

M.Tech. (Full Time) - Environmental Engineering Curriculum & Syllabus 2015 – 2016

FACULTY OF ENGINEERING AND TECHNOLOGY SRM UNIVERSITY SRM NAGAR, KATTANKULATHUR - 603 203

M.TECH - ENVIRONMENTAL ENGINEERING CURRICULUM – 2015-16

SEMESTER I

COURSE CODE	COURSE NAME	L	Т	Ρ	С
EN2001	TRANSPORT OF WATER AND WASTE WATER(THEORY AND PRACTICAL)	3	1	2	4
EN2002	ENVIRONMENTAL MICROBIOLOGY AND ECOLOGY	3	1	0	4
EN2003	SOLID WASTE MANAGEMENT	3	1	0	4
MA2005	ENVIRONMENTAL STATISTICAL METHODS	3	0	0	3
CAC2001	CAREER ADVANCEMENT COURSE FOR ENGINEERS - I	1	0	1	1
ENXXXX	PROGRAM ELECTIVE I	3	0	0	3
Total			3	3	19
Total contact hours 22					

SEMESTER II

COURSE CODE	COURSE NAME	L	Τ	Ρ	С
EN2004	UNIT OPERATION AND PROCESSES IN	3	1	2	4
	WATER AND WASTE WATER TREATMENT				
	(THEORY AND PRACTICAL)				
EN2005	AIR & WATER QUALITY MODELING	3	1	0	4
EN2006	DESIGN AND OPERATION OF WATER AND	3	1	0	4
	WASTE WATER				
CAC2002	CAREER ADVANCEMENT COURSE FOR	1	0	1	1
CACZUUZ	ENGINEERS - II	Ι	0	-	-
ENXXXX	PROGRAM ELECTIVE II	3	0	0	3
ENXXXX	PROGRAM ELECTIVE III	3	0	0	3
	Total	16	3	3	19
Total contact hours 22					

SEMESTER III

COURSE	COURSE NAME	L	Т	Р	С	
CODE						
ENXXXX	PROGRAM ELECTIVE IV	3	0	0	3	
ENXXXX	PROGRAM ELECTIVE V	3	0	0	3	
ENXXXX	PROGRAM ELECTIVE VI	3	0	0	3	
CAC2002	CAREER ADVANCEMENT COURSE FOR	1	0	1	1	
CAC2003	ENGINEERS - I	-	0	-	-	
XXXXXX	INTERDISCIPLINARY ELECTIVE	3	0	0	3	
EN2048	INDUSTRIAL TRAINING	0	0	1	1	
EN2049	PROJECT WORK PHASE -I	0	0	12	6	
	Total	13	0	14	20	
Total Contact Hours 27						

SEMESTER IV

COURSE CODE	COURSE NAME	L	Т	Р	С
EN2050	PROJECT WORK PHASE-II	0	0	32	16
	Total	0	0	32	16
Total Contact Hours 32					
TOTAL CREDITS TO BE EARNED FOR THE AWARD OF M.TECH DEGREE				74	

CORE COURSES

COURSE	COURSE NAME	L	Т	Ρ	С
EN2001	TRANSPORT OF WATER AND WASTE WATER (THEORY AND PRACTICAL)	3	1	2	4
EN2002	ENVIRONMENTAL MICROBIOLOGY AND ECOLOGY	3	1	0	4
EN2003	SOLID WASTE MANAGEMENT	3	1	0	4
EN2004	UNIT OPERATION AND PROCESSES IN WATER AND WASTE WATER TREATMENT (THEORY AND PRACTICAL)	3	1	2	4
EN2005	AIR & WATER QUALITY MODELING	3	1	0	4
EN2006	DESIGN AND OPERATION OF WATER AND WASTE WATER	3	1	0	4

COURSE	COURSE NAME	L	Т	Р	С	
CODE						
EN2101	INDUSTRIAL WASTE WATER TREATMENT	3	0	0	3	
EN2102	NOISE POLLUTION AND CONTROL	3	0	0	3	
EN2103	HAZARDOUS WASTE MANAGEMENT	3	0	0	3	
EN2104	RS AND GIS FOR ENVIRONMENTAL	3	0	0	3	
	ENGINEERING					
EN2105	ECOLOGICAL ENGINEERING	3	0	0	3	
EN2106	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3	
EN2107	BIOLOGICAL TREATMENT OF WASTEWATER	3	0	0	3	
EN2108	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	3	
EN2109	ENVIRONMENTAL POLICIES AND LEGISLATION	3	0	0	3	
EN2110	GROUND WATER CONTAMINATION AND	3	0	0	3	
	TRANSPORT MODELING					
EN2111	INDOOR AIR QUALITY	3	0	0	3	
EN2112	INSTRUMENTAL MONITORING OF	3	0	0	3	
	ENVIRONMENT					
EN2113	MARINE POLLUTION MONITORING	3	0	0	3	
EN2114	MASS TRANSFER IN AIR-WATER-SOIL	3	0	0	3	
	INTERACTION					
EN2115	PHYSICAL AND CHEMICAL TREATMENT OF	3	0	0	3	
	WATER AND WASTEWATER					
EN2116	ENVIRONMENTAL ENGINEERING STRUCTURES	3	0	0	3	
EN2117	CLEANER PRODUCTION	3	0	0	3	
EN2118	AIR POLLUTION CONTROL	3	0	0	3	
EN2119	UNIT OPERATIONS AND UNIT PROCESSES	0	1	4	3	
	LABORATORY					
EN2120	ENVIRONMENTAL CHEMISTRY	3	0	0	3	

LIST OF OPTIONAL / PROGRAM ELECTIVE COURSES

SUPPORTIVE COURSE

COURSE CODE	COURSE NAME	L	Т	Ρ	С
MA2005	Environmental Statistical Methods	3	0	0	3

CONTACT HOUR/CREDIT:

L: Lecture Hours per week

T: Tutorial Hours per week

P: Practical Hours per week

C: Credit CORF COURSES

EN2001	TRANSPORT OF WATER AND WASTE WATER (THEORY AND PRACTICAL)	L	Т	Ρ	С	
	Total Contact Hours - 90	3	1	2	4	
PURPOSE						
To develop a basic knowledge about the concept of transport of water and wastewater and apply the same in the field application.						
INSTRUCTIONAL	OBJECTIVES					
To educate the s mains, water dis emphasis on com	tudents in detailed design concepts related to tribution system, sewer networks and storm puter application.	wate wat	r trar er di	nsmis ain,	ssior with	

UNIT I - FI UID PROPERTIES

Fluid properties; fluid flow - continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, major and minor heads loss, formula for estimation of head loss - pumping of fluids - selection of pumps - Flow measurement.

UNIT II - POPULATION FORECASTING

Forecasting of population - Arithmatic Increase - Geometrical Increase - Incremental Increase - Graphical Methods - Logistic Curve Method - Per capita consumption -Design period - Variation in demand - Factors Affecting per capita consumption.

UNIT III - DISTRIBUTION

Water transmission main design - pipe materials - economics - water distribution pipe networks - methods for analysis and optimization - Laying and maintenance, insitu lining - appurtenances.

UNIT IV - DESIGN OF SEWERS

Design of sanitary sewer; partial flow in sewers, economics of sewer design; sewer appurtenances; material, construction, inspection and maintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive wastewaters.

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(15 hours)

(15 hours)

(15 hours)

(15 hours)

UNIT V - STORM WATER

Planning - run-off estimation, rainfall data analysis, storm water drain design - rain water harvesting. Use of computer software in water transmission, water distribution and sewer design.

UNIT VI - PRACTICAL

Use of computer software in water transmission, water distribution and sewer design - LOOP version 4.0, SEWER, BRANCH

REFERENCES

- 1. *"Manual on water supply and Treatment"*, CPHEEO, Ministry of Urban Development, Gol, New Delhi, 2009.
- 2. *"Manual on Sewerage and Sewage Treatment"*, CPHEEO, Ministry of Urban Development, Gol, New Delhi, 2003.
- 3. Hammer.M.J., "Water and Wastewater Technology", Regents/ Prentice Hall, New Jercy, 2001.

EN2002	ENVIRONMENTAL MICROBIOLOGY AND ECOLOGY	L	Т	Ρ	С
	Total Contact Hours - 60	3	1	0	4

PURPOSE

To develop a basic knowledge about the concept of environmental microbiology and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

To educate the students in microbiology and its applications in environmental engineering, and to train them in experiments related to microbiological examination of water.

UNIT I - MICROORGANISMS

(12 hours)

(12 hours)

Microorganisms - classification, prokaryotic and eukaryotic cells.structure, characteristics, nuclic acids, DNA, RNA.

UNIT II - GROWTH SYSYTEMS

Microbiology of biological treatment process.Aerobic microorganisms-Anaerobic microorganisms-their environment-Attached and suspended growth systems.

(15 hours)

(15 hours)

UNIT III - MICROBIAL TREATMENT

Hydrolysis - Acidogenesis - Acetogenesis - Methanogenesis - Rate of limiting steps Immobilization advantages - Difference between aerobic and anaerobic treatment.

