3
19EVX17	Air and Noise Quality Modeling	1	1,2,3,4,5,6	1	3	0	0	3
19EVX18	Water Quality Modeling	1,111	1,6,9,10,11	1	3	0	0	3
19EVX19	Advanced Wastewater	1,111	1,2,3,5,7	1	3	0	0	3

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		PROFESS	SIONAL ELECTIV	/E - V				
19EVX20	Operation and Maintenance of Water and Waste Water Treatment Plants	I~	1,2,11,12	1	3	0	0	3
19EVX21	Soil Structure Interaction	I.	1,2,3,5,7	1	3	0	0	3
19EVX22	Geotechnical Earthquake Engineering	1,111	1,6,7,8,9	1	3	0	0	3

S.No.	Category		Credits Pe	r Semester	Credit in %		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	of Total edits	
		1	11	III	IV	Credit	III 70	Min	Max
1	BS	04	-	-	-	04	6	15%	20%
2	ES				-	1.1	0	0%	15%
3	HS	-	-	-	-	-	0	0%	10%
4	PC	17	12	10	12	32	46	35%	50%
5	PE		09	06	-	15	21	5%	25%
6	EEC	-	-		-	19	27	5%	30%
	Total	21	21	16	12	70	100	-	-

BS

PE

MC

- Basic Science
- ES
- Professional Elective OE - Mandatory course CA
- Engineering Science HS - Open Elective PC
- Humanities and Social Science
- Professional Core
- Continuous Assessment
- ES -End semester Examination

EEC- Employability Enhancement Course

Chairman - BoS Dept. of Civil Engg. - ESEC

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	CIVIL ENGINEER	ING				R 2019	Semester	IBS
Course	Course Name		lour: Veek		Credit	Total Hours	Maximun Marks	
Code		L	т	P	С		-	
19EV101	PROBABILITY AND STATISTICS FOR ENVIRONMENTAL ENGINEERS	3	1	0	4	60	100	
Acquinter     Deve     problem	ive (s): The purpose of learning this course is nire knowledge to understand the solutions polation methods. basics of Probability elop an understanding of probability concepts ems. ire knowledge to understand the statistical q	to s and	d dis	tribut	ions inclu	ding som	e decision-m	akin
<ul> <li>Unde equa</li> <li>Unde evalu</li> </ul>	nes: At the end of this course, learners will b erstand the numerical solutions to algebra tions, axioms of probability, discrete and con erstand test of hypothesis for both small ar ate control limits using control charts to exar rstand multivariate correlation analysis and f	iic, i tinuc id la nine	expo ous p rge whe	nenti robal samp ther t	oility distri les based he produc	butions. d on norma ct is within o	al distribution	
Unit I PROE	BABILITY THEORY	7		-				12
	ents-Sample space- Axiomatic definition corems-Total Probability and Baye's Theorem				Conditio	Jilai 1 100a	Dinty - Audi	tion,
Discrete Random	VOM VARIABLES AND PROBABILITY DI variable-Probability Function- Continuous R	STR	IBU om va	<b>FION</b> ariabl	e- Probab			
Discrete Random Dimensional Rand unctions. Distribu	variable-Probability Function- Continuous R dom Variables- Joint probability mass functio ttions: Binomial, Poisson, Normal, Gamma –	STR ando n – I	IBU om va Marg	rion ariabl	e- Probab and condit	ional proba	bility density	10
Discrete Random Dimensional Randur unctions. Distribu Unit III CURV	variable-Probability Function- Continuous R dom Variables- Joint probability mass functio itions: Binomial, Poisson, Normal, Gamma – /E FITTING	STR ando n – I Che	IBU om va Marg bysh	rion ariabl inal a iev's	e- Probab and condit in equality	ional proba / (Simple p	ability density roblems).	10
Discrete Random Dimensional Ran functions. Distribu Unit III CURV Correlation –Multi	variable-Probability Function- Continuous R dom Variables- Joint probability mass functio itions: Binomial, Poisson, Normal, Gamma – /E FITTING ple Correlation-Regression –Multiple Regres	STR ando n – I Che	IBU om va Marg bysh	rion ariabl inal a iev's	e- Probab and condit in equality	ional proba / (Simple p	ability density roblems).	12
Discrete Random Dimensional Random Unitions. Distribu Unit III CURV Correlation –Multi Unit IV TEST Large samples: T	variable-Probability Function- Continuous R dom Variables- Joint probability mass functio itions: Binomial, Poisson, Normal, Gamma – /E FITTING	STR ando n – I Che sion	IBU om va Marg bysh –Lin mall	rion ariabl inal a lev's lear f	e- Probab ind condit in equality it- Quadra	ional proba (Simple p tic fit-Cubic ts for Mear	ability density roblems). c Splines	12
Discrete Random Dimensional Random Junctions. Distribut Unit III CURV Correlation –Multi Unit IV TEST Large samples: T Attributes using t,	variable-Probability Function- Continuous R dom Variables- Joint probability mass function titions: Binomial, Poisson, Normal, Gamma – <b>/E FITTING</b> ple Correlation-Regression –Multiple Regres <b>ING OF HYPOTHESIS</b> rests for Means, Variances and Proportions	STR andc n – I Che sion – S sing	IBU om va Varg bysh –Lin mall Chi	rion ariabl inal a lev's lear fi sam Squa	e- Probab ind condit in equality it- Quadra bles: Test re distribu	ional proba (Simple p tic fit-Cubic ts for Mear	ability density roblems). c Splines	12
Discrete Random Dimensional Random Dimensional Random Unit III CURV Correlation –Multi Unit IV TEST Large samples: T Attributes using t, Unit V STAT Statistical basis for lefectives and de	variable-Probability Function- Continuous R dom Variables- Joint probability mass function titions: Binomial, Poisson, Normal, Gamma – <b>/E FITTING</b> ple Correlation-Regression –Multiple Regres <b>ING OF HYPOTHESIS</b> Tests for Means, Variances and Proportions F, Chi square distribution– Goodness of fit u	STR andc n – I Che sion - S sing ELA	IBU Marg bysh –Lin mall Chi TION	rion ariabl inal a nev's ear fi sam Squa	e- Probab ind condit in equality it- Quadra bles: Test re distribu ALYSIS iables: $\overline{X}$ ,	ional proba (Simple p tic fit-Cubic ts for Mean ution. R- charts,	ability density roblems). c Splines ns, Variances Control cha	12 12 12 12
Discrete Random Dimensional Random Dimensional Random Unit III CURV Correlation – Multi Unit IV TEST Large samples: T Attributes using t, Unit V STAT Statistical basis for REFERENCES:	variable-Probability Function- Continuous R dom Variables- Joint probability mass function titions: Binomial, Poisson, Normal, Gamma – <b>/E FITTING</b> ple Correlation-Regression –Multiple Regres <b>ING OF HYPOTHESIS</b> rests for Means, Variances and Proportions F, Chi square distribution– Goodness of fit u <b>ISTICAL QUALITY CONTROL AND CORRE</b> for Control charts– Control limits – Control fects: p, np charts, c chart-Correlation –Regr	STR andc n – I Che sion - S sing ELA <sup>T</sup> char essio	IBU om va Marg bysh –Lin Chi TION ts fo	rion ariabl inal a nev's ear fi sam Squa I ANA r var Multi	e- Probab ind condit in equality it- Quadra bles: Test re distribu ALYSIS iables: X, ple and P	ional proba (Simple p tic fit-Cubic ts for Mear ution. R- charts, artial Corre	ability density roblems). c Splines ns, Variances Control cha elation.	12 12 12 12
Discrete Random Dimensional Random Dimensional Random Unit III CURV Correlation –Multi Unit IV TEST arge samples: T Attributes using t, Unit V STAT Statistical basis for lefectives and de REFERENCES: 1. Miller and Fil	variable-Probability Function- Continuous R dom Variables- Joint probability mass function titions: Binomial, Poisson, Normal, Gamma – <b>ZE FITTING</b> ple Correlation-Regression –Multiple Regres <b>ING OF HYPOTHESIS</b> Tests for Means, Variances and Proportions F, Chi square distribution– Goodness of fit un <b>ISTICAL QUALITY CONTROL AND CORRE</b> for Control charts– Control limits – Control fects: p, np charts, c chart-Correlation –Regres	STR andc n - I Che sion - S sing ELA <sup>1</sup> char essid	IBU om va Marg bysh -Lin Chi TION ts fo on -	rion ariabl inal a nev's ear fi sam Squa r var Multi ice H	e- Probab ind condit in equality it- Quadra bles: Test re distribu ALYSIS iables: X, ple and P all of India	ional proba (Simple p atic fit-Cubic ts for Mean ution. R- charts, artial Corre a Ltd, New	ability density roblems). c Splines ns, Variances Control cha lation. Delhi 2015	12 12 12 12
Discrete Random Dimensional Random Dimensional Random Unit III CURV Correlation – Multi Unit IV TEST Arge samples: T Attributes using t, Unit V STAT Statistical basis for thefectives and de REFERENCES: 1. Miller and F 2. Sheldon M. F	variable-Probability Function- Continuous Ridom Variables- Joint probability mass function totions: Binomial, Poisson, Normal, Gamma – <b>ZEFITTING</b> ple Correlation-Regression –Multiple Regress <b>ING OF HYPOTHESIS</b> rests for Means, Variances and Proportions F, Chi square distribution– Goodness of fit u <b>ISTICAL QUALITY CONTROL AND CORRE</b> for Control charts– Control limits – Control fects: p, np charts, c chart-Correlation –Regr reund "Probability and Statistics for Engineer Ross — "Introduction To Probability And Stat "Probability and Statistics for Engineering an	STR andc n – I Che sion - S sing ELA char essic s", F	IBU om va Marg bysh Lin Chi Chi TION ts fo on - Prenti	rion ariabl inal a nev's ear fi sam Squa I ANA r var Multi ice H. Engi	e- Probab ind condit in equality it- Quadra bles: Test re distribu ALYSIS iables: X, ple and P all of India neers An	ional proba (Simple p tic fit-Cubic ts for Mean ution. R- charts, artial Corre a Ltd, New d Scientists	ability density roblems). c Splines ns, Variances Control cha elation. Delhi 2015 s"-Elsevier	12 12 3 and 12 12 12 12 12

Chairman - BoS Dept. of Maths - ESEC

Dept. of Chairman • BoS Dept. of Civil Engg. • ESEC

Chairman - BoS Dept. of Civil Engg. - ESEQ

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Department	CIVIL ENGINEER	RING				R 2019	Semester I	PC
Course	Course Name		lour Wee		Credit	Total Hours	Maximu Marks	
Code		L	Т	Ρ	С	nours	indirito	
19EV102	ENVIRONMENTAL CHEMISTRY	3	0	0	3	45	100	
<ul><li>Impart kr</li><li>Educate</li></ul>	tive (s): The purpose of learning this counowledge on basic analytical chemistry a about chemical kinetics and colloids and wledge on biochemical activity of organi	and in d sur	nstru face	imer che		ods of ana	alysis.	
Course Outco Understa Learn ab Understa Unit I BASI Concentration of Buffer solutions Problems- EMI lectrodes, ion	mes: At the end of this course, learners and on basic analytical chemistry and ins out chemical kinetics and colloids and si and on biochemical activity of organic po C PRINCIPLES OF ANALYTICAL OF f solutions-Calculations- Ionic equilibriu -Change of pH with salt concentrations, F and Electrode potential–Applications selective electrodes- Fluoride and Nitra RUMENTAL METHODS OF ANALYSI	will t strum urfac Illutar <b>CHE</b> um c , Buff s of p ate	be al nenta ce ch nts <b>MIS</b> of w fer ir	ole to al me emis TRY reak	ethods of stry electroly -Solubility	tes, – co v product	, Hydrolysis d	of salt
pectroscopy-At	omic and Molecular-Difference - Flam	e em	ISSIC	on si	pectrosco	py, and	Atomic Abs	orptic
Spectroscopy– p echniques in AA UV– visible s ead and cadm ind application	tomic and Molecular-Difference – Flam principle, Instrumentation, Application AS – solvent extraction – Co precipita pectrophotometer - principle, Instrume ium in water samples. Chromatograp	in o ation entati	deter – C on,	rmin Chela App	ation of ating res lication in	metals - ins. Mole n determ	- Pre concer ecular spectr ination of m	ntratic oscop iercur
Spectroscopy– p echniques in AA UV– visible s ead and cadm ind application Unit III CHEN Rate constants ates – Derivat nzymes, cofac nzyme kinetics Biochemical action	AS – solvent extraction – Co precipital pectrophotometer - principle, Instrume ium in water samples. Chromatograp <b>MICAL KINETICS</b> of first and second order reactions ion of Arrhenius equation – problem tors – enzyme catalyzed reactions - - Michalei's Menton equation – signific tivity of carbohydrates, proteins, vita	in or ation entation hy – – pr – pr – Te cance	deter – C on, Gas roble cor empe	App chris ch	ation of ating res lication in omatogra – effect utive rea ire depe	metals - ins. Mole h determ phy - sin of temp actions - ndence o	- Pre concer- ecular spectr ination of m nple instrume erature on m basic conce f enzyme a	entration oscop ercurrentation 9 eaction epts of cctivity
Spectroscopy– p echniques in AA - UV– visible s ead and cadm and application Unit III CHEN Rate constants ates – Derivat enzymes, cofac nzyme kinetics Biochemical ac inder aerobic a	AS – solvent extraction – Co precipita pectrophotometer - principle, Instrume ium in water samples. Chromatograp <b>//ICAL KINETICS</b> of first and second order reactions ion of Arrhenius equation – problem tors – enzyme catalyzed reactions - Michalei's Menton equation – signific	in or ation entation hy – – pr – pr – Te cance	deter – C on, Gas roble cor empe	App chris ch	ation of ating res lication in omatogra – effect utive rea ire depe	metals - ins. Mole h determ phy - sin of temp actions - ndence o	- Pre concer- ecular spectr ination of m nple instrume erature on m basic conce f enzyme a	entration oscop ercury entation 9 eaction epts of ctivity
Spectroscopy– p echniques in AA UV– visible s ead and cadm ind application Unit III CHEN Rate constants ates – Derivat nzymes, cofac nzyme kinetics Biochemical ac inder aerobic a Unit IV COLL Colloids – type pplications. So iquid-liquid syst types of dete Unit V BIOCI Dyes – Azodye Organic phosph	AS – solvent extraction – Co precipital pectrophotometer - principle, Instrume ium in water samples. Chromatograp <b>MICAL KINETICS</b> of first and second order reactions ion of Arrhenius equation – problem tors – enzyme catalyzed reactions – Michalei's Menton equation – signific tivity of carbohydrates, proteins, vita and anaerobic conditions. <b>OIDS AND SURFACE CHEMISTRY</b> s, properties (electrical origin of cha chulz Hardy rule - Destabilization a cems, Gas in liquid systems-Colloidal e rgents, ingredients – Biodegradation of <b>HEMICAL ACTIVITY OF ORGANIC PO</b> es – Biodegradation environmental en norus, Pb, Cd, Hg, As pesticides	in or ation entation hy – – pro- – Tecanco amins anges and entation entation anges and entation entation anges and entation entat	deted - C on, Gas roble cor empe e s an des olyte terge TAN s - odes	rmin Chela App chr ems nsec eratu ills id o truct s – ents <b>TS</b> Insegrad	ation of ating res lication in omatogra – effect utive rea are depe and fats ptical) – ion of o surfacta and env ecticides ation –	metals – ins. Mole n determ phy – sin of temp actions – ndence o – Bact Electro colloids. H ints, soa <i>v</i> ironment – Chlor environn	- Pre concer ecular spectr ination of m nple instrume erature on m basic conce f enzyme a rerial decomp kinetic prope Hydrophilic c ps and dete al significant inated pestic nental effects	ntratic oscop ercury entatio 9 eactio epts of ctivity positio 9 rties olloids ergent ce. 9 ides 5-Trac
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RE	FERENCES:
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	Arthur I. Vogel, A text book of Qualitative inorganic analysis, The English Language Book Society, 1977

