Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)



Course Contents (Syllabus) for

First Year M. Tech. Civil (Environmental Engineering) Sem – I to II

AY 2020-21

Title of the		L	Т	Р	Cr
	Methodology (4IC501)	2	-	-	2
Pre-Requis	site Courses: Nil				
Textbooks :					1
	yne Goddard and Stuart Melville, "Research Methodology 4, Juta and Company Ltd.	: An	Introd	uction"	, 2 nd Ed
2. Ran	jit Kumar, "Research Methodology: A Step by Step Guide GE Publications.	for b	eginner	s", 4 th	Ed2014
	art Melville and Wayne Goddard, "Research Methodology: ineering Students", 2000, Juta and Company Ltd.	An In	troduct	tion for	Science &
References					
	bert, "Resisting Intellectual Property", Taylor & Francis Ltd	,200	7.		
	vall, "Industrial Design", McGraw Hill, 1992.				
	bel, "Product Design", McGraw Hill, 1974. Ramappa, "Intellectual Property Rights Under WTO", S. Cha	nd o	000		
Course Ob		ina, z	008		
state 2. To e poss cone 3. To i	prepare students for undergoing research, identify and form e the hypothesis, design a research layout, set a research pro- enable students to investigate the problem, interpret the res- sible/alternative solutions, solve and prove the solution adap- clude the research findings. mpart knowledge to review the literature and publish resear- expose students to research ethics, IPR and patents.	cess a ults, j ted–l	nd met propose ogicall	hodolo theori y and a	gy. es, sugges nalytically
Course Lea	arning Outcomes:				
CO	After the completion of the course the student should be		Bloo	m's Co	gnitive
CO	able to	I	Level	De	scriptor
CO1	Analyze research and its significance in economic, social and legal aspects.	1	IV	Ar	nalyzing
CO2	Evaluate research problem and its design for solution logically and critically.	1	V	Ev	aluating
CO3	Produce research solution, publication, Dissertation, IPI	2	VI		reating

CO-PO Mapping:

and patent.

CO3

PO	1	2	3	4	5	6
CO1	3				1	
CO2	3			2		
CO3	3	3		2		

VI

Creating

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc. MSE: Assessment is based on 50% of course content (Normally first three modules)