UNIT IV - DISTRIBUTION OF MICROORGANISMS

Distribution of microorganisms, coliforms-faecal coliforms - E.coli, Streptococcus facalis and clostridium welchii, differenciation of coliforms-significance-MPN index.

UNIT V - ECOTOXICOLOGY

Ecotoxicology - effects, bioaccumulation - bio-magnification-bioassay-bio monitoring - Saline microbes and their role in salt. Marine eco toxicological testing with organisms with zooplankton/ sea weed.

REFERENCES

- 1. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and PelczarMerna Foss. *"Microbiology"*, 5th edition., Tata McGraw Hill Publishing Company Limited, New Delhi-2006.
- 2. Stainer, R.Y., Ingrahum, J.L., Wheelis, M.C and Painter, P.R. "General Microbiology", Mac MillanEdn., Ltd., London, 2009.
- 3. Pichai, R. and Govindan, V.S., Edn., "Biological processes in pollution control", Anna University, Madras, 2008.

EN2003	SOLID WASTE MANAGEMENT	L	Т	Ρ	С	
	Total Contact Hours - 60	3	1	0	4	
PURPOSE						
To develop a basic knowledge about the concept of solid waste management and apply the same in the field application.						
INST	FRUCTIONAL	OBJECTIVES				
1.	To educate municipal so	the students on the principles involved in the lid waste - from source identification up to dispos	ie m al.	anag	emer	nt of

UNIT I - SOURCES OF SOLID WASTES

(12 hours)

Types and Sources of solid wastes - Need for solid waste management - Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, plastics and fly ash.

UNIT II - PROPERTIES OF SOLID WASTE

(12 hours)

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(12 hours)

(12 hours)

(12 hours)

Waste generation rates and variation - International, global, local level - Composition, physical, chemical and biological properties of solid wastes - waste sampling and characterization plan - Source reduction of wastes - Recycling and reuse - Waste exchange.

UNIT III - COLLECTION & SEGREGATION

Handling and segregation of wastes at source - storage and collection of municipal solid wastes - Analysis of Collection systems - Need for transfer and transport - Transfer stations Optimizing waste allocation - compatibility, storage, labeling wastes.

UNIT IV - ENERGY RECOVERY

Objectives of waste processing - material separation and processing technologies - biological and chemical conversion technologies - methods and controls of Composting - energy recovery and other modern techniques in managing solid waste - Case studies.

UNIT V - SOLID WASTE DISPOSAL

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

REFERENCES

- 1. George Tchobanoglouset.al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 2003.
- 2. Bilitewski.B, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, "Waste Management", Springer, 2004.
- 3. *"Manual on Municipal Solid Waste Management"*, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2010.
- 4. Landreth.R.E. and Rebers.P.A., "Municipal Solid Wastes problems and Solutions", Lewis Publishers, 2002.
- 5. Bhide A.D. and Sundaresan.B.B., *"Solid Waste Management in Developing Countries"*, INSDOC, 2003.

(12 hours)

(12 hours)

(12 hours)

SUPPORTIVE COURSE

MA2005	ENVIRONMENTAL STATISTICAL METHODS	L	Т	Р	С	
	Total contact hours - 45	3	0	0	3	
	Pre-requisite					
	Nil					

PURPOSE

The course is designed to offer knowledge about the application of mathematical models for biological application. It provides fundamental ideas on the useful of data analysis, interpretation and inference including plan for future investigation based on experimental data collected from the conduct of biological experiments.

INSTR	INSTRUCTIONAL OBJECTIVES					
1.	To provide Theoretical Distribution on simple problems					
2.	On the principles of Regression methods and Testing of hypothesis					
3.	Analysis of variance its design of experiments					
4.	Queuing theory application					

UNIT I - DISTRIBUTIONS

Binomial, Poisson and Normal distributions - Definitions, Simple problems only (Derivations not included).

UNIT II - CURVE FITTING

Principle of Least Squares, Fitting of straight line and parabola - Correlation - Karl Pearson's coefficient of correlation and Spearman's rank correlation - Linear regression.

UNIT III - SAMPLING DISTRIBUTIONS

Sampling Distributions - Tests based on Normal, t, Chi-Square and F-Distributions.

UNIT IV - APPLICATIONS OF VARIANCES

One way and Two way classification of ANOVA - Completely Randomized Design -Randomised Block Design - Latin square Design.

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(9 hours)

(9 hours)

(9 hours)

UNIT V - QUEUING MODELS

Single and multiple server Markovian queuing models - M/M/1 and M/M/c queuing models and Applications (Derivations not included).

REFERENCES

- 1. Gupta, S.C., and Kapoor, V.K., *"Fundamentals of mathematical statistics"*, Sultan Chand and sons, Reprint 2003.
- 2. Gupta, S.C., and Kapoor, V.K., "Fundamentals of Applied statistics", Sultan Chand and sons, 2003.
- 3. Veerarajan.T., "Probability Statistics and Random processes", TMH, First reprint, 2004.

CORF COURSES

UNIT OPERATION AND PROCESSES IN WATER т Ρ AND WASTE WATER TREATMENT (THEORY AND Г FN2004 PRACTICAL) Total Contact Hours - 90 3 1 2

PURPOSE

To develop a basic knowledge about the concept of unit operations and processes in water and wastewater treatment and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

To educate the students on the working principles and design of various physical 1. and chemical treatment systems for water and wastewater.

UNIT I - UNIT OPERATIONS AND PROCESSES

Unit operations and processes - Principal type of Reactors - Flow measurement -Screening - Flow Equalisation - Mixing - Coagulation and Flocculation.

UNIT II - SEDIMENTATION

Sedimentation - Type of settling - Discrete, Flocullant, Hindered & Compression Settling - Flotation - Dissolved air flotation.

UNIT III - FILTRATION

Filtration - Type of filters - Headloss through filters - Design of Slow Sand Filter & Rapid Sand Filter - High rate Filter - Pressure Filter.

UNIT IV - MISCELLANFOUS METHODS

Disinfection - Objectives - Different Types - Chlorinator (Advantages & Disadvantages) - Bleaching Powder - Ozone Treatment - UV Irradiation - Types of Chlorination - Breakpoint chlorination - Dechlorination.

UNIT V - CHEMICAL & BIOLOGICAL PROCESSES

Suspended and attached growth processes - Aerobic and Anaerobic - Determination of kinetic coefficients. pH - Conductivity - TDS - Total solids - Hardness - Alkalinity -Turbidity - DO - BOD - COD - Coliform count.

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(15 hours)

(15 hours)

С

4

(15 hours)

(15 hours)

(15 hours)

UNIT VI - PRACTICAL

Testing the samples for BOD, COD, TDS,TS, Turbidity, Hardness, Alkalinity, DO, Conductivity.

REFERENCES

- Birdie G.S., BirdieJ.S., "Water Supply & Sanitary Engineering", DhanpatrRai 1. Publishing COMPANY Pvt Ltd., New Delhi.
- 2. Pannirselvam.R," Environmental Engineering Vol- I", Water Supply and Treatment", SPGS Publishers, Chennai,
- METCALF & EDDY, INC. "Wastewater Engineering Treatment, Disposal, and 3. Reuse", Third Edition, Tata McGraw-Hill Publishing CompanyLimited, New Delhi 2005
- 4. "CASEY. T. J. "Unit Treatment Processes in Water and Wastewater Engineering", John Wiley&Sons, England 2003.

ENDOOF	AIR & WATER QUALITY MODELING	L	Т	Ρ	С
ENZOUD	Total Contact Hours - 60	3	1	0	4
PURPOSE					
To develop a bas	sic knowledge about the concept of air and wat	er qu	ality	mode	elling

and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

To educate the students on the basic principles, development and application of 1 air and water quality models with computer applications.

UNIT I - AIR OUALITY MODELLING

Model - definition - types - uses - systems and models - kinds of mathematical models - model development - water quality standards - ambient air quality standards.

UNIT II - FLOW ANALYSIS

Historical development of water quality models - rivers and streams water quality modelling - river hydrology and flow - low flow analysis - dispersion and mixing - flow, depth, and velocity.

UNIT III - WATER QUALITY MODELLING

Estuaries - estuarine transport, - estuary dispersion coefficient; Lakes and impoundments - water quality response to inputs; water quality modeling process model sensitivity - assessing model performance. (12 hours)

UNIT IV - DISPERSION OF AIR POLLUTANTS

(12 hours)

(12 hours)

(12 hours)

(15 hours)

Transport and dispersion of air pollutants - wind velocity, wind speed and turbulence; estimating concentrations from point sources - the Gaussian Equation - atmospheric stability - Air pollution modelling and prediction - Plume rise, modelling techniques.

UNIT V -SOFTWARE MODELLING

(12 hours)

Exposure to computer models for surface water quality, and air quality.