Course Code       Course Name       Hours / Week       Credit Total Hours       Maximum Marks         19EV103       ENVIRONMENTAL MICROBIOLOGY       3       0       3       45       100         Course Objective (s): The purpose of learning this course is to Provide basic knowledge on microbiology.       Image: Course Objective (s): The purpose of learning this course is to Provide basic knowledge on microbiology.       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: At the end of this course, learners will be able to:       Image: Course Outcomes: Course Course Course: Course Course: Course Course Course:	Department	CIVIL ENGINEER	ING				R 2019	Semester I	PC
Code       L       T       P       C         19EV103       ENVIRONMENTAL MICROBIOLOGY       3       0       0       3       45       100         Course Objective (s): The purpose of learning this course is to         Provide basic knowledge on microbiology.       Enable the students to identify and enumerate bacteria from samples.       Understand the morphology and characteristics fungi, protozoa and algae .         Understand the norphology and characteristics fungi, protozoa and algae .       Understand the norphology and characteristics fungi, protozoa and algae .         Course Outcomes: At the end of this course, learners will be able to:       • The candidate will be having a basic understanding of microbiology.         • The candidate will be posses the knowledge to analyse then samples for the presence of various microbes       • The candidate will posses the knowledge to tackle the environmental issues         Unit 1       INTRODUCTION TO MICROBIOLOGY       10         Classification of microorganisms. Culture of micro-organisms- media preparation, sterilization, pur culture, maintenance of cultures. Growth curve - factors affecting growth, nutritional requirements confirmed and completed test, MPN index, use of Millipore filter technique, tests for faecal streptococc and costridum weichri-their sanitary significance, standards for bacteriological quality.       10         Prief classification of Algae - Structural organization and multiplication of Ameaba and Hydra.       10         Rine dassification of Protozoa. Structural or	Course	Course Name				Credit			
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<ul> <li>Provide basic knowledge on microbiology.</li> <li>Enable the students to identify and enumerate bacteria from samples.</li> <li>Understand the morphology and characteristics fungi, protozoa and algae .</li> <li>Understand the role of microbes in environmental Issues.</li> <li>Course Outcomes: At the end of this course, learners will be able to:         <ul> <li>The candidate will be having a basic understanding of microbiology.</li> <li>The candidate will be posses the knowledge to analyse then samples for the presence of various microbes</li> <li>The candidate able to understand role of understand the impacts of microbes on the environmert and will possess the knowledge to tackle the environmental issues</li> <li>Unit 1</li> <li>INTRODUCTION TO MICROBIOLOGY</li> <li>100</li> </ul> <ul> <li>Classification of microorganisms. Culture of micro-organisms- media preparation, sterilization, pur culture, maintenance of cultures. Growth curve - factors affecting growth, nutritional requirements or micro-organisms. Micro-organisms in Air, water and soil. Aerobic and anaerobic microbiology.</li> <li>Unit 11</li> <li>IDENTIFICATION CHARACTERIZATION OF BACTERIA</li> <li>100</li> </ul> </li> <li>Structure and morphology of bacteria - Gram staining, microscopy. Differential and selective medium 20/04 molechi-their sanitary significance, standards for bacteriological quality.</li> <li>Unit 11</li> <li>ALGAL, FUNGAL &amp; PROTOZOAN MICROBIOLOGY</li> <li>100</li> </ul> <li>Brief classification of Protozoa. Structural organization and multiplication of Amoebae and Hydra.</li> <ul> <li>Unit 11</li> <li>ALGAL, FUNGAL &amp; PROTOZOAN MICROBIOLOGY</li> <li>100</li> <li>Biref classification of Protozoa. Structural organization and multiplication of Amoebae and</li></ul>	19EV103	ENVIRONMENTAL MICROBIOLOGY	3	0	0	3	45	100	
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Brief classification of Protozoa. Structural organization and multiplication of Amoebae and Hydra.       7         Unit IV       IMPACT OF MICROBES ON ENVIRONMENT & HEALTH       7         Waterborne diseases and their causative organisms. Eutrophication. Role of Microbes in Carbon       Phosphorus, Nitrogen and Sulphur cycles. Nutrients Removal – BOD, Nitrogen, Phosphate         Microbiology of Sewage Sludge. Microbe induced Corrosion and Leaching.       8         Unit V       BIOREMEDIATION & BIODEGRADATION       8         Kenobiotics, Classification of pollutants. Biotransformation - important factors, Biodegradation       8         Enzymatic processes in Biodegradation, Bioconcentration, Bio magnification, Bio monitoring       8									
Unit IV       IMPACT OF MICROBES ON ENVIRONMENT & HEALTH       7         Vaterborne diseases and their causative organisms. Eutrophication. Role of Microbes in Carbon       Phosphorus, Nitrogen and Sulphur cycles. Nutrients Removal – BOD, Nitrogen, Phosphate         Vicrobiology of Sewage Sludge. Microbe induced Corrosion and Leaching.       BIOREMEDIATION & BIODEGRADATION       8         Kenobiotics, Classification of pollutants. Biotransformation - important factors, Biodegradation       Biodegradation, Bioconcentration, Bio magnification, Bio monitoring         Ecotoxicology. Case studies       Context       Context       Context									mus
Waterborne diseases and their causative organisms. Eutrophication. Role of Microbes in Carbon         Phosphorus, Nitrogen and Sulphur cycles. Nutrients Removal – BOD, Nitrogen, Phosphate         Microbiology of Sewage Sludge. Microbe induced Corrosion and Leaching.         Unit V       BIOREMEDIATION & BIODEGRADATION         Renobiotics, Classification of pollutants. Biotransformation - important factors, Biodegradation         Enzymatic processes in Biodegradation, Bioconcentration, Bio magnification, Bio monitoring         Ecotoxicology. Case studies							ivebae ai	la riyura.	7
Phosphorus, Nitrogen and Sulphur cycles. Nutrients Removal – BOD, Nitrogen, Phosphate         Microbiology of Sewage Sludge. Microbe induced Corrosion and Leaching.         Unit V       BIOREMEDIATION & BIODEGRADATION         Kenobiotics, Classification of pollutants. Biotransformation - important factors, Biodegradation         Enzymatic processes in Biodegradation, Bioconcentration, Bio magnification, Bio monitoring         Ecotoxicology. Case studies	and the second se					on Role	of Micro	bes in Car	-
Xenobiotics, Classification of pollutants. Biotransformation - important factors, Biodegradation Enzymatic processes in Biodegradation, Bioconcentration, Bio magnification, Bio monitoring Ecotoxicology. Case studies	Phosphorus, N	litrogen and Sulphur cycles. Nutrien	ts F	Rem	oval	– BOI			
Enzymatic processes in Biodegradation, Bioconcentration, Bio magnification, Bio monitoring Ecotoxicology. Case studies	Unit V BIOF	REMEDIATION & BIODEGRADATION			1				8
TEXT BOOK(S):	Enzymatic pro	cesses in Biodegradation, Bioconcer							
TEAT BOON(S).	TEXT POOK		-				. (	a	
	TEXT BOOK(S	oj.			_		Ent	Sel .	

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1.	Pelczar .Jr .M.J., Chan, E.C.S., Krieg.R.Noel., and Pelczar MernaFoss, Microbiology, 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
2.	Joanne Willey and Linda Sherwood and Christopher J. Woolverton., Prescott's Microbiology, 10th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2016.
RE	FERENCES:
1.	S.C.Bhatia, Hand Book of Environmental Microbiology, 3rd Edition, Atlantic Publishers and Distributors, 2008.
2.	Ian L. Pepper, Charles P. Gerba, Terry Gentry and Raina M. Maier, Environmental Microbiology, 3rd Edition, Academic Press, 2014.
3.	S. V. S. Rana, Essentials Of Ecology & Environmental Science, 5th Edition, PHI Learning Press, 2013.

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Department	Department CIVIL ENGINEERING						Semester I	PC
Course	Course Name		lour Wee		Credit	Total Hours	Maximu Marks	
Code	5.0	L	Т	Ρ	С	mouro		
19EV104	PHYSICO-CHEMICAL TREATMENT OF WATER AND WASTE WATER	3	0	0	3	45	100	
	ctive (s): The purpose of learning this cou							
water an treatmen specific	a the students on the principles and product of the students of the principles and product of the students should gain of the systems and the components comprime process. The the recent developments in the treatment of the students of the stude	sing	pete g su	ncy i ch s	in the pro ystems,	cess emp	loyed in des	ign o
	omes: At the end of this course, learners							
<ul> <li>Identifice environment</li> <li>Designer</li> <li>Underster</li> </ul>	ation and assessment of the characteris mental impacts of the various unit processes in wastewate anding the principles and mechanisms inv	stics er tre	of eatm	wate nent	er and wa			
Unit I GEN	ERAL	1						9
	Physical, chemical and biological parameter							
	s -Wastewater Effluent standards -Wate							
	s -Physical processes-chemical process							
	cal treatment- Requirements of success	ful	oper	atior	1 - Opera	ational pro	oblems - Tr	ouble
shooting.		_		-	-			
A CONTRACTOR OF	ARY TREATMENT- WASTE WATER	_			_			9
	atment: Screening, Principles of screen							
	esign – Flow equalization-Types - skimmin grit chamber - Floatation – types – Theor						lisposal – ve	locity
Unit III PRIM	ARY TREATMENT- WATER			2.1			1.1.1	9
	ation - Sedimentation; Types; Aeration ar	nd g	jas t	rans	fer - Co	agulation	and Floccula	ation,
coagulation pro	cesses- Design - stability of colloids - dest	abil	izati	on o	f colloids	Clarifloco	ulation-Desig	jn.
Unit IV FILT	RATION			1				9
and Rapid sand	y of granular media filtration; Classificatio d filter; mechanism of filtration; modes o nding; dual and multimedia filtration.							
				-	_			9
and the second se	sorption equilibriam- adsorption isotherr	ne	- 10	n F	vchange	nrocesse	s Photocat	
	plications of Membrane Processes - Rev							
	Electrocoagulation. Disinfection and its si							
	various methods	9			. njereca			
TEXT BOOK(S		-						
State of the second	& EDDY, "Wastewater Engineering Treat	nen	t Dis	spos	al Reuse	",Tata Mc	Graw-Hill, Ne	ew.
All second se	S. PEAVY, DONALD R. ROWE & GEORG	GE 1	ГСН	OBA	NOGLO	JS, "Envir	onmental	
	g", McGraw-Hill, 1988.						$\bigcirc$	
REFERENCES:					5,000,000	6	00	-
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 QASIM. S.R., "Wastewater Treatment Plant – Planning, Design and operation, Holt Rinchart and Winston, New York, 2002.
 WEBER, W.J. Physicochemical processes for water quality control, John Wiley and sons, Newyork,

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Department	CIVIL ENGINEER	RING	;		1.1	R 2019	Semester I	P
Course	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
Code		L	Т	P	С			
19EV105	AIR POLLUTION AND CONTROL TECHNOLOGIES	3	0	0	3	45	100	
	tive (s): The purpose of learning this co							
Learn at changes	the aspects of the science of atmospher mospheric composition, monitoring, acid in the atmosphere e use of models in air pollution studies				urban ai	r quality a	nd global	
	mes: At the end of this course, learners	will	he a	hle t	0.			
<ul> <li>To descr</li> <li>To revie pollution</li> <li>To asses</li> </ul>	tibe the main chemical components and w established methods for monitoring	reac and heric	tions mod poll	s in t delin ution	he atmos g spatial	and tem	poral pattern	s (
	RCES AND CLASSIFICATION OF AIR					-	2.1	9
	lassification of Air Pollutants: Natura					ol-gases	and vapour.	
	- Meteorology and Air pollution: Atm							
lume behaviou	r-plume rise estimation-effluent dispersion	on th	eorie	es-ls	okinetic s	sampling-I	Modeling.	-
	QUALITY MEASURES	1,111						9
	s, gravitational, centrifugal-multiple typ							
	wet collectors, Electrostatic Precipitatio	n the	eory	partio	cle charg	ing collec	tion-ESP de	sig
rocedure.		_				12111		
	DRY OF ADSORPTION							12
equations. Ads ecovery system ontact conden	ciples, description of equipment-packe orption: principles adsorbents, equipm a continuous rotary bedfluidized bed, De sers-shell and tube condensers, des	nent sign	des and and	cript perf	ions-PSA ormance rformanc	-adsorptions equations e equations	on cycle-sol s. Condensat on. Incinerat	ver
the second s	ineration kinetics, equipment description		noi	and	nerforma			
	TOOL METHODO	n, des	sign		periorina	nce equat	tions.	ior
	TROL METHODS		17					9
lants and glass	s-Processes based control mechanism s manufacturing plants; Thermal power	ns-mi r plai	nera nts,	al pro	oducts-a: oleum re	sphaltic c	oncrete, cen	9 ner
lants and glass ertilizers, Pharr	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust	ns-mi r plai	nera nts,	al pro	oducts-a: oleum re	sphaltic c	oncrete, cen	9 ner
lants and glass ertilizers, Pharr Unit V NOIS	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust E STANDARDS	ns-mi r plai try. F	nera nts, ïeld	al pro Petro stud	oducts-a: oleum re	sphaltic c	oncrete, cen	9 ner
lants and glass ertilizers, Pharr Unit V NOIS loise Standards	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust <b>E STANDARDS</b> s; measurement, control and preventive	ns-mi r plai try. F	nera nts, ïeld	al pro Petro stud	oducts-a: oleum re	sphaltic c	oncrete, cen	9 ner
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lants and glass ertilizers, Pharr Unit V NOIS loise Standards TEXT BOOK(S 1. Richard W.1	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust E STANDARDS s; measurement, control and preventive c):	ns-mi r plai try. F meas	nera nts, ield sure	al pro Petro stud s.	oducts-as oleum re y. nic Press	sphaltic c fining and	oncrete, cen I storage pla	9 ner
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Iants and glass ertilizers, Pharr Unit V NOIS loise Standards TEXT BOOK(S 1. Richard W.I 2. Noel de Nev EFERENCES: 1. M.N. Rao et 2. Fundament Technology	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust <b>E STANDARDS</b> s; measurement, control and preventive in ): Boubel et al, "Fundamentals of Air Pollut vers, "Air Pollution control Engg." McGra t al, "Air Pollution", Tata McGraw Hill, 20 als of Air Pollution' authored by Dan , 2008 (ISBN: 978-0-12-373615-4).	tion", aw-H	nera hts, iield sure: Aca iill, N	al properties and pro	oducts-a: oleum re y. nic Press /ork,200	New Yor 5.	oncrete, cen l storage pla k, 2004. ier's Science	9 ner nts 6
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Iants and glass ertilizers, Pharr Unit V NOIS loise Standards TEXT BOOK(S 1. Richard W.I 2. Noel de Nev EFERENCES: 1. M.N. Rao et 2. Fundament Technology	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust <b>E STANDARDS</b> s; measurement, control and preventive in ): Boubel et al, "Fundamentals of Air Pollut vers, "Air Pollution control Engg." McGra t al, "Air Pollution", Tata McGraw Hill, 20 als of Air Pollution' authored by Dan , 2008 (ISBN: 978-0-12-373615-4).	tion", aw-H	nera hts, iield sure: Aca iill, N	al properties and pro	oducts-a: oleum re y. nic Press /ork,200	New Yor 5.	oncrete, cen l storage pla k, 2004. ier's Science	9 ner nts 6
Inits and glass ertilizers, Pharm Unit V NOIS Noise Standards TEXT BOOK(S 1. Richard W.I 2. Noel de New REFERENCES: 1. M.N. Rao ef 2. Fundamenta Technology 3. 'Environmenta	s-Processes based control mechanism s manufacturing plants; Thermal power maceuticals and wood processing indust <b>E STANDARDS</b> s; measurement, control and preventive in ): Boubel et al, "Fundamentals of Air Pollut vers, "Air Pollution control Engg." McGra t al, "Air Pollution", Tata McGraw Hill, 20 als of Air Pollution' authored by Dan , 2008 (ISBN: 978-0-12-373615-4).	tion", aw-H	nera hts, iield sure: Aca iill, N	al properties and pro	oducts-a: oleum re y. nic Press /ork,200	sphaltic c fining and New Yor 5. on, Elsev authored	oncrete, cen l storage pla k, 2004. ier's Science	9 ner nts 6

Murphy and Eoin A. King, 1st Edition, Elsevier's Science & Technology, 2014 (ISBN: 978-0-12-411595-8).

	CIVIL ENGINEER	ING				R 2019	Semester I	P
Course	Course Name		lour Wee		Credit	Total Hours	Maximu Marks	
Code		L	Т	Ρ	С	nouis	Marks	,
19EV106	TRANSPORT OF WATER AND WASTE WATER	3	0	0	3	45	100	
To educ	ctive (s): The purpose of learning this councite tate the students in detailed design conce ion system, sewer networks and stor ion	epts	rela	ated				
Be able     Be able     Troubles     the desi  Unit I FLU	omes: At the end of this course, learners to select various pipe materials for water to design water supply main, distribution shooting in water and sewage transmissio gn of water and sewage network D PROPERTIES	supp network n be	ply r vork e ab	nain, and le to	distribut sewer fo use vario	r various f ous compt	ield condition uter software	ons e fo
oss in free an	; fluid flow - continuity principle, energy pr d pressure flow, major and minor head is - selection of pumps - Flow measureme	is lo						
	ULATION FORECASTING		-		27911		1.1.1.	10
	rs Affecting per capita consumption.							
Vater transmis	<b>RIBUTION</b> sion main design - pipe materials - ec alysis and optimization - Laving and maint							
Vater transmis nethods for ana	sion main design - pipe materials - ec alysis and optimization - Laying and maint							rks
Water transmis methods for ana Unit IV DESI Design of sanit material, const	sion main design - pipe materials - ed alysis and optimization - Laying and maint GN OF SEWERS ary sewer; partial flow in sewers, econo ruction, inspection and maintenance		nce, s of	insit f sev	u lining - ver desig	appurten in; sewer	ances. appurtenar	8 nces
Water transmis methods for ana Unit IV DES Design of sanit naterial, const conditions; conv	sion main design - pipe materials - ed alysis and optimization - Laying and maint <b>GN OF SEWERS</b> ary sewer; partial flow in sewers, econor ruction, inspection and maintenance reyance of corrosive wastewaters.		nce, s of	insit f sev	u lining - ver desig	appurten in; sewer	ances. appurtenar	8 ixin
Water transmise         nethods for and         Unit IV       DESI         Design of sanite         naterial, constructions; conv         Unit V       STOI         Planning - run-option	sion main design - pipe materials - ed alysis and optimization - Laying and maint GN OF SEWERS ary sewer; partial flow in sewers, econo ruction, inspection and maintenance	enai omic of s	nce, s of sewe	insit f sev ers; Irain	ver desig Design design -	appurten gn; sewer of sewer rain wate	ances. appurtenar outfalls-m	8 nces ixin 8
Water transmise         methods for and         Unit IV       DESI         Design of sanite         material, constructions; conv         Unit V       STOI         Planning - run-conf         of computer soft	sion main design - pipe materials - ed alysis and optimization - Laying and maint GN OF SEWERS ary sewer; partial flow in sewers, econo ruction, inspection and maintenance reyance of corrosive wastewaters. RM WATER off estimation, rainfall data analysis, storm tware in water transmission, water distribu-	enai omic of s	nce, s of sewe	insit f sev ers; Irain	ver desig Design design -	appurten gn; sewer of sewer rain wate	ances. appurtenar outfalls-m	8 nces ixin 8
Water transmise         nethods for analytic         Unit IV       DESIGN of sanite         Design of sanite         naterial, constructions; converte         Unit V       STOP         Planning - run-conf         of computer soft         TEXT BOOK(S         1.       "Manual on Delhi, 2009	sion main design - pipe materials - ed alysis and optimization - Laying and maint <b>GN OF SEWERS</b> ary sewer; partial flow in sewers, econor ruction, inspection and maintenance reyance of corrosive wastewaters. <b>RM WATER</b> off estimation, rainfall data analysis, storm tware in water transmission, water distributes <b>S):</b> water supply and Treatment", CPHEEO, b.	enai omic of s wat	nce, sewe	insit f sev ers; Irain d sev	ver desig Design design - ver desig	appurten n; sewer of sewer rain wate n.	ances. appurtenar outfalls-m r harvesting	8 nces ixin 8
Water transmise         Water transmise         methods for and         Unit IV       DESI         Design of sanite         material, constructions; converte         Unit V       STOP         Planning - run-conf         of computer soft         TEXT BOOK(S         1.       "Manual on Delhi, 2009         REFERENCES:       1.         "Manual on Delhi, 2009	sion main design - pipe materials - ed alysis and optimization - Laying and maint GN OF SEWERS ary sewer; partial flow in sewers, econo- ruction, inspection and maintenance reyance of corrosive wastewaters. RM WATER off estimation, rainfall data analysis, storm tware in water transmission, water distribut S): water supply and Treatment", CPHEEO, b.	enai omic of s wat ition Min	nce, sewe	Irain Irain sev	ver desig Design design - ver desig Jrban De	appurten gn; sewer of sewer rain wate n. velopmen	ances. appurtenar outfalls-m r harvesting t, Gol, New	8 ixin 8 .Use
Water transmiss methods for ana Unit IV DESI Design of sanit material, const conditions; conv Unit V STOI Planning - run-co of computer soft TEXT BOOK(S 1. "Manual on Delhi, 2009 REFERENCES: 1. "Manual on New Delhi,	sion main design - pipe materials - ed alysis and optimization - Laying and maint GN OF SEWERS ary sewer; partial flow in sewers, econor ruction, inspection and maintenance reyance of corrosive wastewaters. RM WATER off estimation, rainfall data analysis, storm tware in water transmission, water distribut S): water supply and Treatment", CPHEEO, b.	enan omic of s wat ution Min	nce, cs of sewe istry O, N	insit f sev ers; lrain d sev	ver desig Design design - ver desig Jrban De ry of Urb	appurten gn; sewer of sewer rain wate n. velopmen an Develo	ances. appurtenar outfalls-m r harvesting t, Gol, New	8 acces ixin 8 .Uso
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Department	. *	CIVIL ENGINEERING					R 2019	Semester I	PC
Course Code	Co	ourse Name	Hours / Week t		Total	Maxim	Maximu		
105/107	ENVIRONMENTAL CHEMISTRY &	LI	Т	Ρ	С	Hours	Marks		
19EV107	MICROBIOL	OGY LABORATORY	0	0	4	2	60	100	

- Train in the analysis of physico-chemical parameters with hands on experience

 Train the students in the analysis of various biological and microbiological techniques, enzymes assay, pollutant removal and bioreactors.

