# **BE CIVIL ENGINEERING**

1701MGX001		PROFESSIONAL ETHICS	L	Т	Р	С
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Course Objecti						
		mary goal is to stimulate critical and responsible reflection				
		ing engineering practice and to provide the conceptual tool	ls necessa	ary fo	or	
		those issues.	1 0	1		
		make the students aware of the different ethical issues, co in the society and moralities in an organization.	des of co	nauc	t for	
Unit I	<u> </u>	DUCTION & HUMAN VALUES			9 H	mrs
		- Work Ethic - Team work – Types of Ethics - Respect for	Others-	Livin		Juis
		age - Valuing Time - Co-operation - Commitment- Self-C				s
and religion-Car						~
Unit II		ERING ETHICS			9 H	ours
		ty of moral issues – Types of Inquiry – Professional accou				
- Moral dilemm	as – Kohlb	berg's Theory – Gilligan's Theory – Theories about Right	Action –	Ethic	al co	les
of IEEE and Inst	titution of	Engineers.				
Unit III	SAFETY	A & RESPONSIBILITY OF ENGINEERS			10 He	ours
		ation - Safety and Risks - Risk - benefit analysis - Comp				
		Engineering standards – Communicating Risk and Public P				
	ional Righ	ts and Employee Rights – Whistle Blowing – Collective B	argaining	g - C	onflic	ts
of Interest.						
Unit IV		CER'S ROLE			9 H	
		dvisors, Consultants, Experts and Witness – Engineers role				
	•	on – Moral leadership - Collegiality and loyalty – IPR – D	iscrimina	tion ·	- Bhoj	pal
gas tragedy case					0 11	
Unit V		L ISSUES	7 1 4		8 H	ours
		-Environmental Ethics- Weapons Development- Code of C				
Pollution contro		- Sustainable technology & development - ozone depleti	on – Eco	syste	em –	
Follution Contro	1.	r	<b>D</b> . 4 . 1.		45 TT	
Eth D			Fotal:		45 He	ours
<b>Further Procee</b>	0		<i>.</i> .			
	1. A	Analysis about Safety and Risk Management in an Organis	ation			
	2. <i>A</i>	Analysis about Code of Conduct for Ethical & Moral value	NC .			
Course Outcom						
Course Outcon		npletion of the course, Student will be able to				
		Destain awareness on Human Values & Social Values of the	e every in	divid	hual	
		Knowledge about ethical theories and relevant code of con-				
		Enumerate the safety and responsibility of engineers in the		argin		
		Realize their responsibilities, professional rights and moral		he		
			1005 101 1			
	e	enhancement of an organization.				
	7. I	Explain about the environmental impacts at present day sce	nario			
	/. [	Explain about the environmental impacts at present day set	.mai 10.			

1702CE305		BUILDING MATERIALS AND RESOURCE PLANNING	L	Т	Р	C		
			3	0	0	3		
Course Obje	ctives:							
	1. To give students an understanding of typical and potential application of Building materials.							
	2.To ensure that students know about the manufacturing process of Building materials and mix designing procedure of concrete							
	3.Give stud constructio	lents an appreciation of the effective use of common and m n	oderr	n mat	erials	in		
Unit I	Stones – b	ricks – concrete blocks			9 H	ours		
Stone as build		- Criteria for selection - Tests on stones - Deterioration and	Preser	vatio				
	otion – Efflor	ation – <mark>Manufacturing of clay bricks</mark> – Tests on bricks – Cor rescence – Bricks for special use – Refractory bricks – Cemer ks.						
Unit II	Lime – cen	nent – aggregates – mortar			9 H	ours		
Properties of Soundness ar	cement and C nd consistenc Crushing stre	e mortar – Cement – Ingredients – Manufacturing process – Cement mortar – Hydration – Compressive strength – Tensile y – Setting time – Industrial byproducts – Fly ash – Aggreg ngth – Impact strength – Flakiness Index – Elongation Index –	streng gates -	gth – – Nat	Finen ural s	ess– tone		
Unit III	Concrete					ours		
Slump – Flow strength – Mo	w and compa odulus of rupt	Manufacturing Process – Batching plants – RMC – Propertie ction Factor – Properties of hardened concrete – Compressiv ure – Tests – Mix specification – Mix proportioning – BIS me compacting Concrete – Other types of Concrete – Durability of	ve, Te thod -	nsile - Higl	and s 1 Stre	hear		
Unit IV		d modern material				ours		
Aluminum co for joints – H	rket forms – 1 mposite pane Fiber glass re	Industrial timber– Plywood – Veneer – Therma Cole – Panels el – Uses – Paints – Varnishes – Distempers – Bitumens.Glass – einforced plastic – Clay products – Refractories – Composit and Geotextiles for earth reinforcement.	-Cera	mics	es – Sea	Steel lants		
Unit V	Materials r	nanagement			9 H	ours		
Materials Ma	anagement -	Material Procurement and Delivery - Inventory Control - T	radeo	offs o	<mark>f Cos</mark>	ts		
in Materials		t						
Further Rea	ding:	Tot	al:		45 H	ours		
		npletion of this course the students will be able to Compare	the r	orope	rties	of		
		ommon and advanced building materials and understand the						
		al applications of these materials	J P-					
<b>Course Outc</b>		**						
		letion of the course, Student will be able to						
		ze the most common and advanced materials used for constru	ction.					
		ne manufacturing process of various building materials						
		the properties of fresh and hardened concrete and performan	ice of	othe	r type	es of		

4. Illustrate the usage of timber, plywood and aluminum, composite material, paints, distemper and modern materials.
5.summarize the procedure in material management

1702CE604		WATER SUPPLY ENGINEERING	r	L	Т	Р	C
				3	0	0	3
Course Obje							
		examine the water supply system and c					
		create an ability to evaluate the water	r treatment and ac	dvanced v	vater	treatr	nent
		stem. train the students to analyze water distr	ibution austam and	d aunalus t	o huil	dinas	
	5.	o train the students to anaryze water distr	ibution system and	i supply t	o bun	ungs	•
Unit I	<b>PLANN</b>	IG FOR WATER SUPPLY SYSTEM				08 Ho	ours
		em -Planning -Design period - Population		ater dema			
water and th	heir chara	eristics -Surface and Groundwater- In	mpounding Reser	voir Wel	ll hyd	drauli	cs -
		on of source - Water quality - Characteriz	zation and standard	ds.			
Unit II		ANCE SYSTEM				07 Ho	
		uctures -Functions and drawings -Pipes					
•	-	es -Transmission main design – Materia			-		g of
pipes - Drawi	ings appur	nances - Types and capacity of pumps -S	Selection of pumps	and pipe	mate	rials.	
TT •4 TTT						10.11	
Unit III		TREATMENT	1 ' 1 1	·		<u>12 Ho</u>	
5	-	ions and processes - Principles, function	U	U		ens, F	lash
mixers. flocc							
,••	ulators, se	mentation tanks and sand filters - Disinfe	ection- Residue Ma	anagemen	it.		
			ection- Residue Ma	anagemen		09 H	)11 <b>r</b> 6
Unit IV	ADVAN	ED WATER TREATMENT				09 Ho salina	
Unit IV Aerator - Iron	ADVAN	ED WATER TREATMENT nese removal, Defluoridation and demin	eralization -Water	softening	g - De	salina	tion
Unit IV Aerator - Iror - Membrane S	ADVAN n and man Systems-C	ED WATER TREATMENT nese removal, Defluoridation and demin nstruction and Operation & Maintenance	eralization -Water	softening	g - De	salina	tion
Unit IV Aerator - Iror - Membrane S	ADVAN n and man Systems-C	ED WATER TREATMENT nese removal, Defluoridation and demin nstruction and Operation & Maintenance	eralization -Water	softening	g - De	salina	tion
<b>Unit IV</b> Aerator - Iron - Membrane S advances-Me	<b>ADVAN</b> n and man Systems-C mbrane pr	ED WATER TREATMENT nese removal, Defluoridation and demin nstruction and Operation & Maintenance	eralization -Water aspects of Water T	softening	g - De Plant	salina	tion cent
Unit IV Aerator - Iror - Membrane S advances-Me Unit V	ADVAN n and man Systems-C mbrane pi WATEI	ED WATER TREATMENT nese removal, Defluoridation and demin nstruction and Operation & Maintenance cesses.	eralization -Water aspects of Water T BUILDINGS	softening Freatment	g - De Plant	salina ts- Re <b>09 H</b> o	tion cent
Unit IV Aerator - Iror - Membrane S advances-Me Unit V Requirements	ADVAN and man Systems-C mbrane pr WATEI s of water	ED WATER TREATMENT nese removal, Defluoridation and demin astruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B	eralization -Water aspects of Water 7 BUILDINGS rvoirs -Functions	softening Freatment and draw	g - De Plant vings	salina ts- Re 09 Ho -Netv	tion cent ours
Unit IV Aerator - Iron - Membrane S advances-Me Unit V Requirements design - Anal	ADVAN n and man Systems-C mbrane pr WATEI s of wate: ysis of dis	ED WATER TREATMENT nese removal, Defluoridation and demin nstruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reservite bution networks –Pipe Appurtenances -Componenter	eralization -Water aspects of Water T BUILDINGS rvoirs -Functions operation and main	softening Treatment and draw	g - De Plant vings Leak	salina ts- Re <b>09 H</b> -Netv detect	tior cen ours vork
Unit IV Aerator - Iror - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin	ADVAN and man Systems-C mbrane pr WATEI s of water lysis of dis nciples of	ED WATER TREATMENT nese removal, Defluoridation and demin astruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reser	eralization -Water aspects of Water T BUILDINGS rvoirs -Functions operation and main	softening Treatment and draw	g - De Plant vings Leak	salina ts- Re <b>09 H</b> -Netv detect	tior cent ours vork
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Unit IV Aerator - Iron - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl	ADVAN and man Systems-C mbrane pr WATEL s of water lysis of dis nciples of lumbing a	ED WATER TREATMENT nese removal, Defluoridation and demin astruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reser bution networks –Pipe Appurtenances -c sign of water supply in buildings -House	eralization -Water aspects of Water 7 BUILDINGS rvoirs -Functions operation and main e service connectio	softening Treatment and draw	g - De Plant vings Leak es and	salina ts- Re <b>09 H</b> -Netv detect	tion cent ours vork tion igs -
Unit IV Aerator - Iron - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl	ADVAN a and man Systems-C mbrane pr WATEI s of wate: ysis of dis nciples of lumbing a ding:	ED WATER TREATMENT nese removal, Defluoridation and demin instruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reser bution networks –Pipe Appurtenances -c sign of water supply in buildings -House drawings of types of plumbing.	eralization -Water aspects of Water T BUILDINGS rvoirs -Functions operation and main e service connectio	softening Treatment and draw atenance - on -Fixture	g - De Plant vings Leak es and	salina ts- Re 09 Ho -Netv detect l fittir	tion cent ours vork tion igs -
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Unit IV Aerator - Iron - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl	ADVAN a and man Systems-C mbrane pr WATEI s of water ysis of dis nciples of lumbing a ding: 1.	ED WATER TREATMENT nese removal, Defluoridation and demin instruction and Operation & Maintenance resses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reservition networks –Pipe Appurtenances - bution networks –Pipe Appurtenances - sign of water supply in buildings -House drawings of types of plumbing.	eralization -Water aspects of Water 7 BUILDINGS rvoirs -Functions operation and main e service connection water treatment. torm run-off genera	softening Freatment and draw atenance - on -Fixture <b>Total:</b>	g - De Plant vings Leak es and	salina ts- Re 09 Ho -Netv detect l fittir	tior cen ours vork tion ags -
Unit IV Aerator - Iror - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl Further Rea	ADVAN a and man Systems-C mbrane pr WATEI s of water lysis of dis nciples of lumbing a ding: 1. 2.	ED WATER TREATMENT nese removal, Defluoridation and demin instruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reser- bution networks –Pipe Appurtenances -c sign of water supply in buildings -House drawings of types of plumbing.	eralization -Water aspects of Water 7 BUILDINGS rvoirs -Functions operation and main e service connection water treatment. torm run-off genera	softening Freatment and draw atenance - on -Fixture <b>Total:</b>	g - De Plant vings Leak es and	salina ts- Re 09 Ho -Netv detect l fittir	tior cen ours vork tion ags -
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Unit IV Aerator - Iror - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl Further Rea	ADVAN and man Systems-C mbrane pr WATEI s of water ysis of dis nciples of lumbing a ding: 1. 2. comes: After co	ED WATER TREATMENT nese removal, Defluoridation and demin instruction and Operation & Maintenance cesses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reservition networks –Pipe Appurtenances - sign of water supply in buildings -House drawings of types of plumbing. pply an appropriate unit system for the vestimate the quantity of wastewater and stand design a suitable collection system for building of the course, Student will be able	eralization -Water aspects of Water T BUILDINGS rvoirs -Functions operation and main e service connection water treatment. torm run-off generar r the generated was e to	r softening Treatment and draw and draw itenance - on -Fixture Total: rated from stewater.	g - De Plant vings Leak es and 2	salina ts- Re 09 Ho -Netv detect l fittir	tior cen ours vork tion ags -
Unit IV Aerator - Iror - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl Further Rea	ADVAN a and man Systems-C mbrane pr WATEI s of water ysis of dis nciples of lumbing a ding: 1. 2. comes: After co 1.	ED WATER TREATMENT nese removal, Defluoridation and demin instruction and Operation & Maintenance resses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reservition networks –Pipe Appurtenances - bution networks –Pipe Appurtenances - sign of water supply in buildings -House drawings of types of plumbing. pply an appropriate unit system for the version stimate the quantity of wastewater and stand design a suitable collection system for buildings about the principles and developments and developme	eralization -Water aspects of Water T BUILDINGS rvoirs -Functions operation and main e service connection water treatment. torm run-off generated was r the generated was e to nent of water suppl	softening Freatment and draw and draw atenance - on -Fixture <b>Total:</b> ated from stewater.	g - De Plant vings Leak es and a the t	salina ts- Re 09 Ho -Netv detect l fittir	tior cen ours vork tion ags -
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Unit IV Aerator - Iror - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin Systems of pl Further Rea	ADVAN A and man Systems-C mbrane pr WATEI s of water ysis of dis nciples of lumbing a ding: 1. 2. comes: After co 1. 2. 3.	ED WATER TREATMENT nese removal, Defluoridation and demin astruction and Operation & Maintenance resses. DISTRIBUTION AND SUPPLY TO B distribution -Components -Service reserving bution networks –Pipe Appurtenances - sign of water supply in buildings -House drawings of types of plumbing. pply an appropriate unit system for the w stimate the quantity of wastewater and stind design a suitable collection system for buildings about the principles and developm esign the pipelines for water supply syste esign drawing of various unit operations	eralization -Water aspects of Water 7 BUILDINGS rvoirs -Functions operation and main e service connectio water treatment. torm run-off generar r the generated was e to hent of water suppl in water supply sy	softening Freatment and draw atenance - on -Fixture Total: rated from stewater. y system. head loss. /stem.	g - De Plant vings Leak es and a the t	salina ts- Re <b>09 Ho</b> -Netv detect l fittir	tior cen ours vork tion ags -
Unit IV Aerator - Iron - Membrane S advances-Me Unit V Requirements design - Anal Methods. Prin	ADVAN A and man Systems-C mbrane pr WATEI s of water ysis of dis nciples of lumbing a ding: 1. 2. comes: After co 1. 2. 3. 4.	ED WATER TREATMENT nese removal, Defluoridation and demin instruction and Operation & Maintenance resses. DISTRIBUTION AND SUPPLY TO B listribution -Components -Service reservition networks –Pipe Appurtenances - sign of water supply in buildings -House drawings of types of plumbing. pply an appropriate unit system for the vestimate the quantity of wastewater and stand design a suitable collection system for boletion of the course, Student will be able iscuss about the principles and development esign the pipelines for water supply system entify the methods for removing contam	eralization -Water aspects of Water 7 BUILDINGS rvoirs -Functions operation and main e service connectio water treatment. torm run-off generar r the generated was e to hent of water suppl in water supply sy	softening Freatment and draw atenance - on -Fixture Total: rated from stewater. y system. head loss. /stem.	g - De Plant vings Leak es and a the t	salina ts- Re <b>09 Ho</b> -Netv detect l fittir	tior cent ours vork tion ags -
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- 1. Garg, S.K., "Environmental Engineering", Vol.1 Khanna Publishers, New Delhi, 2005.
- 2. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.
- 3. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2005