REFERENCES

- 1. Rao.M.N. & RaoH.V.N., "Air Pollution", Tata McGraw Hill, 2006.
- 2. Richard W. Boubel, Donald L. Fox, D. Bruce Turner & Arthur C. Stern, *"Fundamentals of Air Pollution, Hardcover"*, 2007.
- 3. Kenneth Wark, Cecil F. Warn, "Air pollution its origin and control", 2007.
- 4. StevenC.Chapra, "*Surface Water quality modeling*", The McGraw-Hill-Companies Inc., New York, 1997.
- 5. John Wainwright and Mark Mulligan, *"Environmental Modelling Finding Simplicity in Complexity"*, John Wiley and sons Ltd, USA, 2004.
- 6. Deaton and Wine brake, "Dynamic Modeling of Environmental Systems", Wiley & sons, 2002.

EN2006	DESIGN AND OPERATION OF WATER AND WASTE WATER	L	Т	Ρ	С
	Total Contact Hours - 60	3	1	0	4
PURPOSE					
To develop a	basic knowledge about the concept of design and	oper	ation	of w	<i>i</i> ater
and wastewat	er and apply the same in the field application.				

INSTRUCTIONAL OBJECTIVES

1. To educate the students on principles and design of various biological treatment units used for wastewater treatment.

UNIT I - DESIGN OF CONVENTIONAL WATER TREATMENT UNITS (12 hours) Design of conventional water treatment units, - Aeration, chemical dosing tanks, Flash mixers, Flocculators, Sedimentation tanks, Clariflocculators, filter beds, disinfection units - hydraulic profile and layout of conventional treatment units upgrading of existing plants - Residue management.

UNIT II - DESIGN OF SEWAGE TREATMENT PLANT UNITS (12 hours) Design of sewage treatment plant units - screen chamber, Grit chamber with proportional flow weir, sedimentation tank - Trickling filters, Rotating Biological

contactor, activated sludge process & variations, aerated lagoons, waste stabilization ponds - reclamation and reuse - Flow charts, layout, hydraulic profile.

UNIT III - DESIGN OF BIOLOGICAL UNITS

Attached and suspended growth, Design of units - UASB, up flow filters, Fluidised beds - septic tank and disposal - Layout and Hydraulic profile - Recent advances.

UNIT IV - DESIGN OF SLUDGE UNITS

Design of Sludge management facilities, sludge thickening, sludge digestion, Biogas generation, sludge dewatering (mechanical and gravity) - upgrading existing plants - ultimate residue disposal - Recent Advances.

UNIT V - PRACTICAL APPLICATIONS

Operational problems - Trouble shooting, Planning, Organising and Controlling of plant operations - capacity building, Case studies on sewage treatment plants - sludge management facilities.

REFERENCES

- 1. "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2009.
- 2. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Gol, New Delhi, 2009.
- 3. METCALF & EDDY, INC. *"Wastewater Engineering, Treatment and Reuse"*, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2012.
- 4. Arceivala, S.J., "Wastewater treatment for pollution control", TMH, New Delhi, 2001.
- 5. Qasim, S.R, "Wastewater Treatment Plant, Planning, Design & Operation", Technomic Publications, New York, 2004.

(12 hours)

(12 hours)

(12 hours)

EN2048		INDUSTRIAL TRAINING (Training to be undergone after II semester)	L	T	Ρ	С
		3 week practical training in industry	0	0	1	1
		Prerequisite				
		Nil				
PUR	POSE					
То р	rovide pr	actical exposure in Civil Engineering related organizatio	ns.			
INST	FRUCTIO	ONAL OBJECTIVES				
1.	Student organiza concept	s have to undergo three – week practical training in Civ ations so that they become aware of the practical appli s studied in the class rooms.	il Engi ication	neer is of	ing re theoi	elated retical

Students have to undergo three-week practical training in Civil Engineering related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

		L	Т	Р	С
EN2049	PROJECT WORK PHASE I (III semester)	0	0	12	6
EN2050	PROJECT WORK PHASE II (IV semester)	0	0	32	16
PURPOSE					
To underta	ke research in an area related to the program of stud	ly			
INSTRUCT	IONAL OBJECTIVE				
The studen and carry developme	t shall be capable of identifying a problem related to out wholesome research on it leading to finding nt of a new/improved product, process for the benefi	o the s wh t of th	orogra ich w e soci	im of s ill faci ety.	study litate

M. Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. The method of assessment for both Phase I and Phase II is shown in the following table:

Assessment	Tool	Weightage
In- semester	I review	10%
	II review	15%
	III review	35%
End semester	Final viva voce	40%
	examination	

Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

FLECTIVES COURSES

EN0101	INDUSTRIAL WASTE WATER TREATMENT	L	Т	Ρ	С
ENZIUI	Total Contact Hours - 45	3	0	0	3
PURPOSE					
To develop a basi management and	ic knowledge about the concept of industrial wast apply the same in the field application.	ewat	er		
INSTRUCTIONAL	_ OBJECTIVES				
To educate 1. individual wa concepts.	the students on complete management pr astewater - starting from wastewater source ident	incipl ificati	es r on up	elate o to r	d to euse

UNIT I - INDUSTRIES & ENVIRONMENT

Industrial scenario in India - Industrial activity and Environment - Uses of Water by industry - Sources and types of industrial wastewater - Industrial wastewater and environmental impacts - Regulatory requirements for treatment of industrial wastewater - Industrial waste survey - Industrial wastewater generation rates. characterization and variables - Population equivalent - Toxicity of industrial effluents and Bioassay tests.

UNIT II - INDUSTRIAL POLLUTION PREVENTION

Prevention Vs Control of Industrial Pollution - Benefits and Barriers - Source reduction techniques - Waste Audit - Evaluation of Pollution prevention options - Environmental statement as a tool for pollution prevention - Waste minimization Circles.

UNIT III - TREATMENT OF INDUSTRIAL WASTE WATER

Equalisation - Neutralisation - Oil separation - Flotation - Precipitation - Heavy metal Removal - Refractory organics separation by adsorption - Aerobic and anaerobic biological treatment - Sequencing batch reactors - High Rate reactors - Chemical oxidation - Ozonation - Photocatalysis - Wet Air Oxidation - Evaporation - Ion Exchange - Membrane Technologies - Nutrient removal.

UNIT IV - MANAGEMENT OF TREATMENT PLANTS (9 hours)

Individual and Common Effluent Treatment Plants - Joint treatment of industrial wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse - Industrial reuse - Disposal on water and land - Residuals of industrial wastewater treatment - Quantification and characteristics of Sludge - Thickening,

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(9 hours)

(9 hours)

digestion, conditioning, dewatering and disposal of sludge - Management of RO rejects.

UNIT V - PRACTICAL APPLICATION IN INDUSTRIES (9 hours)

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles - Tanneries - Pulp and paper - Petroleum Refining - Pharmaceuticals - Sugar and Distilleries - Food Processing - fertilizers - Thermal Power Plants and Industrial Estates.

REFERENCES

- 1. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 2001.
- 2 Arceivala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw-Hill. 2008.
- 3. Frank Woodard, "Industrial waste treatment Handbook". Butterworth Heinemann, New Delhi, 2001.

EN2102		NOISE POLLUTION AND CONTROL	L	Т	Ρ	С
		Total Contact Hours - 45	3	0	0	3
PURPOSE						
To learn the fundamental concepts in the field of Noise pollution and control						
INSTRUCTIONAL OBJECTIVES						
1.	1. To know the basics, importance of noise pollution measurement.					
2.	2. To study the various effects of noise pollution.					
3.	3. To learn the importance of methods of control of noise.					
4.	4. To study the various noise pollution regulations.					

UNIT I - SOURCES OF NOISE POLLUTION

Sources of noise – Units and Measurements of Noise – Noise Power level, Intensity level, Pressure level - Relationship, Noise level meter - Weighted networks -Decibeladdition - Octave Band - Noise spectrum - Equivalent Noise - Day and night time – Standards, Equations and Application.

UNIT II - CHARACTERIZATION OF NOISE POLI UTION (9 hours)

Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise - General Control Measures - Effects of noise pollution auditory effects, non-auditory effects.

UNIT III - PREVENTION& CONTROL OF NOISE POLLUTION (9 hours) Noise Menace - Noise and the Fetus - Prevention and Control of Noise Pollution -Control of noise at source, control of transmission, protection of exposed person -17 SRM-M.Tech.-Env. Enga.- 2015-16

Control of other types of Noise Sound Absorbent – Noise Pollution Analyzer – Auditorium Designing – Anti Noise Device.

UNIT IV - ACOUSTICS OF NOISE

Designing out Noise – Industrial Noise Control – effects of noise on workers efficiency -Acoustic quieting - mechanical isolation technique, acoustical absorption, constrained layer damping – OSHA Noise standards – public education – other nonlegislative measures.

UNIT V - REGULATORY ASPECTS OF NOISE POLLUTION (9 hours)

Legislation Noise and the Administrative Function – Planning against Noise – Noise and the Law – The Rajasthan noise control Act 1963, Railway Act 1890 (Related to noise only), The Aircraft Act 1934 (Related to noise only), Factories Act 1948 (Related to noise only), The Environmental Protection Act 1986 – Noise pollution remedies.