Course Outcomes: At the end of this course, learners will be able to:

- Determine the physico-chemical parameters
- Do various biological and microbiological techniques, enzymes assay, pollutant removal and bioreactors.

Exp No.	Name of Experiments
	ENVIRONMENTAL CHEMISTRY
1183	Good Laboratory Practices, Quality control and calibration.
2	Sampling and Analysis of water (pH, alkalinity, hardness, chloride, Sulphate , turbidity EC TDS,TS, nitrate, fluoride)
3	Wastewater analysis (BOD, COD, Phosphate, TKN, Oil & Grease, Surfactant and heavy metals).
4	Sampling and characterization of soil (CEC & SAR, pH and K).
	ENVIRONMENTAL MICROBIOLOGY
11	Preparation of culture media
2	Isolation, culturing and Identification of Microorganisms
3	Microorganisms from polluted habitats (soil, water and air)
4	Assay of enzymes involved in biotransformation.
5	Biodegradation of organic matter in waste water
6	Analysis of air borne microorganisms,
7	Staining of bacteria.
8	Effect of pH, temperature on microbial growth
9	Pollutant removal using microbes from industrial effluent.
10	Effect of pesticides on soil microorganisms
11	Bacteriological analysis of wastewater (Coliforms, E.coli, Streptococcus) - MPN

12	Bacteriological analysis of wastewater (Coliforms, <i>Streptococcus</i> ) - MF techniques, Effect of Heavy metals on microbial growth.
13	Detection of Anaerobic bacteria (Clostridium sp.)
14	Bioreactors(cultivation of microorganisms)
TEXT	BOOK(S):
1.	APHA, "Standard Methods for the Examination of Water and Wastewater", 22nd Ed. Washington, 2012.
2.	"Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist, H.
	- Second Edition, VCH, Germany, 3rd Edition, 1999.
3.	. "Methods of air sampling & analysis" ,James P.Lodge Jr(Editor) 3rd Edition, Lewis publishers,Inc,USA,1989.
REFER	RENCES:
1.	Charles P. Gerba, "Environmental Microbiology: A laboratory manual", Elsevier Publications, 2012.
2.	Christon J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, and Linda D. Stetzenbach, "Manual of Environmental Microbiology", 3rd Edition, ASM Press, 2007.

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Department	CIVIL ENGINE	ERING	1			R 2019	Semeste r II	PC
Course	Course Name		Hour Wee		Credit	Total Hours	Maxim Mark	
Code		L	Т	Ρ	С	nours	Mark	5
19EV201	DESIGN OF BIOLOGICAL TREATMENT SYSTEMS	3	0	0	3	45	10	0
<ul> <li>Educate</li> </ul>	tive (s): The purpose of learning this c the students on principles and design ter treatment.				ogical trea	atment un	its used for	
<ul> <li>Develope</li> </ul>	mes: At the end of this course, learner ed conceptual schematics required for e pertinent criteria into system requirer	biolog				wastewate	er	
Unit INTR	ODUCTION TO BIOLOGICAL TREAT	TMEN	Г					9
prowth - Factor	ological treatment - significance - aerol rs affecting growth - attached and rganics removal - Biodegradability ass	suspe	ende	d gi	rowth -	Determina		netic
	GN OF TREATMENT UNITS ge treatment plant units - screen cha							9
ttached and su	s. CEPT OF ANAEROBIC DIGESTION spended growth, Design of units - UAS nt removal systems - Layout and Hydr						- septic tan	9 k an
Unit IV SLUD	GE MANAGEMENT					And Some	a la cara	9
ewatering (med dvances.	e management facilities, sludge thicke chanical and gravity) - upgrading exis	sting p						ecer
and the second se	ELLANEOUS METHODS OF TREAT	Contraction of the second		-	10.1			9
apacity building	blems - Trouble shooting, Planning, , Case studies on sewage treatment p	-		-				ons
TEXT BOOK(S 1. Arceivala, S	.J., "Wastewater treatment for pollution	n cont	rol",	TMF	I, New De	elhi, 2008		
2. Manual on " New Delhi, 2	Sewerage and Sewage Treatment" CF 2009.	PHEE	D, M	inist	ry of Urba	an Develo	pment, Gol	,
REFERENCES		16.1911						
	& EDDY, INC. "Wastewater Engineer Publishing Company Limited, New Do			itme	nt and R	euse. Th	ird Edition,	Tata
2. Qasim, S.R, New York, 2	"Wastewater Treatment Plant", Plann 004.	ning, D	esig	n & (	Operation	Technor	nic Publicat	ons
						K	mly	/

Department	CIVIL ENGINEER	RING	;			R 2019	Semester II	PC
Course	Course Name	Hours / Week		Credit		Maximu Marks	ım	
Code		L	Т	Ρ	С	Hours	INIGINS	,
19EV202	ENVIRONMENTAL AUDITING AND NEW PRODUCT MANAGEMENT	3	0	0	3	45	100	
<ul><li>Introduct</li><li>Introduct</li></ul>	etive (s): The purpose of learning this course about auditing and environmental Asserte about cleaner production about New product development and s	essm	nent	tools		ent		
<ul> <li>Do Envi Impact</li> <li>Carry out</li> </ul>	omes: At the end of this course, learners ronmental Auditing for the industries and at cleaner production tools in the Industrie nvironmental management tools for devel	able es.	e to o	do th	e Assess			
	IRONMENTAL AUDITING		-		100.9.51	111111		6
Unit II EA T Environmental Costing – Ecc Environmental studies Unit III CLE/ Definition – me	statement- Role of Industry, Gover lierarchy - Regulatory versus Market Bas OOLS Impact Assessment - Life Cycle Asse b Labeling – Environmental Manageme audit –Environmental Risk Assessment ANER PRODUCTION thodology – Historical evolution – Ben Steps and Skills - Preparing for the S	sed a ssm ent s - 1	Appr ent Syste Fech	ems- nolo	Elements Standard gy Asses	s of LC ds – ISO sment - Barriers (	A – Life C 14001,190 Tools with Overview of	10 Cycle 00 - case 10 f CP
Flow Diagram Feasibility ana Establishing a Progress – Pollu	- Material Balance - CP Option lysis – Economic valuation of alternativ Program – Organizing a Program ution Prevention and Cleaner Production <b>RONMENTAL ASPECTS OF NEW PRO</b>	Gei ves - n Av	nera - To Prep ware	tion otal oarin ness	– Tech Cost Ai g a Pro Plan.	nical and nalysis – ogram P	Environme CP Financi	enta ng -
New Product De cycle Managem	evelopment Process(NPDP) –Objectives ent – PRO launch –basics, benefits, Pl S), Best Available Technology concept	- op nase	port gat	unitie te, D	es in Prod esign for	duct Desi		Life
	TAINABLE DEVELOPMENT			10.5			1	9
Sustainability -		pme	nt -	Indu	istrial Eco	ology - S	HE – Six-Ag	
					Dept.	Chairmar of Civil E	- BoS ngg ESEC	

TE	XT BOOK(S):
1.	World Bank Group 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production', World Bank and UNEP, Washington D. C., 1998.
22	Prasad modak C. Visvanathan and Mandar parasnis , 'Cleaner Production Audit', Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok, 1995. FERENCES:
	Robert.G.Cooper,'Winning at NewProducts' Third Edition, Basic Books, A member of the Perseus Books Group,2001
2.	Richard Welford and Richard Starkey, Business and the Environment, University Press 2010

Department	CIVIL ENGINEER	RING				R 2019	Semester II	PC
Course	Course Name	Hours / Week		Credit	Total Hours	Maximum Marks		
Code		L	т	P	С	nouis	linainto	
19EV203	INDUSTRIAL WASTE WATER MANAGEMENT	3	0	0	3	45	100	
Impart k     technolo     Understa     Identify t     productio     Course Outco     Define th     Suggest     Discuss     Unit I INTR Industrial scena and types of in	ctive (s): The purpose of learning this con- mowledge on the concept and application ogies, industrial wastewater treatment and and principles of various processes appli- the best applicable technologies for wast on. <b>omes:</b> At the end of this course, learners he Principles of pollution prevention and the suitable technologies for the treatment about the wastewater characteristics and <b>CODUCTION</b> ario in India– Industrial activity and Envir industrial wastewater – Nature and Or impacts – Regulatory requirements for	n of I d res icable tewar will mec ent o nd de ronm	ndus sidue e to ter tr be a hani f was sign nent of I	strial e ma indu reatn ble to sm c stew the - Us Pollu	nagemen strial was nent from o: of oxidatio ater. treatmen es of Wa tants - I	t. tewater tr the persp on process t systems ater by inc ndustrial	eatment bective of yie ses. dustry – Sou wastewater	9 Irces
waste survey – variables –Tox management.	Industrial wastewater monitoring and sa icity of industrial effluents and Bioas	ampl ssay	ing - tes	- ger sts -	neration r - Major	ates, cha issues c	racterization	anduality
	<b>ISTRIAL POLLUTION PREVENTION &amp;</b>							9
Hierarchy - Sou Pollution Preven Pollution Preven	a vis Control of Industrial Pollution – urce reduction techniques – Periodic Wa ntion Options – Cost benefit analysis – ntion Programs in Industries.	aste - Pay	Min	imisa	ation Ass	essments	s - Evaluatio	on o
	ISTRIAL WASTEWATER TREATMENT			4 50		Crosse	Neutralicati	-
Removal of Inc removal, Ion ex Organic Constit Oxidation proce	Equalisation – Solids Separation – Re organic Constituents – Precipitation, H schange, Adsorption, Membrane Filtrati tuents – Biological treatment Process sses – Treatability Studies.	eavy on, es,	e me Eletr Chei	etal i rodia mica	removal, Iysis & E I Oxidati	Nitrogen Evaporatio	& Phospho on – Remov	al of
						km	S.	

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Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse, Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects.

#### Unit V CASE STUDIES

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining– Pharmaceuticals–Sugar and Distilleries

#### TEXT BOOK(S):

- 1. "Industrial wastewater management, treatment & disposal, Water Environment" Federation Alexandria Virginia,3rd Edition, 2008.
- Lawrance K.Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis "handlook of Industrial and Hazardous waste Treatment", Second Edition, 2004
- Metcalf & Eddy/ AECOM, "Water reuse Issues, Technologies and Applications", The Mc Graw- Hill companies, 2007.

#### REFERENCES:

- 1. Nelson Leonard Nemerow, "Industrial waste Treatment", Elsevier, 2007.
- 2. Paul L. Bishop, "Pollution Prevention: Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
- 3. Waste water Treatment for pollution control and reuse by Soli. J. Arceivala, Shyam. R. Asolekar, Tata Mcgraw Hill, 2007

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Depar	tment	CIVIL ENGINEE	RING	3			R 2019	Semester II	PC
Cou		Course Name		loui Wee		Credi t	Total	Maxim	u
405	1004	UNIT OPERATIONS AND	L	т	Ρ	С	Hours	Mark	S
19E\	204	PROCESSES LABORATORY	0	0	4	2	60	100	
Dev	elop the sl	(s): The purpose of learning this cou kill for conducting Treatability studies and noise quality			and v	wastewa	ter treatme	nt and moni	tori
- Desi		s: At the end of this course, learners alyse various treatability options for w					and monito	r ambient a	ir ai
Exp No.		Name of I	Expe	rime	ents		*	i'n is	
1	Coagulati	ion and Flocculation						and the	
2	Batch stu	dies on settling					100		
3	Studies o	n Filtration- Characteristics of Filter m	nedia						
4	Water sof	ftening					Sel com		16
5	Adsorptio	on studies/Kinetics							
6	Langelier	Saturation Index and Silt Density Ind	ex- F	or N	lemb	orane Filt	tration	12.5	
7	Kinetics of	of suspended growth process (activate	ed slu	dge	prod	cess) an	d Sludge vo	olume Index	
8	Sludge Fi	Iterability Test							
9	Anaerobio	c Reactor systems / kinetics (Demons	stratio	n)			5.60	14	
10	Advanced	d Oxidation Processes – (Photo cataly	ysis)						
11	Disinfectio	on for Drinking water (Chlorination)							
12	Ambient A	Air Sampling-Determination of PM10,	PM2.	5, S	02 8	and NO2			
13	Noise Mo	nitoring-Determination of Equivalent I	Noise	Lev	rel				
		Name of the Eq	uipm	ents	5				
1. pH	I meter			16.	Auto	clave			
2. C	OD Digest	er		17.	Mag	netic stir	rer		
3. EC	C & TDS m	neter		18.	Deio	nizer			1
4. Be	ench top p	H, EC and TDS meter		19.	Jar t	est appa	ratus	$\bigcap$	)
				1			k	mll	V

5.	Turbidity Meter (Bench Top)	20. Refrigerator
6.	Flame photometer	21. Orbital Shaking Incubator
7.	BOD incubator	22. Air compressor
8.	Deep freezer	23. Distillation unit
9. (	Centrifuge	24. High speed emulsifier
10. I	Microprocessor controlled centrifuge	25. DC power supply
11.7	Analytical Balance	26. Peristaltic Pump
12. [	Digital Water Bath	27. Fume Hood
13. I	Hot plate	28. Ultrapure Water Unit
14. ł	Hot Air Oven	29. Vacuum pump
15. N	Muffle Furnace	The second start as the spiritual of the
EXT B	OOK(S):	
1.	Metcalf and Eddy. Inc., "Wastewater Engine Edition, Tata McGraw Hill Publishing Comp	eering, Treatment, Disposal and Reuse" Third any Limited, New Delhi, 2003.
2.		nvironmental Engineering Calculations", Mc Graw
3.		ry Manual, Association of Environmental Engineering ngton, 2002.
EFERI	ENCES:	
1.	Aery N C., "Manual of Environmental Analys	sis", Ane Books Pvt. Ltd. New Delhi, 2014
2.		Ambient Air Pollutants, Volume I, Central Pollution

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Department	CIVIL ENGINE	ER	NG			R 2019	Semeste r III	PC
Course	Course Name	1	Hou We		Credit	Total Hours	Maximu	
Code		L	Т	P	С	Hours	Marks	5
19EV301	SOLID AND HAZARDOUS WASTE MANAGEMENT	3	0	0	3	45	100	
	tive (s): The purpose of learning t							
recycling	nowledge and skills in the collect o options for solid wastes inclue methods and equipments.							
<ul> <li>Understa factors a</li> <li>Define a suitable</li> <li>Underst waste ar</li> </ul>	and the characteristics of different iffecting variation nd explain important concepts in t technical solutions for treatment o and the role legislation and policy and apply the basic scientific princip	type he f f mi driv	es of ield unici rers	f sol of so pal a play	id and ha olid waste and indus in stakel	zardous wa e managem strial waste holders' res	ent and sug	gest
	es he different elements of waste ma D WASTE GENERATION, STOR						/STEM	9
and the second se	d wastes - types of solid wastes -							
Disite handling Unit II COLI Collection of so requency of collection system Transfer and T means and me	Seneration rates – Factors affect , Storage and Processing of s ECTION AND TRANSFER OF blid waste - Collection services collection - labour requireme ms – collection routes – Prepara ransport – Need for transfer op thods - location of transfer stat CESSING TECHNIQUES AND F	nts ation oera	wa DILD colle – F of tion:	stes W/ ction acto Mas	- necess ASTES n system rs affect ster sche Transfer	ary equipm n, equipme ing collection edules. stations –	ents – Time on – Analys	sis c
							n/ oquinmor	
Chemical volum Component sep ncineration of s andfills – Leac nonitoring land Compost associated with	hniques – purposes – Mechanic e reduction – incinerators – Mecha baration – Methods – Drying and olid wastes – Disposal in landfills hate and landfill gas managemen dfill remediation – Regulatory a ting – anaerobic and aerobic co composting anaerobic digestion anical and Biological Treatment an	anic Dev : site t; la aspe omp of	al si vate e se ndfil ects oostii mun	ze r ring. lecti l clo of r ng – icipa	eduction on, desig sure and municipa Vermi c	<ul> <li>Selection</li> <li>and ope</li> <li>post-closu</li> <li>solid was</li> <li>composting</li> </ul>	of equipme ration of sar re environm te managen – unit opera	ents nitar enta nent
	ARDOUS WASTES						1. 11 1 2 . S.	9
lazardous wast sources and vastes – analyti nalysis – direct	e definition – Physical and biolog characterization categories and cal approach for hazardous waste ed analysis – analytical methods.	con e ch	trol.	S	ampling	and analys	is of hazar	dous
	RDOUS WASTE MANAGEMEN e: Definition, sources, classificatio		ollor	tion	searoa	ation Treate	nent and	9
	e. Deminion, sources, classificatio	<u>, c</u>	one		, segregi		kn	P

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Disposal – Radioactive waste: Definition, Sources, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB – E-waste characteristics, generation, collection, transport and disposal.

#### TEXT BOOK(S):

- 1. Techbanoglous Thiesen Ellasen : Solid waste Engineering Principles and Management, McGraw Hill, 1977.
- Hagerty D.J., Pevani J. L., and Heer J. E., Solid Waste Management, Van Nostrand Reinhld, 1979.
- Vesilind P.A. and Rimer A.E. Unit operations in resources recovery engineering, Prentice Hall, 1981.
- S. K. Shukla, P. R. Srivastava, Waste Management and control Commonwealth Publishers, New Delhi, 1991.

#### REFERENCES:

- B. B. Sundaresan, A. D. Bhide Solid Waste Management, Collection, Processing and Disposal, Mudrashilpa Offset Printers, 2001.
- 2. Manual on Solid Waste Management, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.
- 3. Management of Solid waste in developing countries by FrankFlintoff, WHO regional publications 1976

Department	CIVIL ENGINE	ERINO	3			R 2019	Semeste r III EEC
Course	Course Name		lour Wee		Credit	Total Hours	Maximum Marks
Code		L	т	Р	С	nours	marks
19EV302	INDUSTRIAL TRAINING	-	-	-	1	-	100

Train the students in the field work so as to have a firsthand knowledge of practical problems
related to Environmental Engineering in carrying out engineering tasks.

Course Outcomes: At the end of this course, learners will be able to:

 Trained in tackling a practical field/industry orientated problem related to Environmental Engineering

#### SYLLABUS

The students individually undertake training in reputed Industries during the summer vacation for a specified period of two weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

Department	CIVIL ENGI	NEERING	i			R 2019	Semester III	EE C
Course	Course Name		loui Wee		Credit	Total Hours	Maximu Marks	
Code		L	Т	Ρ	С	nouis	Marks	
19EV303	PROJECT PHASE I	0	0	12	6	180	100	

Course Objective (s): The purpose of learning this course is to

 Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.

- Develop the methodology to solve the identified problem.
- Train the students in preparing project reports and to face reviews and viva-voce examination.
   Course Outcomes: At the end of this course, learners will be able to:
  - Have a clear idea of his/her area of work and they are in a position to carry out the remaining
    phase II work in a systematic way.

#### SYLLABUS

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

CIVIL ENGIN	IEERING				R 2019	Semester IV
Course Name		1		Credit	Total Hours	Maximum Marks
	L	Т	Ρ	С		
PROJECT PHASE II	0	0	24	12	360	100
	Course Name	Course Name	Course Name / Wee L T	Course Name Hours / Week L T P	Course Name Hours / / Week L T P C	Hours     Credit     Total       Veek     L     T     P     C

Course Objective (s): The purpose of learning this course is to

Solve the identified problem based on the formulated methodology.