	e Course: Phy er Treatment	•				i viater	anu	L	Т	Р	Cr
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-	isite Courses:	A cours	se on E	nvironn	nental E	Engineeri	ing at g	raduate	e level		
Bo	s: avy H, S, Rowe ok Company, I etcalf and Edd	Indian e	dition	2017.							
Pul	olication, India	n Editio	on 2017	7.		-					
Mc	vis, M, L, an Graw Hill Pub it Operations	olishing	Compa	any, Spe	ecial Ind	dian Edit	ion, 20	10.		0	0
Re	ynolds and Pau	ıl A. Ri	chards,	PWS P	ublishi	ng Comp	any, 19	995.			-
Edi	oste, Ronald L ition, 2009.		-		Ū						-
2. We 199	eber W, J, " <i>Pl</i> 94.	hysico-(Chemic	al Proc	cesses o	of Water	qualit	y conti	rol", N	Viley-Ir	nterscience
lea 4. Qu	cero A, P and rning private li asim, S. R., M ited, 2000.	mited,	2004.				-	-	_		
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Municipal Solid Waste Management (4EV502) 3 - 3 Tre-Requisite Courses: Environmental Engineering Image: Constant Science	Title of the								L	Т	Р	Cr	
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2. CPHEEO, "Manual on Municipal Solid waste management", Central Public Health an Environmental Engineering Organization, Government of India, New Delhi, 2000 3. Tchobanoglous G., "Integrated Solid Waste Management", Tata McGraw-Hill Publishin Company Limited, 1 st Edition, 1993. References: 1. Vosilind, Worrell and Reinhart, "Solid Waste Engineering", Cengage Learning India Pv Ltd., 2. Masters G., "Introduction to Environmental Engineering and Science", Pearson Education 2004 3. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", Tata McGraw-Hi Publishing Company Limited, 1 st Edition, 1985. 4. "MSW Rules 2016", Swachh Bharat Mission and Smart Cities Program of India. Course Objectives: 1. Impart basic skills for design and operation of MSWM systems. 3. Have overview of MSW rules and Government initiatives. Course Learning Outcomes: CO After the completion of the course the student should be able to Pravide knowledge on functional elements of MSW and summarize all Understanding Understanding Understanding Understanding Straight and processing of MSW. IV CO1 Recognize fundamental elements of MSWM to analyze collection, transportation, and processing of MSW. IV CO2 Evaluate processing and disposal system; and to devise suitable plans for rehabilitation of existing MSWM V Evaluating CO3 Evaluate processing and disposal system; and to devise transmistion							Vaste N	lanagen	nent", I	ndian	Nationa	l Scientifi	
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3. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", Tata McGraw-Hi Publishing Company Limited, 1 st Edition, 1985. 4. "MSW Rules 2016", Swachh Bharat Mission and Smart Citics Program of India. Course Objectives: 1. Provide knowledge on functional elements of MSWM. 2. Impart basic skills for design and operation of MSWM systems. 3. Have overview of MSW rules and Government initiatives. Course Learning Outcomes: CO After the completion of the course the student should be able to Bloom's Cognitive CO After the completion of the course the student should be able to CO Recognize fundamental elements of MSW and summarize practices for effective MSW management. I CO2 Apply the fundamental elements of MSWM to analyze collection, transportation, and processing of MSW. IV Analyzing CO3 Evaluate processing and disposal system; and to devise suitable plans for rehabilitation of existing MSWM V Evaluating CO-PO Mapping: PO 1 2 3 4 6 CO2 3 3 3 Seestement: FO		,	troductio	on to E	Inviron	nental l	Enginee	ering an	d Scier	nce", F	Pearson	Education	
Publishing Company Limited, 1 st Edition, 1985. 4. "MSW Rules 2016", Swachh Bharat Mission and Smart Cities Program of India. Course Objectives: 1. Provide knowledge on functional elements of MSWM. 2. Impart basic skills for design and operation of MSWM systems. 3. Have overview of MSW rules and Government initiatives. Course Learning Outcomes: CO After the completion of the course the student should be able to CO Recognize fundamental elements of MSW and summarize practices for effective MSW management. CO Apply the fundamental elements of MSWM to analyze practices for effective MSW management. CO Apply the fundamental elements of MSWM to analyze collection, transportation, and processing of MSW. CO Evaluate processing and disposal system; and to devise suitable plans for rehabilitation of existing MSWM CO-PO Mapping: CO Seessments: Pacher Assessment: Pacher Assessment: Pacher Assessment: Pacher Assessment: No components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and on and Semester Examination (ESE) having 20%, 30% and 50% weights respectively. Marks ISE 1 10 MSE 30 ISE 2 10 ESE 50 SE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.			and Ta	h a h a m	. _1	"East		al Erro		~" т	Sata M	Creary II:	
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ASE: Assessment is based on 50% of course content (Normally first three modules)				0			-			odulaa	.)		

MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with 60-70% weightage for course content

	e Course: Pro							L	Т	Р	Cr
Environm	ental Chemis	try and	Micro	biology	y (4EV5	511)		3	-	-	3
Pre-Requi	isite Courses:	A course	e on cl	nemistr	y at grad	duate le	vel				
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Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Title of the Course: Professional Elective 1	L	Т	Р	Cr
Geo-Environmental Engineering (4EV512)	3	-	-	3

Pre-Requisite Courses: Soil Mechanics

Textbooks:

- 1. G L SivakumarBabu, "Soil Reinforcement and Geosynthetics", Universities Press (India) Pvt. Ltd. Hyderabad, 2006.
- 2. S. K. Gulhati, Manoj Datta, "Geotechnical Engineering", Tata McGraw Hill, New Delhi, 2005.
- 3. Braja Das, "Principles of Geotech. Engg", Thomson Asia Pvt. Ltd, 5th Edition, 2002.
- 4. Fang, H.Y, "Introduction to Environmental Geotechnology", CRC Press, 1997.