REFERENCES

- 1. Peterson and Gross .E Jr., "Hand Book of Noise Measurement", 7th Edn, 2003.
- 2. Antony Milne, *"Noise Pollution: Impact and Counter Measures"*, David & Charles PLC, 2009.

EN12102		HAZARDOUS WASTE MANAGEMENT	L	Т	Р	С
EI	NZ 103	3	0	0	3	
PU	RPOSE					
To and	develop I apply t	 a basic knowledge about the concept of hazardous v he same in the field application. 	vaste	e mar	nagei	nent
INS	TRUCT	IONAL OBJECTIVES				
1.	To edu hazard	ucate the students on the principles involved in th ous wastes - from source identification up to disposal.	e m	anag	emer	nt of

UNIT I-SOURCES OF HAZARDOUS WASTE

(9 hours)

Types and Sources hazardous wastes - Need for hazardous waste management - Elements of integrated Hazardous waste management and roles of stakeholders and NGOS - Salient features of Indian legislations on management and handling of hazardous wastes, biomedical wastes, lead acid batteries, E-waste,

UNIT II-CHARACTERIZATION OF HAZARDOUS WASTE (9 hours) Hazardous waste generation rates and variation - Composition, physical, chemical and biological properties of Hazardous wastes - Hazardous Characteristics - TCLP tests - waste sampling and characterization plan - Source reduction of wastes -Recycling and reuse.

UNIT III-HANDLING OF HAZARDOUS WASTE

Handling and segregation of wastes at source - storage and collection Hazardous wastes -Need for transfer and transport - Transfer stations Optimizing waste allocation - compatibility, storage, labeling and handling of hazardous wastes.

UNIT IV-PROCESSING OF HAZARDOUS WASTE

Objectives of waste processing - material separation and processing technologies - biological and chemical conversion technologies - thermal conversion technologies and energy recovery - incineration - solidification and stabilization of hazardous wastes - treatment of biomedical wastes and E-waste.

UNIT V-DISPOSAL OF HAZARDOUS WASTE

Waste disposal options - Disposal in landfills - Landfill Classification- Construction and operation of secured landfills -bioreactors - Ocean dumping - Land disposal - Soil remediation.

REFERENCES

- 1. CPHEEO, "Manual on Municipal Solid waste management", Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
- Micheael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and *"Environmental Resources Management"*, Hazardous waste Management, McGraw-Hill International edition, New York, 2001.
- 3. Vesilind P.A., Worrell W and Reinhart, *"Solid waste Engineering"*, Thomson Learning Inc., Singapore, 2002.

EN2104	RS AND GIS FOR ENVIRONMENTAL ENGINEERING	L	Т	Ρ	С
	Total Contact Hours - 45	3	0	0	3
PURPOSE					
To develop a	basic knowledge about the Remote Sensing and GIS	S for	envir	onme	ental
engineering a	and apply the same in the field application.				

INSTRUCTIONAL OBJECTIVES

1. To study the RS And GIS application for Environmental Engineering.

UNIT I-ENVIRONMENT

Water - Air-Land-Marine Environment Global Climatologic, urban Environment:

UNIT II-INTRODUCTION TO REMOTE SENSING

Role of RS in different types of Environments - Air, Water, Land.GIS for-marine environment, urban environment.

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(9 hours)

(9 hours)

(9 hours)

(9 hours)

UNIT III-CONCEPT OF GEOLOGY

Introduction - spectral characteristics of water, soil, rock-water parameter, pollution studies.

UNIT IV-INTRODUCTION TO GIS

GIS-introduction-role of GIS - data analysis-thematic maps preparation, modeling.

UNIT V-APPLICATION OF GIS

GIS for - soil erosion-Land degradation-Ecology-degradation-Coastal marine studieswater Quality, monitoring and management.

REFERENCES

- 1. Lilliesand, T.M. and Kiefer, R, W., "Remote Sensing and Image Interpretation", John Wily and sons, 2004.
- 2. Burrough, P.A. and, McDonnell, R.A., "Principles of Geograj1JhicaJ Information Systems", Oxford University Press, 2009.
- 3. Lintz, J. and Simonet, "Remote Sensing of Environment", Addison Wesley Publishing Company, 2004.

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4	•	

4.												
E	N2105		ECOLOGICAL ENGINEERING							Т	Р	С
		Total (otal Contact Hours - 45						3	0	0	3
PURF	POSE											
To de in the	velop a basi field applica	c know tion.	ledge abo	ut the	e eco	logical engi	ineer	ing and	d ap	ply th	ie sar	ne
INST	RUCTIONAL	. OBJE	CTIVES									
1.	To educat environmer	e the tal eng	students ineering.	on	the	principles	of	ecolog	jy a	is a	pplied	to to

(9 hours)

(9 hours) (9 hours)

UNIT I-ECOLOGY & ENVIRONMENT

Aim, scope and applications of ecology - Development and evolution of ecosystems -Principles and concepts pertaining to communities in ecosystem - Energy flow and material cycling in ecosystems - productivity in ecosystems - Rationale of ecological engineering and ecotechnology - Classification of ecotechnology

UNIT II-PRINCIPLES OF ECOLOGICAL ENGINEERIN.

Principles, components and characteristics of Systems - Classification of systems -Structural and functional interactions of environmental systems - Environmental systems as energy systems - Mechanisms of steady-state maintenance in open and closed systems - Modelling and ecotechnology - Elements of modelling - Modelling procedure - Classification of ecological models - Applications of models in ecotechnology - Ecological economics.

UNIT III-CONCEPT OF ECOSYSTEM

Self-organizing design and processes - Multiple seeded microcosms - Interface coupling in ecological systems - Concept of energy - Determination of sustainable loading of ecosystems.

UNIT IV-APPLICATION OF FCOLOGICAL ENGINEERING (9 hours)

Ecosanitation - Principles and operation of soil infiltration systems - Wetlands and ponds - Source separation systems - Aquacultural systems - Detritus based treatment for solid wastes - Applications of ecological engineering for marine systems.

UNIT V-CASE STUDIES IN ECOLOGICAL ENGINEERING

Case studies of Integrated Ecological Engineering Systems and their commercial prospects.

REFERENCES

- Kangas, P.C. and Kangas, P., "Ecological Engineering: Principles and Practice", 1. Lewis Publishers, New York. 2003.
- Etnier, C. and Guterstam, B., "Ecological Engineering for Wastewater 2. Treatment", Lewis Publishers, New York, 2007.
- 3. White, I.D., Mottershed, D.N. and Harrison, S.J., "Environmental Systems - An Introductory Text", Chapman Hall, London. 2004.
- Mitsch, J.W. and Jorgensen, S.E., "Ecological Engineering An Introduction to 4. Ecotechnology", John Wiley & Sons, New York. 2009.

EN2104	EN2106 ENVIRONMENTAL IMPACT ASSESSMENT Total Contact Hours - 45	L	Т	Ρ	С
EINZ 100	Total Contact Hours - 45	3	0	0	3

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(9 hours)

(9 hours)

(9 hours)

To develop a basic knowledge about the environmental impact assessment and apply the same in the field application.

INSTRUCTIONAL OB JECTIVES

- To educate the students on the scope, steps involved and various methods 1.
 - related to assessment of environmental impact due to development projects.

UNIT I-INTRODUCTION TO FIA

Environmental Impact Assessment (EIA) - Environmental Impact Statement -Environmental Risk assessment -Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of reference in EIA - Issues in EIA - National - Cross sectoral - social and cultural.

UNIT II-ASSESSMENT TECHNIQUES IN EIA

Components - screening - setting - analysis - Prediction of impacts - mitigation. Matrices - Networks - Checklists - Importance assessment techniques - Cost benefit analysis - Analysis of alternatives - methods for prediction and assessment of impacts - air - water - soil - noise - biological - cultural - social - economic environments.

UNIT III-EVALUATION OF EIA

Standards and guidelines for evaluation Public participation in environmental decision making trends in EIA practice and evaluation criteria - capacity building for quality assurance.Expert system in EIA - use of regulations and AQM.

UNIT IV-EVALUATION OF EIA

Document planning - collection and organization of relevant information - use of visual display materials team writing - reminder checklist .Environmental monitoring guidelines - policies - planning of monitoring programmes. Environmental management plan. Post project audit.

UNIT V-CASE STUDIES OF FIA

Case studies of EIA of developmental projects.