Develop skills to analyze and discuss the test results, and make conclusions

Course Outcomes: At the end of this course, learners will be able to:

Completion of the project work students will be in a position to take up any challenging practical
problem and find better solutions.

#### SYLLABUS

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

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	nent	CIVIL ENGINEER	ING					R 2019	Semester II	PE
Cours		Course Name		lour: Wee		Credi	t	Total Hours	Maximu Marks	
Code			L	т	Ρ	С				
19EVX	01	INSTRUMENTATION, SELECTION AND MANAGEMENT OF ENVIRONMENTAL ENGINEERING EQUIPMENT	3	0	0	3		45	100	
South Course and the second	and the second second	ve (s): The purpose of learning this course is								
		about Machineries and maintenance and an owledge about water and waste water mach					~		-	
	A STATE	nowledge about water and waste water mach			u eq	upmen	5			
• Ge • Lea	t know arn abo	nes: At the end of this course, learners will be ledge about Machineries and maintenance a out water and waste water machineries and e out equipments in air pollution control	and a	nalyt		nstrume	ents			
Unit I	GENE	RAL			1		-			9
Study of	machin	ery, electric motors types and characteris	tics	othe	nrir	ne cov	ers	numps c	anacity one	ratio
and the second se		of pumping machinery, air compressors p						The second second second second second		
		tors to be considered in the selection of t	he e	quip	ment	S.				
Unit II	INST	RUMENTATION								40
Spectrome Analyser po	try - G	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle.	nd c	ompo	onent	s. Tota	l c	arbon ar	nalyser - M	ercur
Spectrome Analyser po Instrumer <b>Unit III</b> Drilling eq Machinery	try - G plar gra nt com WATE uipme	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou	nd c unds VATE	ompo - Ion ER N	sele	s. Tota ctive El	l c ectr	arbon ar rode -SO2	nalyser – M and CO an	alyse
Spectrome Analyser po – Instrumer <b>Unit III</b> Drilling eq	try - G plar gra nt com WATE uipme requir	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. ER SUPPLY MACHINERY AND WASTEV nt, pumping equipment for wells.	nd c unds VATE	ompo - Ion ER N	sele	s. Tota ctive El	l c ectr	arbon ar rode -SO2	nalyser – M and CO an	alyse
Spectrome Analyser po - Instrumen Unit III Drilling eq Machinery equipment. Unit IV Equipment	try - G blar gra t com WATE uipme requir EQUII	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. ER SUPPLY MACHINERY AND WASTEW nt, pumping equipment for wells. ed for primary and secondary treatment, PMENTS FOR TREATMENT UNITS eatment unit - electrically and mechanically	nd c unds VATE sew	ompo - Ion ER M vage	nent sele	is. Tota ctive El HINERY	l c ectr	earbon ar rode -SO2 e pumps,	nalyser – M and CO an vaccum fil	rption ercury alyse 8 ration 8
Spectrome Analyser po – Instrumen Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer	try - G blar gra t com WATE uipme requir requir for tre rators.	me Emission Spectrometry. Absorption spass chromatography – working principle a aph for metal estimation and organic compound ponents and its working principle. <b>ER SUPPLY MACHINERY AND WASTEV</b> Int, pumping equipment for wells. ed for primary and secondary treatment, <b>PMENTS FOR TREATMENT UNITS</b> eatment unit - electrically and mechanically Meters for measurement of flow, head, ele	nd c unds VATE sew	ompo - Ion ER M vage	nent sele	is. Tota ctive El HINERY	l c ectr	earbon ar rode -SO2 e pumps,	nalyser – M and CO an vaccum fil	rption ercury alyse 8 ration 8 ators
Spectrome Analyser po Instrumen Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V	try - G blar gra t com WATE uipme requir for tre rators. AIR F	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. ER SUPPLY MACHINERY AND WASTEV at pumping equipment for wells. ed for primary and secondary treatment, PMENTS FOR TREATMENT UNITS eatment unit - electrically and mechanically Meters for measurement of flow, head, ele POLLUTION CONTROL EQUIPMENTS	nd c unds VATE sew ope ctrici	ompo - Ion ER N vage rated ty.	pum	nps , slu	l c ectr idge	e pumps, ers, aerat	nalyser – M 2 and CO an vaccum fil ors, chlorin	rption ercury alyse 8 ration 8 ators 7
Spectrome Analyser po Instrumen Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V Working p	try - G blar gra t com WATE uipme requir For tre rators. AIR F rinciple e. Mac	me Emission Spectrometry. Absorption spass chromatography – working principle a aph for metal estimation and organic compound ponents and its working principle. <b>ER SUPPLY MACHINERY AND WASTEV</b> Int, pumping equipment for wells. ed for primary and secondary treatment, <b>PMENTS FOR TREATMENT UNITS</b> eatment unit - electrically and mechanically Meters for measurement of flow, head, ele	ope sep	ompo - Ion ER M vage rated ty.	nent sele nACH pum	s. Tota ctive El HINERY nps , slu ators, r	l c ectr ndge	e pumps, ers, aerat	alyser – M and CO an vaccum fil ors, chlorin – operatior	Image: second
Spectromer Analyser po Instrumer Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V Working po Maintenanco ncinerators TEXT BOO	EQUII for tre requir EQUII for tre rators. AIR F rinciple e. Mad S. OK(S):	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. ER SUPPLY MACHINERY AND WASTEV int, pumping equipment for wells. ed for primary and secondary treatment, PMENTS FOR TREATMENT UNITS eatment unit - electrically and mechanically Meters for measurement of flow, head, ele POLLUTION CONTROL EQUIPMENTS es of electrostatic precipitator – cyclone chinery for solid waste collection and dispos	nd c unds VATE sew ope ctrici al inc	ompo - Ion ER M vage rated ty. arato cinera	pum pum agit	ators, r settlin - comp	l c ectr ndge	e pumps, ers, aerat	alyser – M and CO an vaccum fil ors, chlorin – operatior	Image: second
Spectromer Analyser po Instrumer Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V Working po Maintenanco ncinerators TEXT BOO	EQUII for tre requir EQUII for tre rators. AIR F rinciple e. Mad S. OK(S):	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. ER SUPPLY MACHINERY AND WASTEW at pumping equipment for wells. ed for primary and secondary treatment, PMENTS FOR TREATMENT UNITS eatment unit - electrically and mechanically Meters for measurement of flow, head, ele POLLUTION CONTROL EQUIPMENTS es of electrostatic precipitator – cyclone chinery for solid waste collection and dispos	nd c unds VATE sew ope ctrici al inc	ompo - Ion ER M vage rated ty. arato cinera	pum pum agit	ators, r settlin - comp	l c ectr ndge	e pumps, ers, aerat	alyser – M and CO an vaccum fil ors, chlorin – operatior	Image: second
Spectromer Analyser po- Instrumer Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V Norking po Maintenance ncinerators TEXT BOO 1. Opera	try - G blar gra t com WATE uipme requir for tre rators. AIR F rinciple e. Mac tion ar	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. ER SUPPLY MACHINERY AND WASTEV int, pumping equipment for wells. ed for primary and secondary treatment, PMENTS FOR TREATMENT UNITS eatment unit - electrically and mechanically Meters for measurement of flow, head, ele POLLUTION CONTROL EQUIPMENTS es of electrostatic precipitator – cyclone chinery for solid waste collection and dispos	nd c unds VATE sew ope ctrici al inc	ompo - Ion ER M vage rateo ty. arato ciner: R WH	pun pun l agit	s. Tota ctive El IINERY nps , slu ators, r settlin – comp	l c ectr udge mixe	e pumps, ers, aerat	alyser – M and CO an vaccum fil ors, chlorin – operatior	Image: second
Spectromer Analyser po- Instrumer Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V Norking po Maintenance ncinerators TEXT BOO 1. Opera	try - G blar gra t com WATE uipme requir for tre rators. AIR F rinciple ce. Mad c. DK(S): tion ar e Manu	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. <b>ER SUPPLY MACHINERY AND WASTEV</b> int, pumping equipment for wells. ed for primary and secondary treatment, <b>PMENTS FOR TREATMENT UNITS</b> eatment unit - electrically and mechanically Meters for measurement of flow, head, ele <b>POLLUTION CONTROL EQUIPMENTS</b> es of electrostatic precipitator – cyclone chinery for solid waste collection and dispos	nd c unds VATE sew ope ctrici al inc	ompo - Ion ER M vage rateo ty. arato ciner: R WH	pun pun l agit	s. Tota ctive El IINERY nps , slu ators, r settlin – comp	l c ectr udge mixe	e pumps, ers, aerat	alyser – M and CO an vaccum fil ors, chlorin – operatior	Image: second
Spectrome Analyser po Instrument Unit III Drilling eq Machinery equipment. Unit IV Equipment Surface aer Unit V Working po Maintenanco ncinerators TEXT BOO 1. Opera 2. Course REFERENC	EQUII for tre requir EQUII for tre rators. AIR F rinciple e. Mad DK(S): tion ar e Man CES: y R. H	me Emission Spectrometry. Absorption s as chromatography – working principle a aph for metal estimation and organic compou- ponents and its working principle. <b>ER SUPPLY MACHINERY AND WASTEV</b> int, pumping equipment for wells. ed for primary and secondary treatment, <b>PMENTS FOR TREATMENT UNITS</b> eatment unit - electrically and mechanically Meters for measurement of flow, head, ele <b>POLLUTION CONTROL EQUIPMENTS</b> es of electrostatic precipitator – cyclone chinery for solid waste collection and dispos	nd c unds VATE sew ope ctrici al inc DX Cl	ompo - Ion ER M vage rateo ty. arato ciner: R WH ion S	pun pun l agit HO 11 yster	s. Tota ctive El IINERY nps , slu ators, n settlin – comp 964. n, NEE	nixe g ( pact	e pumps, ers, aerat chamber tors – mag	nalyser – M 2 and CO an vaccum fill ors, chlorin – operatior gnetic separ	8 ators 7 ators

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Department	CIVIL ENGINEER	ING				R 2019	Semester II	PE
Course	Course Name		lour Wee		Credit	Total Hours	Maximu Marks	
Code		L	т	P	С		linarite	
19EVX02	REMOTE SENSING AND GIS APPLICATIONS IN ENVIRONMENTAL ENGINEERING	3	0	0	3	45	100	
<ul><li>Educate ab</li><li>Impart know</li></ul>	<b>tive (s):</b> The purpose of learning this course is out fundamentals of remote sensing, aerial pl vledge on data analysis and application of GI udents in the laboratory	hotog	raph	iy and	d satellite	remote ser	nsing	
<ul><li>Learn fund</li><li>Get knowle</li></ul>	mes: At the end of this course, learners will b amentals of remote sensing, aerial photograp edge on data analysis and application of GIS the laboratory			atellit	e remote :	sensing		
Unit I FUN	DAMENTALS OF REMOTE SENSING		-					9
ntroduction to r	remote sensing - Principles of Electro - Mag	gnetic	Rad	diatio	n –	Energy	/Matter	-
	Atmosphere and land surface - spectral r	and the second second				erials and	vegetation -	
Data products.							20032.00	
Unit II AER	IAL PHOTOGRAPHY AND SATELLITE REM	ΛΟΤΕ	SE	NSIN	G			9
ata Analysis –	A ANALYSIS AND GIS Visual interpretation and digital image pro GIS, concepts and data base structure							9
Unit IV REM	OTE SENSING AND GIS APPLICATIONS			17			1.1	10
pplications of	Remote sensing and GIS - Management	and	Mor	nitorir	ng of La	nd, air, wa	ater and poll	lutio
	rvation of resources - coastal zone mana	geme	ent -	- Lim	itations.	L. L. S. L. L	No. 24 2	
	DRATORY PRACTICES							8
oftware - GIS	Visual interpretation - digital image proc Data Analysis in ARC GIS.	essir	ng –	Intr	oduction	to ENVI i	mage proce	ssin
TEXT BOOK(S)	; , "Remote Sensing and Geographical Inform	nation		tem"				BS
1. publication		lation	, oyo					
2. M.G. Sriniv	ras (Edited by) "Remote sensing applicat	ions"	Na	rosa	publishin	ng house,	2001.	_
REFERENCES:								
Publishing	dra and S.K .Ghosh, "Remote Sensing House, 2006.							
	nd Simonet, Remote Sensing of Environme							94.
3. Burroughs	P.A, Principles of Geographical Information S	syster	<u>m, O</u>	xtord	Universit	y Press, 19	1 of	
ian - 8os 1 Engg E863	Chaim Dept. of Civi				D	Chair ept. of Civ	man - BoS 41 Engg E	SEC

Department	CIVIL ENGINEER	RING				R 2019	Semester II	PE
Course	Course Name		lours Wee		Credit	Total Hours	Maximu Marks	
Code		L	т	Р	С			
19EVX03	ECOLOGY AND ENVIRONMENTAL QUALITY MANAGEMENT	3	0	0	3	45	100	
<ul> <li>Educate the</li> </ul>	ive (s): The purpose of learning this course is students on the principles of ecology as ap	is to plied t	to en	viron	mental er	ngineering.		
<ul> <li>Acquire know</li> <li>Understand</li> <li>Understand</li> </ul>	<b>nes:</b> At the end of this course, learners will be weldge in interior and exterior structure of each the crystal structure, mineral types and prop the formation of rocks and its properties.	arth. perties	5					
	rocks for the construction of tunnels, dams	and ro	bad d	cutting	gs.			9
	applications of ecology - Development and e	evolut	tion	ofeco	systems	- Principles	and concept	-
pertaining to co	mmunities in ecosystem - Energy flow and m	nateria	al cyc	cling i	n ecosys	tems - prod	uctivity in	
				01				
ecosystems - R	ationale of ecological engineering and ecote	chnol	ogy -	Clas	sification	of ecotech	nology	8
Unit II PRIN Principles, component	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental system	chnol assific ems a	ation s ene	of sy ergy s	sification stems - S	of ecotech Structural an Mechanisn	nology nd functional ns of steady-	state
Unit II PRIN Principles, comp interactions of e maintenance in procedure - Cla Unit III CON Self-organizing	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic	chnol assific ems a cotecl s of m rocos	ation s ene hnolo nodel ms -	of sy ergy s ogy - Is in e	sification vstems - S systems - Elements ecotechno	of ecotech Structural an Mechanism of modellir blogy - Ecol	nology nd functional ns of steady- ng - Modelling ogical econo	state mics 10
Unit II     PRIN       Principles, complications of emaintenance in procedure - Cla       Unit III     CON       Self-organizing       Concept of energy	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of	chnol assific ems a cotecl s of m rocos	ation s ene hnolo nodel ms -	of sy ergy s ogy - Is in e	sification vstems - S systems - Elements ecotechno	of ecotech Structural an Mechanism of modellir blogy - Ecol	nology nd functional ns of steady- ng - Modelling ogical econo	state mics 10
Unit II     PRIN       Principles, complete     response       Interactions of emaintenance in procedure - Cla     Cla       Unit III     CON       Self-organizing     Concept of energy       Unit IV     APPI       Ecosanitation - systems - Aqua	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic	chnol assific ems a cotecl s of m rocos ecos IG stems	ation s ene hnolo nodel ms - yster	of sy ergy s ogy - ls in e Inter ns. etlane	sification /stems - S systems - Elements ecotechno face coup ds and po	of ecotech Structural an Mechanism of modellir blogy - Ecol bling in ecol	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation	state mics 10 ns -
Unit II     PRIN       Principles, complexity     Principles, complexity       Interactions of emaintenance in procedure - Cla     Cla       Unit III     CON       Self-organizing     Concept of ener       Unit IV     APPI       Ecosanitation - systems - Aquation     Systems - Aquation	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of LICATION OF ECOLOGICAL ENGINEERIN Principles and operation of soil infiltration sys- cultural systems - Detritus based treatment f	chnol assific ems a cotecl s of m rocos ecos icos IG stems for sol	ation s ene hnolo nodel ms - yster	of sy ergy s ogy - ls in e Inter ns. etlane	sification /stems - S systems - Elements ecotechno face coup ds and po	of ecotech Structural an Mechanism of modellir blogy - Ecol bling in ecol	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation	state mics 10 ns -
Unit II     PRIN       Principles, complications of emaintenance in procedure - Cla       Unit III     CON       Self-organizing       Concept of ener       Unit IV     APPI       Ecosanitation - systems - Aquaengineering for       Unit V     CASI	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of LICATION OF ECOLOGICAL ENGINEERIN Principles and operation of soil infiltration sys cultural systems - Detritus based treatment f marine systems.	chnol assific ems a cotecl s of m rocos ecos IG stems for sol	ation s end hnolo nodel ms - yster s - Wa	of sy ogy - ls in e Inter ns. etland	sification vstems - S systems - Elements ecotechno face coup ds and pc - Applica	of ecotech Structural an Mechanism of modellir blogy - Ecol bling in ecol bling in ecol brinds - Source tions of eco	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation	state mics 10 10 ns -
Unit II     PRIN       Principles, completeractions of emaintenance in brocedure - Cla       Unit III     CON       Self-organizing       Concept of ener       Unit IV     APPI       Ecosanitation - systems - Aquatengineering for       Unit V     CASI       Case studies of classification.       TEXT BOOK(S)	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of LICATION OF ECOLOGICAL ENGINEERIN Principles and operation of soil infiltration sys- cultural systems - Detritus based treatment f marine systems. E STUDIES IN ECOLOGICAL ENGINEERIN Integrated Ecological Engineering Systems	chnol assific ems a cotecl s of m rocos ecos IG stems for sol	ation s ene hnold nodel ms - yster s - Wi id wa	of sy ergy s ogy - ls in e Inter ns. etland astes	sification /stems - S systems - Elements ecotechno face coup ds and po - Applica	of ecotech Structural an Mechanism of modellir ology - Ecol oling in ecol onds - Source tions of eco	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation ological	mics mics 10 ns - 9
Unit II     PRIN       Principles, complete constructions of emaintenance in procedure - Cla       Unit III     CON       Self-organizing       Concept of ener       Unit IV     APPI       Ecosanitation - systems - Aqua       angineering for       Unit V     CASI       Case studies of classification.       TEXT BOOK(S)	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of LICATION OF ECOLOGICAL ENGINEERIN Principles and operation of soil infiltration sys- cultural systems - Detritus based treatment f marine systems. E STUDIES IN ECOLOGICAL ENGINEERIN Integrated Ecological Engineering Systems	chnol assific ems a cotecl s of m rocos ecos IG stems for sol	ation s ene hnold nodel ms - yster s - Wi id wa	of sy ergy s ogy - ls in e Inter ns. etland astes	sification /stems - S systems - Elements ecotechno face coup ds and po - Applica	of ecotech Structural an Mechanism of modellir ology - Ecol oling in ecol onds - Source tions of eco	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation ological	mics mics 10 ns - 9
Unit II     PRIN       Principles, complete constant     Principles, complete constant       Interactions of emaintenance in procedure - Cla       Unit III     CON       Self-organizing       Concept of ener       Unit IV     APPI       Ecosanitation - systems - Aqua       engineering for       Unit V     CASI       Case studies of classification.       TEXT BOOK(S)       1.     Kangas, P.C       2003	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of LICATION OF ECOLOGICAL ENGINEERIN Principles and operation of soil infiltration sys- cultural systems - Detritus based treatment f marine systems. E STUDIES IN ECOLOGICAL ENGINEERIN Integrated Ecological Engineering Systems D: C. and Kangas, P., "Ecological Engineering:	chnologia assifications and cotect s of m rocos ecos IG stems for sol NG and the Princi	ation s ene hnold nodel ms - yster ; s - Wi id wa	of sy ergy s ogy - ls in e Inter ns. etland astes	sification vstems - S systems - Elements ecotechno face coup ds and po - Applica hercial pro Practice",	of ecotech Structural an Mechanism of modellir ology - Ecol oling in ecol onds - Source tions of eco ospects.	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation ological	state mics 10 ns - 9 1 9
Unit II     PRIN       Principles, complications of emaintenance in procedure - Cla       Unit III     CON       Self-organizing       Concept of ener       Unit IV     APPI       Ecosanitation - systems - Aquatengineering for       Unit V     CASI       Case studies of classification.       TEXT BOOK(S)       1.     Kangas, P.0       2003       EFERENCES:       1.     Etnier, C. an York. 2007.	CIPLES OF ECOLOGICAL ENGINEERING ponents and characteristics of Systems - Cla environmental systems - Environmental syste open and closed systems - Modelling and en- ssification of ecological models - Application CEPT OF ECOSYSTEM design and processes - Multiple seeded mic rgy - Determination of sustainable loading of LICATION OF ECOLOGICAL ENGINEERIN Principles and operation of soil infiltration sys cultural systems - Detritus based treatment f marine systems. E STUDIES IN ECOLOGICAL ENGINEERIN Integrated Ecological Engineering Systems C. and Kangas, P., "Ecological Engineering: md Guterstam, B., "Ecological Engineering for	chnological characteristics of marked series of marked se	ation s ene hnold ms - yster s - W id wa heir o iples	of sy ergy s ogy - Is in e Inter ns. etland astes comm and I	sification vstems - S systems - Elements ecotechno face coup ds and po - Applica hercial pro Practice",	of ecotech Structural an Mechanism of modellir ology - Ecol oling in ecol onds - Source tions of eco ospects. Lewis Pub	nology nd functional ns of steady- ng - Modelling ogical econo ogical system ce separation ological	state mics 10 ns - 9 1 Yorl

