17EV101						
	_	STATISTICS FOR ENVIRONMENTAL ENGINEERS	L	T	P	C
	_		3	2	0	4
~ ~ ~ ~	•	(Common to Full time and Part Time)				
Course Ob	0					
		duce the basic concept of Stochastic Processes				
		le the students in handling Estimation and Testing of Hypothesi	is			
	3. To learn	the Application of Statistics in Engineering Decision Making				
Unit I	Probability	and Random Variable		9.	+ 3 H	mrs
Probability Binomial -	concepts – Poisson - re	Random Variables – Moment generating function – Sta ctangular or Uniform – Normal - Exponential distributions - nal random variables.		dist	ributic	ons -
Unit II	Stochastic	Processes		9	+ 3 H	ours
Classificati	on – Stationar	y and Random process – Markov process – Markov chains – T chain – Limiting distribution – First passage time – Poisson pro		on pro	obabil	ity –
Unit III	Estimation	Theory		9	+ 3 H	ours
determining	Point and I	nterval estimates for population parameters of large sample size- unbiased Estimators- Maximum Likelihood Estimat		small	sam	ples,
Unit IV	Testing of 1	Aypothesis- Parametric Tests		0	+ 3 H	ours
Hypothesis	testing: one s	ample and two sample tests for means and proportions of larg		ples	z-test,	one
Hypothesis sample and ANOVA or Unit V Chi-square goodness o	testing: one s two sample ne and two wa Non Param test for sing	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification.	e stand	aples f lard o 9 f attri	z-test, leviat + 3 H butes	one ions. ours and
Hypothesis sample and ANOVA or Unit V Chi-square goodness o	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M	e stanc ence of Iann –	ples and control of the second	z-test, leviat + <u>3 H</u> butes ney U	one ons. ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test l Wallis test.	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M	e stand	ples and control of the second	z-test, leviat + 3 H butes	one ons ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test d Wallis test.	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To	e stand ence of Iann –	ples alard of attributed by the second secon	z-test, leviat + <u>3 H</u> butes ney U	one ons ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test l Wallis test.	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M	e stand ence of Iann –	ples alard of attributed by the second secon	z-test, leviat + <u>3 H</u> butes ney U	one ons ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test Wallis test.	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r	e stand ence of Iann –	ples alard of attributed by the second secon	z-test, leviat + <u>3 H</u> butes ney U	one ons ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test l Wallis test. eading Sampling, d After compl	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to	e stand ence of Iann –	ples alard of attributed by the second secon	z-test, leviat + <u>3 H</u> butes ney U	one ons ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test d Wallis test. eading Sampling, d After compl 1. To acque	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to ire knowledge in basic concepts of Probability	e stand ence of fann – otal:	ples : lard c 9 f attri Whit 45 +	z-test, leviat + 3 H butes ney U 15 H	one ons ours and test
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Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing f fit. Sign test d Wallis test. eading Sampling, d After compl 1. To acqu 2. To char 3. To estin	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to ire knowledge in basic concepts of Probability acterize phenomenon which evolve with respect to time in a pro- nate the sample size and prediction of unknown values	e stand ence of fann – otal:	ples : lard c 9 f attri Whit 45 +	z-test, leviat + 3 H butes ney U 15 H	one ons ours and test
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska	testing: one s two sample ne and two wa Non Param test for sing fit. Sign test al Wallis test. eading Sampling, d After compl 1. To acqu 2. To char 3. To estin 4. To solv	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to irre knowledge in basic concepts of Probability acterize phenomenon which evolve with respect to time in a pro- nate the sample size and prediction of unknown values e Parametric and non - parametric statistical problem	e stand ence of fann – otal:	ples : lard c 9 f attri Whit 45 +	z-test, leviat + 3 H butes ney U 15 H	one ons ours and test
Hypothesis sample and ANOVA of Unit V Chi-square goodness o and Kruska Further Ro Course Ou	testing: one s two sample ne and two wa Non Param test for sing fit. Sign test d Wallis test. eading Sampling, d tcomes: After compl 1. To acqu 2. To char 3. To estin 4. To solv 5. To appl	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to ire knowledge in basic concepts of Probability acterize phenomenon which evolve with respect to time in a pro- nate the sample size and prediction of unknown values	e stand ence of fann – otal:	ples : lard c 9 f attri Whit 45 +	z-test, leviat + 3 H butes ney U 15 H	one ons ours and test
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Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska Further Ro Course Ou Course Ou References 1. Jay L. 2002. 2. Richard	testing: one s two sample ne and two wa Non Param test for sing fit. Sign test adding sampling, d After compl 1. To acqu 2. To char 3. To estin 4. To solv 5. To appl s: Devore, "Production of the series"	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to ire knowledge in basic concepts of Probability acterize phenomenon which evolve with respect to time in a pro- nate the sample size and prediction of unknown values e Parametric and non - parametric statistical problem y statistical techniques for solving Engineering problems	e stand ence of fann – otal: method	9 f attri Whit 45 +	z-test, leviat + 3 H butes ney U 15 H anner Duxt	one ours anc tes
Hypothesis sample and ANOVA of Unit V Chi-square goodness o and Kruska Further Ro Course Ou Course Ou References 1. Jay L. 2002. 2. Richare Edition	testing: one s two sample ne and two wa Non Param test for sing fit. Sign test adding Sampling, d tcomes: After compl 1. To acqu 2. To char 3. To estin 4. To solv 5. To appl s: Devore, "Prod d Johnson. "Na, 2007.	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to itre knowledge in basic concepts of Probability acterize phenomenon which evolve with respect to time in a pro- nate the sample size and prediction of unknown values e Parametric and non - parametric statistical problem y statistical techniques for solving Engineering problems bability and Statistics For Engineering and the Sciences", Th filler & Freund's Probability and Statistics for Engineer", Pr	e stand ence of fann – otal: method obabilis	and and and - Ha	z-test, leviat + 3 H butes ney U 15 H anner Duxt	one ours anc tes
Hypothesis sample and ANOVA or Unit V Chi-square goodness o and Kruska Further Ro Course Ou References 1. Jay L. 2002. 2. Richard Edition 3. Gupta	testing: one s two sample ne and two wa Non Param test for sing fit. Sign test twallis test. eading Sampling, d tcomes: After compl 1. To acqu 2. To char 3. To estin 4. To solv 5. To appl s: Devore, "Prod d Johnson. "Na, 2007. S.C. and Kapo	ample and two sample tests for means and proportions of larg tests for means of small sample t-test, F-test for two sample y classification. etric Tests e sample standard deviation. Chi-square tests for independe for paired data. Rank sum test. Comparing two populations. M To istribution, correlation, regression curve fitting by least square r etion of the course, Student will be able to ire knowledge in basic concepts of Probability acterize phenomenon which evolve with respect to time in a pro- nate the sample size and prediction of unknown values e Parametric and non - parametric statistical problem y statistical techniques for solving Engineering problems bability and Statistics For Engineering and the Sciences",Th	e stand ence of fann – otal: method obabilis	and and and 001.	z-test, leviat + 3 H butes ney U 15 H anner Duxt	one ions and tes ours ours ours

17EV102			т		п	C
	-	ENVIRONMENTAL CHEMISTRY	L 3	T 0	P	C 3
	-		3	U	0	3
	• • • • • • • •	(Common to Full time and Part Time)				
Course Ob						
		cate the students about water chemistry				
		art knowledge in the area of air and soil chemistry	•			
	3. To imp	art knowledge on the transformation of chemicals in the en-	vironment			
TT •4 T	T (T (1				0.11	
Unit I	Introductio		1 //17	> 1		ours
precipitation	n, amphoteric	balance-Chemical equilibria, acid base, solubility pr hydroxides,CO ₂ solubility in water and species distribut of green chemistry.				
Unit II	Aquatic Ch	emistry			11 H	ours
		environmental significance and determination; Fate of	chemical	s ir		uatic
	of synthetic s – sorption-	ation, partitioning, hydrolysis, photochemical chemicals-Metals, complex formation, oxidation and redu Colloids, electrical properties, double layer theory, envi	ction, pE	E – pH	diagr	
Unit III	Atmosphor	in Chamistry			7 1	ours
		ic Chemistry	0.000	a 1arra		
		chemical and photochemical reactions – photochemical sm				
		lobal warming, CO ₂ capture and sequestration – Acid rain-	origin an	a com	positio	on or
particulates.	. Air quanty p	arameters-effects and determination.				
Unit IV	Soil Chemis	.4			0.11	ours
		f soil-Clays- cation exchange capacity-acid base and ion-e	vohoncon	anatio		
Agricultural		in soil-Reclamation of contaminated land; salt by le				
** ***						
Unit V	Environme	ntal Chemicals			9 H	ours
Unit V Heavy me		ntal Chemicals 1 speciation – Speciation of Hg & As- Organic	chemic	als-	9 H Pestic	ours ides,
Heavy me Dioxins,PC	etals-Chemica	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials,			Pestic	ides,
Heavy me Dioxins,PC	etals-Chemica Bs,PAHs and	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials,	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen	etals-Chemica Bs,PAHs and tal applicatior	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials,			Pestic	ides, sites,
Heavy me Dioxins,PC	etals-Chemica Bs,PAHs and tal applicatior ading	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, as.	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen Further Re	etals-Chemica Bs,PAHs and tal application ading To analyze a	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials,	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes:	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, as.	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen Further Re	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen Further Re	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to uish the chemistry involved	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen Further Re	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting 2. Underst	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, as. and create a solution for environmental issues. etion of the course, Student will be able to aish the chemistry involved and the chemistry involved in water	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen Further Re	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting 2. Underst 3. Identify	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to ish the chemistry involved and the chemistry involved in water and solve the air pollution related issues	CNT, tita		Pestic ompo	ides, sites,
Heavy me Dioxins,PC environmen Further Re	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting 2. Underst 3. Identify 4. Underst	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to tish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues	CNT, tita	unia, c	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re	ading To analyze a tromes: After compl 1. Disting 2. Underst 3. Identify 4. Underst	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to tish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues contaminating chemicals and can work out chemicals need	CNT, tita	unia, c	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re Course Out	ading To analyze a tromes: After compl 1. Disting 2. Underst 3. Identify 4. Underst 5. Identify purpose	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to tish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues contaminating chemicals and can work out chemicals need	CNT, tita	unia, c	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re Course Out	ading To analyze a tromes: After compl 1. Disting 2. Underst 3. Identify 4. Underst 5. Identify purpose	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to iish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues contaminating chemicals and can work out chemicals need	CNT, tita Total:	ons fo	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re Course Out References 1. Sawyer	etals-Chemica Bs,PAHs and tal application rading To analyze a tcomes: After compl 1. Disting 2. Underst 3. Identify 4. Underst 5. Identify purpose ,C.N., MacCa	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to ish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues contaminating chemicals and can work out chemicals need rty, P.L. and Parkin, G.F., Chemistry for Environmental En	CNT, tita Total:	ons fo	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re Course Out References 1. Sawyer 2. Science	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting 2. Underst 3. Identify 4. Underst 5. Identify purpose c.N., MacCa a, Tata McGra	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to tish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues contaminating chemicals and can work out chemicals need rty, P.L. and Parkin, G.F., Chemistry for Environmental En w – Hill, Fifth edition, New Delhi 2003.	CNT, tita	ons fo	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re Course Out Course Out Sawyer 2. Science 3. Colin B	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting 2. Underst 3. Identify 4. Underst 5. Identify purpose ; ,C.N., MacCa a, Tata McGra aird "Environ	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to uish the chemistry involved and the chemistry involved in water and solve the air pollution related issues contaminating chemicals and can work out chemicals need rty, P.L. and Parkin, G.F., Chemistry for Environmental En w – Hill, Fifth edition, New Delhi 2003. mental Chemistry ^{**} , Freeman and company, New York, 199	CNT, tita	ons fo	Pestic omposition 45 H	ours
Heavy me Dioxins,PC environmen Further Re Course Out References 1. Sawyer 2. Science 3. Colin B 4. Manaha	etals-Chemica Bs,PAHs and tal application ading To analyze a tcomes: After compl 1. Disting 2. Underst 3. Identify 4. Underst 5. Identify purpose c.N., MacCa c, Tata McGra aaird "Environ an, S.E., Envir	l speciation –Speciation of Hg &As- Organic endocrine disruptors and their Toxicity- Nano materials, is. and create a solution for environmental issues. etion of the course, Student will be able to tish the chemistry involved and the chemistry involved in water and solve the air pollution related issues and the soil related chemistry and issues contaminating chemicals and can work out chemicals need rty, P.L. and Parkin, G.F., Chemistry for Environmental En w – Hill, Fifth edition, New Delhi 2003.	CNT, tita	ons fo	Pestic omposition 45 H	ours