REFERENCES

- Lawrence, D.P., "Environmental Impact Assessment Practical solutions to 1. recurrent problems", Wiley-Interscience, New Jersey 2003.
- Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II. 2. Conwell Science London, 2009.
- Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York. 3. 2006

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(9 hours)

(6 hours)

(9 hours)

(9 hours)

(12 hours)

- 4. Biswas, A.K. and Agarwala, S.B.C., "Environmental Impact Assessment for Developing Countries", Butterworth Heinemann, London. 2004
- The World Bank Group, "Environmental Assessment Source Book Vol. I", II and 5. III. The World Bank, Washington. 2001

	10107	BIOLOGICAL TREATMENT OF WASTEWATER	L	Т	Ρ	С	
EN	12107	Total Contact Hours - 45	3	0	0	3	
PUR	PURPOSE						
To d the s	To develop a basic knowledge about the biological treatment of wastewater and appl the same in the field application.						
INST	ructi	ONAL OBJECTIVES					
1.	To edu units us	cate the students on principles and design of various bi sed for wastewater treatment.	iologi	cal tr	eatm	ient	

UNIT I-INTRODUCTION TO BIOLOGICAL TREATMENT

Objectives of biological treatment - significance - aerobic and anaerobic treatment kinetics of biological growth - Factors affecting growth - attached and suspended growth - Determination of Kinetics coefficients for organics removal - Biodegradability assessment - selection of process.

UNIT II-DESIGN OF TREATMENT UNITS

(9 hours) Design of sewage treatment plant units - screen chamber, Grit chamber with proportional flow weir, sedimentation tank - Trickling filters, Rotating Biological contactor, activated sludge process & variations, aerated lagoons, waste stabilization ponds - nutrient removal systems - natural treatment systems - Disinfected disposal options - reclamation and reuse - Flow charts, layout, hydraulic profile - Recent advances.

UNIT III-CONCEPT OF ANAEROBIC DIGESTION

Attached and suspended growth, Design of units - UASB, up flow filters, Fluidised beds - septic tank and disposal - Nutrient removal systems - Layout and Hydraulic profile - Recent advances.

UNIT IV-SLUDGE MANAGEMENT

Design of Sludge management facilities, sludge thickening, sludge digestion, Biogas generation, sludge dewatering (mechanical and gravity) - upgrading existing plants - ultimate residue disposal - Recent Advances.

UNIT V-MISCELLANEOUS METHODS OF TREATMENT

Operational problems - Trouble shooting, Planning, Organising and Controlling of plant operations - capacity building, Case studies on sewage treatment plants - sludge management facilities.

REFERENCES

- 1. Arceivala, S.J., "Wastewater treatment for pollution control", TMH, New Delhi, 2008.
- 2. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Gol, New Delhi, 2009.
- 3. METCALF & EDDY, INC. *"Wastewater Engineering"*, Treatment and Reuse. Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
- 4. Qasim, S.R, *"Wastewater Treatment Plant",* Planning, Design & Operation Technomic Publications, New York, 2004.

EN2100	ENVIRONMENTAL BIOTECHNOLOGY	L	Т	Р	С		
EINZ 108	Total Contact Hours - 45	3	0	0	3		
PURPOSE							
To develop a basi same in the field a	To develop a basic knowledge about the environmental biotechnology and apply the same in the field application.						

INSTRUCTIONAL OBJECTIVES

1. To educate the students on the principles and application of biotechnology in environmental engineering with special reference to waste treatment.

UNIT I-CONCEPT OF ENVIRONMENTAL BIOTECHNOLOGY (9 hours)

Principles and concepts of environmental biotechnology - usefullness to mankind, current status.

UNIT II-TOXIC POLLUTANTS

(9 hours)

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(9 hours)

(9 hours)

Degradation of high concentrated toxic pollutants - halogenated, non-halogenated, petroleum hydrocarbons, metals. Mechanisms of detoxification-oxidation, dehalogenation, biotransformation of metals, biodegradation of solid wastes.

UNIT III-REMEDIAL MEASURES

Biotechnological remedies for environmental pollution - decontamination of groundwater systems, subsurface environment - reclamation conceptsbioremediation. Production of proteins - biofertilizers. Physical, chemical and microbiological factors of composting - health risk - pathogens - odour management - Microbial cell/ enzyme technology - adapted microorganisms - biological removal of nutrients - algal biotechnology and applications in agriculture - role of extracellular polymers. Biogas technology - case studies.

UNIT IV-CONCEPT OF DNA TECHNOLOGY

Concept of DNA technology - expression vectors - cloning of DNA - mutation - construction of microbial strains, radioactive probes, protoplast fusion technology - applications.

UNIT V-ASSESSMENT TECHNOLOGY

Environmental effects and ethics of microbial technology - safety of genetically engineered organisms - microbial containment - Risk assessment, IPR - patents.

REFERENCES

- 1. Chaudhury, G.R. *"Biological degradation and Bioremediation of toxic chemicals"*, Dioscorides Press, Oregon, 2004.
- 2. Martin .A.M, "Biological degradation of wastes", Elsevier Applied Science, London, 2001
- 3. Blaine Metting. F (Jr.,), "Soil Microbiology Ecology", Marcel Dekker Inc., 2003.
- 4. Wainwright, M, "An Introduction to Environmental Biotechnology", 2009.

	12100	ENVIRONMENTAL POLICIES AND LEGISLATION	L	Т	Ρ	С	
EI	11/2/109	Total Contact Hours - 45	3	0	0	3	
PUR	URPOSE						
To d	To develop a basic knowledge about the environmental policies and legislation.						
INST	RUCTIO	ONAL OBJECTIVES					
1	To educate the students on Indian Constitution, Administrative regime and Legal						
1.	regime p	oollution control laws.					

UNIT I-INTRODUCTION TO LAW

(9 hours)

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(9 hours)

(12 hours)

(6 hours)

Basics of jurisprudence - Criminal law - Common Law - Relevant sections of the Code of Civil Procedure - Indian Penal Code

UNIT II-FUNDAMENTAL RIGHTS

Introduction - Fundamental Rights - Directive Principles of State Policy - Article 48 (A) and 51-A(g) Judicial enforceability - Constitution and Resources management and pollution control - Indian Environmental Policy (1992).

UNIT III-REGULATORY BOARDS

Administrative regulations - constitution of Pollution Control Boards Powers. functions, Accounts, Audit - Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement.

UNIT IV-WATER ACT

Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention & control or Pollution) Cess Act. 1977 as amended by Amendment Act 1987 and relevant notifications.

UNIT V-HAZARDOUS WASTE REGULATION

Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Ecolabelling.

REFERENCES

- "Constitution of India", Eastern Book Company Lucknow, 12thEdn. 2007. 1.
- Pandey J.N., "Constitutional Law of India", (31st Edn.) Central Law Agency 2. Allahabad - 2007.
- Kesari U.P.D., "Administrative Law 12008", Universal Book Trade Delhi. 3.
- Tiwari H.N., "Environmental Law", Allahabad Law Agency 2007. 4.
- Divan A., and Noble M., "Environmental Law and Policy in India (cases, 5. *Materials and Statutes)*", Tripathi Bombay, 2001.
- "Environmental Policy, Forest Policy", Bare Acts Government Gazette 6. Notifiaciton

(9 hours)

(9 hours)

(9 hours)

EN2110	GROUND WATER CONTAMINATION AND TRANSPORT MODELING	L	Т	Ρ	С
	Total Contact Hours - 45	3	0	0	3
PURPOSE					
To develop a	a basic knowledge about the groundwater contaminatio	n an	d trai	nspor	t

modeling and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

To educate the students on the hydraulics related ground water contamination 1 and modeling ground water guality.

UNIT I-INTRODUCTION TO GROUND WATER

Ground water and the hydrologic cycles - Ground water as a resource - Ground water contamination - Water quality standards - Sources of contamination - Land disposal of solid wastes - Sewage disposal on Land. Ground water and geologic processes. Physical properties and principles - Darcy's Law - Hydraulic Head and Fluid Potential - Piezometers and Nests. Hydraulic conductivity and permeability -Homogeneity and Anisotropy - Porosity and voids Ratio - Unsaturated flow and the water table - Steady state flow and Transient flow - Compressibility and effective stress.

UNIT II-HYDRAULIC FLOW

Flow nets - Graphical construction - Flow nets by numerical simulation. Steady state Regional Ground Water flow - steady state hydrologic budgets - Fluctuations in ground water levels.

UNIT III-DEVELOPMENT OF GROUND WATER RESOURCES

Development of Ground Water resources - Exploration for Aquifers - the response of Ideal aguifers to pumping - Measurement of parameters - Laboratory tests -Piezometer test - Pumping tests - Estimation of saturated hydraulic conductivity -Numerical simulation for aquifer yield prediction - Artificial recharge and induced infiltration - Land subsidence - Sea water intrusion.

UNIT IV-CHEMICAL EQUILIBRIUM

Constituents - Chemical equilibrium - Association and Dissociation of dissolved species - effects of concentration gradients - Mineral dissolution and solubility -Oxidation and reduction Process - Ion exchange and Adsorption - Environmental isotopes - Field Measurement of Index parameters. Chemical Evolution: Hydro

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(6 hours)

(9 hours)

(9 hours)

(12 hours)

Chemical sequences and facies - graphical methods - Hydro chemical Facies - Ground water in carbonate terrain.