Dept, of Civil Engg. - ESEC

Department	CIVIL ENGINEE	RING				R 2019	Semester II	PE
Course	Course Name		Hour Wee		Credit	Total Hours	Maximur Marks	n
Code		L	т	Р	С		Marks	
19EVX04	URBAN AND RURAL SANITATION	3	0	0	3	45	100	
Educate a     Educate a     Educate a     Course Outcom	ve (s): The purpose of learning this course about healthful housing, Operation and ma about refuse and food sanitation Rural and Urban water supply and sanitation es: At the end of this course, learners will	aintenar on I be abl	e to:					
Understar     Understar     Understar     Unit I GEN Control of environ	nd healthful housing and swimming pool of nd Refuse and food sanitation and Rural and Urban water supply and sani <b>ERAL AND BASIC PRINCIPLES OF HE</b> ment – Engineering methods - Modes ant characteristics and control measures	tation ALTHF of tran	UL H smis	IOUS	ING of disease	es – Mosqu		
eating - ventilat	ion - lighting - air conditioning - noise	control	in r	eside	ential buil	dings.		
	MBING AND SWIMMING POOL SANITA	111111 / - / - 1 - 1				the second se		9
f traps, siphona ransmission of d ppurtenances. M	g - definition of plumbing terms - general p ge – design of plumbing system for m iseases in swimming pools - quality stand leasures of Urban drainage and flood co	nultistor dards o ntrol be	ry bu of poo	uilding ol wat s-Eff	gs - plun ter - desig ective urb	nbing code in features an water u	s and stand of pools and ser organizat	ard: the
	es to operations and maintenance-Comple	exity of	ope	ration	is and nee	ed for diagn	ostic analysis	
The second s	SE AND FOOD SANITATION							9
	istics in urban and rural areas - con							
	lid waste - disposal methods - incinerati	on - de	sign	of inc	cinerators	sanitary la	nafill - compo	stin
	- biogas and gobar gas plants.				untion		in the desire	
	food caused diseases - food poisoning							
	dal treatment of kitchen utensils - Bacteri	and have a second second second			S OT MILK	borne disea	ises - essent	ial (
	airy barn sanitation - pasteurization metho		lk tes	its.				-
- 682 - 10	N AND RURAL WATER SUPPLY SYSTE	1758A						9
consideration in spects in the of evelopment of nethods for rural		ogramr r supply	nes y sy	for ru	ural area is - me	s - health thods of	and econor construction	mica an mer
	L SANITATION		_					9
ifferent privies -	ge systems in urban domestic areas - Twin pit pourflush toilets, VIP latrine epage pits - septic tank systems - oxi	es - w	ater	carri	iage met	hod of se		
Colucto Faul	ronmental Sanitation, John Wiley & Sons,	New Y	ork '	1982				
1.				water a thread		1064		
2. Ehler and Steres:	eel, Municipal Rural Sanitation, Mc - Graw	HIII BO	OKC	0., N	ew YORK,	1904.		
1. E.G. Wagne		for F	Rural	area	as and	small comr	nunities, W.	H.C
	Seneva, 1958. and Donald J.J., Water supply Enginee	ring M	Ac C	Prove	Hill Book	Co Nov	Vork 1000	-
	and bondid o.o., water supply Enginee	ing, iv	10-0	avv	1111 000	, 00., New	1014, 1044	

Chairman - BoS Dept. of Civil Engg. - ESEC

Department	CIVIL ENGINEER	RING				R 2019	Semester II	PE
Course	Course Name	1	Hour Wee		Credit	Total Hours	Maximu Marks	
Code		L	Т	Ρ	С		7.00	
19EVX05	COMPUTING TECHNIQUES IN ENVIRONMENTAL ENGINEERING	3	0	0	3	45	100	
<ul> <li>Educate t</li> <li>Develop t</li> <li>Educate t</li> <li>Develop t</li> <li>Course Outcom</li> <li>Understan</li> <li>Apply the</li> </ul>	ve (s): The purpose of learning this course i the students to know about computing techn the different numerical technique and logic li the students on aspects data management the model Applications for monitoring and management the model Applications for monitoring and management the computing techniques. principle of soft computing for solving Enviro the Environmental Impacts using ANN and Fu	iques ke Al anag e ab onme	NN, F emer le to: ental	nt of I	Environme	ent		
and the second se	nodern advanced computing tools in environ	ment	al stu	idies	and a	1.1	1.6-14	
	PUTING PRINCIPLES			-				10
oartial differential differentiation, De	emputing techniques – Algorithms and Flow l equation using Finite difference and F sign of digital models for Environmental app	inite	elen				A state of the second state of the second	
	GET STATES AND A S	Artifi	cial	Neura	al Networ		- Neural Net	9 tworl
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur	App res, 1	licatio fuzzy	on of logi	ANN Mo	e theory o	f uncertainty	eld - 9 and
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC	App res, 1	licatio fuzzy	on of logi	ANN Mo	e theory o	f uncertainty	eld - 9 and
Knowledge based Structure – Neura Genetic Algorithm <b>Unit III FUZZ</b> Fuzzy sets, fuzzy nformation; applic analysis models.	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur	App res, 1	licatio fuzzy	on of logi	ANN Mo	e theory o	f uncertainty	eld - 9 and
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structu analysis - Network diagram - Goodne	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT are - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA ass of fit.	Appl res, f ontro Data T) - F	licatio fuzzy I, clu retrie	logi Iogi sterir	ANN Mo	e theory o mage proc	f uncertainty f uncertainty essing - Net - RDBMS -	9 and twork 9 Data catter
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structu analysis - Network diagram - Goodne Unit V ENVIR	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT ire - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA iss of fit. RONMENTAL MODELING USING MATLAE	App res, f ontro Data T) - F	licatio fuzzy I, clu retrie Regre	logi Iogi sterir eval-E	ANN Mo c and the ng, and in Data forma	e theory o mage proc at Attribute analysis - h	ironmental fi f uncertainty essing - Net - RDBMS - histogram - so	workeld - 9 and twork 9 Data catter 8
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structu analysis - Network diagram - Goodne Unit V ENVIE ntroduction to M/ ransport, decay a	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT ire - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA iss of fit. RONMENTAL MODELING USING MATLAE ATLAB Software – Environmental modelin nd degradation modeling using MATLAB. C	App res, f ontro Data T) - F g pri	licatio fuzzy I, clu retrie Regre	logi sterir eval-E ession	ANN Mo c and the ng, and in Data forma	e theory o mage proc at Attribute analysis - h	ironmental fi f uncertainty essing - Net - RDBMS - histogram - so	workeld - 9 and twork 9 Data catter 8
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structu analysis - Network liagram - Goodne Unit V ENVIE ntroduction to M/ ransport, decay a TEXT BOOK(S):	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT ire - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA ass of fit. RONMENTAL MODELING USING MATLAE ATLAB Software – Environmental modelin nd degradation modeling using MATLAB. C	Appl res, f ontro Data T) - F 3 g pri ase s	fuzzy fuzzy I, clu retrie Regre	logi sterir eval-E ession es ar es ar	ANN Mo c and the ng, and in Data forma n - factor	e theory o mage proc at Attribute analysis - h AB Applica	ironmental fi f uncertainty essing - Net - RDBMS - nistogram - so tions – Pollu	y and twork 9 Data catter 8 tants
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structur analysis - Network liagram - Goodne Unit V ENVIR ntroduction to M/ ransport, decay a TEXT BOOK(S): 1. Aliev R. A, ar Ltd. Singapor 2. Chepra S. C McGraw-Hill	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT ire - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA ass of fit. RONMENTAL MODELING USING MATLAE ATLAB Software – Environmental modelin nd degradation modeling using MATLAB. C	Appl res, fo Data T) - F 3 g pri ase s oplica	fuzzy fuzzy I, clu retrie Regre studie ations	on of logi sterir eval-L ession ess ar ess. s'', Wo ers'', Wo	ANN Mo c and the ng, and in Data forma n - factor nd MATL/ porld Scien McGraw	e theory o mage proc at Attribute analysis - h AB Applica tific Publica	ironmental fi f uncertainty essing - Net - RDBMS - nistogram - so tions – Pollu ations Co. Pvt	9 9 9 Data catter 8 tants
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZ Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structur analysis - Network liagram - Goodne Unit V ENVIE ntroduction to Maransport, decay a TEXT BOOK(S): 1. Aliev R. A, ar Ltd. Singapor 2. Chepra S. C McGraw-Hill REFERENCES:	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT irre - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA ass of fit. RONMENTAL MODELING USING MATLAE ATLAB Software – Environmental modelin nd degradation modeling using MATLAB. C and Aliev Rashad, "Soft Computing and its Ap re, 2014. . and Canele R. P., "Numerical Methods for Companies, Inc., 1221 Avenue of the American and Companies, Inc., 1221 Avenue of	Appl res, f ontrol Data T) - f g pri ase s oplica for E icas,	fuzzy fuzzy l, clu retrie Regre ations ngine New	on of logi sterir eval-E ession ession s. ", We ers", We ers", York	ANN Mo c and the ng, and in Data forma n - factor nd MATL/ porld Scien McGraw, NY 1002	e theory o mage proc at Attribute analysis - h AB Applica tific Publica -Hill, a bus 20. 6th Edit	ironmental fi f uncertainty essing - Net - RDBMS - nistogram - so tions – Pollu ations Co. Pvt iness unit of ion 2014.	9 anc twork 9 Data catter 8 tants t. The
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZY Fuzzy sets, fuzzy nformation; applidanalysis models. Unit IV DATA Data base structur analysis - Network diagram - Goodne Unit V ENVIE ntroduction to Maransport, decay a TEXT BOOK(S): 1. Aliev R. A, ar Ltd. Singapor 2. Chepra S. C McGraw-Hill REFERENCES: 1. Data-Driven	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT ire - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA iss of fit. RONMENTAL MODELING USING MATLAE ATLAB Software – Environmental modelin nd degradation modeling using MATLAB. C and Aliev Rashad, "Soft Computing and its Ap re, 2014.	Appl res, f ontrol Data T) - f g pri ase s oplica for E icas,	fuzzy fuzzy l, clu retrie Regre ations ngine New	on of logi sterir eval-E ession ession s. ", We ers", We ers", York	ANN Mo c and the ng, and in Data forma n - factor nd MATL/ porld Scien McGraw, NY 1002	e theory o mage proc at Attribute analysis - h AB Applica tific Publica -Hill, a bus 20. 6th Edit	ironmental fi f uncertainty essing - Net - RDBMS - nistogram - so tions – Pollu ations Co. Pvt iness unit of ion 2014.	9 anc twork 9 Data catter 8 tants t. The
Knowledge based Structure – Neura Genetic Algorithm Unit III FUZZY Fuzzy sets, fuzzy nformation; applie analysis models. Unit IV DATA Data base structur analysis - Network diagram - Goodne Unit V ENVIE ntroduction to M/ ransport, decay a TEXT BOOK(S): 1. Aliev R. A, ar Ltd. Singapou 2. Chepra S. C McGraw-Hill REFERENCES: 1. Data-Driven edition. 2. Kotteguda, N	d Expert system concepts - Principle of al Network Operations – ANN Algorithm - s Y LOGIC y numbers, fuzzy relations, fuzzy measur cations of the theory to inference and co MANAGEMENT irre - Data acquisition - Data warehouse - I c data sharing - Statistical Analysis (SYSTA ass of fit. RONMENTAL MODELING USING MATLAE ATLAB Software – Environmental modelin nd degradation modeling using MATLAB. C and Aliev Rashad, "Soft Computing and its Ap re, 2014. . and Canele R. P., "Numerical Methods for Companies, Inc., 1221 Avenue of the American and Companies, Inc., 1221 Avenue of	Appl res, fontrol Data T) - f g pri ase s oplica for E icas, rces a	fuzzy fuzzy l, clu retrie Regre ations ations ngine New	on of logi sterir eval-E ession ess ar ess ar s. ", Wo eers", York	ANN Mo c and the ng, and in Data forma of AATLA orld Scien McGraw , NY 1002	e theory o mage proc at Attribute analysis - h AB Applica tific Publica -Hill, a bus 20. 6th Editi	ironmental fi f uncertainty essing - Net - RDBMS - nistogram - so tions – Pollu ations Co. Pvt siness unit of ion 2014.	9 anc twork 9 Data catter 8 tants t. The

Dept. of Civil Engg. - ESEC

Department	CIVIL ENGINEERI	NG				R 2019	Semester II	PE
Course	Course Name		lour: Wee		Credit	Total Hours	Maximur Marks	n
Code		L	т	Р	С	nouro	Marks	
19EVX06	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3	45	100	
	tive (s): The purpose of learning this course is							
	the students to the need, methodology, docum						imental impac	ct
	nent and to develop the skill to prepare enviror			and the second sec				
	knowledge related to the broad field of environ							
	contaminant transport and tools that can be use mes: At the end of this course, learners will be			aictin	g and mai	haging nun	ian nealth risi	KS.
	and the necessity to study the impacts and risk			ll be	caused by	projects o	r industries a	nd
	nods to overcome these impacts.	-				p. ejeene e		
	oout the legal requirements of Environmental a	nd F	Risk /	Asses	ssment for	projects.		
	RODUCTION					1		8
	opment of Environmental Impact Assessment	(El	A). E	IA in	Project (	Cycle. Lega	al and Regul	
	Types and limitations of EIAEIA pro	- C -	- T.				-	
A STATE AND A STATE AND A STATE AND A STATE AND A	s sectoral issues and terms of reference in				and the second second	1.000	the state of the state of the	
Accreditation.								
Unit II IMP/	ACT INDENTIFICATION AND PREDICTION		1					10
Matrices - Netw	orks – Checklists –Cost benefit analysis – An	alysi	s of	alter	natives -	Software p	ackages for E	EIA -
Expert systems	in EIA. Prediction tools for EIA - Mathematic	cal n	node	ling f	or impact	prediction	- Assessme	nt o
mpacts - air - v	ater – soil – noise – biological — Cumulative I	Impa	act A	ssess	sment 20	- /		
Unit III SOC	IAL IMPACT ASSESSMENT AND EIA DOCU	ME	NTA	TION			- 18 ° - 1	8
Social impact a	ssessment - Relationship between social im	npac	ts a	nd cl	hange in	community	and institut	iona
arrangements. I	ndividual and family level impacts. Commun	ities	in tr	ransit	tion Docu	mentation	of EIA finding	gs -
olanning – organ	ization of information and visual display mater	ials.						
Unit IV ENV	RONMENTAL MANAGEMENT PLAN							7
EIA Report prep	aration. Environmental Management Plan - p	repa	aratio	n, in	plementa	tion and re	eview - Mitiga	ation
and Rehabilitatio	n Plans - Policy and guidelines for planning	and	mor	nitorir	ng program	mmes - Po	st project au	dit -
Ethical and Qual	ty aspects of Environmental Impact Assessme	ent-	Case	Stud	dies			
Unit V ENV	RONMENTAL RISK ASSESSMENT AND MA	NA	GEM	ENT				12
Invironmental	isk assessment framework-Hazard identific	catio	n -[	Dose	Respons	se Evaluat	ion - Expo	sure
ssessment – E	posure Factors, Tools for Environmental Risk	Ass	sessr	nent-	- HAZOP	and FEMA	methods - E	ven
ree and fault	tree analysis - Multimedia and multipath	wa	y e	xposi	ure mode	eling of co	ontaminant-	Risk
Characterization	Risk communication - Emergency Preparedne	ss F	lans	-De	sign of ris	k managen	ent programs	S
							ion program	
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TEXT BOOK(S         1.       Canter, L.W         2.       Lawrence, I         Interscience         REFERENCES:         1.       Raghavan I         CLRI, 1990         2.       Cutter, S.L.         3.       Kolluru Rao	A., Environmental Impact Assessment, McGrav D.P., Environmental Impact Assessment – Pra- e, New Jersey. 2003 K. V. and Khan A A. , Methodologies in Haza	ard I	dent f Indi	ificati a Pvt	s to recurr ion and R t. Ltd., Net	ent probler isk Assess w Delhi, 19	ns, Wiley- ment, Manua 99.	