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17EV103	<u> </u>	ENVIRONMENTAL MICROBIOLOGY	L	T	P	C
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		(Common to Full time and Part Time)				
microorgan Unit II	 The construction The maginee The maginee The maginee The maginee The maginee The maginee An exp The construction The	icrobiology of wastewater, sewage sludge and solid waste treatmed. Aspects on nutrient removal and the transmission of disease covered. posure to toxicology due to industrial products and byproducts are purse provides a basic understanding on microbiology relevatering for candidates with little prior knowledge of the subject.	nt to ba, vir hent p ausin ausin also nt to	envi uses, roces g orga cover envi Prese	ronma and a ses is anisma ed. ronma 5 H a rvatio	ental ilgae also s are ental n of ours
	n of microorg	anisms - Distribution / diversity of Microorganisms - fresh and				
microbes in archaebacte Biogeocher	surface soil, eria – Signi	Air – outdoor and Indoor, aerosols, biosafety in Laboratory – Ex ficance in water supplies – problems and control. Tra Hydrological - Nitrogen, Carbon, Phosphorus, Sulphur, Cyo	treme nsmis	Envi sible	ronme disea	ent – ases.
Unit III	Motabolism	n of Microorganisms			10 H	oure
		m in microorganisms, growth phases, carbohydrate, protein,	linid	met		
respiration,	aerobic and	anaerobic-fermentation, glycolysis, Kreb"s cycle, hexose mon , oxidative phosphorylation, environmental factors, enzymes, Bic	opĥos	phate	path	
Unit IV	Pathogens	in Wastewater			10 H	ours
Transmissio Coliforms Control of oxidation, f	on of pathogo - total c microorganis 3-oxidation, n	orne pathogens and Parasites and their effects on Human, Anir ens – Bacterial, Viral, Protozoan, and Helminths, Indicator o coliforms, E-coli, Streptococcus, Clostridium, Concentration an sms; Microbiology of biological treatment processes – aerobio itrification and de-nitrification, eutrophication. Nutrients Remove of Sewage Sludge.	rganis d det c and	ection anae	f wat 1 of v erobic	er – irus. , □-
Unit V	Toxicology				10 H	ours
		s and toxicity, Factors influencing toxicity. Effects – acute, chro	nic, T	est or		
toxicity test	ing, Bioconce	entration – Bioaccumulation, biomagnification, bioassay, biomon	itoring	g, bio	leachi	ng.
		Tot	al:		45 H	ours
Further Re	eading					
		on and culturing of microorganisms from different sources				
Course Ou	tcomes:					
Course Ou		letion of the course, Student will be able to				
Course Ou	After comp	letion of the course, Student will be able to indidate at the end of the course will have a basic understand	ing o	n the	basic	s of
Course Ou	After comp 1. The ca microb	indidate at the end of the course will have a basic understand iology and their diversity and on the genetic material in the living	g cell.			
<u>Course Ou</u>	After comp 1. The ca microb 2. The ca	indidate at the end of the course will have a basic understand	g cell. nicroo	rgani	sms ir	

		3. The candidate would have understood the role microbial metabolism in a wastewater
		treatment plant.
		4. The candidate would know the role of microorganisms in contaminated water and the
		diseases caused.
		5. The candidate has the ability to conduct and test the toxicity due to various natural and
		synthetic products in the environment.
Re	ferences:	
1.	S.C.Bha	tia, Hand Book of Environmental Microbiology, Part 1 and 2, Atlantic Publisher
2.	Gabriel	Bitton, Wastewater Microbiology, 2nd Edition,
3.	Raina M	I. Maier, Ian L. Pepper, Charles P. Gerba, Environmental Microbiology, Academic Press.
4.	SVS. Ra	ana, Essentials of Ecology and Environmental Science, 3rd Edition, Prentice Hall of India Private
	Limited	
5.	Stanley	E. Manahan, Environmental Science and Technology, Lewis Publishers.
6.	Hurst, C	C.J. (2002) Manual of Environmental Microbiology. 2nd Ed. ASM PRESS, Washington, D.C.
	ISBN 1-	-55581 - 199 - X.
7	F 1 C	

7. Frank C. Lu and Sam Kacew, LU"s Basic Toxicology, Taylor & Francis, London (4th Ed), 2002

		Department of Civil Engineering				
17EV104		TRANSPORT OF WATER AND WASTEWATER	L	Т	P	C
			3	0	0	3
		(Common to Full time and Part Time)				
Course Ob	V					
		cate the students in detailed design concepts related to wate	r trans	missi	on m	ains,
	water di	istribution system, sewer networks and storm water drain				
	2. To educ	cate the students in computer application on design.				
Unit I		draulics and Flow Measurement				ours
		ow - continuity principle, energy principle and momentum pri		fricti	ional	nead
loss in free	and pressure f	low, minor heads losses, Carrying Capacity-Flow measuremen	t.			
Unit II	Water Trai	nsmission and Distribution			10 H	ours
Need for T	ransport of w	ater and wastewater-Planning of Water System -Selection of	pipe n	nateri	als, W	ater
		gn- gravity and pumping main; Selection of Pumps- char				
		and maintenance, water hammer analysis; water distribution				
-		•				
analysis an	d optimizatio	n – appurtenances – corrosion prevention – minimization o	f wate	r loss	ses –	leak
detection St	torage reservo	irs.				
	-					
Unit III		r Collection and Conveyance			10 H	
Planning fa	ctors – Desig	n of sanitary sewer; partial flow in sewers, economics of sew	er desi	gn; W	∕astev	/ater
pumps and	pumping sta	tions- sewer appurtenances; material, construction, inspection	n and	maint	enanc	e of
sewers; Des	sign of sewer (putfalls-mixing conditions; conveyance of corrosive wastewater	S.			
,	U					
Unit IV	Storm Wat	er Drainage			7 H	ours
Necessity-	- combined an	d separate system; Estimation of storm water run-off Formulati	on of r	ainfa	ll inter	nsitv
		lationships- Rational methods.				5
Unit V	Case Studio	es and Software Applications			10 H	ours
		e in water transmission, water distribution and sewer design –	FPAN	JET C		
	-	ANCH, Canal ++ and GIS based softwares.			ло, ц.	501
version 4.0,	, SEWER, DR	Anori, Callal ++ allu OIS Daseu softwales.				
		Тс	otal:		45 H	ours
Further Re	eading					
	Designing o	f pipelines and sewers for various project areas				
Course Ou						
	After compl	etion of the course, Student will be able to				
		and the fluid flow properties				
		water supply main, distribution network and sewer for various	field co	nditio	ons	
		the drainage network for wastewater				
		the storm water drainage systems				
		shooting in water and sewage transmission be able to use varia		nnute	r soft	ware
		lesign of water and sewage network	, ab coi	nput	1 5010	,, ui c
References						
		Handbook on Public Health Engineering Deen Dublishers Sh	imla D	003		
		Handbook on Public Health Engineering, Deep Publishers, Sh				t af
		upply and Treatment", CPHEEO, Ministry of Urban Develop	ment,	Gove	inner	10 01
	New Delhi, 19					
3. "Manua	ai on Sewerag	e and Sewage Treatment", CPHEEO, Ministry of Urban				

		Department of Civil Engineering				
17EV105		PRINCIPLES AND DESIGN OF PHYSICO-CHEMICAL	L	Т	Р	С
		TREATMENT SYSTEMS				
			3	0	0	3
		(Common to Full time and Part Time)				
Course Ob	v					
	1. To edu	acate the students on the principles and process designs of variou	is trea	atmer	nt syst	ems
		ter and wastewater				
		acate the students on design of treatment systems and the compone	ents c	ompr	ising	such
	system	is, leading to the selection of specific process.				
Unit I	Introducti	0.7			5 U.	ours
		wastewater – characteristics, Standards for performance - Sign	ificar			
						sico-
chemical tre	eatment – Sel	lection criteria-types of reactor- reactor selection-batch- continuous	s type	e-kine	encs	
Unit II	Treatment	t Principles			10 H	ourc
		creening – Mixing, Equalization – Sedimentation – Filtratio	n _			
		er – mass transfer coefficient Adsorption – Isotherms – Membrane				
		n, ultra filtration and hyper filtration electro dialysis, distillati				
		Advances. Principles of Chemical treatment – Coagulation floccul				
•		on and stabilization – Disinfection, Ion exchange, Electrolytic			-	
		kidation /reduction – Recent Trends			, 201	
Unit III	Design of	Municipal Water Treatment Plants			10 H	ours
Selection o						
Selection 0	of Treatment		cher	nical	feedi	ng –
		- Design of municipal water treatment plant units - Aerators -				
Flocculation	n – clarifier –	 Design of municipal water treatment plant units – Aerators – tube settling – filters – Rapid sand filters, slow sand filter, pressu 	ure fil	ter, d	ual m	edia
Flocculation Disinfection	n – clarifier - n - Displacen	 Design of municipal water treatment plant units – Aerators – tube settling – filters – Rapid sand filters, slow sand filter, pressunent and gaseous type - Flow charts – Layouts – Hydraulic Profile 	ure fil e, PIE	lter, d) - co	ual m nstruc	edia
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Flocculation Disinfection and O&M a Unit IV Design of I Reverse ossicase studies Unit V Design of thickening- Equalizatio Layouts –H managemer Further Re Course Ou References 1. Metcali 2. Qasim,	n – clarifier – n – Displacen aspects – case Design of I Industrial Wa mosis plants s, Residue ma Design of Y municipal sludge dewat n- Neutraliza Hydraulic Pro nt – Upgradat Hydraulic Pro tot – Upgradat Examplementa teading Implementa After comp 1. Identif 2. Unders 3. Design 4. Design 5. Develo	Design of municipal water treatment plant units – Aerators – tube settling – filters – Rapid sand filters, slow sand filter, pressument and gaseous type - Flow charts – Layouts – Hydraulic Profile estudies, Residue management – Upgradation of existing plants – Industrial Water Treatment Plants atter Treatment Units- Selection of process – Design of softeners – Flow charts – Layouts –Hydraulic Profile, PID - construction anagement – Upgradation of existing plants – Recent Trends. Wastewater Treatment Plants wastewater Treatment Plants wastewater Treatment Plants wastewater Treatment units-screens-detritors-grit chamber-sett tering systems-sludge drying beds - Design of Industrial Wastewa ation-Chemical Feeding Devices-mixers- floatation units-oil skir ofile, PID, construction and O&M aspects – case studies, Recion of existing plants – Recent Trends. Tota ation of advanced treatment technologies for various wastewater treatment principles the pollutants type in the wastewater stand the various treatment principles the sewage treatment plants a uitable treatment units for various industries op conceptual schematics required for the treatment of wastewater Wastewater Engineering, Treatment and Reuse, Tata McGraw Hill, ey, E.M. and Zhu.G. Water works Engineering – Planning, De	al:	ter, d - co nt Tre emine D&M tank: reatm Flow ting ent 	ual m nstruc nds. 10He eralise aspec 10 He s- sh ent U 7 chan - Res 45 He 45 He	edia ettion ours ers - cts - ours idue ours