1702CE652		ENVIRONMENTAL AND IRRIGATION DESIGNAND DRAWING			Т	Р	С
				3	0	0	3
Course Obje							
		out the design of environmental structures					
	2.to know the	pictorial representation of irrigation structures					
Unit I	WATER SU	PPLY AND TREATMENT				08 H	ours
		mixer, flocculator, clarifier – Slow sand filter – Rapid	sand filt	er –			
U	0	towers – Service reservoirs – Pumping station – Hous					
	or water supply						
Unit II	SEWAGE T	REATMENT & DISPOSAL				07 H	ours
Design and D	Drawing of scre	en chamber - Grit channel - Primary clarifier - Activa	ted sludg	e			
process - Aei	ration tank & c	xidation ditch – Trickling filters – Secondary clarifier	s – Sludg	ge			
		ls – Waste stabilisation ponds - Septic tanks and dispe	osal				
arrangements							
Unit III		NG STRUCTURES				12 H	ours
		Weir, Tank Sluice with tower road – Drawing showin	g plan,				
elevation, hal	f section inclu	ling foundation details.					
Unit IV	CANAL TR	ANSMISSION STRUCTURES				09 H	ours
Aqueducts -	Syphon Aqueo	ucts - Super passage - Canal siphon - Canal Drops- 1	Drawing				
showing plan	, elevation and	foundation details.					
Unit V							
Canal head w	CANAL RE	GULATION STRUCTURES				09 H	ours
		GULATION STRUCTURES egular – Canal escape- Proportional Distributors – Dra	awing sho	wi		09 H	ours
	orks- Canal R	egular – Canal escape- Proportional Distributors – Dra	awing sho	owi		09 H	ours
		egular – Canal escape- Proportional Distributors – Dra			ng		
detailed plan,	orks- Canal R , elevation and	egular – Canal escape- Proportional Distributors – Dra	awing sho Total:		ng	09 Ho 45 Ho	
	orks- Canal R elevation and ding:	egular – Canal escape- Proportional Distributors – Dra foundation.	Total:		ng		
detailed plan,	orks- Canal R elevation and ding: 1.to analyse	egular – Canal escape- Proportional Distributors – Dra	Total:		ng		
detailed plan, Further Rea	orks- Canal R elevation and ding: 1.to analyse comes:	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc	Total:		ng		
detailed plan, Further Rea	ding: 1.to analyse After completion	egular – Canal escape- Proportional Distributors – Dra foundation.	Total:		ng		
detailed plan, Further Rea	ding: 1.to analyse After comple 1.design env	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to ronmental treatment system	Total:		ng		
detailed plan, Further Rea	ding: 1.to analyse After comple 1.design env 2. design the	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to	Total:		ng		
detailed plan, Further Rea	ding: 1.to analyse = omes: After completing = 1.design environ = 2. design the 3. design the	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to ronmental treatment system irrigationimpounding structures	Total:		ng		
detailed plan, Further Rea	ding: 1.to analyse = omes: After completing = 1.design environ = 2. design the 3. design the	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to ronmental treatment system irrigationimpounding structures canal transmission structures	Total:		ng		
detailed plan, Further Rea Course Outc	ding: 1.to analyse comes: After completing 1.design environ 2. design the 3. design the 4. design the	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to ronmental treatment system irrigationimpounding structures canal transmission structures	Total: tures		ng		
detailed plan, Further Rea Course Outc References: 1.Garg, S.K., 2.Sathyanara	ding: 1.to analyse a comes: After completing and 1.design envice and 2. design the 3. design the 4. design the "Environmention"	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to ronmental treatment system irrigationimpounding structures canal transmission structures canal regulation structures al Engineering", Vol.1 Khanna Publishers, New Delh frrigation Design and Drawing" Published by MrsL.B	Total: tures			45 He	
detailed plan, Further Rea Course Outc Course State References: 1.Garg, S.K., 2.Sathyanara Godavari Dis	ding: 1.to analyse omes: After completing 1.design envices 2. design the 3. design the 4. design the "Environment yana Murthy " trict. A.P. 199	egular – Canal escape- Proportional Distributors – Dra foundation. and draw advanced irrigation and environmental struc tion of the course, Student will be able to ronmental treatment system irrigationimpounding structures canal transmission structures canal regulation structures al Engineering", Vol.1 Khanna Publishers, New Delh frrigation Design and Drawing" Published by MrsL.B	Total: tures i, 2005. anumathi	, Tı	ng 2	45 Ho	Durs
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5.Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2005

1702CE702	WASTE	WATER ENGINEERING	L	Т	Р	С
			3	0	0	3
Course Obje	ctives:					
	1. To understand the importance of		system.			
	2. To create an ability to evaluate the					
	3. To impart the signification of dis	sposal of Sewage.				
Unit I	PLANNING FOR SEWERAGE				09 Ho	
Sources of wa	stewater generation – Effects – Esti	imation of sanitary sewage flow –	Estimation	of sto	rm ru	noff
	ecting Characteristics and composit	tion of sewage and their significant	nce – Efflu	ent st	andar	ds –
Legislation re	quirements.					
Unit II	DESIGN OF SEWER				09 Ha	mrs
	ydraulics of flow in sewers – Design	n period - Design of sanitary and st	orm sewers			
	terials of sewers– Laying, joining &					
	of sewers- Sewer appurtenances – F					
	aildings – One pipe and two pipe sys		e Dramage		*****	Б
bystem for B	manigs one pipe and two pipe sys					
Unit III	PRIMARY TREATMENT OF S				09 Ho	
	PRIMARY TREATMENT OF S init Operation and Processes – Selec		ciples, funct			
Objective – U		ction of treatment processes – Princ		ions c	lesign	and
Objective – U drawing of se	nit Operation and Processes – Selec	ction of treatment processes – Princ edimentation tanks – Operation ar		ions c	lesign	and
Objective – U drawing of so Onsite sanitat	nit Operation and Processes – Selec creen, grit chambers and primary se ion - Septic tank, Grey water harves	ction of treatment processes – Princ edimentation tanks – Operation ar sting.		ions c ance	lesign aspect	and s –
Objective – U drawing of so Onsite sanitat <b>Unit IV</b>	nit Operation and Processes – Selec creen, grit chambers and primary se ion - Septic tank, Grey water harves SECONDARY TREATMENT O	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b>	nd Maintena	ions c ance	lesign aspect <b>09 H</b> o	and s –
Objective – U drawing of so Onsite sanitat <b>Unit IV</b> Objective – S	nit Operation and Processes – Selec creen, grit chambers and primary se ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> rinciples, Functions, Design and Dr	ad Maintena	ions c ance a nits -	lesign aspect 09 Ho Activ	and s – ours ated
Objective – U drawing of so Onsite sanitat <b>Unit IV</b> Objective – S Sludge Proce	nit Operation and Processes – Selec creen, grit chambers and primary so ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr ss and Trickling filter, other treatme	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> rinciples, Functions, Design and Dr ent methods – Oxidation ditches, U	ad Maintena rawing of U ASB – Was	ions c ance a nits -	lesign aspect 09 Ho Activ abiliza	and as – ours ated ation
Objective – U drawing of se Onsite sanitat Unit IV Objective – S Sludge Proce Ponds – Rec	nit Operation and Processes – Selec creen, grit chambers and primary se ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr as and Trickling filter, other treatme lamation and Reuse of sewage - F	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>F SEWAGE</b> rinciples, Functions, Design and Dr ent methods – Oxidation ditches, U. Recent Advances in Sewage Trea	ad Maintena rawing of U ASB – Was	ions c ance a nits -	lesign aspect 09 Ho Activ abiliza	and as – ours ated ation
Objective – U drawing of se Onsite sanitat Unit IV Objective – S Sludge Proce Ponds – Rec	nit Operation and Processes – Selec creen, grit chambers and primary so ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr ss and Trickling filter, other treatme	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>PF SEWAGE</b> rinciples, Functions, Design and Dr ent methods – Oxidation ditches, U Recent Advances in Sewage Trea Plants.	ad Maintena rawing of U ASB – Was	ions c ance a nits - ste Sta onstru	lesign aspect 09 Ho Activ abiliza	and ss – ours ated ation and
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Objective – U drawing of se Onsite sanitat <b>Unit IV</b> Objective – S Sludge Proce Ponds – Rec Operation & I <b>Unit V</b> Standards for	nit Operation and Processes – Selec creen, grit chambers and primary sec ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr and Trickling filter, other treatme lamation and Reuse of sewage - F Maintenance of Sewage Treatment P <b>DISPOSAL OF SEWAGE AND</b> Disposal - Methods – dilution – Se	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> rinciples, Functions, Design and Dr ent methods – Oxidation ditches, U. Recent Advances in Sewage Trea Plants. <b>SLUDGE</b> elf-purification of surface water bo	ad Maintena awing of U ASB – Was ttment – Co dies – Oxyg	ions c ance a nits - ste Sta onstru	lesign aspect <b>09 Ho</b> Activ abiliza action <b>09 Ho</b> ag cur	and s – ours ated ation and ours ve –
Objective – U drawing of se Onsite sanitat <b>Unit IV</b> Objective – S Sludge Proce Ponds – Rec Operation & D <b>Unit V</b> Standards for Land disposa	nit Operation and Processes – Selec creen, grit chambers and primary se ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr as and Trickling filter, other treatme lamation and Reuse of sewage - F Maintenance of Sewage Treatment P <b>DISPOSAL OF SEWAGE AND</b> Disposal - Methods – dilution – Se I – Sewage farming – Deep well in	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> inciples, Functions, Design and Dr ent methods – Oxidation ditches, U. Recent Advances in Sewage Trea Plants. <b>SLUDGE</b> elf-purification of surface water boo njection – Soil dispersion system	ad Maintena awing of U ASB – Was ttment – Co dies – Oxyg -Sludge cha	ions c ance a nits - ste Sta onstru gen sa aracte	lesign aspect <b>09 Ho</b> Activ abilization <b>09 Ho</b> ag cur erizatio	and s – ours ated ation and ours ve – on –
Objective – U drawing of se Onsite sanitat Unit IV Objective – S Sludge Proce Ponds – Rec Operation & D Unit V Standards for Land disposa Thickening –	nit Operation and Processes – Selec creen, grit chambers and primary sec ion - Septic tank, Grey water harves <b>SECONDARY TREATMENT O</b> election of Treatment Methods – Pr and Trickling filter, other treatme lamation and Reuse of sewage - F Maintenance of Sewage Treatment P <b>DISPOSAL OF SEWAGE AND</b> Disposal - Methods – dilution – Se	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> inciples, Functions, Design and Dr ent methods – Oxidation ditches, U. Recent Advances in Sewage Trea Plants. <b>SLUDGE</b> elf-purification of surface water boo njection – Soil dispersion system	ad Maintena awing of U ASB – Was ttment – Co dies – Oxyg -Sludge cha	ions c ance a nits - ste Sta onstru gen sa aracte	lesign aspect <b>09 Ho</b> Activ abilization <b>09 Ho</b> ag cur erizatio	and s – ours ated ation and ours ve – on –
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Objective – U drawing of se Onsite sanitat <b>Unit IV</b> Objective – S Sludge Proce Ponds – Rec Operation & I <b>Unit V</b> Standards for Land disposa Thickening – in Sludge Tre	nit Operation and Processes – Selectoren, grit chambers and primary sector - Septic tank, Grey water harves  SECONDARY TREATMENT O election of Treatment Methods – Press and Trickling filter, other treatment lamation and Reuse of sewage - Ferret Maintenance of Sewage Treatment P DISPOSAL OF SEWAGE AND Disposal - Methods – dilution – Set  - Sewage farming – Deep well in Sludge digestion – Biogas recovery atment and disposal.  In Section 2.2	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> inciples, Functions, Design and Dr ent methods – Oxidation ditches, U. Recent Advances in Sewage Trea Plants. <b>SLUDGE</b> elf-purification of surface water boo njection – Soil dispersion system	nd Maintena awing of U ASB – Was ttment – Co dies – Oxyg -Sludge cha tring – dispo Total:	ions c ance a nits - ste Sta onstru gen sa aracte osal –	lesign aspect <b>09 Ho</b> Activ abiliza action <b>09 Ho</b> ng cur arizatio Adva	and s – ours ated ation and ours ve – on – nces
Objective – U drawing of se Onsite sanitat <b>Unit IV</b> Objective – S Sludge Proce Ponds – Rec Operation & I <b>Unit V</b> Standards for Land disposa Thickening – in Sludge Tre	nit Operation and Processes – Selecteren, grit chambers and primary sector of - Septic tank, Grey water harves  SECONDARY TREATMENT O election of Treatment Methods – Press and Trickling filter, other treatment lamation and Reuse of sewage - Fermination - Setting - Deep well in Sludge digestion – Biogas recovery - atment and disposal.  Fing: The Setting - Deep well for the recessary treatment - Reuse - Fermination - Setting - Reuse - Fermination - Reu	ction of treatment processes – Princ edimentation tanks – Operation ar sting. <b>DF SEWAGE</b> rinciples, Functions, Design and Dr ent methods – Oxidation ditches, U. Recent Advances in Sewage Trea Plants. <b>SLUDGE</b> elf-purification of surface water bo- njection – Soil dispersion system – Sludge Conditioning and Dewate	nd Maintena awing of U ASB – Was ttment – Co dies – Oxyg -Sludge cha rring – dispo Total:	ions c ance a nits - ste Sta onstru gen sa aracte osal –	lesign aspect O9 Ho Activ abiliza action 09 Ho ag cur rizatio Adva 45 Ho	and and ss – purs ated ated ated ated and purs ve – pn – nces
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2.	Design sewerage systems and discuss about the treatment process step by step done in primary level.
3.	Design the various unit operations for waste water treatment.
4.	Design the sludge treatment and disposal methods.
5.	
	Purification of streams.