References:

- 1. Donald Coduto, "Geotechnical Engineering Principles and Practices Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
- 2. Daniel, D. E, "Geotechnical Practice for Waste Disposal", Chapman and Hall, 1993.
- 3. Koerner, R.M., "Designing with Geosynthetics", Fifth Edition, Prentice Hall, New Jersey, 2005.

Course Objectives:

- 1. To provide students the necessary knowledge and concepts in the field of Subsurface Contamination, their effects, detection and remedial measures.
- 2. To familiarize the students with types and properties of geosynthetic materials, their use for various Civil engineering functions in general and for solid/slurry waste containment in particular.

Course Learning Outcomes:

	After the completion of the course the student should be	Bloon	n's Cognitive
СО	able to	Level	Descriptor
CO1	Describe and Differentiate various engineering properties of soils, available geosynthetic materials, their properties and suitability.	II IV	Understanding Analyzing
CO2	Calculate area requirement of landfill site, Evaluate compaction quality using field tests.	IV V	Analyzing Evaluating
CO3	Describe components of sanitary landfill sites, Analyze stability of landfill embankments, liners and covers.	II IV	Understanding Analyzing

CO-PO Mapping:

PO	1	2	3	4	5	6
CO1			3			
CO2				2		3
CO3				2		3

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc. MSE: Assessment is based on 50% of course content (Normally first three modules)