17EV106	_	ENVIRONMENTAL CHEMISTRY LABORATORY	L	Т	Р	C
	_		0	0	2	1
~ ~ ~		(Common to Full time and Part Time)				
Course Ob	v					
		in the analysis of physical parameters of water and waste water				
L'ALCE		n in the analysis of chemical parameters of water and waste water	[
List of Exp						02
		ctices, Quality control, calibration of Glassware		י דר	C mit	03
2. Sampli fluorid		sis of water (pH, alkalinity, hardness chloride, Sulphate, turbidi	ity ec	., ID	5 , m	12 rate
	/	(BOD, COD, Phosphate, TKN, Oil & Grease, Surfactant and hea	ww me	tale)		12
		is of air pollutants Ambient & Stack (RSPM, SO2 and NOx)	vynic	<i>.</i>		09
		terization of soil (CEC & SAR, pH and K).				09
5. Bumph		chization of son (CLC & SAR, pit and R).	Tota	al:	45 H	
Course Ou	itcomes:		100			
0000000		etion of the course, Student will be able to				
	-	uality of environment				
		t analysis on characteristics of water and waste water				
References						
1. APHA	, Standard Me	thods for the Examination of Water and Wastewater, 21st Ed.				
2. Washir	ngton, 2005.					
3. Labora	tory Manual f	or the Examination of water, wastewater soil Rump, H.H. and Kr	ist, H			
		I, Germany, 1992.				
5. Method	ds of air	sampling & analysis ,James P.Lodge Jr(Editor) 3r	d E	ditior	n, L	ewis
publish	ers,Inc,USA,1	989.			-	
17EV107		ENVIRONMENTAL MICROBIOLOGY LABORATORY	L	Т	Р	C
			0	0	2	1
		(Common to Full time and Part Time)				
Course Ob	Š I					
		in the analysis of physical parameters of water and waste water				
		in the analysis of chemical parameters of water and waste water				
List of Exp						
	ation of culture					
		nd Identification of Microorganisms				
		n polluted habitats (soil, water and air)				
		wth of microorganisms, Assay of enzymes involved in biotransfor		n		
-		ganic matter in waste water Analysis of air borne microorganisms	S			
	g of bacteria					
		ature on microbial growth				
		ng microbes from industrial effluent.				
9. Effect		n soil microorganisms				
		sis of wastewater (Coliforms, E.coli, Streptococcus) – MPN				
10. Bacteri	ological affalv	sis of wastewater (Coliforms, Streptococcus) - MF techniques				
10. Bacteri 11. Bacteri		le on microbiol growth				
 Bacteri Bacteri Bacteri Effect 	of Heavy meta	lls on microbial growth				
 Bacteri Bacteri Bacteri Effect Detecti 	of Heavy metation of Anaerob	lls on microbial growth bic bacteria (Clostridium sp.)				
 Bacteri Bacteri Bacteri Effect 	of Heavy metation of Anaerob		Tot		15 U	01734
 Bacteri Bacteri Bacteri Effect of Detecti Bioread 	of Heavy meta ion of Anaerot ctors		Tota	al:	45 H	ours
 Bacteri Bacteri Bacteri Effect Detecti 	of Heavy meta on of Anaerob ctors itcomes:	pic bacteria (Clostridium sp.)	Tota	al:	45 H	ours
 Bacteri Bacteri Bacteri Effect of Detecti Bioreau 	of Heavy meta ion of Anaerob ctors itcomes: After compl	bic bacteria (Clostridium sp.) etion of the course, Student will be able to		•		our
 Bacteri Bacteri Bacteri Effect of Detecti Bioreau 	of Heavy meta ion of Anaerob ctors atcomes: After compl 1. Field or	pic bacteria (Clostridium sp.)		•		<u>our</u> :

Re	ferences:					
1.	Standard methods for	or the examination	n of water and wa	astewa	ater, American Pub	blic Health Association (21st
	edition) 2005.					
2.	Charles Gerba,	Environmental	Microbiology:	А	laboratory	manual, Elsevier
	Publications, 2012.					
3.	Christon J. Hurst, R	conald L. Crawfo	rd, Jay L. Garla	nd, Da	avid A. Lipson, A	aron L. Mills, and Linda D.
	Stetzenbach, Manua	l of Environment	al Microbiology,	3rd E	dition, ASM Press	, 2007.

17EV201				-	~
	PRINCIPLES AND DESIGN OF BIOLOGICAL	L	Т	Р	С
	TREATMENT SYSTEMS		0	•	
		3	0	0	3
<u> </u>	(Common to Full time and Part Time)				
Course Ob					6
	To educate the students on the principles and process designs of various tr		-		
	water and wastewater and students should gain competency in the process er			-	
	treatment systems and the components comprising such systems, leading	to t	he se	lection	n of
	specific process.				
Unit I	Introduction			10 H	ours
Objectives	of biological treatment – significance – Principles of aerobic and anaerobic treatment	eatme	ent - l	cinetic	s of
-	growth – Factors affecting growth – attached and suspended growth - Deter				
-	for organics removal – Biodegradability assessment -selection of proc				
			Icaci	015-02	uen-
continuous	type.				
Unit II	Aerobic Treatment of Wastewater			10 H	MIRC
	ewage treatment plant units –Activated Sludge process and variations, Sequer	noina			
	Biological Reactors-Trickling Filters-Bio Tower-RBC-Moving Bed Rea				
	rated lagoons, waste stabilization ponds – nutrient removal systems – natura				
	wet land – Disinfection – disposal options – reclamation and reuse – Flow				
	rofile, recent trends.	Char	ls, 1ay	out, 1	ш,
nyuraune p	torne, recent trends.				
Unit III	Anaerobic Treatment of Wastewater			10 H	nire
	nd suspended growth, Design of units – UASB, up flow filters, Fluidized bec	le M			
	I – Nutrient removal systems – Flow chart, Layout and Hydraulic profile – Rec			epue	uant
und unspose	i i i i uni i i uni i gisterno i i i ovi enari, La gout and i guiadate prome i ice	ent tr	ends		
		ent tr	ends.		
Unit IV		ent tr	ends.	5 H	mrs
Unit IV Design of	Sludge Treatment and Disposal				ours
Design of	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas	gen	eratio	n, slı	ıdge
Design of dewatering	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existi	gen	eratio	n, slı	ıdge
Design of dewatering	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas	gen	eratio	n, slı	ıdge
Design of dewatering residue disp	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existi- posal – recent advances.	gen	eratio ants -	n, slı – ultiı	idge nate
Design of dewatering residue disp Unit V	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existinosal – recent advances. Construction Operations and Maintenance Aspects	gen ng pl	eratio ants -	n, slu – ultin 10 H e	ndge nate
Design of dewatering residue disp Unit V Construction	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existinosal – recent advances. Construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Planning	gen ng pl	eratio ants -	n, slu - ultin 10 H izing	udge nate Durs and
Design of dewatering residue disp Unit V Construction controlling	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existing in construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Planning of plant operations – capacity building - Retrofitting Case studies – sewage	gen ng pl	eratio ants -	n, slu - ultin 10 H izing	udge nate Durs and
Design of dewatering residue disp Unit V Construction controlling	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existinosal – recent advances. Construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Planning	gen ng pl	eratio ants -	n, slu - ultin 10 H izing	udge nate Durs and
Design of dewatering residue disp Unit V Construction controlling	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existinosal – recent advances. Construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Plannin of plant operations – capacity building - Retrofitting Case studies – sewagagement facilities.	gen ng pl ng, (e trea	eratio ants Drgan atmen	n, slu – ultin 10 He izing t plan	ours and ts –
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Design of dewatering residue disp Unit V Construction controlling	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existitionsal – recent advances. Construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Plannin of plant operations – capacity building - Retrofitting Case studies – sewagagement facilities. Tota tcomes:	gen ng pl ng, (e trea	eratio ants Drgan atmen	n, slu – ultin 10 He izing t plan	udge nate ours and ts –
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Design of dewatering residue disp Unit V Construction controlling sludge man Course Ou References	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existinosal – recent advances. Construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Plannin of plant operations – capacity building - Retrofitting Case studies – sewage agement facilities. Tota tcomes: After completion of the course, Student will be able to 1. Develop conceptual schematics required for biological treatment of wasted 2. Translate pertinent criteria into system requirements.	al:	eratio ants - Drgan atmen	n, slu – ultin 10 He izing t plan 45 He	udge nate ours and ts –
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Design of dewatering residue disp Construction controlling sludge man Course Ou References 1. Arceiva 2. Manua of India 3. Metcal	Sludge Treatment and Disposal sludge management facilities, sludge thickening, sludge digestion, biogas (mechanical and gravity) Layout, PID, hydraulics profile – upgrading existi posal – recent advances. Construction Operations and Maintenance Aspects n and Operational Maintenance problems – Trouble shooting – Plannin of plant operations – capacity building - Retrofitting Case studies – sewage agement facilities. Tota tcomes: After completion of the course, Student will be able to 1. Develop conceptual schematics required for biological treatment of waste 2. Translate pertinent criteria into system requirements. : ala, S.J., Wastewater Treatment for Pollution Control, TMH, New Delhi, Secon I on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Develor a, New Delhi, 1999. f & Eddy, INC, "Wastewater Engineering – Treatment and Reuse, Fourth Edit	al:	eratio ants - Drgan atmen atmen	n, slu – ultin 10 He izing t plan 45 He 2000.	ndge mate and ts – Durs
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	Department of Civil Engine	ering				
17EV202	AIR POLLUTION MONITORING AN		L	Т	Р	С
			3	0	0	3
	(Common to Full time and Part Time)					
Course Ob	jectives:					
	To impart knowledge on the principles and design of	f control of indoor	r/particu	late/g	aseou	s air
	pollutant and its emerging trends					
				<u> </u>		
Unit I	Introduction				7 H	
	nd composition of Atmosphere - Sources and classif	-				
-	n human health, vegetation & animals, Materials & Str					
atmosphere	, Soil & Water bodies - Long- term effects on the planet	- Global Climate	Change,	Ozor	ne Hol	les -
Ambient A	r Quality and Emission Standards – Air Pollution Indic	es – Emission Inv	entories	– An	nbient	and
Stack Samp	ling and Analysis of Particulate and Gaseous Pollutants.					
-						
Unit II	Air Pollution Modelling				5 He	
	neteorology on Air Pollution - Fundamentals, Atmosphe					
	e patterns- Transport & Dispersion of Air Pollutants	- Modeling Tech	ıniques	- Air	Pollu	itioi
Climatolog	1.					
TT •4 TTT				<u> </u>	11 TT	
Unit III	Control Of Particulate Contaminants		<u> </u>		<u>11 Ho</u>	
	cting Selection of Control Equipment – Gas Particle Int					
	e equations of Gravity Separators (cyclone), Centrific					
	Electrostatic Precipitators – Operational Consideratio APC equipment – Case studies for stationary and mobile		and and	I MOI	morm	ig -
Costing of A	Are equipment – Case studies for stationary and mobile	sources.				
Unit IV	Control of Gaseous Contaminants			<u> </u>	11 H	our
	ecting Selection of Control Equipment – Working princi	nle Design and pe	erformar	ice ea		
	Adsorption, condensation, Incineration, Bio scrubbers, B			-		
	al Considerations - Costing of APC Equipment – Case stu					
1		2				
Unit V	Indoor Air Quality Management				11 H	our
Sources typ	es and control of indoor air pollutants, sick building s	yndrome types - I	Radon P	olluti	on an	d its
control - N	lembrane process - UV photolysis - Internal Combustio	on Engines - Sourc	es and F	Effects	s of N	oise
Pollution –	Measurement – Standards –Control and Preventive measurement	ures.				
		7	Fotal:		45 He	ours
Course Ou	tcomes:		I			
	After completion of the course, Student will be able to					
	1. Apply sampling techniques					
	2. Apply modelling techniques					
	3. Suggest suitable air pollution prevention equipmen	t's and techniques	for vario	ous ge	iseous	and
	particulate pollutants to Industries. Discuss the emi	1	ioi vuin	140 80		un
References		ission standards				
	• ce K. Wang, Norman C. Parelra, Yung Tse Hung, Air Po	Illution Control En	aineerin	a Tol	$\alpha \alpha \gamma$	004
			gmeening	<u>, 10</u>	.y0, 20	J04
	Nevers, Air Pollution Control Engg., Mc Graw Hill, Ne					
	I.F. Liu, Bela G. Liptak "Air Pollution", Lweis Publisher					
4. Anjane	yulu. Y, "Air Pollution & Control Technologies" Allied I	Publishers (P) Ltd.,	, India, 2	.002.		
5. Arthur	C.Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Pr	ess, 2006.				_
6. Wayne	T.Davis, "Air Pollution Engineering Manual", John Wile	ey & Sons,Inc.,200	0.			
	Vallero "Fundamentals of Air Pollution", Fourth Edition					
		.,				