Chairman - BoS Dept. of Civil Engg. - ESEC

Department	CIVIL ENGINEER	ING				R 2019	Semester II	PE
Course	Course Name	100	lours Wee		Credit	Total Hours	Maximu Marks	
Code		L	т	Р	С	Hours	Warks	
19EVX07	ENVIRONMENTAL POLICIES AND LEGISLATIONS	3	0	0	3	45	100	8
Course Objecti	ve (s): The purpose of learning this course i	s to						
	students conversant with the legislations in	India						
	nd the basic principles in pollution control.							
	he students to the pollution control policies in							
Course Outcon	nes: At the end of this course, learners will b	lated	to n	olluti	on contro	1		
	e students conversant with the legislations re			Ullutio	on contro			
	ents will get idea about the implementation of ent shall be able to enforce the rules.	Ji Tule	53.					
	ER (PREVENTION & CONTROL OF POLLI	ITIO		T 1	974			9
Unit WAT	t features-Powers & functions of Regulator	ry an	enci	es-R	esponsibi	lities of oc	cupier, prov	vision
permitions-saller	ention& control-procedures to obtain con	sent-	Moni	itorine	and co	mpliance	mechanisms	s-lega
revision for viol	ation of Water(P&CP)Act-Case studies on	water	r poll	uting	industrie	s-Textile dy	eing, Paper	mills
lectroplating St	arch industries-inventorisation of new water	pollut	ting i	ndust	try and its	managem	ent-field visit	S.
Unit II THE	AIR (PREVENTION & CONTROL OF POLL	UTIC	N)A	CT, 1	981	C		9
Definition-Salient	features- Powers &functions of Regulator	y age	encie	s -N	ational ar	mbient Air	quality stand	dards
mission standar	rds for industries specific- Responsibilities o	of occ	upier	r, pro	visions re	lating to pr	evention& co	ontro
rocedures to	obtain consent Monitoring and complian	nce r	mech	anisi	ms- lega	provision	for violati	on d
ir(P&CP)Act- C	ase studies on Air polluting industries-Foun	dries,	, Cer	ment,	Thermal	power plan	nts- inventori	satio
of new Air polluti	ing industry and its management-field visits.						1 . E. C.	
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UNILIII IINE	ENVIRONMENT (PROTECTION) ACT, 198	6						9
Genesis of the A	ENVIRONMENT (PROTECTION) ACT, 198 Act-Salient features-Role of Central Govern	ment	-vari	ous r	notification	ns and rul	es –prohibiti	ion o
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Genesis of the A mport of genetic Dzone depleting noise pollution- Tribunals(NGT),E Unit IV REG Restriction on Balient features mechanisms-con Best practices-C visits. Unit V ELEC Definition-Environ of E-waste mana TEXT BOOK(S) 1. Rosencrant Tripathi pvt 2. Stem A.C./ REFERENCES:	Act-Salient features-Role of Central Govern cally modified organisms-chemicals-hazard substances-EIA notification-Siting of indus coastal regulations- Monitoring and ca Environmental courts & Public interest litigation <b>ULATIONS ON INDUSTRIAL SOLID WAST</b> Hazardous waste-Bio-medical wastes-Recy s-Responsibilities of occupier/generator/l sent clearance, Authorization, Registration ase studies on lead refining, engineering u <b>CTRONIC WASTE (MANAGEMENT &amp;HANI</b> mental & Occupational Health hazards of nsibility-issues and challenges –Compliance gement-Case studies on E-waste recycling u Ltd. Bombay. Air pollution, Vol. I to VIII, Academic press.	iment dous tries- ompli on -C TE M/ vcled local proce units DLINC e-wa e and units, and p	was State ance case : ANAC plas boo edure ,hos G)RL G)RL Con Bulk	tes- e leve studio GEM tic w dies/F es for pitals JLES Salier sent cons	Batteries el EIA Au echanisms es ENT astes-Mu PCBs- M r industry , plastic r 2011 nt features Clearanc sumers, C dia, cases	managem thorities-ec s-Role of nicipal soli lonitoring specific-Iss units, Muni s of E-was e mechanis ollection C s, materials	ent-Restriction o-mark-Cont National d wastes-e-v and comp sues &Challe cipal landfills te Rules-Ext sms-Best pra entres-field v and statutes	9 waste 9 waste liance enge: s,-fie 9 ende actice visits. s,
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2.	Delhi, 2001.								
	The safe disposal of hazardous waste. Vol. I, II, & III Bat stone, Smith, Wilson, Joint study Sponsored by the								
	world bank, the WHO, & UN Environmental Program UNEP, The world bank Freeman, H.M. standard								
	Handbook of Hazardous Waste Treatment and Disposal, 1989								
3.	E WASTE MANAGEMENT IN INDIA (2009), Electronics for you, www. efymag.com.								

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Department	CIVIL ENGINEER	R 2019	Semester II	PE				
Course	Course Name ENVIRONMENTAL BIO-TECHNOLOGY	Hours / Week			Credit	Total Hours	Maximum Marks	
Code		L	т	P	С	Tiours	Marks	
19EVX08		3	0	0	3	45	100	
Educate     Impart k     Provide     Course Outco     Learn a     Attain kr	ive (s): The purpose of learning this course is the students about the principles and biologi nowledge about application biotechnology in i knowledge about biotechnology applications i mes: At the end of this course, learners will b bout the principles and biological intervention nowledge about application biotechnology in in pout biotechnology applications in waste man	cal ir ndus n wa e abl n ndust	try a ste r e to: ry ar	nd ge nana	enetic mo gement			
	RODUCTION: BASICS& PRINCIPLES				1			9
lipids. Analysis Mechanism of de Unit II FUN Extremophiles a	n on DNA and RNA Microbes- prokaryotes of metabolism for environmental applicat etoxification, Photorespiration, immobilization, DAMENTALS OF BIOLOGICAL INTERVEN and thermophiles and its potential applications	ion biod TION in er	and egra	its i idatio	mechanis n, biogeo	m, effectiv chemical cy	e microorga /cle	nism 9
	bitors of degradation-xenobiotics, endocrine of	lisrup	oters	1				-
	JSTRIAL APPLICATION					·		9
Decontamination	of ground water, biofertilizers, physical, c management, biological removal of nutrients-	biot	cal a ricklir	and r	ers, biom	embrane te	chnology	sung
	ETIC MANIPULATION			5				9
Basic principles	of genetic engineering, concept of recombination technology, genetically modified or						cloning of D	NA ·
	GRATED ENVIRONMENTAL BIOTECHNOL					1911	13293	9
of biosorption, w	as production, biodiesel, Bioremediation, factor vaste minimization, ,pollution prevention, Bio	sens	ors a	and it	ts applica	tion in env	ironmental is	sues
to the plants, pla TEXT BOOK(S	Itural application, plant disease suppression nt/microbe interaction, Biotransformation ): and Reed G, Biotechnology, a comprehensive					-		terna
to the plants,	nt/microbe interaction, Biotransformation ): and Reed G, Biotechnology, a comprehensive	e trea	tise,	VCH	Verleg, C	-		terna
to the plants, pla TEXT BOOK(S 1. Rehm H J a 2. A K Chater REFERENCES:	nt/microbe interaction, Biotransformation ): and Reed G, Biotechnology, a comprehensive ee, Introduction to Environmental Biotechnolo	e trea	tise, PHI,	VCH India	Verleg, 0	Germany, 1	999.	
to the plants, pla <b>TEXT BOOK(S</b> 1. Rehm H J a 2. A K Chater <b>REFERENCES:</b> 1. Andrew D I Examinatio	nt/microbe interaction, Biotransformation ): and Reed G, Biotechnology, a comprehensive ee, Introduction to Environmental Biotechnolo Eaton, Lenore S Clesceri, Eugene W Rice ar n of Water and Wastewater, American Public	e trea ogy, nd Ar Hea	tise, PHI, nold th A:	VCH India E Gi ssoci	Verleg, 0 , 2000 reenberg, ation, 200	Germany, 1 Standard I 05.	999. Methods – Fo	or the
to the plants,	nt/microbe interaction, Biotransformation ): and Reed G, Biotechnology, a comprehensive ee, Introduction to Environmental Biotechnolo Eaton, Lenore S Clesceri, Eugene W Rice ar	e trea ogy, nd Ar Hea ronm	tise, PHI, nold th As	VCH India E Gi ssocia	Verleg, 0 , 2000 reenberg, ation, 200 robiology,	Germany, 1 Standard I 05. Academic	999. Methods – Fo Press, 2009.	or the

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Department	CIVIL ENGINEERING						Semester	PE
Course	Course Name		Hours / Week			Total Hours	Maximun	n
Code		L	т	Р	С	nours	Marks	
19EVX09	ENVIRONMENTAL STRUCTURES		0	0	3	45	100	
<ul> <li>Educate t</li> <li>Impart kn</li> <li>Provide k</li> <li>Course Outcom</li> <li>Acquire k</li> <li>Do desig</li> <li>Learn ab</li> </ul>	ve (s): The purpose of learning this course he students about design of pipes and con- owledge about the design of water tank and nowledge about repair and rehabilitation of nes: At the end of this course, learners will l chowledge about design of pipes and concr n of water tank and special structures out repair and rehabilitation of structure. <b>CN OF PIPES</b>	crete r d spec struct be abl	ial st ure. e to:	ructu	ires			9
etection - sewer	of Concrete, Prestressed Concrete, Stee age tank design – anchorage for pipes – m	nassiv	e out				and the second se	
	siderations - Advances in the manufacture		pes.				<u> </u>	•
Contrastante anti-ficialità	ON OF CONCRETE ROOFING SYSTEM	118. 				Same Distance	n de ser	9
-	te roofing systems - Cylindrical, Spherica				10	-		
	s types of folded plates for roofing with co	oncret	e – [	Desig	n of pump	oing station	s – Drainage	pla
f a building. Unit III ANAL	YSIS AND DESIGN OF WATER TANK	9			-			9
								-
anks using concre	design of water retaining structures. Des ete. Design of prestressed concrete cylind esign and packages.	-			-			
and the second se	ON OF SPECIAL PURPOSE STRUCTUR	RES	1.2	T <sub>1</sub> n		Sector 1		10
Inderground res	ervoirs and swimming pools, Intake tow	ers S	truct	ural	design inc	luding four	dation of v	vate
	es such as settling tanks, clari-flocculators				-			
	ns - selection of materials of construction.							
Unit V REPA	IR AND REHABILITATION OF STRUCT	TURES	S					8
iagnosing the g	cause and damage, identification of diffe	erent t	vpes	of s	tructural a	and non-stru	uctural crac	KS
	bilitation methods for Masonry, Concrete							
tructures used i	n water and sewerage works.							
TEXT BOOK(S):		104						
Desetusesed	Concrete by Krishna Raju, Tata McGraw H	lill Pub	olishi	ng Co	o. 2nd edi	tion, 1988.	States, 1	
1. Prestressed	Concrete by Krishna Raju, Tata McGraw H	the second second	cong-second	-	and some series	tion, 1988.		
Prestressed2.Reinforced (		the second second	cong-second	-	and some series	tion, 1988.		
Prestressed2.Reinforced (REFERENCES:	Concrete by Krishna Raju, Tata McGraw H	nand a	nd C	0.,19	985.		n Ltd., 1986.	
Prestressed2.Reinforced (REFERENCES:1.Hulse R. and	Concrete by Krishna Raju, Tata McGraw H Concrete by N. C. Sinha & S .K. Roy -S. Ch	nand a gn by (	nd C Com	o.,19	985. , Macmilla	an Educatio		

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	CIVIE ENGINE	ERING				R 2019	Semester II	PE
Course	Course Name		Hour Wee		Credit	Total Hours	Maximu Marks	
Code		L	т	Р	С		inditio	
19EVX10	ENVIRONMENTAL REACTION ENGINEERING	3	0	0	3	45	100	2
framewo Apply a field of e Understa societal Course Outcor Success solve con meet des Be know environm Use adva professio	and address current and future societal pro rk of sustainable development. multi-disciplinary approach to conceive, pla nvironmental reaction engineering. anding the impact of solutions to environme systems context. <b>mes:</b> At the end of this course, learners wil fully apply advanced concepts of fundament mplex environmental engineering problems sired needs of society, both, professionally ledgeable of contemporary issues and rese mental engineering, and engage in life-long anced techniques, skills, and modern scient and practice in the field of environmental re	an, desig ental en Il be abl ntal scie s, also t and eth earch c learnin ntific and	gn, a gined e to: ences o des nicall halle g to l d eng	ering s and sign, y. nges keep ginee	problems engineer analyze, opportun abreast o ring tools	solutions to in a global ing to ident and develop ities related f such issue	i problems in , scientific, au ify, formulate o technologie I to chemical es.	nd , and s to and
	ODUCTION ering principles with applications to en		1 - 1					9
stabilization– Dis – Recent Trends					tems, ye	neral react	tion mechan	isms
	hemical treatment – Coagulation flocol infection, Ion exchange, Electrolytic metho s. Rate relationships: Concepts and applications.	ods, So lications	– F Ivent s to	Precip extra	oitation – action – a	flotation	solidification xidation /redu	and uctior neous
Unit II POLI	infection, Ion exchange, Electrolytic metho a. Rate relationships: Concepts and applications and biological reactions. UTANTS AND REACTIONS IN ENVIRON	ods, So lications	– F Ivent s to	Precip extra homo	bitation – action – a ogenous	flotation dvanced ox systems ar	solidification xidation /redu nd heterogen	and uction neous 9
Unit II POLI Reaction leading depletion, smog reactions, catalyt	infection, Ion exchange, Electrolytic metho s. Rate relationships: Concepts and appli- bective chemical and biological reactions. <b>UTANTS AND REACTIONS IN ENVIRON</b> to generation of pollutants, impact of p formation, acid rain, chemical reactions ic oxidation of VOCs, incineration, selecti	ods, So lications <b>NMENT</b> pollutant in majo ive cata	- F lvent s to ts an or tre llytic	homo	eirs react eirs react	flotation dvanced ox systems ar ions on en ologies- gas s – liquid re	solidification xidation /redu nd heterogen wironment, c s – solid cat eaction FCC	and uction neous 9 ozone alytic
Unit II POLI Reaction leading depletion, smog reactions, catalyt catalytic cracking	infection, Ion exchange, Electrolytic metho s. Rate relationships: Concepts and appli- bective chemical and biological reactions. <b>LUTANTS AND REACTIONS IN ENVIRON</b> to generation of pollutants, impact of p formation, acid rain, chemical reactions	ods, So lications <b>NMENT</b> pollutant in majo ive cata	- F lvent s to ts an or tre llytic	home home	eirs react eirs react	flotation dvanced ox systems ar ions on en ologies- gas s – liquid re	solidification xidation /redu nd heterogen wironment, c s – solid cat eaction FCC	and uction neous 9 ozone alytic
Unit II POLI Reaction leading depletion, smog reactions, catalytic catalytic cracking Unit III REAC Ideal systems modeling and dep	infection, Ion exchange, Electrolytic metho a. Rate relationships: Concepts and appli- bective chemical and biological reactions. <b>LUTANTS AND REACTIONS IN ENVIRON</b> to generation of pollutants, impact of p formation, acid rain, chemical reactions ic oxidation of VOCs, incineration, selecti ) off gas cleaning, wet- gas scrubbing, H2S	ods, So lications <b>NMENT</b> pollutant in majo ive cata <u>S remov</u> al reacto s in set	– F lvent s to ts an or tre llytic val an ors, r	extra homo ad the extra reduced reduced reduced reaction	eirs react eirs react ent techno ction. Ga ent caust on rate n reactors i	flotation idvanced ox systems ar ions on en ologies- gas s – liquid re ic oxidation	solidification xidation /redu nd heterogen wironment, c s – solid cat eaction FCC	and uction neous 9 ozone alytic (fluic 9 vstem
Unit II POLI Reaction leading depletion, smog reactions, catalytic catalytic cracking Unit III REAC Ideal systems modeling and des modeling and des	infection, Ion exchange, Electrolytic metho a. Rate relationships: Concepts and appli- bective chemical and biological reactions. <b>LUTANTS AND REACTIONS IN ENVIRON</b> to generation of pollutants, impact of p formation, acid rain, chemical reactions ic oxidation of VOCs, incineration, selecti ) off gas cleaning, wet- gas scrubbing, H2S <b>CTORS MODELLING AND DESIGN</b> bdeling and design, reactor concepts, idea asign, sequencing batch reactor, reactors	ods, So lications <b>NMENT</b> collutant in majo ive cata S remov al reacto s in set ysis, PF	- F Ivent s to ts an or tre lytic val ar ors, r ries a FDR	reaction and in the satme reduced by the sateme reduced	eirs react eirs react ent techno ction. Ga ent caust on rate n reactors i	flotation idvanced ox systems ar ions on en ologies- gas s – liquid re ic oxidation neasuremer n recycle.	solidification xidation /redu nd heterogen wironment, c s – solid cat eaction FCC hts, hybrid sy Non-ideal sy	and uction neous 9 ozone alytic (fluic 9 vstem
Unit II     POLI       Reaction leading       depletion, smog       reactions, catalytic       catalytic cracking       Unit III       REAC       Ideal systems modeling and des       modeling and des       Unit IV       MASS       Principles of diffue       extraction, drying	infection, Ion exchange, Electrolytic metho a. Rate relationships: Concepts and appli- bective chemical and biological reactions. <b>LUTANTS AND REACTIONS IN ENVIRON</b> to generation of pollutants, impact of pr formation, acid rain, chemical reactions ic oxidation of VOCs, incineration, selection ) off gas cleaning, wet- gas scrubbing, H2S <b>CTORS MODELLING AND DESIGN</b> bideling and design, reactor concepts, idea asign, sequencing batch reactor, reactors sign, non-ideal reactor behavior, RTD analy	ods, So lications NMENT collutant in majo ive cata S remov al reacte s in sel ysis, PF IN ENV Gas abs	- F Ivent s to ts ar or tre val ar ors, i ries a DR i IRON	recip extra homo nd the eatme reduced reduced reduced reaction and re mode <b>NMEN</b> ion, h	eirs react ogenous eirs react ent techno ction. Ga ent caust on rate n reactors i el. <b>ITAL EN</b> pumidifica	flotation dvanced ox systems ar ions on en ologies- gas s – liquid re ic oxidation neasuremer n recycle. GINEERING tion operati	solidification xidation /redu nd heterogen wironment, c s – solid cat eaction FCC hts, hybrid sy Non-ideal sy G	and uction neous 9 szone alytic (fluic (fluic (fluic 9 y stem 9 g and
Unit IIPOLIReaction leadingdepletion, smogreactions, catalyticcatalytic crackingUnit IIIREACIdeal systems modeling and deemodeling and deeUnit IVMASSPrinciples of diffuextraction, dryingliquid bulk phaseUnit VBIOL	infection, Ion exchange, Electrolytic metho a. Rate relationships: Concepts and appli- bective chemical and biological reactions. <b>LUTANTS AND REACTIONS IN ENVIRON</b> to generation of pollutants, impact of p formation, acid rain, chemical reactions ic oxidation of VOCs, incineration, selection ) off gas cleaning, wet- gas scrubbing, H2S <b>CTORS MODELLING AND DESIGN</b> belong and design, reactor concepts, idea esign, sequencing batch reactor, reactors sign, non-ideal reactor behavior, RTD analy <b>S TRANSFER AND ITS APPLICATIONS I</b> sion and mass transfer between phases, C of solids, fixed-bed separation, membrane	ods, So lications NMENT collutant in majo ive cata S remov al reacte s remov al reacte s respan Gas abs e sepan	- F Ivent s to ts ar or tre val ar ors, i ries a DR i IRON sorpt ation	recip extra homo nd the eatme reduced reduced reaction and in mode <b>NMEN</b> ion, h proc	eirs react ogenous eirs react ent techno ction. Ga ent caust on rate n reactors i el. <b>ITAL EN</b> pumidifica ess, fluid	flotation dvanced ox systems ar ions on en ologies- gas s – liquid re ic oxidation neasuremer n recycle. GINEERING tion operati solid surfac	solidification xidation /redu nd heterogen wironment, c s – solid cat eaction FCC hts, hybrid sy Non-ideal sy G ions, leaching ce reactions,	and uction neous 9 szone alytic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic (fluic)) 9 szene (fluic (fluic (fluic)) 9 szene (fluic) (fluic (fluic)) 9 szene (fluic) (fluic (fluic)) 9 szene (fluic) (flui

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TE	XT BOOK(S):
1.	A Weber, W.J and Di Giano, F.A., "Process Dynamics in Environmental systems", John Wiley sons Inc, 1996.
2.	Metcalf and Eddy, "wastewater engineering, treatment, disposal and Reuse", Inc. Third edition McGraw – hill 1991.
REF	ERENCES:
1.	M Dunn I.J, Elmar Heinzle, John Ingham, Prenosil J.E, "Biological reaction engineering", Wiley inter science, 2005.
2.	A. The Engineering of Chemical reactions by Lanny.D.Schmidt,Oxford University Press, 1997.