Comnutati	e Course: Professional Elective 2 onal Methods and Optimization Techniques (4EV515)	L T	Р	Cr
-		3 -	-	3
	site Courses: All Courses in Mathematics for UG			
Textbooks				
	pra S.C. and Canale R.P., "Numerical Methods for Englishing	gineers", 7	Tata Mc	Graw Hil
	lications, 4 th Edition, 2002.			
	u Ram "Numerical Methods", Pearson, 1 st Edition, 2010.			
	ndy A. Taha, "Introduction to O.R.", 6 th edition, (PHI)			
References			T . 1 .	nd n u.e
	guruswamy, E. "Numerical Methods", Tata McGraw-Hill Pu	blishing Co	5. Ltd., 2	2 nd Editior
200 2 Jain		Now Ag	a Intarn	ational (D
	M.K., Iyengar S. R., Jain R. K., "Numerical Methods" ted, 5 th Edition, 2007.	, New Age	e miem	ational (P
	D. Vora, "Quantitative Techniques in Management", 2 nd edition	on (TMH)		
Course Ob)n (11 v 111).		
	provide knowledge of numerical approach and significance o	f error anal	vsis	
	provide necessary knowledge of numerical tools require		•	nd solvin
	plems in the field of engineering.		,	
-	provide pre-requisite statistical knowledge to the students for	analyzing	the data	/results.
	deliver know-how of typical optimization techniques applical			
Course Le	arning Outcomes:	C C		
60	After the completion of the course the student should be	Bloo	m's Co	gnitive
CO	able to	Level	De	scriptor
				scriptor
	Solve linear, nonlinear equations, ODE and PDE by		Δ	nnlying
CO1		111	A	DDIVINS
CO1	numerical methods.	III	A	pplying
	numerical methods. Analyze data using various methods of regression and	1		
CO1 CO2	numerical methods.			nalyzing
	numerical methods. Analyze data using various methods of regression and	1	Aı	
CO2 CO3	numerical methods. Analyze data using various methods of regression and interpolation. Propose optimal solution using appropriate techniques.	IV	Aı	nalyzing
CO2	numerical methods. Analyze data using various methods of regression and interpolation. Propose optimal solution using appropriate techniques. apping:	IV V	Aı	nalyzing
CO2 CO3	numerical methods. Analyze data using various methods of regression and interpolation. Propose optimal solution using appropriate techniques. apping: PO 1 2 3 4 5	IV	Aı	nalyzing
CO2 CO3	numerical methods. Analyze data using various methods of regression and interpolation. Propose optimal solution using appropriate techniques. apping: PO 1 2 3 4 5 CO1 1 1 1	IV V	Aı	nalyzing
CO2 CO3	numerical methods. Analyze data using various methods of regression and interpolation. Propose optimal solution using appropriate techniques. apping: PO 1 2 3 4 5 CO1 1 1 1 CO2 2 2 1	IV V	Aı	nalyzing
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CO2 CO3 CO-PO Ma Assessmen Teacher Aa	numerical methods. Analyze data using various methods of regression and interpolation. Propose optimal solution using appropriate techniques. apping: PO 1 2 3 4 5 CO1 1 1 1 CO2 2 2 1 1 CO3 1 1 1 1 ts:	¹ IV V 6		alyzing
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ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Title of the				ctive 2				L	Т	Р	Cr
Water Qual	ity Modelin	Ig (4EV	516)					3	-	-	3
Pre-Requisi	te Courses:	Basics	of hydı	aulics a	and wate	er qualit	у				
Modi 2. Chap 3. Wals References: 1. Lee (Hill H 2. Todd 3. Metc	banoglous (fications", <i>A</i> ra S., "Surfa ki, Chase an C. C and Li Publication, 2 D. K., "Gro alf and Edd cation, 6 th R	Addison ace Wat <u>d Savic</u> n S. D. 2 nd Edit oundwat dy, "W	-Wesle er Qual , "Wate , "Han ion 200 ter Hyd astewat	y publis lity Mod er Distri d book 07. rology"	shing co deling", <u>bution 1</u> of envi	ompany, Tata M Modelin ronmen Viley &	Reprin c-Graw u <u>g", Hao</u> tal engi Sons, S	t 1987. Hill, 1 estad P ineerin Second	997. ress, Fi g calcu Editio	irst editi ilations' n, 2007	ion, 2007. '', McGra
 Imparsurface Enharmode 	rt in-depth ce sources. nce technica	al comp	-		-			-	•		
	After the co	mpletio	on of the	e course	the stu	dent sho	uld be		Bloo	m's Co	gnitive
	able to]	Level	De	scriptor
CO1	Explain and pollutant trawater.		-	-			-		II III		erstanding pplying
	Analyze and quality varia		ate the	proces	ses con	tributing	g to wa	ter	IV V		nalyzing valuating
1 1 1 2	Apply the m design of en			-	ering fo	r the an	alysis a	ind	III	A	pplying
CO-PO Maj	pping:										
		PO CO1 CO2	1	2	3 3	4	5	6			
	·	CO2				5		3	_		
Assessments Feacher Ass				-	-			•			
Two compor End Semeste											E) and or
			essmen				Mai				
			SE 1				1(
			MSE 2				30				
			SE 2 ESE				<u>1(</u> 5(
ISE 1 and IS	E 2 are base			nt/decla	red test	/quiz/se					
MSE: Assess ESE: Assess	sment is base	ed on 5	0% of c	course c	ontent (Normal	ly first	three m		,	rse conte
normally lo											

(normally last three modules) covered after MSE.