UNIT V-TRANSPORT MODELING

(9 hours)

Transport process - non-reactive constituents in homogeneous media and Heterogeneous media - Transport in Fracture media - Hydro chemical behavior of contaminants - Trace metals - Trace nonmetals - Nitrogen, organic substances - Measurement of parameters - Velocity - Dispersivity - chemical partitioning. Modelling Principles - MOC Modelling. Case studies

REFERENCES

- 1. Randall J. Charbeneau, "Ground water Hydraulics and Pollutant transport", Prentice Hall, Upper Saddle River, 2009.
- 2. Todd David Keith, "Ground water Hydrology", Second edition, John Wiley and Sons, New York, 2010.
- 3. Allen Freeze, R. and John A. Cherry, "Ground Water", Prentice Hall, Inc., 2009.

EN0111	INDOOR AIR QUALITY	L	Т	Ρ	С
ENZIII	Total Contact Hours - 45	3	0	0	3

PURPOSE

To develop a basic knowledge about the indoor air quality and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

1. To educate the students on air pollution and control in the indoor environment.

UNIT I-INDOOR ACTIVITIES

Indoor activities of inhabitants - residence time.Levels of many pollutants in indoor and outdoor air.Design and operation of buildings for improvements of public health. IAQ policy issues: sustainability; indoor air quality as a basic human right.

UNIT II-INDOOR AIR POLLUTANTS

Air pollutants in indoor environments, private residences, offices, schools, sand public buildings, factors that govern pollutant indoors concentrations, including ventilation. Characteristics, Consequences.

UNIT III-CONTROL MEASURES

Control of several pollutant classes, such as radon, toxic organic gases, combustion byproducts, and microorganisms such as molds and infectious bacteria. Case study by an exploration of public policy related to indoor air.

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(9 hours)

(9 hours)

UNIT IV-CONCEPTS OF MODELS

Concepts and tools: exposure, material-balance models, statistical models Ventilation.

UNIT V-INDOOR AIR POLLUTION FROM OUTDOOR SOURCES (9 hours)

Indoor air pollution from outdoor sources: particulate matter and ozone; Combustion byproducts; Radon and its decay products. Volatile organic compounds: odors and sick-building syndrome, Humidity Bio-aerosols: infectious disease transmission. Special indoor environments: A/C units in indoor; museums-labs; Measurement methods, Control technologies, Control strategies,

REFERENCES

- 1. ThaddesGodish, "Indoor air and Environmental Quality", CRC press, 2000.
- Nazaroff W.W and L Alvarez-Cohen, "Environmental Engineering Science", 2. Wiley sons, New York, 2001.
- 3. Moroni Marco, Seifet Bernd and Lindrall Thomas, "Indoor Air Quality: A Comprehensive Reference Book", Elsvier Science, Vol. 3, 2005.

		-					
EN2112	INSTRUMENTAL MONITORING OF ENVIRONMENT	L	Т	Ρ	С		
	Total Contact Hours - 45	3	0	0	3		
PURPOSE							
To develop a	a basic knowledge about the instrumental monitoring c	of env	vironn	nent	and		
apply the same in the field application.							
INSTRUCTIONAL OBJECTIVES							

To educate the students on the various instruments used for analysis of air 1. water and soil.

UNIT I-INTRODUCTION

(9 hours)

Instrumental Methods, Selection of method, Precision and Accuracy, Errors in measuring signals, Noise/ signal ratio, base line drift, Indicator tubes.

UNIT II-INSTRUMENTAL METHODS

(9 hours) Electromagnetic radiation, matter radiation interactions; Colorimetry and spectrophotometry, fluorimetry, nephelometry and turbidimetry, flame photometry Atomic Absorption Spectrometry (AAS), Atomic Emission Spectrometry (AES) -Inductively coupled plasma (ICP) and Direct Current Plasma (DCP) spectrometry. ICP - MS (Mass spectrometry).

UNIT III-CLASSICAL METHODS

Classical methods, Column, Paper and thin layer chromatography (TLC), Gas Chromatrography (GC), GC-MS, High performance liquid chromatography (HPLC) and Ion chromatrography (IC).

UNIT IV-METHODS BASED ON RAYS

Conductometry, potentiometry, coulometry, amperometry polarography, Neutron Activation Analysis (NAA), X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) methods.

UNIT V-MISCELLANEOUS METHODS

Non - dispersive infra-red (NDIR) analyzer for CO, chemiluminescent analyzer for NOx, Fluorescent analyzer for SO2, Auto analyzer for water quality using flow injection analysis; permeation devices.

REFERENCES

- 1. Willard. H., Merritt, L., Dean, D.A. and Settle. F.A. "Instrumental methods of analysis", 7th Edn. Words Worth, New York, 2004.
- 2. Ewing, "Instrumental Methods of Chemical Analysis", 5th Edn., McGraw-Hill, New York, 2005.

E	N0110	MARINE POLLUTION MONITORING	L	Т	Р	С		
	INZ 1 13	Total Contact Hours - 45	3	0	0	3		
PUR	PURPOSE							
To d sam	To develop a basic knowledge about the marine pollution monitoring and apply the same in the field application.							
INS	INSTRUCTIONAL OBJECTIVES							
1.	To educate the students on aspects of marine pollution and methods of water quality assessment and marine pollution control							

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(9 hours)

(9 hours)

UNIT I-INTRODUCTION

General features of ocean - Conservation laws - Wave characteristics and theories -Sediment transport - Tides - Ocean Currents - Thermocline circulation - General circulation of ocean waters, Tsunamis, Storm surge - Principles of Marine geology.

UNIT II-LIVING RESOURCES

Living resources - coral reefs, mangroves, sea grass, seaweeds, fishery potential nonliving resources - manganese nodules, heavy minerals - Beaches, Estuaries, Lagoons - Shoreline changes.

UNIT III-MARINE SURVEYING

Sea surveying planning and preparation - Oceanographic instrumentation -Hydrographic Surveying - Underwater surveying - Measurement of physical properties of ocean water - sea bed sampling.

UNIT IV-SOURCES & PROPERTIES OF MARINE POLI UTION (12 hours)

Physiochemical properties of sea water - Sources of marine pollution and impacts on coastal ecosystems, Oil pollution - oil spill detection, dispersion, impacts on adjacent area - Oil spill modeling, mitigation measures - Oil exploration and their effects -Marine outfalls - Impacts of Ports and Harbour on marine water guality - dredging -Human intervention in estuarine ecosystem - sea water classification - Physical modeling in Coastal Engineering - Ocean monitoring satellites - Applications of Remote sensing and GIS in marine studies.

UNIT V-REGULATIONS

National and International treaties, protocols in marine pollution - Exclusive Economic Zone - Sustainable development.

REFERENCES

- 1. Kennish, M.J., "Pollution impacts on Marine Biotic Communities", CRC press New York, 2008.
- 2. Newman, M.C., Roberts Jr. M.H., Male R.C. (Editors), "Coastal and Estuarine *Risk Assessment*", Lewis Publishers, Washington, D.C., 2002.
- U.S. Army Corps of Engineers, "Shore Protection Manual", Washington D.C., 3. 2002

(9 hours)

(9 hours)

(6 hours)

EN	2114	MASS TRANSFER IN AIR-WATER-SOIL	L	Т	Р	С
		INTERACTION				
		Total Contact Hours - 45	3	0	0	3
PUF	RPOSE					
To	develop	a basic knowledge about the mass transfer in air wa	ter s	oil in	terac	tion
and	apply t	he same in the field application.				
INS	TRUCT	IONAL OBJECTIVES				
1.	To eq	lucate the students on the mechanism of material	trans	sfer	betw	een
	enviro	nmental components - air, water and soil.				

UNIT I-INTRODUCTION

Ideal solutions - air - water equilibrium occurrences - pure gases in contact with water-pure liquid in contact with air - partition coefficient for the air - water system. Earthern solid - waste equilibrium occurrences - pure solid and liquid chemicals in contact with water and earthern solids. Earthern solid - air equilibrium occurrences water - liquid chemical equilibrium occurrences - thermal equilibrium at environmental interfaces

UNIT II-HEAT & MASS TRANSFER

Diffusion and mass transfer - molecular diffusion - eddy diffusion - mass transfer theories - mass transfer coefficients - binary mass transfer coefficients in two phases and two resistance theory of interphase mass transfer turbulence in the environment fundamentals of heat transfer - analogy theories of momentum, heat and mass transfer

UNIT III-CONCEPT OF LIQUID & GASES

Desertion of gases and liquids from aerated basins and rivers - completely mixed basin - plug flow basin - gas exchange rates between the atmosphere and the surface of rivers - exchange of chemical across the air - water interface of lakes and oceans.

UNIT IV-DISSOLUTION OF CHEMICALS

Dissolution of chemicals on the bottom of flowing streams - geometric forms - stream bottom mass transfer coefficients - natural convection dissolution - the upsurge of chemicals from the sediment - water interface of lakes - a Fikian analysis - annual upsurge rate at sediment - water interface - mass transfer coefficients at the sediment - water interface. Flux of chemicals between sediment and the overlying seawater movement of chemicals through the benthic boundary layer.