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End within the

Department	CIVIL ENGINEER	ING				R 2019	Semester II	PE
Course	Course Name		ours Veel		Credit	Total Hours	Maximu Marks	
Code		L	Т	Ρ	С		marks	
19EVX11	ENVIRONMENTAL SYSTEM ANALYSIS	3	0	0	3	45	100	
Introduce     Educate     Introduce     Educate     Educate     Elaborate     Course Outcom	<b>ive (s):</b> The purpose of learning this course is a about ecological modeling, single and multi a about the modeling of CSTR and the kinetics are the concepts of river and stream water mode about the microbial energetic in various react the computational techniques for modeling <b>mes:</b> At the end of this course, learners will be ed conceptual schematics required for system	species of re deling, tors s e able	acti wat yste to:	on ta ter qu ems.	king place Jality para	e in it. ameters mo		tori
into syst	em requirements	i anai	y 515	anu	an ability	to translate	pertinent er	
Unit I ECO	LOGICAL SYSTEM							9
nodeling - Struct	Prey-predator models: Lotka-Volterra, Rosen tural analysis and stability of complex ecosyst		-Ma	CARI	ner, Kolm	ogorov mo	ueis. muiti-sp	2
Image: Structure       Unit II     CON       CSTR, Plug-Flow       Search algorithm       Ialdane kinetics       Unit III       WAT       Rivers and stream       ensitivity-assess	tural analysis and stability of complex ecosyst <b>TINUOUS-FLOW REACTOR MODELING</b> w, Dispersion. A case study of a tubular re- is for nonlinear dynamical models, Variance <b>ER QUALITY MODELING</b> ams water quality modeling -dispersion and sing model performance; Models for dissolve	eactor of es nd mix	wit time xing	h ax ated p	ial disper paramete ter qualit	rsion, Para rs. Applicat	meter Calibr ion to Mono g process- i	9 ation d an 9 mode
modeling - Struct         Unit II       CON         CSTR, Plug-Flow         Search algorithm         Haldane kinetics         Unit III       WAT         Rivers and stream         Rivers and stream         Institutiv-asses         Inamics -Disso	tural analysis and stability of complex ecosyst <b>TINUOUS-FLOW REACTOR MODELING</b> w, Dispersion. A case study of a tubular re- is for nonlinear dynamical models, Variance <b>ER QUALITY MODELING</b> ams water quality modeling -dispersion ar- sing model performance; Models for dissol- lved Oxygen dynamics -Groundwater quality re-	eactor of es nd mix	wit time xing	h ax ated p	ial disper paramete ter qualit	rsion, Para rs. Applicat	meter Calibr ion to Mono g process- i	9 ation d an 9 node utrien
modeling - Struct         Unit II       CON         CSTR, Plug-Flow         Search algorithm         Haldane kinetics         Unit III       WAT         Rivers and stream         Sensitivity-assess         Anit IV       MICF         Requirements for	tural analysis and stability of complex ecosyst <b>TINUOUS-FLOW REACTOR MODELING</b> w, Dispersion. A case study of a tubular re- is for nonlinear dynamical models, Variance <b>ER QUALITY MODELING</b> ams water quality modeling -dispersion and sing model performance; Models for dissolve	eactor of es nd mix ved o model	wit tima xing xygu ing	h ax ated p - wa en a	ial disper paramete ter qualit nd patho schemes:	rsion, Para rs. Applicat ty modeling gens- Pollu completely	meter Calibr ion to Mono g process- n utant and nu	9 ation d an 9 mode utrien 9 -flov
modeling - Struct         Unit II       CON         CSTR, Plug-Flow         Search algorithm         Haldane kinetics         Unit III       WAT         Rivers and stress         Sensitivity-assess         dynamics -Disso         Unit IV       MICF         Requirements for         SBR, nutrient reprocesses.	tural analysis and stability of complex ecosyst <b>TINUOUS-FLOW REACTOR MODELING</b> w, Dispersion. A case study of a tubular re- ins for nonlinear dynamical models, Variance <b>ER QUALITY MODELING</b> ams water quality modeling -dispersion ar- sing model performance; Models for dissol- lived Oxygen dynamics -Groundwater quality in <b>ROBIAL DYNAMICS AND ENERGETICS</b> r carbon and nutrient removal. Activated sluce	eactor of es nd mix ved o model	wit tima xing xygu ing	h ax ated p - wa en a	ial disper paramete ter qualit nd patho schemes:	rsion, Para rs. Applicat ty modeling gens- Pollu completely	meter Calibr ion to Mono g process- n utant and nu	9 atio d ar 9 mod utrie 9 -flov tme
modeling - Struct         Unit II       CON         CSTR, Plug-Flow         Search algorithm         Haldane kinetics         Unit III       WAT         Rivers and streadynamics -Disson         Unit IV       MICF         Requirements for         SBR, nutrient reprocesses.         Unit V       COM         Formulation of limer         Commulation of limer         Communication of limer	tural analysis and stability of complex ecosyst <b>TINUOUS-FLOW REACTOR MODELING</b> w, Dispersion. A case study of a tubular re- is for nonlinear dynamical models, Variance <b>ER QUALITY MODELING</b> ams water quality modeling -dispersion ar- sing model performance; Models for dissol- lved Oxygen dynamics -Groundwater quality is <b>ROBIAL DYNAMICS AND ENERGETICS</b> r carbon and nutrient removal. Activated sluce emoval. Anaerobic digestion: process dynamics <b>PUTER BASED SOLUTIONS</b> hear optimization models. Linear programming programming; Formulation of linear optimization and experimental design.	eactor of es nd mix ved o model dge: F mics, g. Ser	wit time xing xyge ing Proce Op	h ax ated p - wa en a ess s eratio	ial disper paramete ter qualit nd patho schemes: pnal cont esting and	rsion, Para rs. Applicat ty modeling gens- Pollo completely rol of was d duality. S	meter Calibrition to Mono g process- nutant and nut mixed, plug tewater trea	9 ation d an 9 mode utrien 9 -flov tmen <b>9</b> ique
modeling - Struct         Unit II       CON         CSTR, Plug-Flow         Search algorithm         Haldane kinetics         Unit III       WAT         Rivers and streates         Synamics -Disso         Unit IV       MICF         Requirements for         SBR, nutrient reprocesses.         Unit V       COM         Formulation of limit         Micr parameter estimat         TEXT BOOK(S)	tural analysis and stability of complex ecosyst <b>TINUOUS-FLOW REACTOR MODELING</b> w, Dispersion. A case study of a tubular re- is for nonlinear dynamical models, Variance <b>ER QUALITY MODELING</b> ams water quality modeling -dispersion ar- sing model performance; Models for dissol- lived Oxygen dynamics -Groundwater quality of <b>ROBIAL DYNAMICS AND ENERGETICS</b> r carbon and nutrient removal. Activated sluce emoval. Anaerobic digestion: process dyna <b>PUTER BASED SOLUTIONS</b> hear optimization models. Linear programming programming; Formulation of linear optimization and experimental design.	eactor of es nd mix ved o model dge: F mics, g. Ser zation	wit time xing xyge ing Proce Op	h ax ated p - wa en a ess s eratic	ial disper paramete ter qualit nd patho schemes: onal cont esting and . Applica	rsion, Para rs. Applicat ty modeling gens- Pollu completely rol of was d duality. S	meter Calibr ion to Mono g process- n utant and nu mixed, plug tewater trea olution techn odels- simul	9 ation d an 9 mode utrien 9 -flow tmen ique ation
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Department	CIVIL ENGINEE	RING				R 2019	Semester I	PE
Course	Course Name		lours Wee		Credit	Total Hours	Maximur Marks	n
Code	847	L	т	Р	С		inarito	
19EVX12	ROLE OF ENVIRONMENTAL LEGISLATIONS IN INDUSTRIES	3	0	0	3	45	100	
Make the     Understa     Expose th     Course Outcom     Make the     Get idea     Enforce th     Unit I THE M     Definitions-Salien     elating to prevent     provision for viola     Electroplating, Stat     Unit II THE M	ve (s): The purpose of learning this course e students conversant with the legislations ind the basic principles in pollution control. he students to the pollution control policies nes: At the end of this course, learners will students conversant with the legislations about the implementation of rules. he rules. WATER (PREVENTION & CONTROL OF the features-Powers & functions of Regulate ention & control-procedures to obtain control ation of Water (P&CP) Act-Case studies on arch industries-inventorisation of new wate AIR (PREVENTION & CONTROL OF POL features- Powers & functions of Regulated	in India. in India be able related f POLLU tory age onsent-M n water er polluti LUTIO	a. e to: to po encie Monif pollu ing ir <b>N)AC</b>	N)AC es-Re toring uting ndust CT, 1 s -Na	<b>CT, 1974</b> esponsibi and cc industries ry and its <b>981</b>	mpliance s-Textile d managem	mechanisms yeing, Paper ent-field visits	-leg mill s. <b>9</b>
rocedures to c ir(P&CP)Act- Ca f new Air pollutin Unit III THE F enesis of the A	ds for industries specific- Responsibilities obtain consent Monitoring and complia ase studies on Air polluting industries-Fou ng industry and its management-field visits ENVIRONMENT (PROTECTION) ACT, 19 act-Salient features-Role of Central Gover	ance m indries, 5. <b>86</b> rnment-	Cem	anisn nent, ous n	ns- legal Thermal otification	lating to p provisior power pla s and ru	revention& con for violation nts- inventoria	ontro on satio
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Chairman - BoS Dept. of Civil Engg. - ESEC

Department	CIVIL ENGINEE	RING				R 2019	Semester III	PE
Course	Course Name		lour Wee	10.00	Credit	Total Hours	Maximu Marks	
Code		L	т	Р	С	incure	Marks	
19EVX13	CLEANER PRODUCTION AND SUSTAINABLE DEVELOPMENT	3	0	0	3	45	100	
	re (s): The purpose of learning this course the students on complete management print		relat	ed to	Cleaner I	Production	and Control o	of
Industrial F						2		
	es: At the end of this course, learners will	be abl	e to:					
	te analysis of materials of construction ne quantities of materials of construction							
	ne cost of buildings							
				-		1.2		9
	elopment-Indicators of Sustainability-Sust	ainabil	ity St	trateg	gies Barrie	ers to Susta	inability-Indu	stria
	onment-Industrialization and sustainable of		-					
	Sustainability-Prevention versus Control							
	ulations to Encourage Pollution Prevention	n and (	Clear	ner Pi	roduction-	Regulatory	versus Mark	et
Based Approache		1						-
	UTION PREVENTION ance-Historical evolution-Benefits-Promot	ion Po	rriore	Dal	o of Induo	try Covorn	mont and	9
a service of the serv	ronmental Management Hierarchy Source							
	se, recovery, recycle, raw material substitu							5.
and the second sec	CEPT OF CLEANER PRODUCTION							9
Overview of CP /	Assessment Steps and skills, Preparing fo	or the s	ite vi	sit, Ir	formation	Gathering	, and process	flov
	balance, CP Option Generation Technica							
	natives total cost analysis-CP Financing-E							
and the second	leasuring progress-pollution prevention ar	nd clea	ner p	orodu	ction Awa	ireness pla	n -Waste aud	it-
Environmental Sta			-	_			1.1.1	9
	CYCLE ASSESSMENT -Life Cycle Costing -Eco Labeling-Design	for the	Env	ironn	ant Inter	national En	vironmental	9
	4001-Enironmental audit.	ior the		nonn	nent inten		vironmentai	
Jnit V CASE			-	α.	1.1.1	1.5.1.1		9
the second of the second s	tion of CP, LCA, EMS and Environmental	Audits						
EXT BOOK(S):							1275	
Paul L Bishop	, "Pollution Prevention Fundamental and	Practic	e". N	AcGra	aw-Hill Int	ernational.	2000.	
	Group, "Pollution Prevention and Abatem							rld
	EP, Washington D.C, 2005.	ient na	anub	UUK-		Jeaner I To		nu
EFERENCES:	21, Washington D.S, 2000.		-	-				-
	k, C.Visvanathan and Mandarparasnis "C			luctio	n Audit", I	Environmei	ntal System	1
Reviews, No.	38, Asian Institute of Technology, Bangko	K, 200	<b>.</b>			1	$( \cap )$	
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Department	CIVIL ENGINEER	RING				R 2019	Semester	PE
Course	Course Name		lours		Credit	Total Hours	Maximu Marks	
Code		L	т	Р	С	nouis	Warks	5
19EVX14	SOLAR ENERGY TECHNOLOGIES	3	0	0	3	45	100	
	ve (s): The purpose of learning this course dents understand the fundamental theory go		ng so	blar th	nermal an	d photovolt	aic devices a	and
	m carry out preliminary system designs.		-					
<ul><li>Estimate</li><li>Predict th</li></ul>	nes: At the end of this course, learners will a solar radiation received on a surface ne performance of solar thermal devices and sizing of solar photovoltaic systems			s per	formance			
	RODUCTION							6
	relations – Radiation on horizontal and tilted	surfa	ces -	- Ext	raterrestr	al radiation	- Estimation	of
	on – Total radiation on fixed sloped surfaces		000	Ent	atonooti	arradiation	Loundation	
	TRANSFER & PERFORMANCE ANALYS							12
	pects in solar thermal – Radiation absorbed		olar	colle	ator The		Dista Callast	
Flat Plate Collec	tors - Mean fluid and plate temperature calo					and the second		ors
simulation Unit III SOLA Theory of solar	tors - Mean fluid and plate temperature calc <b>R AIR HEATERS &amp; PV CELLS</b> air heaters – Basics of concentrating collect	culation	n – C	Collec	tor perfo	mance - nu	umerical	
simulation Unit III SOLA Theory of solar Performance par	tors - Mean fluid and plate temperature calc <b>R AIR HEATERS &amp; PV CELLS</b> air heaters – Basics of concentrating collect rameters – PV system configurations	culation	n – C	Collec	tor perfo	mance - nu	umerical	10
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	CIVIL ENGINEERI	NG					R 2019	Semester III	PE
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19EVX15	ENVIRONMENT, HEALTH AND SAFETY IN INDUSTRIES	3	0	0	3	-	45	100	<u>.</u>
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Departr	ment	CIVIL ENGINEER	ING				R 2019	Semester	PE
Cours	1. A	Course Name	1.	lour: Wee		Credit	Total Hours	Maximu Marks	
Code	e		L	т	Р	С			
19EVX	16	CLIMATE CHANGE AND ADAPTATION	3	0	0	3	45	100	
	-	ive (s): The purpose of learning this course is							
		about Climate system and its changes and ca			lineat				
	-	owledge about impacts, adaptation and mitig			limat	e change			
		nowledge about clean technology and clean							_
		nes: At the end of this course, learners will be							
		wledge about Climate system and its change bout impacts, adaptation and mitigation of cli							
		bout clean technology and clean energy	nate	Cilai	nge				
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		- The Hydrological Cycle – Global Ocean Circ							n –
		ural Green House Effect – Green House Gas	es ar	nd Gi	lobal	vvarming	- Carbon C	Sycle.	_
Jnit II	OBS								
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RE	FERENCES
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2.	Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007

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air polluti	e the theory of dispersion of air pollution in the on modeling rate the features and the use of most widely u		Ĵ					for
	<b>mes:</b> At the end of this course, learners will be p conceptual schematics required for air quali							
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	DELING CONCEPT							9
numerical and s	erent types of models-deterministic and stoch simulations models- calibration and validation s-Model development and decision making.				the second s		e esta a seconda de la construcción	Mas
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Unit III AIR	significant to transport and diffusion of stack e QUALITY MODELS	miss	ion –	- stac	k plume c	haracterist	ics.	
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Department	CIVIL ENGINEE	RING				R 2019	Semester	PE
Course	Course Name		lour Wee		Credit	Total Hours	Maximu Marks	m
Code		L	т	Р	С	incure	marks	
19EVX18	WATER QUALITY MODELLING	3	0	0	3	45	100	
Educate     Impart kr     Provide I     Course Outcom     Learn ab     Acquire I     Attain kn Unit I     SURF and Processes nfiltration, Evapo Unit II     SURF	ive (s): The purpose of learning this course the students about surface water hydrology nowledge about ground water hydrology and knowledge about ground water modeling <b>nes:</b> At the end of this course, learners will out surface water hydrology and run off. knowledge about ground water hydrology ar owledge about ground water modeling <b>FACE WATER HYDROLOGY</b> - Subsurface and Channel Processes- paration, Transpiration, Process and models. <b>FACE RUNOFF MODEL</b> & S curve Hydrograph, Dimensionless Unit	v and ro d flow be abl nd flow	e to:	ion -			Normal A	9
Nodels.								
Unit III GRO	UNDWATER HYDROLOGY							9
Forchheimer assund a solution filtration gallerie	Movement of Ground water, Propertie umptions, Well hydraulics, Partial penetrat es UNDWATER FLOW						and the second sec	
	nalysis for unconfined and non leaky and le oundaries, Well design criteria.	aky co	nfine	ed aq	uifer and	water table	aquifer, Loca	ating
	UNDWATER MODEL		-				-	9
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vater	cial Recharge of Ground water- Salt water in	ntrusio	, , ,	pilod		nite Differer	nce in ground	
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vater EXT BOOK(S): 1. Ven Te Chor 2. Singh, Vijay REFERENCES:	w, "Applied Hydrology", Mc GrawHill Scienc	ce Pub					nce in ground	