1703CE006		SOLID WASTE MANAGEMENT	L	Т	Р	С
			3	0	0	3
Course Obje	ctives:			v	v	
		ne Sources and types of municipal solid wastes				
	•	the knowledge of On-site Processing, collection and tra	nsfer of so	lid wa	ste.	
	1	the knowledge of Off –site Processing and waste dispo				
	10 acquire	the knowledge of off site Processing and waste dispe	sui munug	entent.		
Unit I	SOURCES	AND TYPES OF MUNICIPAL SOLID WASTES			8 H	ours
		wastes - Quantity – factors affecting generation of soli	d wastes-	charact		
		characterization- Effects of improper disposal of solid v				
		waste management – social & economic aspects - Publi				
NGOs-Legis	lation.	-				
Unit II		STORAGE & PROCESSING			8 H	
		materials used for containers - on-site segregation of s				alth
& economic a		rage – options under Indian conditions – Critical Evalu	ation of O	ptions.		
Unit III		FION AND TRANSFER			8 H	ours
		sypes of vehicles - Manpower requirement - collect			sfer	
		ocation, operation & maintenance; options under In-	dian condi	ions.		
Unit IV		PROCESSING			12 He	
		Equipment; Resource recovery from solid wastes - co	mposting,	incine	ration,	
		Indian conditions.				
Unit V	DISPOSA				9 He	ours
		anitary landfills - site selection, design and operation of	of sanitary			
landfills – Le	achate collec	tion & treatment				
			Total:		45 He	ours
<b>Further Rea</b>	ding:					
	They can c	ategorize the types of wastes				
		hoose the disposal units				
<b>Course Outc</b>	omes:					
		letion of the course, Student will be able to				
	Explain the	e Sources and types of municipal solid wastes				
		e suitable method of Segregation of solid waste under	Indian con	lition.		
		e methods of collection and transfer of solid wastes				
		te the suitable Off -site Processing techniques				
	Choose the	various options for disposal of wastes and their selecti	on criteria			
<b>References:</b>						

Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000

R.E.Landreth and P.A.Rebers, Municipal Solid Wastes – problems and Solutions, Lewis Publishers, 1997.

		CROUND WATER ENCINEERING		Т	Р	С
1703CE009		GROUND WATER ENGINEERING	3	0	0	3
Course Obje						
		ce the student to the principles of Groundwater governing H	Equation	ns and	l	
		tics of different aquifers				
		isticsofdifferentaquifers				
		stand the techniques of development and management of gro	undwat	er		
		oduced to the different theories of traffic flow				
		are of the importance of traffic safety				
Unit I		EOLOGICAL PARAMETERS				ours
storage coefficien	t - Methods of	erties of Rock—Type of aquifers - Aquifer properties —permeability, specific Estimation—Ground water table fluctuation and its interpretations — Ground				
Potential in India- Unit II		DRAULICS			<u>он</u>	ours
		rhydraulics–Darcy'sLaw-Groundwaterequation–steadystate	flo		Dup	
		-Unsteady state flow-Theis method-Jacob Method-Slug test				
	etrations of w		s – mag	ge we	n mec	лу
Unit III	GROUND	WATER MANAGEMENT			9H	ours
Need for Mar	nagement Mo	del – Database for groundwater management –groundwater	balanc	e stud	ly –	
Introduction	to Mathemati	cal model - Conjunctive use - Collector well and Infiltratio	n gallei	y		
Unit IV	GROUND	WATER QUALITY			9 H	ours
		Origin, movement and quality - Water quality standards – H Saline intrusion – Environmental concern and Regulatory re			sthetio	с
			•			
Unit V	<b>GROUND</b>	WATER CONSERVATION			9 H	ours
Artificial recl	narge techniq	ues – Remediation of Saline intrusion– Ground water mana	-	studi		ours
Artificial recl	narge techniq		-	studi		ours
Artificial recl Protection zo	harge techniq ne delineation	ues – Remediation of Saline intrusion– Ground water mana	-	studi		ours
Artificial recl Protection zo - Ground wat	narge techniq ne delineation er Pollution a	ues – Remediation of Saline intrusion– Ground water mana n, Contamination source inventory, remediation schemes and legislation.	-			
Artificial recl Protection zo	narge techniq ne delineation er Pollution a	ues – Remediation of Saline intrusion– Ground water mana n, Contamination source inventory, remediation schemes and legislation.	gement		es –	
Artificial recl Protection zo - Ground wat	harge techniq ne delineation er Pollution a <b>ding:</b>	ues – Remediation of Saline intrusion– Ground water mana n, Contamination source inventory, remediation schemes and legislation.	gement		es –	
Artificial recl Protection zo - Ground wat	harge techniq ne delineation er Pollution a <b>ding:</b> 1. Ground	ues – Remediation of Saline intrusion– Ground water mana n, Contamination source inventory, remediation schemes and legislation.	gement		es –	

1. Students will be able to understand aquifer properties and its dynamics after the completion of the course. It gives an exposure towards well design and practical problems of ground water aquifers
2. Studentswillbeabletounderstandtheimportanceofartificialrechargeandgroundwater quality concepts
3. Model regional ground water flow and design water wells
4.Estimatewaterqualityparameters 5.To safety ground water improvements of quality parameter

# ME ENVIRONMENTAL ENGINEERING

17EV102		ENVIRONMENTAL CHEMISTRY	L	Т	Р	С	
			3	0	0	3	
Course Ob	jectives:						
	1. To edu	cate the students about water chemistry					
	2. To imp	part knowledge in the area of air and soil chemistry					
	3. To imp	part knowledge on the transformation of chemicals in the en	vironi	nent			
Unit I	<b>Introducti</b>	o <mark>n</mark>			9 Ho	ours	
Stoichiome	try and mass	balance-Chemical equilibrium, acid base, solubility produc	t (Ksp	), he	avy		
metal precip	pitation, amp	hoteric hydroxides, CO2 solubility in water and species dist	tributi	on –			
Chemical k	inetics, First	order- 12 Principles of green chemistry.					
Unit II	Aquatic C	hemistry			11 Ho	ours	
Water quali	ty parameter	s- environmental significance and determination; Fate of ch	nemica	als in	aqua	tic	
environmen	nt, volatiliz	zation, partitioning, hydrolysis, photochemical tra	ansfor	mati	on –		
Degradation	n of synthetic	c chemicals-Metals, complex formation, oxidation and reduc	ction,	pE –	pН		
diagrams, re	edox zones -	- sorption- Colloids, electrical properties, double layer theory	y, env	ironr	nenta	1	
significance	e of colloids,	coagulation.					
Unit III	<b>Atmosphe</b>	ric Chemistry			7 Ho	ours	
Atmospheri	c structure –	-chemical and photochemical reactions - photochemical sm	log. O	zone	layer	,	
depletion – greenhouse gases and global warming, CO <sub>2</sub> capture and sequestration – Acid rain- origin							
and composition of particulates. Air quality parameters-effects and determination.							
Unit IV	Soil Chem	<mark>istry</mark>			9 Ho	ours	
Nature and	composition	of soil-Clays- cation exchange capacity-acid base and ion-e	exchai	nge re	eactio	ns	
in soil – Ag	ricultural ch	emicals in soil-Reclamation of contaminated land; salt by le	achin	g-He	avy		
metals by e	lectrokinetic	remediation.					
Unit V	<b>Environm</b>	ental Chemicals			9 Ho	ours	

Heavy metals-Chemical speciation –Speciation of Hg &As- Organic chemicals- Pesticides, Dioxins, PCBs, PAHs and endocrine disruptors and their Toxicity- Nano materials, CNT, titania, composites, environmental applications.

			Total:	45 Hours
<b>Further Readin</b>	ng			
То	analyze	and create a solution for environmental issues.		
Course Outcom	ies:			
Aft	er comp	pletion of the course, Student will be able to		
1.	Disting	guish the chemistry involved		
2.	Unders	stand the chemistry involved in water		
3.	Identif	y and solve the air pollution related issues		
4.	Unders	stand the soil related chemistry and issues		
5.	Identif	y contaminating chemicals and can work out ch	emicals need	calculations for
	treatme	ent purpose		

17EV103		ENVIRONMENTAL MICROBIOLOGY L	Т	Р	С
		3	0	0	3
Course Ob	jectives:				
	1. The co	urse provides a basic understanding on microbiology relevant to	envir	onme	ental
	engine	ering for candidates with little prior knowledge of the subject.			
	2. The m	orphology, behavior and biochemistry of bacteria, fungi, protoze	oa, vii	uses,	and
	algae a	are outlined.			
		icrobiology of wastewater, sewage sludge and solid waste treatm			
		rovided. Aspects on nutrient removal and the transmission of a	diseas	e-cau	sing
	-	sms are also covered.			
		posure to toxicology due to industrial products and byproducts ar			
		purse provides a basic understanding on microbiology relevant to	envir	onme	ntal
		ering for candidates with little prior knowledge of the subject.			
Unit I		tion And Characteristics		5 Ho	
		organisms – prokaryotic, eukaryotic, cell structure, characteristics	, Pres	ervati	on
-		A, RNA, replication, Recombinant DNA technology.			
Unit II	Microbes 2	And Nutrient Cycles		10 Ho	ours
		ganisms - Distribution / diversity of Microorganisms - fresh and			
terrestrial -	microbes in	surface soil, Air - outdoor and Indoor, aerosols, biosafety in Lal	oorato	ry –	
Extreme Er	vironment -	- archaebacteria – Significance in water supplies – problems and	contro	ol.	
Transmissi	ole diseases.	Biogeochemical cyclesHydrological - Nitrogen, Carbon, Phe	ospho	rus,	
Sulphur, Cy	vcle – Role d	of Micro Organism in nutrient cycle.			
Unit III		m of Microorganisms		10 Ho	
		m in microorganisms, growth phases, carbohydrate, protein, lipic			m –
respiration,	aerobic and	anaerobic-fermentation, glycolysis, Kreb"s cycle, hexose monop	hospł	nate	

pathway, electron transport system, oxidative phosphorylation, environmental factors, enzymes, Bioenergetics.