17EV203		INDUSTRIAL WASTE MANAGEMENT	L	Т	Р	C
			3	0	0	3
		(Common to Full time and Part Time)				
Course Ob	v					
	-	knowledge on the concept and application of Industrial pollution	n prev	ventio	n, cle	anei
	technologi	es, industrial wastewater treatment and residue management.				
	1					
Unit I	Introducti				8 H	
		idia- Industrial activity and Environment - Uses of Water by ind	•			
		ewater - Nature and Origin of Pollutants - Industrial wastewater				
-		quirements for treatment of industrial wastewater – Industrial wast		-		
	-	and sampling -generation rates, characterization and variables -T	oxici	ity of	indus	stria
effluents an	nd Bioassay te	ests – Major issues on water quality management.				
Unit II	Industrial	Pollution Prevention & Waste Minimisation			8 H	our
		ntrol of Industrial Pollution – Benefits and Barriers – Waste mana	agem	ent H		
		ques – Periodic Waste Minimisation Assessments – Evaluation of I				
		t analysis – Pay-back period – Implementing & Promoting F				
Programs in	n Industries.					
	1				10	
Unit III	Industrial	Wastewater Treatment			10 H	
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- 1. Industrial wastewater management, treatment & disposal, Water Environment
- 2. Lawrance K.Wang, Yung . Tse Hung, Howard H.Lo and Constantine Yapijakis, "handlook of Industrial and Hazardous waste Treatment", Second Edition, 2004.
- 3. Metcalf & Eddy/ AECOM, water reuse Issues, Technologies and Applications, The Mc Graw- Hill companies, 2007.

4. Nelson Leonard Nemerow, "industrial waste Treatment", Elsevier, 2007.

5. W.Wesley Eckenfelder, "Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 1989.

6. Paul L. Bishop, "Pollution Prevention: - Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.

17EV204	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	Т	Р	C
		3	0	0	3
	(Common to Full time and Part Time)				
Course Ob					
	To impart knowledge and skills in the collection, storage, transport, trea			-	
	recycling options for solid wastes including the related engineering princi	ples,	desig	n crit	eria,
	methods and equipment.				
Unit I	Sources, Classification and Regulatory Framework			9 H	ours
	Sources of solid and hazardous wastes - Need for solid and hazardous waste m	anage	ment		
	Indian legislations on management and handling of municipal solid waste				
	wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics and f				
	vaste management and roles of stakeholders - Financing and Public Private P	-			
manageme					
Unit II	Waste Characterization and Source Reduction			8 H	011 r (
	eration rates and variation - Composition, physical, chemical and biologica	1 pro	pertie		
	Hazardous Characteristics - TCLP tests - waste sampling and characteriz				
reduction o	f wastes -Waste exchange - Extended producer responsibility - Recycling and	reuse.			
Unit III	Storage, Collection and Transport Of Wastes			<u>9 H</u>	
	nd segregation of wastes at source – storage and collection of municipal solid				
	systems - Need for transfer and transport – Transfer stations Optimizir ty, storage, labeling and handling of hazardous wastes – hazardous waste mani				
compation	ty, storage, labeling and handling of hazardous wastes – hazardous waste main		ina u	anspo	11.
Unit IV	Waste Processing Technologies			10 H	
-	of waste processing - material separation and processing technologies - bio	-			
	technologies - methods and controls of Composting - thermal conversion tech		-		
•	incineration – solidification and stabilization of hazardous wastes - treatment o				
	siderations in the context of operation of facilities, handling of materials and	impa	ct of o	output	ts of
the environ	ment.				
Unit V	Waste Disposal			9 H	our
Waste disp	osal options – Disposal in landfills - Landfill Classification, types and meth-	ods –	site	selecti	ion
	operation of sanitary landfills, secure landfills and landfill bioreactors - lead				
	nt - landfill closure and environmental monitoring - Rehabilitation of op	en du	imps	– lan	ldfil
remediation	1.				
<u> </u>	Tot	al:		45 H	our
Course Ou	After completion of the course, Student will be able to				
		1			41-
	1. Understand the characteristics of different types of solid and hazard	ious	waste	s and	th
	factors affecting variation	0.000	ant a	d are	
	2. Define and explain important concepts in the field of solid waste man	•	ent af	ia sug	gges
	suitable technical solutions for treatment of municipal and industrial was			41-	
	3. Understand the role legislation and policy drivers play in stakeholders' no and apply the basic acientific principles for solving prostical waste many	-			
D.C.	and apply the basic scientific principles for solving practical waste mana	geme	nt cha	uieng	es
References					
		to Ma	nocc	nort	Ma
1. George	Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Was Hill International edition, New York, 1993.	te Ma	inage	nent,	Mc

- 2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.
- 3. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
- 4. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.
- 5. Paul T Williams, Waste Treatment and Disposal, Wiley, 2005

7EV205	ENVIRONMENTAL IMPACT ASSESSMENT	L	Т	Р	С
		3	0	0	3
	(Common to Full time and Part Time)				
Course Ob	ojectives:				
	1. To expose the students to the need, methodology, documentation	n and	usef	ulnes	s of
	environmental impact assessment and to develop the skill to pre-	epare	envi	ronme	ental
	management plan.				
	2. To provide knowledge related to the broad field of environmental risk a	issessi	nent,	impo	tant
	processes that control contaminant transport and tools that can be us	ed in	predi	cting	and
	managing human health risks.				
Unit I	Introduction			8 H	
	development of Environmental Impact Assessment (EIA). EIA in Project	•		•	
	aspects in India Types and limitations of EIA EIA process- screening	-	-		1g –
analysis – 1	nitigation. Cross sectoral issues and terms of reference in EIA – Public Particip	oation	in EL	A .	
TI . •4 TT			<u> </u>	10 77	
Unit II	Impact Identification and Prediction	oftwo		10 H	
	Networks – Checklists –Cost benefit analysis – Analysis of alternatives – S pert systems in EIA. Prediction tools for EIA – Mathematical modeling for				
	t of impacts – air – water – soil – noise – biological — Cumulative Impact Ass			Juicin	л –
11000000111011		essine			
Unit III	Social Impact Assessment and EIA Documentation			8 H	ours
Social imp	act assessment - Relationship between social impacts and change in commu	nity a	nd in	stituti	onal
0,0000					onui
arrangemer	nts. Individual and family level impacts. Communities in transition Documenta				
•	- organization of information and visual display materials – Report preparation	ation of			
– planning	- organization of information and visual display materials - Report preparation	ation of		A find	ings
– planning Unit IV	 – organization of information and visual display materials – Report preparation Environmental Management Plan 	ation on a state of the state o	of EIA	A find 7 H	ings ours
– planning Unit IV Environme	 – organization of information and visual display materials – Report preparation Environmental Management Plan ntal Management Plan - preparation, implementation and review – Mitigation 	ation on and	of EIA	A find 7 He abilita	ings ours ition
– planning Unit IV Environme Plans – Po	 – organization of information and visual display materials – Report preparation Environmental Management Plan ntal Management Plan - preparation, implementation and review – Mitigation plicy and guidelines for planning and monitoring programmes – Post project 	ation on and	of EIA	A find 7 He abilita	ings ours ition
– planning Unit IV Environme Plans – Po	 – organization of information and visual display materials – Report preparation Environmental Management Plan ntal Management Plan - preparation, implementation and review – Mitigation 	ation on and	of EIA	A find 7 He abilita	ings ours ition
– planning Unit IV Environme Plans – Po Quality asp Unit V	 – organization of information and visual display materials – Report preparation Environmental Management Plan ntal Management Plan - preparation, implementation and review – Mitigation plicy and guidelines for planning and monitoring programmes – Post project pects of Environmental Impact Assessment - Case Studies. Environmental Risk Assessment and Management 	ation of an and t audit	of EI4	A find 7 He abilita thical 12 He	ours and
 planning Unit IV Environme Plans – Po Quality asp Unit V Environme 	 – organization of information and visual display materials – Report preparation Environmental Management Plan ntal Management Plan - preparation, implementation and review – Mitigation blicy and guidelines for planning and monitoring programmes – Post project bects of Environmental Impact Assessment- Case Studies. Environmental Risk Assessment and Management ntal risk assessment framework-Hazard identification -Dose Response Evolution 	ation on and t audit	of EIA	A find 7 He abilita thical 12 He Expo	ings ours ition and ours sure
 planning Unit IV Environme Plans – Po Quality asp Unit V Environme Assessmen 	 – organization of information and visual display materials – Report preparation Environmental Management Plan ntal Management Plan - preparation, implementation and review – Mitigation blicy and guidelines for planning and monitoring programmes – Post project bects of Environmental Impact Assessment- Case Studies. Environmental Risk Assessment and Management ntal risk assessment framework-Hazard identification -Dose Response Ev t – Exposure Factors, Tools for Environmental Risk Assessment– HAZOP and State Studies 	ation on n. on and t audit aluation nd FE	of EIA Reh t – E	A find 7 He abilita thical 12 He Expo	ings ours ition and ours sure ds –
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	McGraw Hill Inc., New York, 1996.
5.	K. V. Raghavan and A A. Khan, Methodologies in Hazard Identification and Risk Assessment, Manual by
	CLRI, 1990.
6.	Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and
	Control, 4th Edition, Butterworth Heineman, 2012.