	e Course:			, .		/ 4	***		L	Т	P	Cr
	ental Chemistry				aborate	ory (4E	V551)		-	-	4	2
	isite Courses: E	ngineeri	ng Che	emistry								
Fextbooks			d Taba	h		· F i		1 En ein		" M.C		1 1
	avy H. S., Rowe l npany, 1 st Edition		a rene	obanogio	Jus G,	Enviro	nmenia	i Engine	eering	, MCG	raw-mi	1 000
	czar Jr., M.J.E.C		eg R	Noel	and Del	lozar M	[F "]	Microbi	alagy"	Tata	McGray	w Hi
	blishing Company					iczai iv	1. 1., 1	VIICIOUI	ology	, Tata	MCOIa	vv 111
	wyer C.N. and M	-				or Envi	ronment	al Eng	ineers'	'. Tata	McGra	w-Hi
	blishing Company							2.18		,		
Reference	<u> </u>			,								
1. An	nerican Public H	ealth As	ssociat	ion (AP	PHA), "	Standa	rd Meth	ods for	the E	xamina	tion of	Wate
anc	d Wastewater", 2	3 rd Editi	on, 20	17.				·			Ū	
2. Me	etcalf and Eddy "	Wastew	ater Er	igineerii	ng Trea	tment a	nd Reus	se", Tat	a McG	raw Hi	ll Publi	catior
6th	Reprint. 2003.											
Course O	bjectives :											
	provide hands-o	-	ce for	analyzi	ng the	water a	ind was	tewater	by ph	ysical,	chemic	al an
	trumental method		. .									
	provide fundame											
	impart knowledg		crobiol	ogy and	bacteri	al ident	ificatio	n.				
Course Le	earning Outcom	es:										
~ ~				_					B	loom's	Cognit	tive
CO	After the compl	etion of	the co	urse the	studen	t should	l be able	e to	L	evel	Desci	rinto
	Experiment wa	otor/was	townto	r quality	, opolya	is throu	ah phys	vical		ever	Deser	-pro-
CO1	chemical, biolo				•		• • •	sical,]	II	App	lying
		-							1	II	Ann	lying
CO2	Analyze and in	terpret	data ac	equired	from the	e exper	iments.			V	Anal	
											Anal	
CO3	Identify types of	of cells,	bacteri	a by usi	ing prop	er stair	ing met	thods.]	V		J8
CO-PO M	lapping:											
		PO	1	2	3	4	5	6]			
		CO1			2	3			_			
		CO2			2	2						
		CO3			2	1						
Assessmer	nts:	<u> </u>		<u> </u>	<u> </u>	1	<u>I</u>	1	1			
Г <mark>eacher</mark> А	ssessment:											
n Semeste	er Evaluations (IS	SE 1 & I	SE 2),	Mid Se	mester	Evaluat	ion (MS	SE) and	End S	emeste	r Exami	inatio
ESE) have	e 25% weights ea	ich.										
	Ass	sessmen	t					Mark	S			
	-	ISE 1						25				
		MSE						25				
		ISE 2						25				
		ESE						25				
SE 1, ISE	E 2 and MSE ar		on ex	perimer	ntal wor	rk/perfo	ormance	-	oratory	/assign	ment/de	eclare

Title of the Course:								L	Т	Р	Cr
Water Treatability Stu	dies Labo	ratory	(4EV55	52)			-	-	-	4	2
Pre-Requisite Courses:	Physico-C	Chemica	al Meth	ods for	Water a	nd Wa	stewater	Treati	nent		
Textbooks:	-										
1. Peavy H, S, Row Company, Intern				ous G, '	'Enviro	nmenta	l Engine	ering"	', McGı	aw-Hill	l Book
 Metcalf and Edd 6th Reprint, 2003 		ater En	igineerii	ng Trea	tment a	nd Reu	se", Tata	ı McG	raw Hi	ll Publi	cation,
3. "Manual on wate Delhi, 1999.	er supply a	ind Tre	atment'	', CPHI	EEO, M	linistry	of Urba	n Dev	elopme	ent, Gol	, New
References:											
1. Sincero A, P and private limited, 2		G, A, '	Enviro	nmenta	l Engin	eering	A Desig	n app	roach",	PHI le	arning
2. Sawyer and Mct 2003.	-	-				-					
3. Clesceri, L. S., C Water and Waste	water, Wa	shingto	n, D.C.	, 21st E	Ed., 200	1.					
4. Quasim, S. R., " 2010.	Water trea	tment	plants p	olanning	g, desig	n and c	peration	", CR	C Pres	s, 2 nd E	dition,
Course Objectives:											
 To provide expose To provide an op set ups by applyi 	portunity t	o contr	ibute in	dividua	ally/ in g	groups			-		
Course Learning Outco	• •		L	-							
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	1							Le	evel	Desc	riptor
CO1 Design exp techniques a		oy app	olying t	he acq	uired	knowle	dge on	,	VI	Crea	ating
CO2 Carry out estimation, teams.	1					· •]	III	App	lying
CO3 Analyze, cr application cresults.	—		-	-			-		IV V		yzing ıating
CO-PO Mapping:											
•• •	PO	1	2	3	4	5	6				
	C01			3	-						
	CO2			3							
	CO3				3	1					
Assessments:	<u> </u>						· 1				
Teacher Assessment:											
	(ISE 1 & 1	(SE 2),	Mid Se	mester	Evaluat	tion (M	SE) and I	End S	emeste	r Exami	nation
Teacher Assessment:	•	(SE 2),	Mid Se	mester	Evaluat	ion (M	SE) and I	End S	emeste	r Exami	nation
Teacher Assessment: In Semester Evaluations (ESE) have 25% weights	•	(SE 2),	Mid Se	mester	Evaluat	ion (M		End S a rks	emeste	r Exami	nation