Unit IVPathogens in Wastewater10 HoursIntroduction to Water Borne pathogens and Parasites and their effects on Human, Animal and Plant<br/>health, Transmission of pathogens – Bacterial, Viral, Protozoan, and Helminths, Indicator organisms of<br/>water – Coliforms – total coliforms, E-coli, Streptococcus, Clostridium, Concentration and<br/>detection of virus. Control of microorganisms; Microbiology of biological treatment processes –<br/>aerobic and anaerobic,  $\Box$ -oxidation,  $\beta$ -oxidation, nitrification and de-nitrification, eutrophication.<br/>Nutrients Removal – BOD, Nitrogen, Phosphate. Microbiology of Sewage Sludge.10 HoursUnit VToxicology10 Hours

Ecotoxicology – toxicants and toxicity, Factors influencing toxicity. Effects – acute, chronic, Test organisms – toxicity testing, Bio concentration – Bioaccumulation, bio magnification, bioassay, bio monitoring, bioleaching.

				otal:	45 Hours
Fu	rther Re	ading			
		Identificati	on and culturing of microorganisms from different source	2S	
Co	ourse Ou	tcomes:			
		After comp	pletion of the course, Student will be able to		
			indidate at the end of the course will have a basic understand biology and their diversity and on the genetic material in the	•	
			indidate would be able to understand and describe the type vironment and the role of microorganisms in the cycli stem.		÷
			andidate would have understood the role microbial metab ent plant.	oolism in a	a wastewater
			indidate would know the role of microorganisms in conta es caused.	uminated w	vater and the
			indidate has the ability to conduct and test the toxicity due tic products in the environment.	to variou	s natural and
Re	eferences				
1.	S.C.Bha	atia, Hand B	ook of Environmental Microbiology, Part 1 and 2, Atlanti	ic Publish	er
2.	Gabriel	Bitton, Was	stewater Microbiology, 2nd Edition,		
3.	Raina M	1. Maier, Iar	n L. Pepper, Charles P. Gerba, Environmental Microbiolog	gy, Acade	mic Press.
4.	SVS. R	ana, Essenti	als of Ecology and Environmental Science, 3rd Edition,	Prentice ]	Hall of India
	Private	Limited			
5.	Stanley	E. Manahar	n, Environmental Science and Technology, Lewis Publishe	ers.	
6.		C.J. (2002) N -55581 - 199	Ianual of Environmental Microbiology. 2nd Ed. ASM PRE 9 - X.	ESS, Wash	nington, D.C.
7	Emanly (	Lu and Ca	m Kasaw III'' Dagis Taviaslary Taviar & Francis I on	ndan (Ath	E4) 2002

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

17EV104		TRANSPORT OF WATE	R AND WASTEWATER	L	Т	Р	С
				3	0	0	3
Course Ob	jectives:						
		cate the students in detailed d	<b>e</b>		missi	on ma	ains,
		istribution system, sewer netw		n			
<b>T</b> T •4 <b>T</b>		cate the students in computer a	<u> </u>			0.11	
Unit I		ydraulics and Flow Measure					ours
Fluid prope	rties; fluid fl	ow – continuity principle, ene	rgy principle and moment	um princip	le; fri	ctiona	.1
head loss in	free and pre	ssure flow, minor heads losses	s, Carrying Capacity–Flow	v measuren	nent.		
Unit II	Water Tra	nsmission and Distribution				10 H	nire
				<u> </u>			Juis
		ater and wastewater-Planning n design- gravity and pumping					
		nting, laying and maintenance					
	•	is and optimization – appurter	•			· ·	
	•	ction Storage reservoirs.	rr				
		6					
Unit III	Wastewate	r Collection and Conveyanc	e			10 TT	
~		a concerion una convegune				10 H	ours
		in of sanitary sewer; partial flo		f sewer des		10 H	ours
Planning fa	ctors – Desig	n of sanitary sewer; partial flo	ow in sewers, economics o		sign;		
Planning fa Wastewater	ctors – Desig pumps and p	n of sanitary sewer; partial flo pumping stations- sewer appu	ow in sewers, economics o rtenances; material, constr	uction, ins	sign; pectio		
Planning fa Wastewater	ctors – Desig pumps and e of sewers;	n of sanitary sewer; partial flo	ow in sewers, economics o rtenances; material, constr	uction, ins	sign; pectio		
Planning fa Wastewater maintenanc	ctors – Desig pumps and e of sewers;	n of sanitary sewer; partial flo pumping stations- sewer appu	ow in sewers, economics o rtenances; material, constr	uction, ins	sign; pectio		

Necessity- - combined and separate system; Estimation of storm water run-off Formulation of rainfall intensity duration and frequency relationships- Rational methods.

Unit V	Case Studi	es and Software Applications	10 Hours
Use of con	nputer softwar	re in water transmission, water distribution and sewer design -	EPANET 2.0,
LOOP vers	sion 4.0, SEW	ER, BRANCH, Canal ++ and GIS based softwares.	
		Tota	d: 45 Hours
Further R	eading		<b>i</b>
	Designing of	of pipelines and sewers for various project areas	
Course Ou	utcomes:		
	After comp	letion of the course, Student will be able to	
	1. Underst	tand the fluid flow properties	
	2. Design	water supply main, distribution network and sewer for various	field conditions
	3. Design	the drainage network for wastewater	
	4. Design	the storm water drainage systems	
	5. Trouble	eshooting in water and sewage transmission be able to use	various computer
	softwar	e for the design of water and sewage network	-

17EV105		PRINC						0-		L	Т	Р	С
		CHEM	ICAL T	REATN	MENT S	SYSTE	EMS						
										3	0	0	3
Course Ob	<u>v</u>												
		ucate the s		-	rinciples	es and pi	rocess d	lesigns o	f variou	is trea	tmen	it syst	ems
	-	ater and wa											
		ucate the s							he com	ponei	nts co	ompri	sing
		ystems, le	ading to	the sele	ection of	of specif	fic proce	ess.					
Unit I	Introduct	-											ours
Pollutants i	in water and	l wastewat	ter – cha	aracterist	tics, Sta	andards	for per	formanc	e - Sig	nifica	nce c	of phy	<mark>/sio-</mark>
<mark>chemical tr</mark>	eatment – Se	election cr	riteria-ty	vpes of re	eactors-	- reactor	r selecti	on-batcl	<mark>1- conti</mark>	nuous	s type	e-kine	etics.
Unit II	Treatmen	nt Princip	es								1	10 Ho	
		ie i i meipi											JIII'S -
Physical fr	eatment - S	Screening	– Mixi	ng. Equ	alizatior	n – Se	dimenta	ation –	Filtratio	on –			
		Screening Isfer – ma									Evap	oratio	on –
Incineration	n – gas tran	isfer – ma	iss trans	fer coef	ficient A	Adsorp	otion –	Isotherm	ns – Me	embra	Evap ine se	oratio epara	on – tion,
Incineration Reverse Os	n – gas tran smosis, nano	sfer – ma filtration,	iss trans ultra-fi	fer coef	ficient A and hype	Adsorp er filtra	tion – intion ele	Isotherm ctro dial	ıs – Me ysis, di	embra stillat	Evap ine se ion –	oratio epara strip	on – tion, ping
Incineration Reverse Os and crystal	n – gas tran smosis, nano llization – R	sfer – ma filtration, Recent Ad	uss trans ultra-fi vances.	fer coef ltration a Principl	ficient A and hype les of C	Adsorp er filtra Chemic	otion – i ation ele al treat	Isotherm ectro dial ment –	ıs – Me ysis, di Coagul	embra stillat ation	Evap ine so ion – flocc	oratio epara strip culatio	on – tion, ping on –
Incineration Reverse Os and crystal Precipitation	n – gas tran smosis, nano	sfer – ma filtration, Recent Ad solidifica	ss trans ultra-fi vances. ation and	fer coef ltration a Principl d stabiliz	ficient A and hype les of C zation –	Adsorp er filtra Chemica Disinfe	otion – i ation ele al treat ection, l	Isotherm ectro dial ment –	ıs – Me ysis, di Coagul	embra stillat ation	Evap ine so ion – flocc	oratio epara strip culatio	on – tion, ping on –
Incineration Reverse Os and crystal Precipitation	n – gas tran smosis, nano llization – R on – flotation	nsfer – ma o filtration, Recent Ad n solidifica Ivanced ox	ss trans ultra-fi vances. ation and idation	ofer coef ltration a Principl d stabiliz /reductio	ficient A and hype les of C zation – on – Rec	Adsorp per filtra Chemica Disinfo ccent Tr	otion – i ation ele al treat ection, l	Isotherm ectro dial ment –	ıs – Me ysis, di Coagul	embra stillat ation	Evap ine so ion – flocc olytic	oratio epara strip culatio	on – tion, ping on – ods,
Incineration Reverse Os and crystal Precipitation Solvent ext Unit III	n – gas tran smosis, nano llization – R on – flotation traction – ad	sfer – ma filtration, Recent Ad solidifica vanced ox Municipa	uss trans ultra-fi vances. ation and idation al Wate	efer coef ltration a Principl d stabiliz /reduction r Treatu	ficient A and hype les of C zation – on – Rec ment Pla	Adsorp per filtra Chemica Disinfe ccent Tr lants	otion – a ation ele al treat ection, l ends	Isotherm ectro dial ment – Ion exch	us – Me ysis, di Coagul ange, E	embra stillat ation Electro	Evap ine se ion – flocc olytic	oratio eparate strip culation meth	on – tion, ping on – lods, <b>ours</b>
Incineration Reverse Os and crystal Precipitation Solvent ext <b>Unit III</b> Selection o	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b>	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design	uss trans ultra-fi vances. ation and idation al Wate of mun	fer coef ltration a Principl d stabiliz /reduction r Treatu icipal wa	ficient <i>A</i> and hype les of C zation – on – Rec ment Pla ater treat	Adsorp per filtra Chemica Disinfa ccent Tr lants atment p	otion – i ation ele al treati ection, l ends plant un	Isotherm ectro dial ment – Ion exch its – Ae	ns – Me ysis, di Coagul ange, E rators –	embra stillat ation Clectro	Evap ine so ion – flocc olytic	oratic epara strip culatic meth 10 Hc feedi	on – tion, ping on – ods, <b>ours</b> ng –
Incineration Reverse Os and crystal Precipitation Solvent ext <b>Unit III</b> Selection o Flocculation	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b> of Treatment	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design – tube se	uss trans ultra-fi vances. ation and idation al Wate of muni ettling –	fer coef ltration a Principl d stabiliz /reduction r Treatu icipal wa filters –	ficient A and hype les of C zation – on – Rec ment Pla ater treat - Rapid	Adsorp per filtra Chemica Disinfa cent Tr lants atment p sand fi	otion – i ation ele al treati ection, l rends plant un ilters, sl	Isotherm ectro dial ment – Ion exch its – Ae low sand	ns – Me ysis, di Coagul ange, E rators –	embra stillat ation Clectro - chen press	Evap ine se ion – flocc olytic 	oratic epara strip culatic meth <b>10 H</b> c feedi ilter,	on – tion, ping on – ods, ours ng – dual
Incineration Reverse Os and crystal Precipitation Solvent ext <b>Unit III</b> Selection of Flocculation media Disi	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b> of Treatment on – clarifier	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design – tube se Displaceme	ultra-fi vances. ation and idation al Wate of muni- ettling – ent and	fer coef ltration a Principl d stabiliz /reduction r Treatu- icipal wa filters – gaseous	ficient A and hype les of C zation – on – Rec ment Pla ater treat - Rapid type - F	Adsorp ber filtra Chemica Disinfa cent Tr lants atment p sand fi Flow cl	otion – ation ele al treat ection, l ends plant un ilters, sl harts –	Isotherm ectro dial ment – for exch lon exch nits – Ae low sand Layouts	ls – Mo ysis, di Coagul ange, E rators – l filter, – Hydr	embra stillat ation Clectro - chen press raulic	Evap ine se ion – flocc olytic lytic inical ure fi Prof	oratic epara strip culatic meth <b>10 H</b> feedi ilter, ile, P	on – tion, ping on – iods, ours ng – dual ID -
Incineration Reverse Os and crystal Precipitation Solvent ext <b>Unit III</b> Selection of Flocculation media Disi	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b> of Treatment on – clarifier infection - D on and O&M	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design – tube se Displaceme	ultra-fi vances. ation and idation al Wate of muni- ettling – ent and	fer coef ltration a Principl d stabiliz /reduction r Treatu- icipal wa filters – gaseous	ficient A and hype les of C zation – on – Rec ment Pla ater treat - Rapid type - F	Adsorp ber filtra Chemica Disinfa cent Tr lants atment p sand fi Flow cl	otion – ation ele al treat ection, l ends plant un ilters, sl harts –	Isotherm ectro dial ment – for exch lon exch nits – Ae low sand Layouts	ls – Mo ysis, di Coagul ange, E rators – l filter, – Hydr	embra stillat ation Clectro - chen press raulic	Evap ine se ion – flocc olytic lytic inical ure fi Prof	oratic epara strip culatic meth <b>10 H</b> feedi ilter, ile, P	on – tion, ping on – iods, ours ng – dual ID -
Incineration Reverse Os and crystal Precipitation Solvent ext Unit III Selection o Flocculation media Disi constructio	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b> of Treatment on – clarifier infection - D on and O&M	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design – tube se Displaceme 1 aspects -	ss trans ultra-fi vances. ation and idation al Wate of muni ettling – ent and – case s	fer coef ltration a Principl d stabiliz /reduction r Treatu icipal wa filters – gaseous tudies, I	ficient A and hype les of C zation – on – Rec ment Pla ater treat - Rapid type - F Residue	Adsorp per filtra Chemic Disinfa cent <u>Tr</u> lants atment p sand fi Flow cl e manag	otion – ation ele al treat ection, l ends plant un ilters, sl harts –	Isotherm ectro dial ment – for exch lon exch nits – Ae low sand Layouts	ls – Mo ysis, di Coagul ange, E rators – l filter, – Hydr	embra stillat ation Clectro - chen press raulic	Evap ine so ion – floccolytic lytic lical ure fi Prof isting	oratic epara strip culatic meth <b>10 H</b> feedi ilter, ile, P	on – tion, ping on – ods, ng – dual ID – nts –
Incineration Reverse Os and crystal Precipitation Solvent ext Unit III Selection on Flocculation media Disi construction Recent Tree Unit IV	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b> of Treatment on – clarifier nfection - D on and O&M ends.	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design – tube se Displaceme I aspects - Industria	ultra-fi vances. ation and idation al Wate of muni ettling – ent and – case s	fer coef ltration a Principl d stabiliz /reductio r Treatu icipal wa filters – gaseous tudies, I r Treatu	ficient A and hype les of C zation – on – Rec ment Pla ater treat - Rapid type - F Residue	Adsorp per filtra Chemic: Disinfe ccent Tr lants atment p sand fi Flow cl e manag	otion – ation ele al treat ection, l rends plant un ilters, sl harts – gement	Isotherm ectro dial ment – Ion exch its – Ae low sand Layouts – Upgra	is – Me ysis, di Coagul ange, E rators – l filter, – Hydi dation	embra stillat ation Clectro - chen press raulic of ex	Evap ine so ion – flocc olytic inical ure fi Prof isting	oratic eparate strip culatic meth <b>10 Ho</b> feedi ilter, ile, P g plar <b>10Ho</b>	on – tion, ping on – iods, <b>ours</b> ng – dual ID - nts – urs
Incineration Reverse Os and crystal Precipitation Solvent ext Unit III Selection on Flocculation media Disi construction Recent Tre Unit IV Design of I Reverse ost	n – gas tran smosis, nano llization – R on – flotation traction – ad <b>Design of</b> of Treatment on – clarifier infection - D on and O&M ends. <b>Design of</b>	sfer – ma filtration, Recent Ad solidifica vanced ox <u>Municipa</u> – Design – tube se Displaceme aspects – <u>Industria</u> ater Treatr s –Flow ch	ultra-fi vances. ation and idation al Wate of muni- ent and – case s al Water ment Ur narts – I	fer coef ltration a Principl d stabiliz /reduction r Treatra filters – gaseous tudies, I r Treatra its- Sele _ayouts -	ficient A and hype les of C zation – on – Rec ment Pla ater treat - Rapid type - F Residue ment Pla ection of –Hydrau	Adsorp Der filtra Chemics Disinfe cent Tr lants atment p sand fi Flow cl e manag lants f proces ulic Pro	otion – ation ele al treat ection, l ends plant un ilters, sl harts – gement ss – Des ofile, PI	Isotherm ectro dial ment – fon exch lon exch its – Ae low sand Layouts – Upgra sign of so D - cons	is – Ma ysis, di Coagul ange, E rators – I filter, – Hyd dation	embra stillat ation Clectro - chen press raulic of ex s – De n and	Evap ane so ion – floccolytic lytic inical ure fi Prof isting	oratic epara strip culatic meth <b>10 Hc</b> feedi ilter, ile, P g plar <b>10Ho</b> eralise	on – tion, ping on – iods, <b>Durs</b> ng – dual ID - nts – <b>urs</b> ers –