			Department of Civil Engineering				
17E	EV206		UNIT OPERATIONS AND PROCESSES LABORATORY	L	Т	P	C
				0	0	2	1
			(Common to Full time and Part Time)				
Cou	urse Obj	ectives:					
		1. To dev	elop the skill for conducting Treatability studies of water and was	tewat	er tre	eatmer	it by
		various	s Unit Operations and Processes using laboratory scale models.				
			relop the skill for conducting Treatability studies of water and was	stewat	er tre	eatmer	it b
		various	s Unit Operations and Processes using laboratory scale models.				
List	t of Exp	eriments:					
1.		tion and Flo					,
2.		udies on set					1(
3.	Studies	on Filtration	- Characteristics of Filter media				7
4.	Water se	oftening					7
5.	Adsorpt	ion studies/I	Kinetics				
6.			ilt Density Index				
7.	Kinetics	of suspende	ed growth process (activated sludge process)- Sludge volume Inde	Х			14
8.			ystems / kinetics (Demonstration)				10
9.	Advanc	ed Oxidatior	n Processes – (Ozonation, Photocatalysis)				1
10.	Disinfec	tion for Dri	nking water				-
				Tota	ıl:	45 He	our
Coi	urse Out	comes:					
			bletion of the course, Student will be able to				
		1. Condu	ct treatability studies for water and waste water treatment.				
		2. Design	laboratory models for various unit operations and processes.				
	erences:						
1.	Metcalf	and Eddy.	Inc. "Wastewater Engineering, Treatment, Disposal and Reuse,	Third	l Ed	ition, '	Tat
	McGrav	v Hill Publis	hing Company Limited, New Delhi, 2003.				
2.	Lee, C.C	C. and Shun	dar Lin. Handbook of Environmental Engineering Calculations,	Mc G	raw	Hill, I	Nev
	York, 1					,	
3.	· · ·		eatment Processes in Water and Wastewater Engineering, John W	Vilevs	Son	s I on	dor
5.	•	, Ont 11	carnent rocesses in water and wastewater Englitering, John W	neys	5013	5, LUII	uoi
	1993.			~ 1			
4.	David V	V.Hendricks	, "Water Treatment Unit Processes: Physical and Chemical", CRO	J Pres	s, Bo	oca Ra	itor
	2000						

2006.

17EV001	AIR POLLUTION METEOROLOGY AND MODEI	ING	L	Т	Р	С
			3	0	0	3
	(Common to Full time and Part Time)					
Course Ob	jectives:					
	To introduce the emerging concepts of climate modeling and proje	cting futi	ure c	limat	te cha	nge,
	understand data analysis and application.					
Unit I	Atmospheric Pollution				9 H	ours
Atmospheri	c Pollution, type of pollutants, gaseous and particulate pollutants, si	ze of atr	nosp	heric	parti	cles,
emission in	ventory, various sources of emissions, bio-mass burning, pollution	ı formati	ion	in co	mbus	tion,
Visibility a	nd Acid Deposition Industrial pollution.					
2						
Unit II	Meteorology				9 H	ours
Air pollutio	on meteorology: sources of air pollution, methods for air pollution	measur	emei	nt an	d cor	ntrol,
meteorolog	ical factors that contribute to air quality degradation, basic chemistry of	of the atm	nospl	nere a	and ho	ow it
contributes	to secondary pollutant formation. Effect of air pollution on Human hea	alth. mate	erial	and v	egeta	tion.

Deposition of particulate pollutants in the respiratory system.	
Unit III Transport Models	9 Hours
Atmospheric chemical transport models, box models, three-dimensional atmospheric che	emical transport
models, components of air quality forecasting and modelling, evaluation and validation, air q	quality standards
and index, long range transpoanad rt of pollutants. Back trajectory construction and application	IS
Unit IV Dispersion Models	9 Hours
Transport and dispersion of air pollutants - wind velocity, wind speed and turbule	nce; estimating
concentrations from point sources - the Gaussian Equation - atmospheric stability - Air poll	lution modelling
and prediction - Plume rise, modelling techniques.	
Unit V Software Modelling	9 Hours
Exposure to computer models for air quality.	
Total:	45 Hours
Course Outcomes:	
After completion of the course, Student will be able to	
1. Know the causes of climate change	
2. Know the effects of climate change on various environments and various mod	dels.
References: 1. Rao.M.N. &RaoH.V.N., "Air Pollution", Tata McGraw Hill,2006.	
	1 (1 CA
2. Richard W. Boubel, Donald L. Fox, D. Bruce Turner & Arthur C. Stern, "Fund	amentals of All
Pollution, Hardcover", 2007.	
Pollution, Hardcover", 2007.3. Kenneth Wark, Cecil F. Warn, "Air pollution its origin and control", 2007.	
Pollution, Hardcover", 2007.	oanies Inc., New

		Department of Civil Engineering				
17EV002		CLIMATE CHANGE AND MODELING	L	Т	Р	C
			3	0	0	3
		(Common to Full time and Part Time)				
Course Ob						
		uce the emerging concepts of climate modeling and projec	ting future	clima	te cha	nge
	understan	d data analysis and application.				
Unit I		Change and Climate Variability			9 H	
		ohere - weather and Climate - climate parameters (Tempe				
	-	governing the atmosphere - Numerical Weather Predictio	n Models	Intro	ductio	n to
GCMs - Ap	plication in	Climate Change Projections.				
Unit II		ES Scenarios			9 H	
		el on Climate Change (IPCC) - An Overview - Key Assun	antions S	onari		
•		• • • •	ipuons - S	Jenan	J Fam	ny
Storynne (A	A1, B1, A2,	D2).				
Unit III	Global C	limate MODEL (GCM) and Regional Climate Model (RC	CM)		9 H	our
		HadCM3Q-UK Met Office) - Issues with GCMs - Introduc		Ms an		
• •		ke PRECIS, Sim CLIM, MAGICC/SCENGENE - Advant				
GCMs and		ke FRECIS, SIIII CLIIVI, MAOICC/SCENOLINE - Auvani	ages and I	Isauv	amage	5 0
TT •4 TT7					0.11	
Unit IV		ling Global Climate Model - An OverviewSelection of GCMs for regional climate change studies - E	noomhlo th	0.0111	9 H	
		Domain (Spatial domain and temporal domain), Resolution				
	-	itions - Methods of downscaling (Statistical and Dynamical)) - example	s fron	n each	and
their limitat	tions.					
Unit V	Analysis	/Post Processing			9 H	our
		ost processing – Introduction to Analysis tools - Ferret, R, G	rads IDL 9	SPSS		
		act - Vulnerability assessment – adaptation strategies.	iaus, IDL, i	n 55,	meon	0
	8 8 I	Ţ				
			Total:		45 H	our
Course Ou						
		pletion of the course, Student will be able to				
		v the causes of climate change				
		v the effects of climate change on various environments and	various mo	dels.		
References						
		ssment Report, Cambridge University Press, Cambridge, UK		т 1	117'1	
		Handanson Callerry A StA Cl. (M. 1.11, D. T.	ira Edition	, John	wile	y ð
		Henderson-Sellers, A. "A Climate Modelling Primer, Th				
	David I "C	ter, UK. ,2005				
4 Ihoma		ter, UK. ,2005 limate Change and Climate Modelling", Cambridge Univers	ity Press	Env	ironme	enta
	s Stocker,	ter, UK. ,2005	ity Press	l Env	ironme	enta