Title of the	e Course:							L	Т	Р	Cr
Biological	Methods for	r Wastev	vater T	Freatm	ent (4E	V521)		3	-	_	3
Pre-Requi	isite Courses	S: A cour	se on V	Wastew	ater Tre	atment	at gradu	ate lev	el and	Physico	-Chemical
	or Water and									-	
Textbooks											
	avy H, S, Ro				oglous (G, "Env	vironme	ntal En	gineeri	ng", M	cGraw-Hill
	ok Company,					т (,	1 D	" т		C II.11
	etcalf and Ed				ineering	g Treati	ment a	nd Reu	ise", I	ata Mc	Graw Hill
	blication, Ind				nvironn	nontal F	Ingingo	ring 2	nd Ed	ition b	w Tom D
	ynolds and Pa						-	-	na La	ition, u	y tom D.
Reference			cilaras,	,1 (0)1	uonsin	ng com	ipany, i	<i>))]</i> .			
1. Dro	oste, Ronald ition, 2009.	L "Theo	ry and	Practice	e of Wa	ater and	Wastev	vater T	reatme	ent", Wi	ley student
2. Cri	tes Ron and	Tchoban	oglous	George	e, "Sma	and i	Decentr	alized	Wastev	vater M	lanagement
-	<i>stems</i> ", McGr				•						
	ncero A, P a			А, "Ел	nvironm	ental E	Engineer	ring A	Design	n appro	oach", PHI
	rning private										
-	asim, S. R., "	Wastewa	ater trea	atment j	plants p	lanning	, design	and op	eration	n", CRC	Press, 2nd
	ition, 2010.										
Course Ol	•		and f	ald 1.		- for 41	1	d	:		luction of
	provide con		and H	iela kno	owledge	e for u	ne anal	ysis, a	esign -	and eva	aluation of
hio											
	ological proce	esses of w	vastewa	ater trea	tment.		racaaral	-	addraad	the p	roblams of
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2. To ind	logical proce enhance the lustry/society	esses of w e technic related to	astewa al con o waste	ater trea npetenc ewater t	tment. y to co reatmer	onduct 1	research	-	address	s the p	roblems of
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Textbooks 1. Wa	rk and V	Warner,	, "Air l	Pollutic	on", C.F	., H.R.							
3. Ma	vers N., rtin Cra												
197 Reference													
1. Ric Nev	hard W w York,	Third e	edition	, 1994.									Press
3. Rao	rn A. C. DH.V.N	I. and R										94.	
	ojective provide ferent ty	knowl	0	1 .		-		eorology	y and it	s relati	on to ai	r poll	lutior
Course Le		+	-			quipin							
				n of the	e course	the stu	dent sh	ould be		Bloo	m's Co	gniti	ve
CO	able to		- r]	Level	1	scrip	
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Environm	e Course: Pr							L	Т	Р	Cr
	ental Manag	ement S	System	s (4EV5	531)			3	-	-	3
Pre-Requi	isite Courses:	: Enviro	nmenta	l Engin	eering (Course a	at Gradu	ate Lev	vel		
Textbooks	5:										
	nter, L. W., E										
	arwal, N. P., I										
	lith, P. and I							nent fo	or Was	ste Trea	atment an
Reference	posal Faciliti	es, John	wiley	& Sons	, 1st Ed	1tion, 1	994.				
	s: nvironmental	Auditing	r" Pub	lished h	W CPCF	B Govt	of Indi	a Publi	cation	New D	elhi
	askar, A.K., I				•						CIIII.
	Whitelaw and			,				,		k. 1997	
Course Ob			, , ,				<u> </u>			,	
	provide know	ledge of	f ecolo	gical asp	pects.						
	provide know	-			-	s.					
	provide know										
	provide nece							ed for	assessi	ng, ana	lyzing an
	ving problems		field of	environ	mental	manage	ement.				
Course Le	earning Outco	omes:									
CO	After the co	ompletio	n of the	e course	the stu	dent sho	ould be		Bloo	m's Co	gnitive
	able to							Ι	Level	De	scriptor
	Explain eco						s of				
CO1	pollution ar	nd percer	ive env	ironmei	ntal ethi	cs and			II	Und	erstanding