Unit V	<b>Design of</b>	Wastewater Treatment Plants		10 Hours
Design of a	municipal v	wastewater treatment units-screens-detritors-grit cham	ber-settling	g tanks- sludge
thickening-s	sludge dewa	atering systems-sludge drying beds - Design of Industr	rial Wastev	vater Treatment
Units-Equal	ization- Ne	utralization-Chemical Feeding Devices-mixers- floatation	on units-oil	l skimmer Flow
charts – Lag	youts –Hyd	raulic Profile, PID, construction and O&M aspects - of	case studie	s, Retrofitting -
Residue man	nagement –	Upgradation of existing plants – Recent Trends.		
			Total:	45 Hours
<b>Further Re</b>	ading			
	Implement	ation of advanced treatment technologies for various wa	stewater tre	eatment
<b>Course Out</b>	tcomes:			
	After comp	pletion of the course, Student will be able to		
	1. Identif	y the pollutants type in the wastewater		
	2. Unders	stand the various treatment principles		
	3. Design	the sewage treatment plants		
	4. Design	suitable treatment units for various industries		
	5. Develo	op conceptual schematics required for the treatment of w	vastewater	

17EV106		ENVIRONMENTAL CHEMISTRY LABORATORY	L	Т	Р	С
			0	0	2	1
Course Ob	jectives:					
	1. To trair	in the analysis of physical parameters of water and waste wat	ter			
	2. To train	n in the analysis of chemical parameters of water and waste wa	ater			
List of Exp	eriments:					
	aboratory Pra	actices, Quality control, calibration of Glassware				03
2. Samplii	ng and Analy	sis of water (pH, alkalinity, hardness chloride, Sulphate, turbidi	ity EC	C, TD	<mark>S, nit</mark>	rate,
fluoride	/					12
	vater analysis	6 (BOD, COD, Phosphate, TKN, Oil & Grease, Surfactant	and l	ieavy	/ met	als).
12						
		is of air pollutants Ambient & Stack (RSPM, SO2 and NOx)				09
5. Samplii	ng and charac	exterization of soil (CEC & SAR, pH and K).				09
			Tot	al	45 H	ours
<u> </u>	4			:		
Course Ou		lation of the course. Student will be able to				
		letion of the course, Student will be able to				
		uality of environment				
References		t analysis on characteristics of water and waste water				
		the defensite Exemination of Water and Westernaton 21st Ed				
1. APHA,	Standard Me	ethods for the Examination of Water and Wastewater, 21st Ed.				
<ol> <li>APHA,</li> <li>Washin</li> </ol>	Standard Me gton, 2005.			4 TT		
<ol> <li>APHA,</li> <li>Washin</li> <li>Laborat</li> </ol>	Standard Me gton, 2005. tory Manual f	for the Examination of water, wastewater soil Rump, H.H. and		t, H.		
<ol> <li>APHA,</li> <li>Washin</li> <li>Laborat</li> <li>Second</li> </ol>	Standard Me gton, 2005. tory Manual Edition, VC	for the Examination of water, wastewater soil Rump, H.H. and H, Germany, 1992.	l Kris			
<ol> <li>APHA,</li> <li>Washin</li> <li>Laborat</li> <li>Second</li> <li>Method</li> </ol>	Standard Me gton, 2005. tory Manual Edition, VC	for the Examination of water, wastewater soil Rump, H.H. and H, Germany, 1992. sampling & analysis, James P.Lodge Jr(Editor) 3rd	l Kris	t, H. litior	n, Lo	ewis

17EV107	ENVIRONMENTAL MICROBIOLOGY	L	Т	P	С
	LABORATORY				
		0	0	2	1
<b>Course Ob</b>	jectives:				
	1. To train in the analysis of physical parameters of water and was	ste water			
	2. To train in the analysis of chemical parameters of water and wa	ste water			
List of Exp	periments:				
1. Prepara	ation of culture media				
2. Isolatio	on, culturing and Identification of Microorganisms				
3. Microo	rganisms from polluted habitats (soil, water and air)				
4. Measu	rement of growth of microorganisms, Assay of enzymes involved in t	oiotransfor	natio	n	
5. Biodeg	radation of organic matter in waste water Analysis of air borne micro	organisms			
<mark>6. Stainin</mark>	g of bacteria				
7. Effect	of pH, temperature on microbial growth				
	nt removal using microbes from industrial effluent.				
	of pesticides on soil microorganisms				
10. Bacteri	ological analysis of wastewater (Coliforms, E.coli, Streptococcus) -	<mark>MPN</mark>			
11. Bacteri	ological analysis of wastewater (Coliforms, Streptococcus) - MF tech	nniques			
12. Effect	of Heavy metals on microbial growth				
13. Detecti	on of Anaerobic bacteria (Clostridium sp.)				
14. Biorea	ztors				
		To	tal	45 H	ours
			:		
Course Ou					
	After completion of the course, Student will be able to				
	1. Field oriented testing of water, wastewater and solid waste for t	microbial c	ontai	ninati	on.
	2. Perform toxicity test.				
References					
	rd methods for the examination of water and wastewater, American	Public Hea	lth A	ssocia	ition
	dition) 2005.				
	Gerba, Environmental Microbiology: A laboratory	manual,	Elsev	ier	
	ations, 2012.				
	n J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aa		s, an	d Lind	la D.
Stetzer	bach, Manual of Environmental Microbiology, 3rd Edition, ASM Pre-	ess, 2007.			

		PRINCIPLES AN TREATMENT S		OF BIOLOG	FICAL	L	Т	Р	С
		IKLAIMENI 5	1916115			3	0	0	3
Course O	bjectives:						Ŭ	Ū	
	To educate	the students on the	principles a	nd process desi	gns of various	treatm	ent sy	ystem	IS
	for water a	nd wastewater and	students show	ild gain compe	tency in the p	rocess e	emplo	yed i	n
		reatment systems ar			• •		-	•	
	•	f specific process.	1	1	e ,	<i>.</i>	U		
Unit I	Introducti	<u> </u>						10 Ho	ours
Objectives	of biologica	l treatment – signifi	cance – Prin	ciples of aerob	c and anaerob	ic treat			
·	Ű,	Factors affecting gro		•					
	-	organics removal –			-				<mark>.</mark> _
	inuous type.		21000810000			proces			-
outen cont	muous type.								
Unit II	Aerobic T	reatment of Waste	water					10 Ho	ours
		<b>reatment of Waste</b> nent plant units –Ao		ge process and	variations, Se	quenci			ours
Design of	sewage treatr		ctivated Slud	• •		-	ng Ba	ıtch	ours
Design of a reactors, N fluidized b	sewage treatr Iembrane Bio ed reactors, a	nent plant units –Ao blogical Reactors-Tr aerated lagoons, was	ctivated Slud rickling Filte ste stabilizati	rs-Bio Tower- on ponds – nut	RBC-Moving rient removal	Bed Re system	ng Ba actor s – na	itch s- itural	
Design of a reactors, N fluidized b treatment s	sewage treatr Iembrane Bio ed reactors, a systems, cons	nent plant units –Ad blogical Reactors-Transrated lagoons, was structed wet land – I	ctivated Slud rickling Filte ste stabilizati Disinfection	rs-Bio Tower- on ponds – nut	RBC-Moving rient removal	Bed Re system	ng Ba actor s – na	itch s- itural	
reactors, N fluidized b treatment s charts, laye	sewage treatr Iembrane Bio ed reactors, a systems, cons out, PID, hyd	nent plant units –Ad blogical Reactors-Transfer herated lagoons, was structed wet land – I raulic profile, recen	ctivated Slud rickling Filte ste stabilizati Disinfection t trends.	rs-Bio Tower- on ponds – nut	RBC-Moving rient removal	Bed Re system	ng Ba actor s – na l reus	itch s- itural e – Fl	low
Design of a reactors, M fluidized b treatment s charts, layo <b>Unit III</b>	sewage treatr Iembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio	nent plant units –Ad ological Reactors-Tra- nerated lagoons, was structed wet land – I lraulic profile, recent <b>Treatment of Wa</b>	ctivated Slud rickling Filte ste stabilizati Disinfection t trends. stewater	rs-Bio Tower- on ponds – nut – disposal optio	RBC-Moving rient removal ons – reclamat	Bed Re system ion and	ng Ba actor s – na l reus	atch s- atural e – Fl <b>10 H</b> o	low D <b>urs</b>
Design of a reactors, M fluidized b treatment s charts, laye <b>Unit III</b> Attached a	sewage treatr fembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio nd suspendeo	nent plant units –Ad ological Reactors-Tra- nerated lagoons, was structed wet land – I raulic profile, recent <b>Treatment of Wa</b> d growth, Design of	ctivated Slud rickling Filte ste stabilizati Disinfection t trends. stewater units – UAS	rs-Bio Tower- on ponds – nut - disposal optio B, up flow filt	RBC-Moving rient removal ons – reclamat ers, Fluidized	Bed Re system ion and beds M	ng Ba actor s – na l reus BR, s	itch s- atural e – Fl 10 Ho septic	low ours
Design of a reactors, M fluidized b treatment s charts, laye <b>Unit III</b> Attached a tank and d	sewage treatr Iembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio and suspended isposal – Nut	nent plant units –Ad blogical Reactors-Tra- nerated lagoons, was structed wet land – I raulic profile, recent <b>Treatment of Wa</b> d growth, Design of rient removal system	ctivated Slud rickling Filte ste stabilizati Disinfection t trends. stewater units – UAS ns – Flow ch	rs-Bio Tower- on ponds – nut - disposal optio B, up flow filt	RBC-Moving rient removal ons – reclamat ers, Fluidized	Bed Re system ion and beds M	ng Ba actor s – na l reus BR, s	itch s- atural e – Fl 10 Ho septic nt tree	low <b>ours</b> nds.
Design of a reactors, M fluidized b treatment s charts, laye <b>Unit III</b> Attached a tank and d <b>Unit IV</b>	sewage treatr Iembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio ind suspended isposal – Nut Sludge Tr	nent plant units –Ad ological Reactors-Tra- nerated lagoons, was structed wet land – I raulic profile, recen- te <b>Treatment of Wa</b> d growth, Design of rient removal system eatment and Dispon	ctivated Slud cickling Filte ste stabilizati Disinfection t trends. stewater units – UAS ns – Flow ch sal	rs-Bio Tower- on ponds – nut – disposal optio B, up flow filt part, Layout and	RBC-Moving rient removal ons – reclamat ers, Fluidized d Hydraulic pr	Bed Re system ion and beds M ofile –	ng Ba actor s – na l reus BR, s Rece	itch s- atural e – Fl 10 Ho septic nt tre 5 Ho	ours nds.
Design of a reactors, M fluidized b treatment s charts, laye <b>Unit III</b> Attached a tank and da <b>Unit IV</b> Design of a	sewage treatr fembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio and suspended isposal – Nut Sludge Tr sludge manag	nent plant units –Ad ological Reactors-Tra- nerated lagoons, was structed wet land – I lraulic profile, recent <b>Treatment of Wa</b> d growth, Design of rient removal system eatment and Dispo gement facilities, shu	ctivated Slud cickling Filte ste stabilizati Disinfection t trends. stewater units – UAS ns – Flow ch sal udge thicken	rs-Bio Tower- on ponds – nut - disposal optio B, up flow filt art, Layout and ng, sludge dig	RBC-Moving rient removal ons – reclamat ers, Fluidized d Hydraulic pr estion, biogas	Bed Re system ion and beds M ofile – generat	ng Ba actor s – na l reus BR, s Rece	itch s- itural e – Fl <b>10 H</b> septic nt tren <b>5 H</b> sludge	ours nds.
Design of a reactors, M fluidized b treatment s charts, laye <b>Unit III</b> Attached a tank and da <b>Unit IV</b> Design of a dewatering	sewage treatr fembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio ind suspended isposal – Nut Sludge Tr sludge manag g (mechanical	nent plant units –Ad plogical Reactors-Tra- nerated lagoons, was structed wet land – I raulic profile, recent <b>Treatment of Wa</b> d growth, Design of rient removal system <b>eatment and Dispo</b> gement facilities, shu l and gravity) Layou	ctivated Slud rickling Filte ste stabilizati Disinfection t trends. stewater units – UAS ns – Flow ch sal udge thickeni tt, PID, hydr	rs-Bio Tower- on ponds – nut - disposal optio B, up flow filt art, Layout and ng, sludge dig	RBC-Moving rient removal ons – reclamat ers, Fluidized d Hydraulic pr estion, biogas	Bed Re system ion and beds M ofile – generat	ng Ba actor s – na l reus BR, s Rece	itch s- itural e – Fl <b>10 H</b> septic nt tren <b>5 H</b> sludge	ours nds.
Design of a reactors, M fluidized b treatment s charts, laye <b>Unit III</b> Attached a tank and da <b>Unit IV</b> Design of a dewatering	sewage treatr Iembrane Bio ed reactors, a systems, cons out, PID, hyd Anaerobio isposal – Nut Sludge manag g (mechanical ssidue disposa	nent plant units –Ad ological Reactors-Tra- nerated lagoons, was structed wet land – I lraulic profile, recent <b>Treatment of Wa</b> d growth, Design of rient removal system eatment and Dispo gement facilities, shu	ctivated Slud rickling Filte ste stabilizati Disinfection t trends. stewater units – UAS ms – Flow ch sal udge thicken it, PID, hydr	rs-Bio Tower- on ponds – nut – disposal optio B, up flow filt art, Layout an ng, sludge dig aulics profile –	RBC-Moving rient removal ons – reclamat ers, Fluidized d Hydraulic pr estion, biogas	Bed Re system ion and beds M ofile – generat	ng Ba actor s – na l reus BR, s Rece ion, s lants	itch s- itural e – Fl <b>10 H</b> septic nt tren <b>5 H</b> sludge	ours nds. ours