		Department of Civil Engineering		1		
17EV003		ING TECHNIQUES IN ENVIRONMENTAL	L	Т	Р	С
	ENGINEE	CRING		<u> </u>		
			3	0	0	3
~ ~ ~	``````````````````````````````````````	to Full time and Part Time)				
Course Ob						
		ents to know about computing techniques				
	-	nt numerical technique and logic like ANN, Fuzzy				
	3. To educate the stud	lents on aspects data management				
	4. Develop the model	Applications for monitoring and management of Er	vironn	nent		
Unit I	Computing Principles				10 H	our
Introduction	to Computing technique	es – Algorithms and Flowcharts, Numerical methods	s - Solu	tion to	o ordi	nar
		using Finite difference and Finite element				-
-	-	n of digital models for Environmental applications.	metho	u , 1	(unite	iicu
Unit II	Artificial Intelligence				9 H	
Knowledge	based Expert system con	ncepts - Principle of Artificial Neural Network (AN	$N) - \overline{N}$	Neura	l Netv	vorł
Structure -	Neural Network Operat	ions – ANN Algorithm - Application of ANN Me	odel to	Envi	ronme	enta
field – Gen	etic Algorithms					
Unit III	Fuzzy Logic				9 H	aur
		relations, fuzzy measures, fuzzy logic and the	theory	ofu		
•	Tully numbers, Tully					
	•		•			-
	ation; applications of th	e theory to inference and control, clustering, an	•			-
	•		•			-
Network an	ation; applications of th alysis models.		•		ocessi	ng
Network an Unit IV	ation; applications of th alysis models. Data Management	e theory to inference and control, clustering, an	d imag	ge pro	ocessi 9 He	ng
Network an Unit IV Data base s	ation; applications of th alysis models. Data Management tructure - Data acquisition	e theory to inference and control, clustering, an on - Data warehouse - Data retrieval-Data format	d imag Attribu	ge pro	9 H RDBN	ng Dur AS
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4. Mathew	vs I H and Fink K I) "Numerical methods using MATIAR" F					
17EV004	vs J. H. and Fink K.D., "Numerical methods using MATLAB", F ENVIRONMENTAL BIOTECHNOLOGY		L	T	Р	С
1.2.001			3	0	0	3
	(Common to Full time and Part Time)			Ŭ	-	-
Course Ob						
	1. To impart students an understanding of pollution of e	environm	nent by	air, v	vater	and
	soil responsible and					
	2. To impart knowledge on degradation of natural resources	S				
	3. To impart knowledge on degradation of biodiversity.					
Unit I	Introduction				5 H	our
Principles a	nd concepts of environmental biotechnology -usefulness to manki	ind.				
Unit II	Degradation				11 H	our
Degradatior	n of high concentrated toxic pollutants – non-halogenated, haloge	enated -p	etroleum	hydro	ocarbo	ons
metals. M	echanisms of detoxification, oxidation reactions, dehalogenation	on -biotra	ansforma	tion	of me	tals
	ell/enzyme technology -adapted microorganisms -biological ren					
	gy and applications in agriculture - role of extra cellular polymer					U
	······					
Unit III	Biotechnological remedies ogical remedies for environmental damages - decontamination				11 H	
Biodegrada risk - pathog	environment - reclamation concepts - bioremediation. Product tion of solid wastes - physical, chemical and microbiologic gens – odor management - technologies of commercial importance	tion of proceedings of the content o	roteins – rs of com	bio postir	fertili 1g - he	ns – zers ealth
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17EV005		ENVIRONMENTAL POLICIES AND LEGISLATION	L	Т	Р	С
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~ ~ ~ ~		(Common to Full time and Part Time)				
Course Ob	3					
	-	knowledge on the policies, legislations, institutional frame wo	ork ar	nd en	forcer	nen
	mechanism	s for environmental management in India.				
	-					
Unit I	Introducti				9 H	our
Indian Co	onstitution	and Environmental Protection - National Environmental	nental	ро	licies	
Precautiona	ary Principle	and Polluter Pays Principle - Concept of absolute liability - multil	lateral	l envi	ronme	enta
agreements	and Protoco	ls – Montreal Protocol, Kyoto agreement, Rio declaration- Envir	ronme	ental	Protec	tio
Act, Water	er (P&CP) Ac	t, Air (P&CP) Act – Institutional framework(SPCB/CPCB/MoEF))			
Unit II		zCP) Act, 1974			8 H	
Power & fu	unctions of r	egulatory agencies - responsibilities of Occupier Provision relation	ng to	preve	ention	an
control Sch	neme of Con	sent to establish, Consent to operate - Conditions of the consen	nts –	Outle	et – L	ega
sampling p	procedures, S	tate Water Laboratory - Appellate Authority - Penalties for	violat	tion c	of con	ser
conditions e	etc. Provisio	ns for closure/directions in apprehended pollution situation.				
	-					
Unit III		P) Act, 1981			8 H	
	unctions of r	egulatory agencies - responsibilities of Occupier Provision relation	ng to	preve	ention	an
			•	-		
control Sch	neme of Con	sent to establish, Consent to operate – Conditions of the conser	•	Outle	et – L	ega
		sent to establish, Consent to operate - Conditions of the consen	nts –			
sampling p	procedures, S	sent to establish, Consent to operate – Conditions of the conser tate Air Laboratory – Appellate Authority – Penalties for	nts –			
sampling p	procedures, S	sent to establish, Consent to operate - Conditions of the consen	nts –			
sampling p conditions e	procedures, S etc. Provisio	sent to establish, Consent to operate – Conditions of the conser tate Air Laboratory – Appellate Authority – Penalties for	nts –	ion c		ser
sampling p conditions e Unit IV	procedures, S etc. Provisio	sent to establish, Consent to operate – Conditions of the consent tate Air Laboratory – Appellate Authority – Penalties for as for closure/directions in apprehended pollution situation	nts – violat	ion c	of con 13 He	ser
sampling p conditions e <u>Unit IV</u> Genesis of	etc. Provisio Environm the Act – d	sent to establish, Consent to operate – Conditions of the consent tate Air Laboratory – Appellate Authority – Penalties for hs for closure/directions in apprehended pollution situation ent (Protection) Act 1986 elegation of powers – Role of Central Government - EIA Notif	nts – violat	ion c	of con 13 H Sitting	ser
sampling p conditions e <u>Unit IV</u> Genesis of Industries	erccedures, S etc. Provisio Environm the Act – d – Coastal Z	sent to establish, Consent to operate – Conditions of the consent tate Air Laboratory – Appellate Authority – Penalties for as for closure/directions in apprehended pollution situation ent (Protection) Act 1986 elegation of powers – Role of Central Government - EIA Notif one Regulation - Responsibilities of local bodies mitigat	nts – violat ficatio	ion c on – S chemo	of con 13 H Sitting e etc	ser
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17EV006		ENVIRONMENTAL SYSTEM ANALYSIS L	Т	Р	С
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Course Ob			1 .		
		roduce about ecological modeling, single and multi-species modeling of			
		acate about the modeling of CSTR and the kinetics of reaction taking pl			
	3. Introdu modeli	uce the concepts of river and stream water modeling, water quaing.	lity p	oarame	eters
	4. To edu	acate about the microbial energetic in various reactors systems.			
	5. To ela	borate the computational techniques for modeling			
Unit I	Ecological	System		9 H	ours
Basic conc		logy and ecological modeling, Population Dynamics: Birth and o	leath	proces	sses.
	-	Prey-predator models: Lotka-Volterra, Rosenzweig-MacArther, Kolm		-	
	-	- Structural analysis and stability of complex ecosystems.	05010	i ilio	
Unit II	Continuou	Is-Flow Reactor Modeling		9 H	ours
CSTR, Plug	g-Flow, Disp	ersion. A case study of a tubular reactor with axial dispersion, Parame	eter C	alibra	tion:
Search algo	orithms for n	onlinear dynamical models, Variance of estimated parameters. Applic	ation	to Mo	onod
and Haldan	a trimatica				
and manual	le kinetics.				
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Unit III	Water Qu	ality Modeling		9 H	
Unit III Rivers and	Water Qu streams w	rater quality modeling -dispersion and mixing- water quality mo		g proc	ess-
Unit III Rivers and model sens	Water Qu streams w	vater quality modeling -dispersion and mixing- water quality mossing model performance; Models for dissolved oxygen and patho		g proc	ess-
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17EV007		LAND FILL ENGINEERING AND REMEDIATION TECHNOLOGY	L	Т	Р	С
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		(Common to Full time and Part Time)	_		-	
Course Ob	ojectives:					
	1. To ur	nderstand the important characteristics and design principles of th	ne was	ste co	ntainr	nent
	and re	emediation industry				
	2. To in	part the knowledge on relevant regulations and engineering de	esign 1	equir	emen	ts of
	landf	ills and contaminated site remediation				
Unit I	Landfill	Basics			8 H	our
Waste ma	inagement l	Hierarchy- Need for landfills – Environmental Protection by	Land	dfills-	Lan	dfil
	•	ry and Secure Landfills - Components and Configuration - I				
		Site investigation- Regional Landfills- Environmental control u				
-	esign Tasks	She investigation regional Landing Linvironmental control (using	site	acoigi	
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Unit II	Landfill	Liners and Cover Systems			10 H	our
Landfill ba		m components – Design of Compacted clay liners: Factors	affec			
conductivit	ty, Water	content-density criteria, Thickness, Desiccation - Geo synthet	tic Cl	ay L	iners	anc
	-	, manufacturing, handling, seaming and testing - Asphalt Ba		-		
					-	-
	Composite L	iner system design- liner construction and quality control- Leak	kage t	hroug	sh Lir	ners
	-	iner system design- liner construction and quality control- Leak chemical compatibility - Installation of Geo membranes - Liner L	•	~		
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Bioremediation - Natural Attenuation - Remedy Selection and Risk Assessment – Geotechnical Asp	ects
of In Situ Remediation Technology - Specific case studies in contaminated site remediation – Rehabilitation	
Open dumps- Landfill Mining.	-
-1	
Total: 45 Ho	urs
Course Outcomes:	
After completion of the course, Student will be able to	
1. Have an overview of the Indian and international landfill regulations and guidelines for	the
design, construction, operation and management of landfills	
2. Design and construction of landfills, processes in landfills, methods for management	and
treatment of landfill gas and leachate	
3. Have an in-depth understanding of the key pollutants in leachate and gas, t	
potential environmental impacts and the engineering design and performance of con	trol
systems used to manage and treat pollutant and waste emissions from sites	
4. Apply a risk based assessment of contaminated sites and implement site remedia	ion
technologies	
References:	
1. David E Daniel and Robert M. Koerner "Waste Containment Facilities -Guidance for construc	
Quality Assurance and Construction Quality Control of Liner and Cover Systems, American Soc of Civil Engineers, ASCE Press.2007,	irty
2. Donald L Wise and Debra J Trantolo, "Remediation of Hazardous Waste Contaminated Soils, Ma	rcel
Dekker Inc., New York, 1994	
3. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, I	Ac-
Graw Hill International edition, New York, 1993.	
4. Hari D Sharma and Krishna R. Reddy, Geoenvironmental Engineering: Site Remediation, W	iste
Containment, and Emerging Waste Management Techonolgies, John Wiely, New Jersy, 2004	
5. Neal Bolton P.E "The Handbook of Landfill Operations", Blue Ridge Services Inc., Atascadro,	CA
– ISBN 0-9646956-0-x, 1995	

WASTE WATER TREATMENT	
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(Common to Full time and Part Time)	
Course Objectives:	
To introduce the concept and principles of membrane separation and its applications in w	ater a
wastewater treatment.	
Unit IMembrane Filtration Processes10) Hou
Solid Liquid separation systems- Theory of Membrane separation - mass Transport Characteristics	s- Cro
Flow filtration - Membrane Filtration- Flux and Pressure drop -Types and choice of men	
porous, non-porous, symmetric and asymmetric - Plate and Frame, spiral wound and hollow fibre mer	mbran
– Liquid Membranes	
Unit II Membrane Systems 10) Hou
Microfiltration principles and applications – Ultra filtration principles and applications - Nano F	iltrati
principles and applications – Reverse Osmosis: Theory and design of modules, assembly, plant	
	-
control and applications - Electro dialysis : Ion exchange membranes, process design- Pervapo	
Liquid membrane - Liquid Pertraction - Supported Liquid Membrane and Emulsion Liquid mem	
Membrane manufactures – Membrane Module/Element designs – Membrane System components – D	esign
Membrane systems - pump types and Pump selection- Plant operations - Economics of Membrane syst	ems
Unit III Membrane Bioreactors	9 Hou
Introduction and Historical Perspective of MBRs, Biotreatment Fundamentals, Biomass Separation	
•	
Principles, Fouling and Fouling Control, MBR Design Principles, Design Assignment, Alternativ	ve ME
Configurations, Commercial Technologies, Case Studies.	
Unit IV Pretreatment Systems 8	8 Hou
Membrane Fouling - Control of Fouling and Concentration Polarisation-Pretreatment methods and st	trategi
- monitoring of Pretreatment - Langlier Index, Silt Density Index, Chemical cleaning, Biofoulant contra	rol.
Unit V Case Studies 8	8 Hou
Case studies on the design of membrane based water and wastewater treatment systems - zero Liquid	efflue
discharge Plants – Desalination of brackish water.	
Total: 45	5 Hou
Course Outcomes:	5 HOU
After completion of the course, Student will be	catior
After completion of the course, Student will be 1. familiar with main membrane processes, principles, separation mechanisms, and applied	
1. familiar with main membrane processes, principles, separation mechanisms, and appli	
 familiar with main membrane processes, principles, separation mechanisms, and applie understand the selection criteria for different membrane processes 	
 familiar with main membrane processes, principles, separation mechanisms, and applie understand the selection criteria for different membrane processes know the principle of the most common membrane applications 	
 familiar with main membrane processes, principles, separation mechanisms, and applie understand the selection criteria for different membrane processes know the principle of the most common membrane applications Carry out design of project for a particular membrane technology application. 	
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17EV009	REMOTE SENSING AND GIS APPLICATIONS IN	L	Т	Р	С
	ENVIRONMENTAL MANAGEMENT				-
		3	0	0	3
	(Common to Full time and Part Time)				
Course Ob					
	1. To educate the students on aspects of Remote Sensing				
	2. Develop the different remote sensing technique				
	3. To educate the students on aspects of GIS and data management				
	4. Develop the GIS Applications for monitoring and management of enviro	onmen	t		
Unit I	Remote Sensing Elements			8 H	ours
Historical I	Perspective, Principles of remote sensing, components of Remote Sensing	, Ene	rgy s	ource	and
	etic radiation, Electromagnetic spectrum, Energy interaction, Spectral				
	e features, Energy recording technology.	1		1	
Unit II	Remote Sensing Technology			9 H	ours
	on of Remote Sensing Systems, Aerial photographs, Photographic systems	s - A	cross		
	scanning, Multispectral remote sensing, Thermal remote sensing, Microwa				
-	passive sensors, RADAR, LIDAR			~	-0
Unit III	Social Impact Assessment and EIA Documentation			9 H	
Social impa	ct assessment - Relationship between social impacts and change in commun	nıty a	nd in	stituti	onal
arrangemen	ts. Individual and family level impacts. Communities in transition Documenta	ation of	of EL	A find	ings
-	- organization of information and visual display materials – Report preparation				
Unit IV					
Environmen	Environmental Management Plan			10 H	ours
Plans – Po	Environmental Management Plan tal Management Plan - preparation, implementation and review – Mitigatio	on and	l Reh		
Quality oco				abilita	ation
Quanty asp	tal Management Plan - preparation, implementation and review - Mitigatio			abilita	tion
Unit V	tal Management Plan - preparation, implementation and review – Mitigation icy and guidelines for planning and monitoring programmes – Post project			abilita thical	ation and
Unit V	tal Management Plan - preparation, implementation and review – Mitigatio icy and guidelines for planning and monitoring programmes – Post project ects of Environmental Impact Assessment- Case Studies.	t audi	t – E	abilita thical 9 H e	ation and
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- 3. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- 4. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York,1996.
- 5. K. V. Raghavan and A A. Khan, Methodologies in Hazard Identification and Risk Assessment, Manual by CLRI, 1990.
- 6. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