	legislation.	• ,	- (1	1 1		1	1.4.	1	TTT		1 '
CO2	Choose app	-	metho	dology	for EIA	and au	diting ai	nd	III		pplying
	assess the in Justify EMS	-	wironn	oontol N	Ionogon	nont Dle	n for		IV	Al	nalyzing
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CO-PO M			nics.								
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		CO2			2	2					
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	e Course: P s Waste Ma		t (4EV						Т	Р	Cr
Pro Poqui	site Course	e		•	strial W	acta trac	tmont	3	-	-	3
Textbooks		s. waster									
1. LaC	• Grega, M. D tion, McGra			P. L. a	and Eva	ins, J. C	C., Haza	rdous	Waste	Manage	ment, 2 ^r
	tcalf and E blication, 6 th			er Engi	ineering	Treatn	nent an	d Rev	ise", T	ata McC	Braw Hi
References		Keprint, I	2003.								
 Sine lear We Lev 	cero A, P a ning private ntz, C. A., H vandowski	limited, Iazardous G.A. and	2004. Waste	Manag	ement, 2	2nd Ed.	, McGra	w Hill	l, 1995.		
	ey & Sons,	1998.									
Course Ob	•	1. 1 1 .	16	1 1 .							
2. To	vide in-dept enhance the elopment, ir	e technica	al com	petency	and ap	ply the	-	ed kno	wledge	e for rese	earch an
Course Le	arning Out								DI	• •	• , •
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						<u> </u>			Level	Des	criptor
CO1	Explain transportat hazardous	tion, site	terizati remed	,	waste and risk		imizatio ated wi	<i>'</i>	II	Under	standing
CO2	Explain a methods o	f treating	hazard	lous was	ste.				II III		standing plying
CO3	Design tr waste.	eatment	and di	isposal	facilitie	es for	hazardo	us	VI	Cr	eating
CO-PO M	apping:			-							
		PO	1	2	3	4	5	6	_		
		CO1			2				_		
		CO2				2			_		
•	4	CO3				2		2			
Assessmen Feachar A	ssessment:										
	onents of In	Semeste	r Evalı	ution (ISE) O	ne Mid	Semest	er Exa	minatio	on (MSE) and or
I wo comp				`	<i>,</i> .					•) und on
1			essmen	-			Mar	-	y		
1							10				
1		I	SE 1								
1			ASE I				30				
1		N I	ASE SE 2				10				
End Semes		N]	MSE SE 2 ESE				10 50				
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	Course: Pro			ctive 4				L	Т	Р	Cr
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-	ite Courses:	Buildir	ng Mate	erials an	d Const	truction	, Buildi	ng Plan	ining a	nd Desi	gn
	ewable Energ	gy: Pow	er for S	Sustaina	ble Futi	ure, Ed.	By God	lfrey B	oyle, C	Oxford U	Jniv. Press,
	d Edition. ual of tropic	cal Hou	ising a	nd Buil	lding- (Climatio	c Desig	n by I	Koenig	sberger	, Ingersoll,
•	hew, Szokola	•									
K. S	rnative Build . Nanjunda R	-	terials a	and Tec	hnologi	ies by K	K.S. Jaga	adish, l	B.V.Ve	enkatara	ma Reddy,
References			D!1	din a Di	anian fi		ant Int			her N	V Dolvor
	ive and Low lished by Cor	-	•	-	-	-		ind Ch	mates	- by IN.	v. Daker,
	gy Policy in					•		Pub. L	.td. Lo	ndon.	
	ld Energy In										y, London,
2014											
Course Ob	,		•			1 •			c		
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	mpress upon effectiveness		-						-		-
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and	operational p	hases.				•	C	Ĩ		C	
Course Lea	rning Outco	omes:									
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	building sys				J. J.	- 61					
	Apply the co	1				0		1			
CO3	passive and		0			maximi	ze hum	an	III	A	pplying
<u> </u>	comfort in b	ouilding	s for tro	opical re	egions.						
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	Course: Pro							L	Т	Р	Cr