Construction and Operational Maintenance problems – Trouble shooting – Planning, Organizing and controlling of plant operations – capacity building - Retrofitting Case studies – sewage treatment plants – sludge management facilities.

Total: 45 Hours

#### **Course Outcomes:**

- After completion of the course, Student will be able to
- 1. Develop conceptual schematics required for biological treatment of wastewater
- 2. Translate pertinent criteria into system requirements.

#### **References:**

- 1. Arceivala, S.J., Wastewater Treatment for Pollution Control, TMH, New Delhi, Second Edition, 2000.
- 2. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
- 3. Metcalf & Eddy, INC, "Wastewater Engineering Treatment and Reuse, Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.
- 4. F.R. Spellman, Hand Book of Water and Wastewater Treatment Plant operations, CRC Press, New York (2009).

17EV202	AIR POLLUTION MONITORING AND CONTROL	L	Т	Р	С
		3	0	0	3
Course Ob	jectives:				
	To impart knowledge on the principles and design of control of indoor/p	articul	ate/g	aseou	S
	air pollutant and its emerging trends				
Unit I	Introduction			7 H	ours
Structure and	nd composition of Atmosphere – Sources and classification of air pollutan	ts - Ef	fects	of air	
	on human health, vegetation & animals, Materials & Structures – Et				
•	on the atmosphere, Soil & Water bodies – Long- term effects on the planet	– Glo	bal C	limat	e
	zone Holes – Ambient Air Quality and Emission Standards – Air Pollution				
-				211135	
-	- Ambient and Stack Sampling and Analysis of Particulate and Gaseous I			211135	
-				5 He	
Inventories Unit II	– Ambient and Stack Sampling and Analysis of Particulate and Gaseous I	Polluta	nts.	5 H	ours
Inventories Unit II Effects of n	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> </ul>	Polluta	nts. Wind	5 He	ours
Inventories Unit II Effects of n and stack p	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inver</li> </ul>	Polluta	nts. Wind	5 He	ours
Inventories Unit II Effects of n and stack p	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inver</li> <li>lume patterns- Transport &amp; Dispersion of Air Pollutants – Modeling Tech</li> </ul>	Polluta	wints. Wind - Air	5 He	ours les
Inventories Unit II Effects of n and stack p Pollution C Unit III	– Ambient and Stack Sampling and Analysis of Particulate and Gaseous I Air Pollution Modelling neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inver lume patterns- Transport & Dispersion of Air Pollutants – Modeling Tech limatology.	Polluta rsion, V niques	unts. Wind - Air	5 Ho profi	ours les ours
Inventories Unit II Effects of n and stack p Pollution C Unit III Factors affe	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inver lume patterns- Transport &amp; Dispersion of Air Pollutants – Modeling Tech</li> <li>Timatology.</li> <li>Control Of Particulate Contaminants</li> </ul>	Polluta rsion, V niques	wind Wind - Ain	5 Ho profi 11 Ho o, Des	ours les ours
Inventories Unit II Effects of n and stack p Pollution C Unit III Factors affe and perform	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inver</li> <li>lume patterns- Transport &amp; Dispersion of Air Pollutants – Modeling Tech</li> <li>Control Of Particulate Contaminants</li> <li>ecting Selection of Control Equipment – Gas Particle Interaction, – Working</li> </ul>	Polluta sion, V niques ng prin abric 1	wints. Wind - Ain nciple	5 He profit 11 He , Des	ours les ours
Inventories Unit II Effects of n and stack p Pollution C Unit III Factors affe and perform Particulate	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inver</li> <li>lume patterns- Transport &amp; Dispersion of Air Pollutants – Modeling Tech</li> <li>Climatology.</li> <li>Control Of Particulate Contaminants</li> <li>ecting Selection of Control Equipment – Gas Particle Interaction, – Workin</li> <li>nance equations of Gravity Separators (cyclone), Centrifugal separators F</li> </ul>	Pollutz sion, V niques ng prin abric f	wints. Wind - Ain nciple	5 He profit 11 He , Des	ours les ours
Inventories Unit II Effects of n and stack p Pollution C Unit III Factors affe and perform Particulate	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inverlume patterns- Transport &amp; Dispersion of Air Pollutants – Modeling Tech</li> <li>Control Of Particulate Contaminants</li> <li>ecting Selection of Control Equipment – Gas Particle Interaction, – Workin</li> <li>nance equations of Gravity Separators (cyclone) , Centrifugal separators F</li> <li>Scrubbers, Electrostatic Precipitators – Operational Considerations - Proce</li> </ul>	Pollutz sion, V niques ng prin abric f	Wind Wind - Ain nciple ilters ntrol	5 He profit 11 He , Des	ours les ours ign
Inventories Unit II Effects of n and stack p Pollution C Unit III Factors affe and perform Particulate Monitoring Unit IV	<ul> <li>Ambient and Stack Sampling and Analysis of Particulate and Gaseous I</li> <li>Air Pollution Modelling</li> <li>neteorology on Air Pollution - Fundamentals, Atmospheric stability, Inverlume patterns- Transport &amp; Dispersion of Air Pollutants – Modeling Tech</li> <li>Control Of Particulate Contaminants</li> <li>ecting Selection of Control Equipment – Gas Particle Interaction, – Workin</li> <li>nance equations of Gravity Separators (cyclone), Centrifugal separators F</li> <li>Scrubbers, Electrostatic Precipitators – Operational Considerations - Proce</li> <li>Costing of APC equipment – Case studies for stationary and mobile source</li> </ul>	Polluta rsion, <sup>1</sup> niques ng prin abric f ess Co irces.	Wind Wind - Ain nciple filters ntrol	<b>5 H</b> profi <b>11 H</b> , Des , and <b>11 H</b>	ours les ours ign

Monitoring mobile sou	· •	al Considerations - Costing of	APC Equipment – Case s	tudies for sta	tionary and
Unit V	<mark>Indoor Ai</mark>	r Quality Management			11 Hours
control – N	Iembrane pro	rol of indoor air pollutants, sic ocess - UV photolysis – Intern urement – Standards –Control	al Combustion Engines - S		
				Total:	45 Hours
Course Ou	itcomes:				
	After com	pletion of the course, Student	will be able to		
	1. Apply	sampling techniques			
	2. Apply	modelling techniques			
	3. Sugge	st suitable air pollution preven	tion equipment's and tech	niques for va	rious gaseous
	and pa	rticulate pollutants to Industrie	es. Discuss the emission st	andards	-

17EV203		INDUSTRI	AL WAST	E MANA	GEMI	ENT			L	Т	Р	С
									3	0	0	3
Course Ob	jectives:											
	To impart	nowledge or	the concep	ot and app	lication	n of Inc	lustrial p	ollutio	n pre	venti	on,	
	cleaner tec	nologies, in	dustrial was	tewater tr	reatmen	t and r	esidue n	nanage	ment.			
Unit I	Introduct	on									8 H	ours
Industrial s	cenario in Ir	dia– Industria	al activity ar	nd Enviro	nment -	- Uses	of Wate	r by in	dustry	$y - S_{i}$	ource	<mark>s</mark>
and types o	f industrial y	vastewater –	Nature and (	Origin of	Polluta	<mark>nts - I</mark> r	ndustrial	wastev	water	and		
environmer	ntal impacts	- Regulatory	requirement	ts for trea	itment c	of indu	strial wa	stewat	er – I	ndust	trial	
waste surve	y – Industri	l wastewater	monitoring	and samp	<mark>pling -g</mark>	generati	ion rates	, chara	cteriz	atior	<mark>1 and</mark>	
variables –	Foxicity of i	dustrial efflu	ents and Bi	oassay te	sts – M	lajor iss	sues on v	water q	uality	7		
	. 4											
managemen	11.											
managemer Unit II		Pollution Pr	evention &	: Waste N	<b>Ainimis</b>	sation					8 H	ours
Unit II Prevention	<b>Industria</b> and Control	of Industrial	Pollution –	Benefits a	and Bar	rriers –					archy	
Unit II Prevention Source redu	Industrial and Control action techn	of Industrial ques – Perioc	Pollution – I lic Waste M	Benefits a	and Bar on Asse	rriers – essmen	its – Eva	luation	of P	olluti	archy on	
Unit II Prevention Source redu Prevention	Industrial and Control action techn Options – C	of Industrial ques – Perioc ost benefit an	Pollution – I lic Waste M	Benefits a	and Bar on Asse	rriers – essmen	its – Eva	luation	of P	olluti	archy on	
Unit II Prevention Source redu Prevention Prevention	Industrial and Control action techn Options – C Programs ir	of Industrial ques – Perioc ost benefit an Industries.	Pollution – lic Waste M alysis – Pay	Benefits a inimisatio -back per	and Bar on Asse	rriers – essmen	its – Eva	luation	of P	olluti Polli	archy on ution	7 _
Unit II Prevention Source redu Prevention Prevention Unit III	Industrial and Control action techn Options – C Programs ir Industrial	of Industrial ques – Perioc ost benefit an Industries. <b>Wastewater</b>	Pollution – lic Waste M alysis – Pay Treatment	Benefits a linimisation -back per	and Bar on Asse riod – Ii	rriers – essmen mplem	ts – Eva enting &	luation & Prom	of Poting	olluti Pollu	archy on ution <b>10 H</b>	7 _
Unit II Prevention Source redu Prevention Prevention Unit III Flow and L	Industrial and Control action techn Options – C Programs ir Industrial oad Equaliz	of Industrial ques – Perioc ost benefit an Industries. Wastewater tion – Solids	Pollution – 1 lic Waste M alysis – Pay Treatment Separation	Benefits a linimisatio -back per back per - Remov	and Bar on Asse riod – In 7al of Fa	rriers – essmen mplem ats, Oil	ts – Eva enting &	luation & Prom	of Poting	olluti Pollu zatio	archy on ution <b>10 H</b> n –	7 _
Unit II Prevention Source redu Prevention Prevention Unit III Flow and L Removal of	Industrial and Control action techn Options – C Programs ir Industrial oad Equaliz f Inorganic (	of Industrial ques – Perioc ost benefit an Industries. Wastewater tion – Solids onstituents –	Pollution – lic Waste M alysis – Pay Treatment Separation Precipitatic	Benefits a (inimisation z-back per back – Remov on, Heavy	and Bar on Asse riod – In val of Fa	rriers – essmen mplem ats, Oil remova	ts – Eva enting & & Grea al , Nitro	luation & Prom se- Net ogen &	of Po oting utrali Phos	olluti Pollu zatio	archy on ution 10 He n – ous	ours
Unit II Prevention Source redu Prevention Prevention Unit III Flow and L Removal of removal, Io	Industrial and Control action techn Options – C Programs ir Industrial oad Equaliz f Inorganic C n exchange,	of Industrial ques – Perioc ost benefit an Industries. <b>Wastewater</b> tion – Solids onstituents – Adsorption, T	Pollution – lic Waste M alysis – Pay Treatment Separation Precipitatic Membrane I	Benefits a finimisation -back per - Remov on, Heavy Filtration,	and Bar on Asse riod – In val of Fa v metal n , Eletroo	rriers – essmen mplem ats, Oil remova dialysis	tts – Eva lenting & l & Grea al , Nitro s & Evaj	luation 2 Prom ase- New ogen & poratio	of Po oting utrali Phos n – R	olluti Pollu zation phore	archy on ution 10 Ho n – ous val of	ours
Unit II Prevention Source redu Prevention Prevention Unit III Flow and L Removal of removal, Io Organic Co	Industrial and Control action techn Options – C Programs ir Industrial oad Equaliz f Inorganic C n exchange, onstituents –	of Industrial ques – Perioc ost benefit an Industries. Wastewater tion – Solids onstituents – Adsorption, T Biological tre	Pollution – F lic Waste M alysis – Pay Treatment Separation Precipitation Membrane I eatment Proc	Benefits a finimisation -back per - Remov on, Heavy Filtration,	and Bar on Asse riod – In val of Fa v metal n , Eletroo	rriers – essmen mplem ats, Oil remova dialysis	tts – Eva lenting & l & Grea al , Nitro s & Evaj	luation 2 Prom ase- New ogen & poratio	of Po oting utrali Phos n – R	olluti Pollu zation phore	archy on ution 10 Ho n – ous val of	ours
Unit II Prevention Source redu Prevention Prevention Unit III Flow and L Removal of removal, Io Organic Co	Industrial and Control action techn Options – C Programs ir Industrial oad Equaliz f Inorganic C n exchange, onstituents – processes –	of Industrial ques – Perioc ost benefit an Industries. <b>Wastewater</b> tion – Solids onstituents – Adsorption, T	Pollution – lic Waste M alysis – Pay Treatment Separation Precipitatic Membrane I eatment Proc udies.	Benefits a finimisation - back per - Remov on, Heavy Filtration, cesses, Cl	and Bar on Asse riod – In val of Fa v metal n , Eletroo hemical	rriers – essmen mplem ats, Oil remova dialysis	tts – Eva lenting & l & Grea al , Nitro s & Evaj	luation 2 Prom ase- New ogen & poratio	of Po oting utrali Phos n – R	olluti Pollu zation phore	archy on ution 10 Ho n – ous val of	ours