17EV010		RESOURCE AND ENERGY RECOVERY FROM LWASTE	,	Т	Р	С
		WASTE 3		0	0	3
		(Common to Full time and Part Time)		U	•	5
Course Obj	jectives:	(
		lerstand the principles and design of recovering materials and ene	rgy	fro	m wa	stes
	through	n mechanical, biological and thermal methods and manage the undesir	able	e by	-prod	ucts
Unit I	Mechanica	l Processing for Material Recycling			10 H	ours
Resource re	ecovery for a	a sustainable development- Material and energy flow management	and	d a	nalysi	s -
Systems ar	nd processes	s for reduction, reuse and recycling -Objectives of Waste P.	roce	essii	ng-So	urce
Segregation	and Hand S	orting-Waste Storage and Conveyance - Shredding - Pulping - Siz	e Se	epa	ration	by
		ation by Air Classification -magnetic and electromechanical separ				
		pment selection		•		
-		-		_	40.77	
Unit II		Processing for Resource Recovery			10 H	
		al Processing – Aerobic Processing of Organic fraction - Composi-	•			
-		ting- Design of Windrow Composting Systems- In Vessel Comp		-		-
-		ulture: definition, scope and importance - common species for culture				
-		nethods- Applications of vermiculture- Potentials and constraints for	or co	om	postin	g ir
India-Large	scale and dec	entralized plants.				
Unit III	Bio-Chemi	cal Conversion of Waste to Energy			9 H	mr
		car conversion of waste to Energy			7 11	
i interpres u		f Anaerobic Digesters – Process characterization and control- The l	ninc	hen	nistrv	
microhiolog	-	f Anaerobic Digesters – Process characterization and control- The logic treatment - Toxic substances in anaerobic treatment - Methane			-	and
-	y of anaerol	bic treatment - Toxic substances in anaerobic treatment - Methane	ge	ener	ation	and by
Anaerobic	y of anaerol Digestion- A	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog	ge gies-	ener - Si	ation	and by tage
Anaerobic and multista	y of anaerol Digestion- A age digesters	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog - Digester design and performance- Gas collection systems-Methane	ge gies-	ener - Si	ation	and by tage
Anaerobic and multista	y of anaerol Digestion- A age digesters	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog	ge gies-	ener - Si	ation	and by tage
Anaerobic and multista Recovery in	y of anaerol Digestion- A age digesters Landfills – I	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog - Digester design and performance- Gas collection systems-Methane	ge gies-	ener - Si	ation	and by tage and
Anaerobic and multista Recovery in Unit IV	y of anaerol Digestion- A age digesters Landfills – I Thermo-C	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog - Digester design and performance- Gas collection systems-Methane Biofuels from Biomass	ge gies- e Ge	ener - Sin ener	ation ngle s ration	and by tage and
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Anaerobic and multista Recovery in Unit IV Principles a Incinerator	y of anaerol Digestion- A age digesters Landfills – I Thermo-C nd Design of design - M	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog - Digester design and performance- Gas collection systems-Methane Biofuels from Biomass hemical Conversion of Waste To Energy f Energy Recovery Facilities -Types and principles of energy conve	ge gies- e Ge rsion fuel	ener - Sin ener n pr ls a	ration ngle s ration 8 He rocess nd wa	and by tage and ours es -
Anaerobic and multista Recovery in <u>Unit IV</u> Principles a Incinerator Determination	y of anaerol Digestion- A age digesters Landfills – I Thermo-C nd Design of design - M on of the sto	bic treatment - Toxic substances in anaerobic treatment - Methane Anaerobic reactor technologies - Commercial anaerobic Technolog - Digester design and performance- Gas collection systems-Methane Biofuels from Biomass hemical Conversion of Waste To Energy f Energy Recovery Facilities -Types and principles of energy conve ass Burn and RDF Systems- Composition and calorific value of	ge gies- e Ge rsion fuel on	ener - Sin ener n pr ls a - gr	ration ngle s ration 8 He rocess nd war	and by tage and es es uste ring
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	Department of Civil Engineering
	2. Appreciate the increasing importance of waste and resource management in achieving
	environmental sustainability.
	3. Analyze and describe the potential of solid waste as a secondary raw material,
Re	ferences:
1.	Aarne Veslind and Alan E Rimer (1981), "Unit operations in Resource Recovery Engineering", Prentice
	Hall Inc., London
2.	Manser A G R, Keeling A A (1996). Practical handbook of processing and recycling on municipal waste.
	Pub CRC Lewis London, ISBN 1-56670-164
3.	Chiumenti, Chiumenti, Diaz, Savage, Eggerth, and Goldstein , Modern Composting Technologies,
	JG Press October 2005
4.	Charles R Rhyner (1995), Waste Management and Resource Recovery, Lewis Publishers
5.	Gary C. Young (2010)Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and
	Renewable Comparisons, John Wiley & Sons

	W	ATER QUALITY MODELING L	Т	P	С	
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		ommon to Full time and Part Time)				
Course Ob	v					
		uce the fundamentals of mathematical models for water of	uality	and	the	
importance of model building.						
	2. To educate about the water parameters modeling and various ground water qua					
	Modeling.					
	3. To demons	strate the features and the use of most widely used computerized r	nodels	for w	vater	
	quality.					
Unit I	Modeling Perc	ceptions		9 He	ours	
Historical	development of	Environmental Impact Assessment (EIA). EIA in Project Cy	vcle. I	Legal	and	
		- Types and limitations of EIA EIA process- screening - sco				
analysis – r	nitigation. Cross	sectoral issues and terms of reference in EIA – Public Participation	in EL	A.	-	
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Unit II		nsport and Reactor Modeling		10 He		
	-	dvection, diffusion, dispersion- simple transport models - Plu	-			
Application	of PFR and MF	FR model - Steady state and time variable solutions-completely	mixed	syste	ems,	
concept ar	nd models in C	ompletely Stirred Tank Reactors, mass balance equations, loa	ding t	ypes,	feed	
forward vs.	feedback reactor	systems.				
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Unit III		· Quality Modeling		10 H		
Water qual	ity modeling of S	treams, Lakes and impoundments and Estuaries – Water quality- r		sensiti	vity	
Water qual – assessing	ity modeling of S model performa	treams, Lakes and impoundments and Estuaries – Water quality– r nce; Models for dissolved oxygen, pathogens and BOD-Streeter F	helps	sensiti mode	vity	
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	& Sons, 2008.
4.	"Modeling Groundwater Flow and Contaminant Transport By Jacob Bear, A. HD. Cheng, Springer
	Science & Business Media, 2010.
5.	"Mathematical Modeling of Groundwater Pollution" Ne-Zheng Sun, Alexander Sun, Springer
	New York, 2012

	NOISE POLLUTION AND CONTROL ENGINEERING	L	Т	Р	С
		3	0	0	3
	(Common to Full time and Part Time)				
Course Ob					
	1. To know the basics, importance of noise pollution measurement.				
	2. To study the various effects of noise pollution.				
	3. To learn the importance of methods of control of noise.				
	4. To study the various noise pollution regulations.				
	5. To know the basics, importance of noise pollution measurement.				
Unit I	Sources of Noise Pollution			9 H	ours
	noise – Units and Measurements of Noise – Noise Power level, Intensity h	evel I	Pressii		
	p, Noise level meter – Weighted networks – Decibeladdition – Octave Ban Noise – Day and night time –Standards, Equations and Application.	d – No	oise sj	pectru	m –
Unit II	Characterization of Noise Pollution			9 H	ours
	ation of Noise from Construction, Mining, Transportation and Industrial Activ ntrol Measures – Effects of noise pollution – auditory effects, non-auditory eff		Airpo	rt Noi	.se –
Unit III	Prevention& Control of Noise Pollution			9 H	ours
Noise Men:	ace – Noise and the Fetus – Prevention and Control of Noise Pollution – Cont	trol of	noise	at sou	ırce,
control of 1	transmission, protection of exposed person - Control of other types of Nois	e Som			
	tion Analyzer – Auditorium Designing – Anti Noise Device.	e bou		sorbe	nt –
Noise Pollu Unit IV	Acoustics of Noise			9 H	ours
Noise Pollu Unit IV Designing of mechanical	Acoustics of Noise Out Noise – Industrial Noise Control – effects of noise on workers efficiency -	Acous	tic q	9 H ouietin	ours g -
Noise Pollu Unit IV Designing of mechanical	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dam public education – other non- legislative measures.	Acous	tic q	9 H ouietin	g - oise
Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan n (Related to	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dam	Acous ping - e and Aircr	tic q - OSI the L	9 Ho uietin HA N 9 Ho aw – Act 1	ours g - oise ours The .934
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Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan n (Related to	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dam public education – other non- legislative measures. Regulatory Aspects of Noise Pollution Noise and the Administrative Function – Planning against Noise – Noise noise control Act 1963, Railway Act 1890 (Related to noise only), The pollution remedies.	Acous ping - e and - Aircr mental	tic q - OSI the L aft A Prote	9 H uietin HA N 9 H aw – Act 1 ection	ours g - oise Durs The 934 Act
Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan 1 (Related to 1986 – Noise	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dam public education – other non- legislative measures. Regulatory Aspects of Noise Pollution Noise and the Administrative Function – Planning against Noise – Noise noise control Act 1963, Railway Act 1890 (Related to noise only), The pollution remedies.	Acous ping - e and - Aircr mental	tic q - OSI the L aft A Prote	9 H uietin HA N 9 H aw – Act 1 ection	ours g - oise Durs The 934 Act
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Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan 1 (Related to 1986 – Noise	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dame public education – other non- legislative measures. Regulatory Aspects of Noise Pollution Noise and the Administrative Function – Planning against Noise – Noise noise control Act 1963, Railway Act 1890 (Related to noise only), The pollution remedies. To After completion of the course, Student will be able to 1. Understand the necessity to study the impacts and risks that will	Acous ping - e and - Aircr mental tal:	tic q - OSI the L aft A Prote	9 Ho uietin HA N 9 Ho aw – Act 1 ection 45 Ho	g - oise Durs The 934 Act
Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan n (Related to 1986 – Noise	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dame public education – other non- legislative measures. Regulatory Aspects of Noise Pollution Noise and the Administrative Function – Planning against Noise – Noise noise control Act 1963, Railway Act 1890 (Related to noise only), The pollution remedies. To After completion of the course, Student will be able to	Acous ping - e and Aircr mental tal:	tic q - OSI the L raft A Prote	9 Ho uietin HA N 9 Ho aw – Act 1 ection 45 Ho	g - oise Durs The 934 Act
Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan 1 (Related to 1986 – Noise Course Ou	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dame public education – other non- legislative measures. Regulatory Aspects of Noise Pollution Noise and the Administrative Function – Planning against Noise – Noise noise control Act 1963, Railway Act 1890 (Related to noise only), The pollution remedies. To After completion of the course, Student will be able to 1. Understand the necessity to study the impacts and risks that will pollution and the methods to overcome these impacts. 2. Know about the legal requirements for preventing and controlling noise	Acous ping - e and Aircr mental tal:	tic q - OSI the L raft A Prote	9 Ho uietin HA N 9 Ho aw – Act 1 ection 45 Ho	g - oise Durs The 934 Act
Noise Pollu Unit IV Designing of mechanical standards – Unit V Legislation Rajasthan 1 (Related to 1986 – Noise Course Ou References	Acoustics of Noise out Noise – Industrial Noise Control – effects of noise on workers efficiency - isolation technique, acoustical absorption, constrained layer dame public education – other non- legislative measures. Regulatory Aspects of Noise Pollution Noise and the Administrative Function – Planning against Noise – Noise noise control Act 1963, Railway Act 1890 (Related to noise only), The pollution remedies. To After completion of the course, Student will be able to 1. Understand the necessity to study the impacts and risks that will pollution and the methods to overcome these impacts. 2. Know about the legal requirements for preventing and controlling noise	Acous ping - e and Aircr mental tal:	tic q - OSI the L raft A Prote	9 Ho uietin HA N 9 Ho aw – Act 1 ection 45 Ho	g - oise Durs The 934 Act