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Pre-Requis	site Courses:	A cour	se on V	Wastewa	ater Tre	atment	at gradu	ate lev	el and	Physico	o-Chemical
-	r Water and W						0			J	
Textbooks:											
	vy H, S, Rowe	e D, R,	and T	chobanc	glous (G, "Env	ironmen	tal Eng	gineeri	ng", M	cGraw-Hil
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	lication, India	•		-	L L				,		
	t Operations				nvironm	nental E	Ingineer	ing, 2	nd Ed	ition, b	y Tom D
	nolds and Pau						-	-			•
References	•						-				
	ste, Ronald L ion, 2009.	"Theor	y and	Practice	e of Wa	ter and	Wastew	vater Ti	reatme	nt", Wi	ley studen
	es Ron and T	choban	oglous	George	e "Sma	ll and I	Decentro	alized V	Wastev	vater M	anagemen
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	sim, S. R., "W			atment r	lants p	lanning	design	and op	eratior	" CRC	Press. 2nd
-	ion, 2010.			r	P			°P		-,	
Course Ob	,										
	provide conc	entual	and fi	eld kno	wledge	o for th	e anals	veie de	asian	and ev	aluation of
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CO2	Analyze and systems used					iemical	treatme	nt	IV		nalyzing aluating
		i in wai					<u> </u>		V	EV	amaing
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CO3	Design physic		chem	ical trea	unioni s	ystems	for wate	r	VI	C	creating
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Textbook	s:											
1. Wa	ayne T. D., Air P	ollution	Engine	ering N	Ianual,	John W	iley & Son	is, 20	000.			
2. Ra	o C. S., Environi	nental P	ollution	n Contro	ol Engir	neering,	New Age	Int. l	Pubs, 2	2005.		
3. "N	Ianual for wet an	d dry de	positin	g", CPC	CB Meth	nods, Co	entral Lab	test r	nethod	ls, 200	1.	
2. Pri 2. Na and 3. W3 Course O	ncero A. P. and wate limited, 200 athanson J. A. d Pollution contro ark K. and Warne	04. "Basic ol", PHI er C.F., '	Enviro Publis Air Po	onmenta hing Co ollution'	al tech mpany, ', C.F., l	nology 5th Edit H.R. Pu	for wate tion, 2009. blication, 1	r su IstEc	ipply, lition,	waste 1978.	e manag	gement
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ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	
Module 1: Engineering Research Process	6 Hrs.
Meaning of research problem, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Definition, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.	
Module 2: Research Methodology Tools	7 Hrs.
Problem statement formulation, resources identification for solution, Experimental and Analytical modelling, Numerical and Statistical methods in engineering research, Software tools like spread sheets.	
Module 3: Research Ethics and Report Writing	6 Hrs.
Effective literature studies approaches, critical analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper. Presentation of paper/report/seminar.	
Module 4: Introduction to IPR and Patents	7 Hrs.
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies	
Module wise Outcomes:	
 At end of each module students will be able to: Identify and formulate the research problems, state the hypothesis, design a research layout, set a research process and methodology. Apply research tools to obtain solution to research problem. Analyze critically existing literature and prepare seminar, write research article and report. Create IPR in his domain of research and produce patent. 	