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

Unit VCase Studies10 HoursIndustrial manufacturing process description, wastewater characteristics, source reduction options and<br/>waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining –<br/>Pharmaceuticals – Sugar and Distilleries10 Hours

			Total:	45 Hours
Course Ou	tcomes:			
	After comp	pletion of the course, Student will be able to		
	1. Define	the Principles of pollution prevention and mechanism	n of oxidation	n processes.
	2. Sugge	st the suitable technologies for the treatment of waster	vater.	
	3. Discus	s about the wastewater characteristics		
	4. Design	the treatment systems		

17EV204	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	Т	Р	С				
		3	0	0	3				
Course Ob	bjectives:								
	To impart knowledge and skills in the collection, storage, transport, treatr	nent,	dispo	osal a	nd				
	recycling options for solid wastes including the related engineering principles, design								
	criteria, methods and equipment.	-	-						
Unit I	Sources, Classification and Regulatory Framework			9 H	ours				
Types and	Sources of solid and hazardous wastes - Need for solid and hazardous was	aste r	nanag	gemer	ıt				
Salient feat	tures of Indian legislations on management and handling of municipal soli	d was	stes, ł	nazaro	lous				
wastes, bio	omedical wastes, nuclear wastes - lead acid batteries, electronic wastes, pl	wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes , plastics and fly ash							
		lastic	s anu	ny a	$\sin -$				
	of integrated waste management and roles of stakeholders - Financing			•					
Elements of				•					
Elements of	of integrated waste management and roles of stakeholders - Financing on for waste management.			•					
Elements of Participation	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction	and	Publi	ic Pri 8 Hou	vate irs				
Elements of Participation	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biologica	and	Publi	ic Pri 8 Hou es of s	vate urs solid				
Elements of Participation Unit II Waste gene wastes – H	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biologica Hazardous Characteristics – TCLP tests – waste sampling and characteriz	and al proj	Publi pertie plan	ic Pri 8 Hou es of s	vate urs solid				
Elements of Participation Unit II Waste gene wastes – H	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biologica Hazardous Characteristics – TCLP tests – waste sampling and characteriz of wastes –Waste exchange - Extended producer responsibility - Recycling and	and al proj	Publi pertie plan	ic Pri 8 Hou es of s	vate urs solid				
Elements of Participation Unit II Waste gene wastes – H reduction of Unit III	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biological Hazardous Characteristics – TCLP tests – waste sampling and characterization f wastes –Waste exchange - Extended producer responsibility - Recycling a Storage, Collection and Transport Of Wastes	and all prop ation and re	Publi pertie plan euse.	ic Pri 8 Hou es of s - So 9 Hou	vate <b>Irs</b> solid urce <b>Irs</b>				
Elements of Participation Unit II Waste gene wastes – H reduction of Unit III Handling a	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biological Hazardous Characteristics – TCLP tests – waste sampling and characterize of wastes –Waste exchange - Extended producer responsibility - Recycling a Storage, Collection and Transport Of Wastes and segregation of wastes at source – storage and collection of municipal solit	and and proj and re id wa	Publi pertie plan euse.	<b>8 Hou</b> s of s - So <b>9 Hou</b> - Anal	vate <b>Irs</b> solid urce <b>Irs</b> lysis				
Elements of Participation Unit II Waste gene wastes – H reduction of Unit III Handling a of Collecti	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biologica Hazardous Characteristics – TCLP tests – waste sampling and characteriz of wastes –Waste exchange - Extended producer responsibility - Recycling a Storage, Collection and Transport Of Wastes and segregation of wastes at source – storage and collection of municipal solit on systems - Need for transfer and transport – Transfer stations Optimizir	and al proj ation and re id wa	Publi pertie plan cuse.  stes – ste al	8 Hou 8 Hou 8 s of s - So 9 Hou - Anal 10cat	vate <b>Irs</b> solid urce <b>Irs</b> lysis ion–				
Elements of Participation Unit II Waste gene wastes – H reduction of Unit III Handling a of Collecti	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biological Hazardous Characteristics – TCLP tests – waste sampling and characterize of wastes –Waste exchange - Extended producer responsibility - Recycling a Storage, Collection and Transport Of Wastes and segregation of wastes at source – storage and collection of municipal solit	and al proj ation and re id wa	Publi pertie plan cuse.  stes – ste al	8 Hou 8 Hou 8 s of s - So 9 Hou - Anal 10cat	vate <b>Irs</b> solid urce <b>Irs</b> lysis ion–				
Elements of Participation Unit II Waste gene wastes – H reduction of Unit III Handling a of Collecti	of integrated waste management and roles of stakeholders - Financing on for waste management. Waste Characterization and Source Reduction eration rates and variation - Composition, physical, chemical and biologica Hazardous Characteristics – TCLP tests – waste sampling and characteriz of wastes –Waste exchange - Extended producer responsibility - Recycling a Storage, Collection and Transport Of Wastes and segregation of wastes at source – storage and collection of municipal solit on systems - Need for transfer and transport – Transfer stations Optimizir	and al proj ation and re id wa	Publi pertie plan cuse.  stes – ste al	8 Hou 8 Hou 8 s of s - So 9 Hou - Anal 10cat	vate <b>Irs</b> solid urce <b>Irs</b> lysis ion–				

Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes - Health considerations in the context of operation of facilities, handling of materials and impact of outputs on the environment.

### Unit V Waste Disposal

9 Hours

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation.

		Total:	45 Hours
<b>Course Outcomes:</b>			
After com	pletion of the course, Student will be able to		
1. Under	stand the characteristics of different types of sol	lid and hazardous	wastes and the
factors	affecting variation		
	e and explain important concepts in the field of solutions for treatment of municipal a		
	stand the role legislation and policy drivers play and apply the basic scientific principles for solv ages		·

Image: Course Objectives:       3       0       0       3         1. To expose the students to the need, methodology, documentation and usetulness of environmental impact assessment and to develop the skill to prepare environmental management plan.       Image: I	17EV205		ENVIRONMENTAL IMPACT ASSESSMENT	L	Т	Р	С			
1. To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.         2. To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.         Unit I       Introduction       8 Hours         Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA –.EIA process- screening – scoping - setting – analysis – mitigation. Cross sectoral issues and terms of reference in EIA – Public Participation in EIA.         Unit II       Impact Identification and Prediction       10 Hours         Matrices – Networks – Checklists –Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment.       8 Hours         Unit III       Social Impact Assessment and EIA Documentation       8 Hours				3	0	0	3			
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predicting and managing human health risks.8 HoursUnit IIntroduction8 HoursHistorical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA –.EIA process- screening – scoping - setting – analysis – mitigation. Cross sectoral issues and terms of reference in EIA – Public Participation in EIA.Unit IIImpact Identification and Prediction10 HoursMatrices – Networks – Checklists –Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment.8 HoursUnit IIISocial Impact Assessment and EIA Documentation8 Hours		2. To pro	ovide knowledge related to the broad field of environment	tal ris	sk as	sessm	lent,			
Unit IIntroduction8 HoursHistorical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA –.EIA process- screening – scoping - setting – analysis – mitigation. Cross sectoral issues and terms of reference in EIA – Public Participation in EIA.Unit IIImpact Identification and Prediction Matrices – Networks – Checklists –Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment.Unit IIISocial Impact Assessment and EIA Documentation8 HoursSocial impact assessment - Relationship between social impacts and change in community and		import	ant processes that control contaminant transport and tools t	hat c	an be	e use	d in			
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Unit IIISocial Impact Assessment and EIA Documentation8 HoursSocial impact assessment - Relationship between social impacts and change in community and8	- Assessme	nt of impact	s – air – water – soil – noise – biological — Cumulative Impac	et Ass	essm	ent.				
institutional arrangements, mutvitutal and ranning level impacts. Communities in transition Documentation	•	institutional arrangements. Individual and family level impacts. Communities in transition Documentation								

of EIA find	ings – plann	ing – organization of information and visual display mat	terials – Rep	port
preparation.				
Unit IV	<mark>Environm</mark>	<mark>ental Management Plan</mark>		7 Hours
Environmer	ntal Manage	ment Plan - preparation, implementation and review – M	litigation an	ıd
Rehabilitati	on Plans – F	Policy and guidelines for planning and monitoring progra	ammes – Po	st project audit
- Ethical an	d Quality as	pects of Environmental Impact Assessment- Case Studie	es.	
Unit V	<b>Environm</b>	ental Risk Assessment and Management		12 Hours
Environmer	ntal risk asse	essment framework-Hazard identification -Dose Response	se Evaluatio	n – Exposure
Assessment	– Exposure	Factors, Tools for Environmental Risk Assessment-HA	AZOP and F	FEMA
methods - H	Event tree ar	nd fault tree analysis – Multimedia and multipathway exp	posure mod	eling of
contaminan	t- Risk Char	acterization Risk communication - Emergency Prepared	ness Plans -	-Design of risk
managemen	t programs.			_
			Total:	45 Hours
Course Ou	tcomes:			
	After comp	pletion of the course, Student will be able to		
	1. Unders	stand the necessity to study the impacts and risks that wi	ill be caused	l by projects or
	industr	ies and the methods to overcome these impacts.		
	2. Know	about the legal requirements of Environmental and Risk	Assessmen	t for projects.

17EV206	UNIT OPERATIONS AND PROCESSES	L	Т	Р	С
	LABORATORY				
		0	0	2	1
Course Ob	jectives:				
	1. To develop the skill for conducting Treatability studies of water and w	vastev	vater	treatr	nent
	by various Unit Operations and Processes using laboratory scale mod	lels.			
	2. To develop the skill for conducting Treatability studies of water and w	vastev	vater	treatr	nent
	by various Unit Operations and Processes using laboratory scale mod	lels.			
List of Exp	eriments:				
1. Coagul	ation and Flocculation				7
2. Batch s	tudies on settling				10
3. Studies	on Filtration- Characteristics of Filter media				7
4. Water s	oftening				7
5. Adsorp	tion studies/Kinetics				7
	Osmosis- Silt Density Index				7
	s of suspended growth process (activated sludge process)- Sludge volume Ir	ndex			14
	bic Reactor systems / kinetics (Demonstration)				10

<mark>9.</mark>	Advanc	ed Oxidatio	n Processes – (Ozonation, Photocatalysis)		<u>14</u>						
<u>10.</u>	Disinfe	ction for Dri	inking water		7						
				Total	45 Hours						
Co	urse Ou	tcomes:									
		After com	pletion of the course, Student will be able to								
		1. Condu	ct treatability studies for water and waste water treatment.								
		2. Design	a laboratory models for various unit operations and processes.								
Re	ferences										
1.	Metcalf	and Eddy.	Inc. "Wastewater Engineering, Treatment, Disposal and Reuse,	, Third E	dition, Tata						
	McGrav	w Hill Publi	shing Company Limited, New Delhi, 2003.								
2.	Lee, C.	C. and Shu	n dar Lin. Handbook of Environmental Engineering Calculati	ons, Mc	Graw Hill,						
	New Yo	ork, 1999.									
3.	Casey 7	Г.J., Unit T	Treatment Processes in Water and Wastewater Engineering,	John W	ileys Sons,						
	London	, 1993.									
4.	David V	W.Hendrick	s, "Water Treatment Unit Processes: Physical and Chemical'	', CRC I	Press, Boca						
	Raton, 2	2006.									