17EV013		OPERATION AND MAINTENANCE OF ETP PLANTS	L	Т	Р	С
			3	0	0	3
		(Common to Full time and Part Time)				
Course Obj						
	1. To ed	ucate the student on the various Operation & Maintenanc	e asp	ects	of W	Vater
	treatme	ent systems, sewer systems, sewage treatment plants and	Efflu	lent	Treat	ment
	Plants.					
Unit I	Elements of	of Operation and Maintenance			9 H	ours
Strategy for	r Good Ope	eration and Maintenance- Knowledge of process and equipm	ient-	Preve	ntive	and
Corrective	maintenance	scheduling Operation and Maintenance Plan - Proper	and	adeq	uate t	ools,
Spare units	and parts - '	Training Requirements- Laboratory control- Records and Repor	ts- H	louse	keepii	ng -
Corrosion	prevention	and control -Sampling procedure-Analytical techniques- Co	ode (of pi	ractice	e for
analytical 1	aboratories-	Measurement of Flows, Pressures and Levels -Safety in	0&M	[Op	eratio	ns -
-		n System - Measures for Conservation of Energy- management o		-		
maintenance						L
Unit II	Operation	and Maintenance of Supply Systems			9 H	ours
Operational	problems, O	&M practices and Records of Operation of Reservoir and	Intak	es -	Cause	es of
Failure of V	Wells- Rehal	bilitation of Tube wells & Bore Wells- Prevention of Incrusta	tion a	nd (Corro	sion-
Maintenance	e of Lined ar	nd Unlined Canals- Problems in Transmission Mains- Maintenan	ce of	Pipe	elines	and
Leakage Co	ntrol- Repai	r Method for Different types of Pipes- Preventive and correc	tive 1	naint	enanc	e of
water pump	os – Algal	Control - O&M of Service Reservoirs - Problems in the water	r Distı	ributi	on Sy	stem
and remedie	es- Water Q	uality Monitoring and Surveillance- Water Meters, Instrumer	itation	, Tel	emetr	у&
Scada- Com	puterised W	ater Billing System				•
Unit III		and Maintenance of Sewer Systems	1 0			ours
		ns of sewer system – Conduits or pipes – Manholes – Ventilating				
	-	Operational Problems- Clogging of pipes - Hazards - Pr			-	-
		against infections - Devices for cleaning the conduits - Preve				
		pumps –operation and maintenance of sewage pumping stations-	Mainte	enanc	e Haz	zards
and Operato	r Protection	-Case Studies.				
Unit IV	Onoration	and Maintenance of Physico-Chemical Treatment Units			01	ours
		nance in screen chamber, Grit Chamber and clarifiers-	_ <u>Or</u>	eratic		
-		es and record keeping requirements for clarifier, Equalization b	-			
	-	e and mixing equipment - Chemical metering equipment - Fl				
		ges- Filter Press - Start-up and maintenance inspection -				-
		Handling – Jar Test - Chlorination Equipment - Membrane p		s syst	ems-	SDI
and LSI dete	ermination- I	Process Chemistry and Chemical dosage calculations- Case Studie	ès			
Unit V	Operation	and Maintenance of Biological Treatment			9 H	ours
		t - Relationship between social impacts and change in commu	nitv a	nd in		
-		and family level impacts. Communities in transition Document	-			
-		n of information and visual display materials – Report preparation				
Pranning	Jiganizatio	a of information and visual display materials - Report preparation	••			

			Total:	45 Hours
Co	urse Outcomes:			
	After com	letion of the course, Student will be able to		
	1. To ide	ntify the problems in treatment plants		
	2. To op	rate and maintain effluent treatment plants		
	3. To tro	ble shooting for smooth functioning of the pla	ants.	
Re	ferences:			
1.	CPHEEO, Manual	on operation and maintenance of water supp	ply systems, Central P	ublic Health and
	Environmental Eng	neering Organisation, Ministry of Urban D	Development, Governm	ent of India 2005
2.	Ministry of Drinkir	g Water and Sanitation, operation and maint	enance manual for run	al water supplies,
	Government of Indi	, 2013		
3.	Metcalf & Eddy, In	c., G. Tchobanoglous, H. D. Stensel, R. Tsu	chihashi, and F. L.Bu	rton. "Wastewater
	Engineering: Treatr	ent and Resource Recovery"5th edition). M	cGraw Hill Company.,	2014
4.	Ananth S Kodavas	l, The STP Guide-Design, Operation and 1	maintenance, Karnatal	a State Pollution
	Control Board, Ban	alore,2011		
5.	Frik Schutte, handl	ook for the operation of water Treatment W	orks, The Water Research	arch Commission,
	The Water Institute	of Southern Africa, TT265/06, 2006.		

17EV014		Department of Civil Engineering MARINE POLLUTION AND CONTROL	Т	Т	P	C
1/12/014		MARINE I OLLU HUN AND CUNTKUL		0	P 0	C 3
		(Common to Full time and Part Time)	3	U	U	3
Course Ob	niectives:	(Common to 1 un time and 1 art 1 me)				
	v	ate the Coastal and Marine Environment.				
	2. To edu	ate the ocean dynamics				
		sources of marine pollution and methods for monitoring, mo	odeling an	d con	trol.	
		1 0/	0			
Unit I	Marine an	Coastal Environment			9 H	ours
Seas and oc	ceans, Contin	ntal area, Coastal zone, Properties of sea water, Principles of	f Marine (Geolo	gy, co	astal
features – E	Beaches, Estu	ries, Lagoons-The oceans and climate				
Unit II	Ocean Hy	rodynamics			9 H	ours
Wave Theo	ory, Waves in	shallow waters - Refraction, Diffraction and Shoaling, App	proximatio	ns fo	r deep	and
shallow wa	ater conditior	s - Tidal Classification - General circulation of ocean w	vaters - O	cean	curren	nts -
Coastal sed	diment transp	rt - Onshore offshore sediment transport - Beach formatio	on and coa	istal p	roces	ses -
Tsunamis, s	storm surge, I	l Niño effect.				
Unit III	Marina Da	lution Sources and Effects			9 H	
		ion – Point and non-point sources, Pollution caused by O	il Explor	ntion		
	fuctures, Ti					arine
discharges a		riculture Impacts of pollution on water quality and coa	ustur eeosy	stems	, IVIC	arıne
discharges a	and effluent s		ustur eeosy	sterns	, I VI	arıne
Unit IV	and effluent s					arine ours
Unit IV	and effluent s	andards.			9 H	ours
Unit IV Basic meas	and effluent s Marine Po surements - Second	andards. Iution Monitoring unding boat, lead lines, echo sounders – current meters - ti	de gauge	- use	9 H of G	ours PS -
Unit IV Basic meas Measureme	and effluent s Marine Po surements - Seent of coasta	andards. lution Monitoring unding boat, lead lines, echo sounders – current meters - ti water characteristics – sea bed sampling – Modeling of	de gauge f Pollutar	- use it trar	9 H of G	ours PS - and
Unit IV Basic meas Measureme dispersion	and effluent s Marine Po surements - S ent of coasta - Oil Spill M	andards. Iution Monitoring unding boat, lead lines, echo sounders – current meters - ti water characteristics – sea bed sampling – Modeling of odels - Ocean Monitoring satellites – Applications of Rer	de gauge f Pollutar	- use it trar	9 H of G	ours PS – and
Unit IV Basic meas Measureme dispersion monitoring	and effluent s Marine Po surements - Seent of coasta	andards. Iution Monitoring unding boat, lead lines, echo sounders – current meters - ti water characteristics – sea bed sampling – Modeling of odels - Ocean Monitoring satellites – Applications of Rer	de gauge f Pollutar	- use it trar	9 H of G	ours PS – and
Unit IV Basic meas Measureme dispersion monitoring Unit V	and effluent s Marine Po surements - Se ent of coasta - Oil Spill M marine pollu Environm	andards. lution Monitoring unding boat, lead lines, echo sounders – current meters - tic water characteristics – sea bed sampling – Modeling of odels - Ocean Monitoring satellites – Applications of Ren on ntal Risk Assessment and Management	de gauge f Pollutar mote Sens	- use at tran ing a	9 Ha of G nsport nd Gl 9 Ha	ours PS – and S in ours
Unit IV Basic meas Measureme dispersion monitoring Unit V	and effluent s Marine Po surements - Se ent of coasta - Oil Spill M marine pollu Environm	andards. lution Monitoring unding boat, lead lines, echo sounders – current meters - ti- water characteristics – sea bed sampling – Modeling of odels - Ocean Monitoring satellites – Applications of Rer on	de gauge f Pollutar mote Sens	- use at tran ing a	9 Ha of G nsport nd Gl 9 Ha	ours PS – and S in ours
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Science, CRC Press, 1996.

17EV015	ENVIDONMENT HEALTH AND CAPETY FOD				
	ENVIRONMENT, HEALTH AND SAFETY FOR	L	Т	Р	С
	INDUSTRIES				
		3	0	0	3
	(Common to Full time and Part Time)				
Course Ob	jectives:				
•	1. To provide exposure to the students about safety and health provisions	relate	d to	hazar	dous
	processes as laid out in Factories act 1948.				
	2. To familiarize students with powers of inspectorate of factories.				
	· · ·				
	3. To help students to learn about Environment act 1986 and rules framed u	under	the ac	et.	
	4. To provide wide exposure to the students about various legislatio	ns ap	plica	ble to	o an
	industrial unit.				
Unit I	Factories Act – 1948			9 H	ours
	uthorities – inspecting staff, health, safety, provisions relating to hazardous	s prod	resses		
•	ours, employment of young persons – special provisions – penalt	-			
-		ies a	nu pi	oceui	1168-
Tamilnadu	Factories Rules 1950 under Safety and health chapters of Factories Act 1948.				
Unit II	Environment Act – 1986			9 H	01110
	wers of the central government, prevention, control and abatement of environment		4 1		
powers and	81 and Water Act 1974: Central and state boards for the prevention and confunctions of boards – prevention and control of air pollution and water pollution enalties and procedures.				
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	Department of Civil Engineering
	4. To understand the statutory requirements for an Industry on registration, license and its
	renewal.
	5. To prepare onsite and offsite emergency plan.
Re	ferences:
1.	The Factories Act 1948, Madras Book Agency, Chennai, 2000
2.	The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
3.	Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New
	Delhi.
4.	Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New
	Delhi.
5.	The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
6.	The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
7.	The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.
8.	National seminar on hazardous waste management organized by National Safety council, Ministry
	of environment and forests, Government of India, United States - Asia environmental partnership,
	Tamilnadu pollution control board and Indian chemical manufacturers association, April 2001.