UNIT V-AIR & SOIL INTERFACE

(9 hours)

(9 hours)

(9 hours)

(9 hours)

Turbulence above the air - soil interface - the Richardson number - chemical flux rates through the lower layer of the atmosphere - Thronthwaite - Holzman equation - evaporation of liquid chemicals spilled on land - chemical flux rates through the upper layer of earthern material.

REFERENCES

- 1. Thibodeaux, L.J, "Environmental Chemo dynamics: Movement Of Chemicals In Air, Water and Soil", edition 2., Wiley – Interscience, New York, 2006.
- 2. Cusssler, E.L, "*Diffusion: Mass Transfer In Fluid Systems*", Cambridge University press, 2004.

EN2115	N2115 PHYSICAL AND CHEMICAL TREATMENT OF WATER AND WASTEWATER Total Contact Hours - 45	L	Т	Ρ	С
	Total Contact Hours - 45	3	0	0	3

PURPOSE

To develop a basic knowledge about the physics and chemical treatment of water and wastewater and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

1. To educate the students on the working principles and design of various physical and chemical treatment systems for water and wastewater.

UNIT I-INTRODUCTION

Pollutants in water and wastewater - characteristics, Standards for performance - Significance and need for physico-chemical treatment.

UNIT II-PHYSICAL TREATMENT

Principles of Screening - Mixing, Equalisation - Sedimendation - Filtration - modelling - back washing - Evaporation - Incineration - gas transfer - mass transfer coefficients. Adsorption - Isotherms - Principles, equilibria and kinetics, reactors, regeneration, membrane separation, Reverse Osmosis, nano filtration ultra filtration and hyper filtration - electrodialysis, distillation - stripping and crystallization - Recent Advances.

UNIT III-CHEMICAL TREATMENT

Principles of Chemical treatment - Coagulation flocculation - Precipitation - flotation, solidification and stabilization - Disinfection.lon exchange, Electrolytic methods, Solvent extraction - advance oxidation / reduction - Recent Advances.

UNIT IV-CONVENTIONAL TREATMENT UNITS

Selection of unit operations and processes - Design of conventional water treatment plant units - Aerators - chemical feeding - Flocculation - clarifier - filters - Rapid sand filter, slow sand filter, pressure filter - chlorinators. Displacement and gaseous 33 SRM-M.Tech.-Env. Engg.- 2015-16

(9 hours)

(9 hours)

(9 hours)

type.Layouts - flow charts - Hydraulic Profile - O & M aspects - case studies, Residue management - Upgradation of existing plants - Recent Advances.

UNIT V-MISCELLANEOUS METHODS

(9 hours)

Selection of process - Design of softeners - Demineralisers - Wastewater reclamation - Reverse osmosis plants - Residue management - O and M aspects - Recent Advances - case studies.

REFERENCES

- 1. Metcalf and Eddy, *"Wastewater engineering, Treatment and Reuse",* Tata McGraw-Hill, New Delhi, 2003.
- 2. "Manual on water supply and Treatment CPHEEO", Ministry of Urban Development, GOI, New Delhi, 2009.
- 3. Lee, CC and Shun dar Lin, *"Handbook of Environmental Engineering Calculations"*, McGraw-Hill, New York, 2009.
- 4. Qasim, S.R., Motley, E.M., Zhu, G. "Water works Engineering Planning, Design and operation", Prentice Hall, New Delhi 2002.

EN0114	ENVIRONMENTAL ENGINEERING STRUCTURES	L	Т	Ρ	С
ENZIIO	Total Contact Hours - 45	3	0	0	3

PURPOSE

To develop a basic knowledge about the environmental engineering structures and apply the same in the field application.

INSTRUCTIONAL OBJECTIVES

At the end of the subject the students will able to design environmental engineering structures such as pipes, water tanks, special structures, repair and rehabilitation of structures and maintenance.

UNIT I-PIPE MATERIALS

(9 hours)

(9 hours)

Material used for piping machines-Prestressed concrete, mild steel, cast iron ductile iron, material characteristics and comparison. Anchorage for pipes-necessity-principle-design force to be considered including hydro dynamic forces.Pipe laying technology.

UNIT II-DESIGN OF ELEVATED TANKS

Capacity calculation of overhead water tanks and sumps-use of mass curve.Types of water tanks-RCC and prestressed concrete-Cylindrical-conincal spherical - Intzc type.Componenets of various types of water tanks design forces acting on

UNIT III-DESIGN OF TREATMENT UNITS

Function of underground reservoirs-intake towers, settling tanks - Clarifloculators-Aeration tanks. Functional design of intake tower, settling tanks and clarifloculators.Nature of design forces-Hydraulic pressure-Earth pressure-Uplift forces.

UNIT IV-MECHANISM OF CORROSION

(9 hours) Mechanism of corrosion-Proneness of environmental structures to corrosion-Precautions to be taken to prevent corrosion in planning, design, execution and maintenance stages including material selection. Rehabilitation measures for distress due to corrosion

UNIT V-MAINTENANCE OF STRUCTURES

Importance of maintenance-Schedule of maintenance-Checklist for maintenance-Manpower for maintenance-Proactive maintenance-Consequence of non-maintenace.

REFERENCES

- Hulse R., and Mosley, W.H., "Reinforced Concrete Design by Computer", 1. Macmillan Education Ltd., 2006.
- Ramaswamy, G.S., "Design and Construction of Concrete shell roofs", CBS 2. Publishers, India, 2006.
- "Manual on Sewerage and Sewage Development", CPHEEO, Ministry of Urban 3. Development, GOI, New Delhi, 2003.
- "Sewage Disposal and Air pollution Engineering", S.K. GargKhanna Publishers 4. Volume-1, 2006.
- 5. "Water Supply Engineering", S.K.Garg, Khanna Publishers, New Delhi2005.
- Prestressed Concrete by Krishna Raju, Tata McGraw Hill Publishing Co, 2nd 6. Edition2008

EV	10117	CLEANER PRODUCTION	L	Т	Р	С
EN	12117	Total Contact Hours - 45	3	0	0	3
PURF	POSE					
To de the fie	velop a b eld applica	asic knowledge about the cleaner production and ap ation.	ply th	ne sa	me ii	l
INST	RUCTION	AL OBJECTIVES				
1.	To educa Cleaner	ate the students on complete management principles Production and Control of Industrial Pollution.	s rela	ted t	C	
UNIT	I-SUSTA	INABLE DEVELOPMENT		(9 ho	urs)

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(9 hours)

Sustainable Development-Indicators of Sustainability-Sustainability Strategies-Barriers to Sustainability-Industrial activity and Environment-Industrialisation and sustainable development-Industrial Ecology-Cleaner Production (CP) in Achieving Sustainability-Prevention versus Control of Industrial Pollution-Environmental Policies and Legislations-Regulations to Encourage Pollution Prevention and Cleaner Production-Rgulatory versus Market Based Approaches.

UNIT II-POLI UTION PREVENTION

Definition-Importance-Historical evolution-Benefits-Promotion-Barriers-Role of Industry, Government and Institutions - Environmental Management Hierarchy-Source Reduction Techniques-Process and equipment optimisation, reuse, recovery, recycle, raw material substitution-Internet Information and Other CP Resources.

UNIT III-CONCEPT OF CLEANER PRODUCTION

Overview of CP Assessment Steps and skills, Preparing for the site visit, Information Gathering, and process flow diagram, material balance, CP Option Generation Technical and Environmental feasibility analysis-Economic valuation of alternativestotal cost analysis-CP Financing-Establishing a program-Organizing a programpreparing a program plan-Measuring progress-pollution prevention and cleaner production Awareness plan -Waste audit-Environmental Statement.

UNIT IV-LIFE CYCLE ASSESSMENT

Elements of LCA-Life Cycle Costing -Eco Labelling-Design for the Environment-International Environmental Standards-ISO 14001-Enironmental audit.

UNIT V-CASE STUDIES

Industrial application of CP,LCA,EMS and Environmental Audits.

REFERENCES

- 1. Paul L Bishop, "Pollution Prevention Fundamental and Practice", McGraw-Hill International, 2000.
- 2. World Bank Group, "Pollution Prevention and Abatement Handbook-Towards Cleaner Production", World Bank and UNEP, Washington D.C, 2005.
- Prasad modak, C.Visvanathan and Mandarparasnis "Cleaner Production Audit", 3. Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok, 2005.

EN0110	AIR POLLUTION CONTROL	L	Т	Р	С
ENZIIO	Total Contact Hours - 45	3	0	0	3
PURPOSE					

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(9 hours)

(12 hours)

(9 hours)

(6 hours)

To develop a basic knowledge about the Air Pollution and its control and applying the same in the field application.

INSTRUCTIONAL OBJECTIVES

To educate the students on various methods of control of particulate and 1 gaseous air pollutants.