17EV001			METEOROLOGY AND	L	Т	Р	C		
		MODELING		3	0	0	3		
Course Ob	jectives:			5	U	U	5		
To introduce the emerging concepts of climate modeling and projecting future climate									
	change, un	derstand data analysis	and application.						
Unit I	Atmosphe	ric Pollution				9 H	ours		
Atmospheri	c Pollution,	type of pollutants, gas	eous and particulate pollutants,	size of atmo	spherio	с			
particles, er	nission inve	ntory, various sources	of emissions, bio-mass burning	, pollution fo	rmatio	on in			
combustion	, Visibility a	and Acid Deposition Ir	dustrial pollution.						
Unit II	<b>Meteorolo</b>	<mark>)gy</mark>				9 H	ours		
Air pollutio	n meteorolo	gy: sources of air poll	ution, methods for air pollution	measuremen	t and c	contro	l,		
meteorolog	ical factors t	hat contribute to air qu	ality degradation, basic chemis	try of the atn	nosphe	ere an	d		
how it contr	ributes to se	condary pollutant form	ation. Effect of air pollution on	Human heal	th, ma	terial	and		
vegetation,	Deposition	of particulate pollutant	s in the respiratory system.						
Unit III	<b>Transport</b>	t Models				9 H	ours		

Atmospheric chemical	Atmospheric chemical transport models, box models, three-dimensional atmospheric chemical transport								
models, components of	models, components of air quality forecasting and modelling, evaluation and validation, air quality								
standards and index, long range transport of pollutants. Back trajectory construction and applications									
Unit IV Dispersio			9 Hours						
Transport and dispersion	on of air pollutants - wind velocity, wind speed and turbul	lence; estimat	ing						
concentrations from po	int sources - the Gaussian Equation - atmospheric stabilit	ty - Air pollut	ion						
modelling and prediction	on - Plume rise, modelling techniques.								
			-						
Unit V Software	Modelling		9 Hours						
Exposure to computer	nodels for air quality.								
		Total:	45 Hours						
Course Outcomes:									
	pletion of the course, Student will be able to								
	the causes of climate change								
	the effects of climate change on various environments an	nd various mo	dels.						
References:									
1. Rao.M.N. &RaoH.	V.N., "Air Pollution", Tata McGraw Hill,2006.								
2. Richard W. Boub	el, Donald L. Fox, D. Bruce Turner & Arthur C. St	tern, "Fundam	entals of Air						
Pollution, Hardcov	ver", 2007.								
3. Kenneth Wark, Ce	cil F. Warn,"Air pollution its origin and control", 2007.								
4. StevenC.Chapra,	"Surface Water quality modeling", The McGraw-H	Hill- Compani	es Inc., New						
York, 1997.									

17EV002	CLIMATE CHANGE AND MODELING	L	Т	Р	С					
		3	0	0	3					
Course Objectives:										
	To introduce the emerging concepts of climate modeling and projecting a	future	clima	ate						
	change, understand data analysis and application.									
Unit I	Climate Change and Climate Variability			9 H	ours					
Introduction	- Atmosphere - weather and Climate - climate parameters (Temperature	,Raint	fall, F	Iumio	lity,					
Wind etc) -	Equations governing the atmosphere - Numerical Weather Prediction Mo	dels -	Intro	ducti	on					
to GCMs -	Application in Climate Change Projections.									
Unit II	IPCC SRES Scenarios				ours					
Intergovern	mental Panel on Climate Change (IPCC) - An Overview - Key Assumption	ns - S	cenar	io						
Family - Ste	oryline (A1, B1, A2, B2).									
-										
Unit III	Global Climate MODEL (GCM) and Regional Climate Model (RCM	<b>1</b> )		9 H	ours					

Some typical GCMs (HadCM3Q-UK Met Office) - Issues with GCMs - Introduction to RCMs and LAMs - some typical RCMs like PRECIS, Sim CLIM, MAGICC/SCENGENE - Advantages and Disadvantages of GCMs and RCMs.

# Unit IV Downscaling Global Climate Model - An Overview

9 Hours

9 Hours

Need for downscaling - Selection of GCMs for regional climate change studies - Ensemble theory – Selection of - Ensembles, Model Domain (Spatial domain and temporal domain), Resolution and climate variables - Lateral boundary conditions - Methods of downscaling (Statistical and Dynamical) - examples from each and their limitations.

Unit V Analysis /Post Processing

a. Model validation - post processing – Introduction to Analysis tools - Ferret, R, Grads, IDL, SPSS, ArcGIS

b. Climate change Impact - Vulnerability assessment – adaptation strategies.

									Total:	45 Hour	ſS
Co	ourse Ou	tcomes:									
		After com	pletion of	f the course	e, Studen	nt will b	be able to				
		1.Know th	e causes	of climate	change						
		2.Know th	e effects	of climate	change of	on varie	ous enviro	nments and	d various m	odels.	
Re	ferences	:									
1.	IPCC F	ourth Asses	sment Re	eport, Cam	bridge U	Iniversi	ty Press,	Cambridge,	UK.		
2.	McGuff	fie, K. and I	Henderso	n-Sellers,	A. "A Cl	limate	Modelling	g Primer, T	hird Edition	n, John Wiley &	&
	Sons, L	td, Chichest	ter, UK. ,	2005							
3. Neelin David J, "Climate Change and Climate Modelling", Cambridge University Press						SS					
4.	Thomas	s Stocker, "	Introduct	ion to Clir	nate Moo	delling	", Advano	es in Geop	hysical and	d Environmenta	al
	Mechan	nics and Mat	thematics	s. Springer	Publicati	ion.		_			

17EV005		ENVIRONMENTAL POLICIES AND LEGISLATION	L	Т	Р	С			
			3	0	0	3			
Course Objectives:									
	To impart	knowledge on the policies, legislations, institutional frame wor	k and	enfo	rcem	ent			
	mechanism	ns for environmental management in India.							
Unit I	Introducti	on la			9 Ho	ours			
Indian Co	nstitution a	nd Environmental Protection – National Environmental	polic	cies -	_				
<b>Precautiona</b>	ary Principle	and Polluter Pays Principle – Concept of absolute liability – n	nultila	teral					
environmer	ntal agreeme	nts and Protocols – Montreal Protocol, Kyoto agreement, Rio	declar	ration	<b></b>				
Environme	ntal Protection	on Act, Water (P&CP) Act, Air (P&CP) Act – Institutional							
framework(	SPCB/CPC	B/MoEF)							
Unit II	Water (P&	&CP) Act, 1974			8 Ho	ours			
Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention									
and control	and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet –								

Legal samp	ling procedu	es, State Water Laboratory – Appellate Author	rity – Pena	lties for vio	olation of
consent cor	nditions etc.	Provisions for closure/directions in apprehende	ed pollutior	n situation.	
Unit III	Air (P&C	) Act, 1981			8 Hours
		gulatory agencies - responsibilities of Occupier	r Provision	relating to	
		onsent to establish, Consent to operate – Cond		-	-
		es, State Air Laboratory – Appellate Authori			
<b>U</b>	01	Provisions for closure/directions in apprehende	•		
			1		
Unit IV		nt (Protection) Act 1986			13 Hours
Genesis of	the Act – de	egation of powers – Role of Central Governme	ent - EIA N	otification	<ul> <li>Sitting of</li> </ul>
Industries -	– Coastal Zo	e Regulation - Responsibilities of local bod	dies mitiga	ation schem	e etc., for
Municipal S	Solid Waste	Aanagement - Responsibilities of Pollution Co	ontrol Boar	ds under H	azardous
Waste rules	and that of	ccupier, authorization - Biomedical waste rule	es – respon	sibilities of	generators
and role of	Pollution Co	ntrol Boards			
Unit V	Other Top	cs			7 Hours
Relevant Pr	ovisions of	ndian Forest Act, Public Liability Insurance Ac	ct, CrPC, Il	PC -Public	Interest
Litigation -	Writ petitio	s - Supreme Court Judgments in Landmark cas	ses.		
				Total:	45 Hours
Course Ou	tcomes:				
	After com	etion of the course, Student will be able to			
	1. Know	he National environmental legislations and the	policies		
	2. plan p	ogrammes to comply with the legal requirement	nts related	to organiza	tions

17EV008		MEMBRANE TECHNOLOGIES FOR WATER AND	L	Т	P	C
		WASTE WATER TREATMENT				
			3	0	0	3
Course Ob	jectives:					
	To introdu	ce the concept and principles of membrane separation and its a	applica	ations	s in w	ater
	and wastew	vater treatment.				
Unit I	Membrane	e Filtration Processes			10 He	ours
Solid Liqui	d separation	systems- Theory of Membrane separation - mass Transport C	haract	eristi	ics- C	ross
Flow filtrat	ion - Mem	brane Filtration- Flux and Pressure drop -Types and choice	ce of	mem	brane	s,
porous, non	-porous, syr	nmetric and asymmetric – Plate and Frame, spiral wound and	hollov	v fibr	e	
membranes	– Liquid M	embranes				
	1					
Unit II	<b>Membran</b>	e Systems			10 H	ours
Microfiltrat	ion principl	les and applications - Ultra filtration principles and applic	cations	s - N	Vano	
Filtration pr	inciples and	applications – Reverse Osmosis: Theory and design of modul	les, as	semb	ly, pl	ant

process control and applications – Electro dialysis : Ion exchange membranes, process design-Pervaporation – Liquid membrane – Liquid Pertraction – Supported Liquid Membrane and Emulsion Liquid membrane - Membrane manufactures – Membrane Module/Element designs – Membrane System components – Design of Membrane systems - pump types and Pump selection– Plant operations – Economics of Membrane systems

# Unit III Membrane Bioreactors

9 Hours

Introduction and Historical Perspective of MBRs, Biotreatment Fundamentals, Biomass Separation MBR Principles, Fouling and Fouling Control, MBR Design Principles, Design Assignment, Alternative MBR Configurations, Commercial Technologies, Case Studies.

Unit IV Pretreatment Systems

Membrane Fouling – Control of Fouling and Concentration Polarisation-Pretreatment methods and strategies – monitoring of Pretreatment – Langlier Index, Silt Density Index, Chemical cleaning, Biofoulant control.

Unit V Case Studies

8 Hours

8 Hours

Case studies on the design of membrane-based water and wastewater treatment systems – zero Liquid effluent discharge Plants – Desalination of brackish water.

									Total:	45 H	lours
Course	e Outcon	nes:									
	After co	ompletio	n of the	e cours	e, Student w	vill be					
	1.	familiar	with	main	membrane	processes,	principles,	sepa	ration m	nechanisms,	and
		applicat	ions								
	2.	understa	and the	selecti	ion criteria f	or different	membrane pi	rocess	ses		
	3.	know th	e princ	iple of	the most co	mmon men	brane application	ations			
	4.	Carry or	ut desig	gn of p	roject for a p	particular m	embrane tech	nolog	gy applica	tion.	

17EV009		REMOTE SENSING	AND GIS	APPLICATIONS IN	L	Т	Р	С
		ENVIRONMENTAL	MANAG	EMENT				
					3	0	0	3
Course Ob	jectives:							
	1. To edu	cate the students on asp	pects of Re	emote Sensing				
	2. Develo	op the different remote s	sensing teo	chnique				
	3. To edu	cate the students on asp	pects of G	IS and data management				
	4. Develo	op the GIS Applications	for monit	toring and management o	f environ	ment		
Unit I	Remote Se	nsing Elements					8 H	ours
Historical I		0	sing, com	ponents of Remote Sensi	ng, Energ	gy sou		
electromag	netic radiatio	on, Electromagnetic spe	ctrum,	Energy interaction, Spec	tral respo	nse p	attern	n of
0		Energy recording techno			Ĩ	Ĩ		
Unit II	Remote Se					1	0.77	ours

	ion of Remot	te Sensing Systems, Aerial photographs, Photographic systems – Act	ross track and
along track	scanning, N	Iultispectral remote sensing, Thermal remote sensing, Microwave re-	mote sensing
– Active ar	nd passive se	nsors, RADAR, LIDAR	
	_		
Unit III		pact Assessment and EIA Documentation	9 Hours
		nt - Relationship between social impacts and change in community a	
	-	nts. Individual and family level impacts. Communities in transition I	
of EIA find	dings – plann	ing – organization of information and visual display materials – Rep	port
preparation	1.		
Unit IV	Fnvironm	ental Management Plan	10 Hours
		ment Plan - preparation, implementation and review – Mitigation and	
	-	Policy and guidelines for planning and monitoring programmes – Pos	
		spects of Environmental Impact Assessment- Case Studies.	st project addit
Lincara	na Quanty a	speets of Environmental impact Assessment- Case Studies.	
Unit V	<b>Environm</b>	ental Risk Assessment and Management	9 Hours
		ental Risk Assessment and Management essment framework-Hazard identification -Dose Response Evaluatio	
Environme	ental risk asse	<u>0</u>	on – Exposure
Environme Assessmen	ental risk asse at – Exposure	essment framework-Hazard identification -Dose Response Evaluatio	n – Exposure FEMA
Environme Assessmen methods –	ental risk asse at – Exposure Event tree at	essment framework-Hazard identification -Dose Response Evaluatio Factors, Tools for Environmental Risk Assessment– HAZOP and F	n – Exposure EMA leling of
Environme Assessmen methods – contaminar	ental risk asse at – Exposure Event tree at	essment framework-Hazard identification -Dose Response Evaluatio e Factors, Tools for Environmental Risk Assessment– HAZOP and F nd fault tree analysis – Multimedia and multipath way exposure mod racterization Risk communication - Emergency Preparedness Plans –	n – Exposure EMA leling of
Environme Assessmen methods – contaminar	ental risk asse at – Exposure Event tree an nt- Risk Char	essment framework-Hazard identification -Dose Response Evaluatio e Factors, Tools for Environmental Risk Assessment– HAZOP and F nd fault tree analysis – Multimedia and multipath way exposure mod racterization Risk communication - Emergency Preparedness Plans –	n – Exposure EMA leling of -Design of risk
Environme Assessmen methods – contaminar manageme	ental risk asse at – Exposure Event tree ar nt- Risk Char nt programs.	essment framework-Hazard identification -Dose Response Evaluatio e Factors, Tools for Environmental Risk Assessment– HAZOP and F nd fault tree analysis – Multimedia and multipath way exposure mod racterization Risk communication - Emergency Preparedness Plans –	n – Exposure EMA leling of
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