Membrane separation processes – process classification – membrane materials-Symmetric and asymmetric nembranes – membrane configuration – membrane fouling- Molecular weight cutoff – Reverse osmosis heory – membrane structure and rejection mechanism – osmotic pressure – Transport models and flu- equations – ultra filtration – Electro dialysis – theory – power requirement.		CIVIL ENGINEERI	NG				R 2019	Semester III	PI
Code         L         T         P         C           19EVX19         ADVANCED WASTEWATER TREATMENT AND REUSE         3         0         0         3         45         100           Course Objective (6): The purpose of learning this course is to         •         Provide knowledge about Stripping, nitrogen removal and oxidation         •         Impart knowledge about Stripping, nitrogen removal and oxidation           Educate about phosphorous removal , reclamation and reuse         Course Outcomes: At the end of this course, learners will be able to:         •         Get knowledge about air sripping           Learn about various nutrient processes         •         Learn about various nutrient processes - regulations in removal of NBOD and other nutrient for advanced wastewater treatment – technologies used for advanced treatment-conventional react officiations in advanced treatment-oxidation processes – regulations in removal of NBOD and other nutrient factor of unit operation in advanced treatment Gas stripping – Analysis of gas stripping – Design pripping fovers – applications – Air stripping of ammonia – Breakpoint chlorination – Ion exchange.         9           Unit II         INTROGEN REMOVAL AND OXIDATION PROCESSES         9         9         10		Course Name				Credit	and the second for the second		n
INDERUSE         3         0         3         45         100           Course Objective (s): The purpose of learning this course is to         •         Provide knowledge about stripping, nitrogen removal and oxidation           •         Impart knowledge about Membrane separation, elecrodialysis         •         Educate about phosphorous removal, reclamation and reuse           Course Outcomes: At the end of this course, learners will be able to:         •         Get knowledge about air sripping         •           Learn about various nutrient processes         •         Learn about reclamation and reuse of wastewater         9           Veed for advanced wastewater treatment – technologies used for advanced treatment-conventional react nodifications in dvanced treatment-oxidation processes – regulations in removal of NBOD and other nutrient proping towers – applications. – Air stripping of ammonia – Breakpoint chlorination – lon exchange.         9           Vuirient removal – Nitrogen removal – forms and sources of nitrogen – Biological nitrogen memoval – Nitrificatic increases. Oxidation processes – applications – Arm Stripping – Molecular weight cutoff         9           Nutrient removal – Stripping of ammonia – membrane materials-Symmetric and asymmetric membrane separation processes – process classification – membrane materials-Symmetric and asymmetric membrane separation processes – process classification – membrane materials-Symmetric and asymmetric membrane structure and rejection mechanism – osmotic pressure – Transport models and fit quations – ultra filtration – Electro dialysis – theory – power requirement.         9	Code		L	т	Р	С			
Provide knowledge about stripping, nitrogen removal and oxidation     Impart knowledge about Membrane separation, elecrodialysis     Educate about phosphorous removal, reclamation and reuse Course Outcomes: At the end of this course, learners will be able to:     Get knowledge about air sripping     Learn about various nutrient processes     Learn about reclamation and reuse of wastewater Unit I GENERAL AND STRIPPING     9 eleed for advanced treatment – technologies used for advanced treatment –conventional react inping towers – applications. –Air stripping of ammonia – Breakpoint chlorination – lon exchange. Unit I NITROGEN REMOVAL AND OXIDATION PROCESSES Unit removal – Nitrogen removal – forms and sources of nitrogen – Biological nitrogen removal – Nitrification in techs of persory. Cl- and oxy radicals in reducing COD. Unit II MEMBRANE SEPARTION PROCESSES AND ELECTRO DIALYSIS     8 fembrane separation processes – process classification – membrane materials-Symmetric and asymmetr     embranes configuration – membrane fouling. Molecular weight cutoff – Reverse osmosis reory – membrane structure and rejection mechanism – osmotic pressure – Transport models and flu quations – ultra filtration – Electro dialysis – theory – power requirement. Unit V MASTEWATER RECLAMATION AND REUSE     9 Forsphorous removal – By biological methods – Phosphorous removal by chemical addition – chemist f precipitation with Aluminium, calcium and Iro – Comparison of processes – Estimation of sludge roduced from chemical precipitation of phosphorous inte PST.  EVT BOOK(S):     MASTEWATER RECLAMATION AND REUSE     4 Arecivala S. J. "Wastewater Treatment and Disposal" Marcelderdekker Publishers, 1981. EFERENCES:     Arceivala S. J. "Wastewater Treatment and Disposal" Marcelderdekker Publishers, 1981. EFERENCES:     Arceivala S. J. "Wastewater Treatment Plant – Planning, Design and operation, Holt Rinchart and Winston, New York, 2002.     Arceivala S. J. "Wastewater Treatment Plant – Planning, Design and operation, Holt Rinchart and		AND REUSE		0	0	3	45	100	
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Get knowledge about air sripping     Learn about various nutrient processes     Learn about reclamation and reuse of wastewater     Unit I GENERAL AND STRIPPING     Setting GENERAL AND STRIPPING GENERAL AND STRIPING GENERAL AND STRIPPING G						-			_
Learn about various nutrient processes     Learn about reclamation and reuse of wastewater Unit I GENERAL AND STRIPPING     Set of advanced wastewater treatment – technologies used for advanced treatment –conventional react nodifications in advanced treatment-oxidation processes – regulations in removal of NBOD and other nutrient election of unit operation in advanced treatment. Gas stripping – Analysis of gas stripping – Design inping towers – applications. – Air stripping of ammonia – Breakpoint chlorination – lon exchange.     Unit II NITROGEN REMOVAL AND OXIDATION PROCESSES     Set on portion kinetics – Design parameters – Nitrogen removal by – physical and chemic rocesses. Oxidation processes -advanced oxidation process in removal of nitrogen and phosphorus derivative se of peroxy, CI- and oxy radicals in reducing COD.     Unit II MEMBRANE SEPARTION PROCESSES AND ELECTRO DIALYSIS     Bembrane separation processes – process classification – membrane materials-Symmetric and asymmetri eembranes separation processes – process classification – membrane materials-Symmetric and asymmetri eembrane separation processes – process classification – membrane materials-Symmetric and asymmetri eembrane structure and rejection mechanism – osmotic pressure – Transport models and fli quations – ultra filtration – Electro dialysis – theory – power requirement.     Unit IV PHOSPHOROUS REMOVAL     PHOSPHOROUS REMOVAL     Set of procipitation with Aluminium, calcium and Iron – Comparison of processes – Estimation of sludge roduced from chemical precipitation of phosphorous with lime in PST.     Unit V MASTEWATER RECLAMATION AND REUSE     The role of water recycling in the hydrologic cycle – wastewater. Wastewater reclamation ar     use – The role of water recycling in the hydrologic cycle – wastewater.     EXT BOOK(S):     The role of water recycling in the hydrologic cycle – wastewater.     Fata McGraw-Hill, New     Yor			abi	e to.					
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<ul> <li>election of unit operation in advanced treatment. Gas stripping – Analysis of gas stripping – Design tripping towers – applications. – Air stripping of ammonia – Breakpoint Chlorination – Ion exchange.</li> <li>Unit II NITROGEN REMOVAL AND OXIDATION PROCESSES 9</li> <li>Pattreat emoval – Nitrogen removal – forms and sources of nitrogen – Biological nitrogen removal – Nitrificatio inetics – Denitrification kinetics – Design parameters – Nitrogen removal by – physical and chemic rocesses. Oxidation processes-advanced oxidation process in removal of nitrogen and phosphorus derivative: es of peroxy, CI- and oxy radicals in reducing COD.</li> <li>Unit II MEMBRANE SEPARTION PROCESSES AND ELECTRO DIALYSIS 8</li> <li>fembrane separation processes – process classification – membrane materials-Symmetric and asymmetric membranes – membrane configuration – membrane materials-Symmetric and asymmetric membranes – membrane configuration – theory – power requirement.</li> <li>Unit IV PHOSPHOROUS REMOVAL 9</li> <li>hosphorous removal – By biological methods – Phosphorous removal by chemical addition – chemistif f precipitation with Aluminium, calcium and Iron – Comparison of processes – Estimation of sludg roduced from chemical precipitation of phosphorous with lime in PST.</li> <li>Unit V MASTEWATER RECLAMATION AND REUSE 9</li> <li>lerits and demerits of advanced treatment-applications of treated wastewater- Wastewater reclamation – analyse – The role of water recycling in the hydrologic cycle – wastewater reuse applications – public healt network.</li> <li>EXTEDOK(S):</li> <li>Arceivala S. J.' "Wastewater Ireatment and Disposal" Marcelderdekker Publishers, 1981.</li> <li>EFERENCES:</li> <li>HOWARD S. PEAVY, DONALD R. ROWE &amp; GEORGE TCHOBANOGLOUS, "Environmental Engineering", McGraw-Hill, 1988.</li> <li>QASIM S. R., "Wastewater Treatment Plant – Planning, Design and operation, Holt Rinchart and Winston, New York, 2003.</li> <li>Larry D. Benefield and Clifford</li></ul>									
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Department	CIVIL ENGINEER	R 2019	Semester II	PE				
Course	Course Name		Hour Wee		Credit	Total Hours	Maximum Marks	
Code		L	Т	P	С			
19EVX20	OPERATION AND MAINTENANCE OF WATER AND WASTE WATER TREATMENT PLANTS	3	0	0	3	45	100	
	tive (s): The purpose of learning this course i							- 24
	the student on the various Operation & Main				cts of Wa	ter treatme	nt systems, s	sewe
	s, sewage treatment plants and Effluent Treat							
Acquired	mes: At the end of this course, learners will b d the knowledge required to operate and nt plants including trouble shooting.				ter treatn	nent plants	and waste	wate
Unit I ELI	EMENTS OF OPERATION AND MAINTENA	NCE						9
Strategy for Goo	od Operation and Maintenance- Knowledge o	of pro	cess	and	equipme	nt- Prevent	ive and Corre	ective
maintenance scl	heduling Operation and Maintenance Plan	- Pro	per a	and a	adequate	tools, Spar	e units and p	arts
	ements- Laboratory control- Records and I							
	ng procedure-Analytical techniques- Code of							
and the rest of the second	es and Levels -Safety in O&M Operations				t Informa	tion Syster	n - Measure	es fo
and the second se	Energy- management of residues from plant							
Unit II OP	ERATION AND MAINTENANCE OF WATER	R INT	AKE	S AN	ID SUPPL	Y SYSTEM	IS	9
Operational prob	olems, O&M practices and Records of Operation	ation	of R	eser	oir and In	ntakes - Ca	uses of Failu	ure o
	ation of Tube wells & Bore Wells- Prevention							
	nals- Problems in Transmission Mains- Mai							
	rent types of Pipes- Preventive and corrective							
	rvoirs - Problems in the water Distribution S							g and
	ater Meters, Instrumentation, Telemetry & Sca				ized Wate	er Billing Sy	stem	
	ERATION AND MAINTENANCE OF SEWER							9
	d functions of sewer system – Conduits or pi							
	m – Operational Problems– Clogging of pip							
	inst infections - Devices for cleaning the c							
	-operation and maintenance of sewage pur	mping	g sta	tions	- Mainter	ance Haza	irds and Ope	erato
Protection -Case						4.1.1.1.		-
the second of the second	ERATION AND MAINTENANCE OF PHYSIC		UP A CHERTIN	ALL STREET	and the second and the second		the second se	9
	naintenance in screen chamber, Grit Chambe							
	ecord keeping requirements for clarifier, Equa							
	pment - Chemical metering equipment - Fla							
	and maintenance inspection - Motors and F							
	uipment - Membrane process systems- SI	DI ar	nd L	SI de	eterminati	on- Proces	s Chemistry	and
	e calculations- Case Studies		-		No. of Concession	1		
	ERATION AND MAINTENANCE OF BIOLOG							9
SBR, UASBR, I guidelines – Inte	MBRs- Startup and Shutdown Procedures- raction with other Treatment Processes - Pla	-DO,	MLS	SS a	nd SVI n	nonitoring-	Trouble sho	ooting
	ng, case studies of Retrofitting- Case studies					1. 1. 1. S.	-	_
TEXT BOOK(S):							$( \cap )$	
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Chairman - Bos Dept. of Civil 5

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1.	CPHEEO, Manual on operation and maintenance of water supply systems, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, Government of India 2005
2.	Ministry of Drinking Water and Sanitation, operation and maintenance manual for rural water supplies, Government of India, 2013
REF	ERENCES:
1.	Metcalf & Eddy, Inc., G. Tchobanoglous, H. D. Stensel, R. Tsuchihashi, and F. L.Burton. "Wastewater Engineering: Treatment and Resource Recovery"5th edition). McGraw Hill Company.,2014
2.	Ananth S Kodavasal, The STP Guide-Design, Operation and maintenance, Karnataka State Pollution Control Board, Bangalore,2011
3.	B Frik Schutte, handbook for the operation of water Treatment Works, The Water Research Commission, The Water Institute of Southern Africa, TT265/06, 2006.

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Chairman - BoS Dept. of Civil Engg. - ESEC

Department		CIVIL ENGINEER	R 2019	Semester III	PE				
Course		Course Name		Hours / Week			Total Hours	Maximum Marks	
Code	9	L	т	Р	С	neuro	WIATKS		
19EVX21		SOIL STRUCTURE INTERACTION		0	0	3	45	100	
	Get an i	ive (s): The purpose of learning this course idea on soil structure interaction, soil four and elastic analysis of piles and piled raft.		n ma	odels	, finite di	fference a	and finite ele	mer
	<ul> <li>Understa</li> <li>Come up</li> </ul>	<b>nes:</b> At the end of this course, learners will hand various soil response models applicable with elastic solutions for problems of pile, pware packages to analyze soil-foundation sy	to soi ile-raf	l-foui t sys	tem.			s.	
Un	it I SOI	L - FOUNDATION INTERACTION		_					9
-		oil – Foundation interaction problems – Soil	beha	viour	- Fo	undation	behaviour -	- Interface	
		ope of soil-foundation interaction analysis - S							n,
Tw	o parameter	elastic models, Elastic - Plastic behaviour -	Time	depe	ende	nt behavio	bur		
Un	it II BEA	MS ON ELASTIC FOUNDATION - SOIL M	ODEL	S	11				
					-		Concernance of the second		9
Infi	nite beam - <sup>-</sup>	Two parameters – Isotropic elastic half spac	and the state of the	nalys	is of	beams of	finite length	n – Classificat	-
of f	inite beams i	n relation to their stiffness – Analysis throug	e – Ar	-			finite length	n – Classificat	ion
of f Un	inite beams i it III PLA	n relation to their stiffness – Analysis throug TE ON ELASTIC MEDIUM	e – Ar h appl	icatio	on pa	ackages.			ion 9
of f Un Inf	inite beams i it III PLA inite plate – V	n relation to their stiffness – Analysis throug TE ON ELASTIC MEDIUM Winkler, Two parameters, Isotropic elastic m	e – Ar h appl edium	ication, Thi	on pa	ackages. d thick pla	ites – Analy	sis of finite p	9 ate
of f Un Inf – R	inite beams i it III PLA inite plate – V tectangular a	n relation to their stiffness – Analysis throug TE ON ELASTIC MEDIUM Winkler, Two parameters, Isotropic elastic m nd circular plates – Numerical analysis of fin	e – Ar h appl edium	ication, Thi	on pa	ackages. d thick pla	ites – Analy	sis of finite p	9 ate
of f Un Inf – R cut	inite beams i it III PLA inite plate – V tectangular a s – Applicatio	n relation to their stiffness – Analysis throug <b>TE ON ELASTIC MEDIUM</b> Winkler, Two parameters, Isotropic elastic m nd circular plates – Numerical analysis of fin on packages.	e – Ar h appl edium	ication, Thi	on pa	ackages. d thick pla	ites – Analy	sis of finite p	9 ate:
of f Un Inf – R cut	inite beams i it III PLA inite plate – V tectangular a s – Applicatic it IV ELA	n relation to their stiffness – Analysis throug TE ON ELASTIC MEDIUM Winkler, Two parameters, Isotropic elastic m nd circular plates – Numerical analysis of fin on packages. STIC ANALYSIS OF PILE	e – Ar h appl edium ite pla	icatio , Thi ates -	on pa in and - Sim	ackages. d thick pla pple solution	ites – Analy ons – Analy	vsis of finite p vsis of braced	ion 9 ate: 9
of f Un Inf – R cut Un Ela	inite beams i it III PLA inite plate – V tectangular a s – Applicatio it IV ELA stic analysis	n relation to their stiffness – Analysis throug TE ON ELASTIC MEDIUM Winkler, Two parameters, Isotropic elastic m nd circular plates – Numerical analysis of fin on packages. STIC ANALYSIS OF PILE of single pile – Theoretical solutions for settl	e – Ar h appl edium ite pla	icatio n, Thi ates -	in and - Sim	ackages. d thick pla nple solution	ites – Analy ons – Analy on – Analys	rsis of finite p rsis of braced sis of pile grou	ion 9 ates 9
of f Un Inf – R cut Uni Ela	inite beams i it III PLA inite plate – V ectangular a s – Applicatio it IV ELA stic analysis eraction analy	n relation to their stiffness – Analysis throug <b>TE ON ELASTIC MEDIUM</b> Winkler, Two parameters, Isotropic elastic m nd circular plates – Numerical analysis of fin on packages. <b>STIC ANALYSIS OF PILE</b> of single pile – Theoretical solutions for settl rsis – Load distribution in groups with rigid c	e – Ar h appl edium ite pla	icatio n, Thi ates -	in and - Sim	ackages. d thick pla nple solution	ites – Analy ons – Analy on – Analys	rsis of finite p rsis of braced sis of pile grou	9 ates 9 up –
of f Un Inf Cut: Uni Ela Inte	inite beams i it III PLA inite plate – V tectangular a s – Applicatio it IV ELA stic analysis eraction analy it V LAT	n relation to their stiffness – Analysis throug TE ON ELASTIC MEDIUM Winkler, Two parameters, Isotropic elastic m nd circular plates – Numerical analysis of fin on packages. STIC ANALYSIS OF PILE of single pile – Theoretical solutions for settl vsis – Load distribution in groups with rigid co ERALLY LOADED PILE	e – Ar h appl edium ite pla emen ap – F	t and Pile ra	in and - Sim I load	ackages. d thick pla nple solution I distributi Applicatio	ites – Analy ons – Analy on – Analys n packages	vsis of finite p vsis of braced sis of pile grou	9  ates   1p -   9
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<sup>1</sup> Chairman - Boß Dept. of Civil Engg. - E&EC

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Department	CIVIL ENGINE	R 2019	Semester	PE				
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Course Objectiv • Understan hazards, th Course Outcom • Acquire kn to study th • Analyze th • Design ear resistance. Unit I EAR Causes of earthq Elastic Rebound Locating an earth Unit II GRO Characteristics of tests – Need for C Unit III LIQU Liquefaction rela Cyclic Strain appr Liquefaction com	ve (s): The purpose of learning this course and the mechanism of earthquake, wave pre- heir mitigation and design of earthquake re- nes: At the end of this course, learners will nowledge about the earthquake ground make ground motion. The liquefaction susceptibility of the site usi arthquake resistant geotechnical structures <b>THQUAKE SEISMOLOGY</b> quake – Plate tectonics –Earthquake Fault theory – Locating an earthquake – Quant aquake –Case studies. <b>UND MOTION AND GROUND RESPON</b> f ground motion – Factors influencing gro Ground Response Analysis – Methods of <b>EFACTION AND LATERAL SPREADING</b> ted phenomena – Liquefaction susceptibili roaches – Lateral deformation and spread putation from Lab and Field tests.	opagati resistan I be abl otion, n ng labo s and th t source tification <b>SE AN</b> und mo Ground <b>G</b> ility – E ding – C	ion an t four le to: nakin rator ne me es – I n of e ALYS tion - d Res valua Criter	nalys ndation g fan y and ethod Elastic earthod SIS – Eva spons ation o ia for	is, ground ons. hiliar with I field test s to impro c Reboun quakes – I aluation of se analysis of liquefac mapping	I motion, e code and s s. we the gro d theory – ntensity ar shear way s.	arthquake software pac und for haza Seismic way nd magnitude ve velocity – clic Stress a	kage rd 9 ves- es - 9 Lab 9 nd
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