UNIT I-SOURCES AND CLASSIFICATION OF AIR POLLUTANTS (9 hours)

Sources and classification of Air Pollutants: Natural contaminants-aerosol-gases and vapour. Air gualitystandards - Meteorology and Air pollution: Atmospheric stability and inversions-mixing height-plume behaviour-plume rise estimation-effluent dispersion theories-Isokinetic sampling-Modeling.

UNIT II-AIR QUALITY MEASURES

Objectives-Filters, gravitational, centrifugal-multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theoryparticle charging collection-ESP design procedure.

UNIT III-THEORY OF ADSORPTION

Absorption: principles, description of equipment-packed and plate columns, design and performance equations. Adsorption: principles adsorbents, equipment descriptions-PSA-adsorption cycle-solvent recovery system continuous rotary bedfluidized bed, Design and performance equations. Condensation: contact condensers-shell and tube condensers, design and performance equation. Incineration: hydrocarbon incineration kinetics, equipment description, design and performance equations.

UNIT IV-CONTROL METHODS

Control methods-Processes based control mechanisms-mineral products-asphaltic concrete, cement plants and glass manufacturing plants; Thermal power plants, Petroleum refining and storage plants, Fertilizers, Pharmaceuticals and wood processing industry. Field study.

UNIT V-NOISE STANDARDS

Noise Standards; measurement, control and preventive measures.

REFERENCES

- Richard W.Boubel et al, "Fundamentals of Air Pollution", Academic Press, 1. New York, 2004.
- 2. Noel de Nevers, "Air Pollution control Engg." McGraw-Hill, New York, 2005.
- 3. M.N. Rao et al, "Air Pollution", Tata McGraw Hill, 2009.

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(9 hours)

(6 hours)

(9 hours)

(12 hours)

EN2119	UNIT OPERATIONS AND UNIT PROCESSES LABORATORY	L	Т	Ρ	С
	Total Contact Hours - 75	0	1	4	3
PURPOSE					

To develop a basic knowledge about the concept of unit operation and unit process and impart knowledge in application in the different fields of environmental related problems.

INSTRUCTIONAL OBJECTIVES

1. To conduct laboratory studies on water and wastewater treatment units.

LIST OF EXPERIMENTS

- Coagulation and Flocculation •
- Batch studies for sedimentation •
- Characteristics of Filter media
- Studies on Filtration •
- Water softening •
- Adsorption studies / Kinetics
- Silt Density Index •
- **Reverse Osmosis**
- Kinetics of suspended growth process (activated sludge process) •
- Kinetics of attached growth process (Rotating Biological Contactors) •
- Sludge volume Index
- Anaerobic Reactor systems / Kinetics •
- Advanced Oxidation Processes •
- Chlorine Demand Estimation •

REFERENCES

- 1. Metcalf & Eddy, Inc. "Wastewater Engineering, Treatment, Disposal and Reuse", Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2003.
- Lee, CC & Shun dar Lin, "Hand book of Environmental Engineering 2. Calculations", McGraw Hill, New York, 2009.
- 3. Casey T.J. "Unit treatment processes in water and wastewater engineering", John Wileys Sons, London, 2003.

EN0100	ENVIRONMENTAL CHEMISTRY	L	Т	Р	С
EN2120	Total Contact Hours - 45	3	0	0	3
PURPOSE					
To develop a basic knowledge about the concept of environmental chemistry and					
apply the same in the field application.					
INSTRUCTIONAL OBJECTIVES					
1. To educate the students in the area of water, air and soil chemistry and train					
					5-16

them in the laboratory in the determination of pollutants present in air, water, wastewater and soil.

UNIT I-INTRODUCTION

Laws of mass action-Chemical equilibrium - Chemical kinetics - zero, first, second orders-Chemistry of colloids instrumentation - Isotopes and radiation - properties -GM counter - radiation sources.

UNIT II-ORGANIC REACTIONS

Common organic reactions - enzymes and factors influencing enzyme reactions -Biodegradability - DO, BOD and COD.

UNIT III-FCOSYSTEMS

Abiotic and biotic interactions in aqueous system-Exchange process-Speciation-Transformation and degradation - Chemistry of sea and salt water their biotic interaction

UNIT IV-ATMOSPHERE

Lavers of atmosphere-ozone laver - depletion-Acid rain - Green house gases and global warming and aerosols.

UNIT V-SOIL-PROPERTIES

Soil properties, clay minerals-acid - base and ion exchange reaction in soil-salt affected soil and its remediation.

REFERENCES

- 1. Sawyer, C.N. and McCarty, P.L., and Parkin, G.F. "Chemistry for Environmental Engineers", 4th edition, McGraw Hill New Delhi, 2010.
- De.A.K. "Environmental Chemistry", New age International Ltd., New Delhi, 2. 2001
- 3. "Standard Methods for the Examination of water and wastewater", 21st edition. American Public Health Association, Washington. D.C. 2001.
- Manahan S.E., "Environmental Chemistry", Sixth Edition, Lewis Publisher, New 4. York, 2004.

(9 hours)

(9 hours)

(9 hours)

(9 hours)

SEMESTER I

	Career Advancement Course	L	Т	Р	С	
CAC2001	For Engineers - I					
	Total Contact Hours - 30	1	0	1	1	
	Prerequisite					
	Nil					
PURPOSE						
To enhance holistic development of students and improve their						
employability skills						

INSTRUCTIONAL OBJECTIVES

1. To improve aptitude, problem solving skills and reasoning ability of the student.

2. To collectively solve problems in teams & group.

3. Understand the importance of verbal and written communication in the workplace

4. Understand the significance of oral presentations, and when they may be used.

5. Practice verbal communication by making a technical presentation to the class

6. Develop time management Skills

UNIT I-BASIC NUMERACY

> Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II-ARITHMETIC – I

Percentages, Profit & Loss, Equations

UNIT III-REASONING - I

Logical Reasoning

UNIT IV-SOFT SKILLS - I

Presentation skills, E-mail Etiquette

UNIT V-SOFT SKILLS - II

Goal Setting and Prioritizing

ASSESSMENT

Soft Skills (Internal)

Assessment of presentation and writing skills.

Quantitative Aptitude (External)

Objective Questions- 60 marks Descriptive case lets- 40 marks* Duration: 3 hours *Engineering problems will be given as descriptive case lets.

REFERENCE:

1. Quantitative Aptitude by Dinesh Khattar – Pearsons Publicaitons

2. Quantitative Aptitude and Reasoning by RV Praveen - EEE Publications

3. Quantitative Aptitude by Abijith Guha – TATA Mc GRAW Hill Publications

4. Soft Skills for Everyone by Jeff Butterfield – Cengage Learning India Private Limited

5. Six Thinking Hats is a book by <u>Edward de Bono</u> - Little Brown and Company

6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd - Meerut

SEMESTER II

	Career Advancement Course For	L	Т	Р	С	
CA C2002	Total Contact Hours - 30	1	0	1	1	
CAC2002	Prerequisite					
	Nil					
PURPOSE						
To enhance holistic development of students and improve their employability skills						

INSTRUCTIONAL OBJECTIVES

1. To improve aptitude, problem solving skills and reasoning ability of the student.

2. To collectively solve problems in teams & group.

3. Understand the importance of verbal communication in the workplace

4. Understand the significance of oral presentations, and when they may be used.

5. Understand the fundamentals of listening and how one can present in a group discussion

6. Prepare or update resume according to the tips presented in class.

UNIT I-ARITHMETIC – II

Ratios & Proportions, Mixtures & Solutions

UNIT II - MODERN MATHEMATICS

Sets & Functions, Data Interpretation, Data Sufficiency

UNIT III – REASONING - II

Analytical Reasoning

UNIT IV - COMMUNICATION - I

Group discussion, Personal interview

UNIT V - COMMUNICATION - II

Verbal Reasoning test papers

ASSESSMENT Communication (Internal)

- Individuals are put through formal GD and personal interviews.
- Comprehensive assessment of individuals' performance in GD & PI will be carried out.

Quantitative Aptitude (External)

Objective Questions- 60 marks (30 Verbal +30 Quants) Descriptive case lets- 40 marks* Duration: 3 hours *Engineering problems will be given as descriptive case lets. 42 SRM-M.Tech.-Env. Enga.- 2015-16

REFERENCES

1. Quantitative Aptitude by Dinesh Khattar - Pearsons Publicaitons

2. Quantitative Aptitude and Reasoning by RV Praveen - EEE Publications

3. Quantitative Aptitude by Abijith Guha – TATA Mc GRAW Hill

Publications

4. General English for Competitive Examination by A.P. Bharadwaj – Pearson Educaiton

5. English for Competitive Examination by Showick Thorpe - Pearson Education

6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd - Meerut

7. Verbal Ability for CAT by Sujith Kumar - Pearson India

8. Verbal Ability & Reading Comprehension by Arun Sharma - Tata McGraw - Hill Education

SEMESTER III

CAC2003		Career Advancement Course For Engineers - III	L	Т	Р	С
		Total Contact Hours - 30	1	0	1	1
		Prerequisite				
		Nil				
PUR	POSE					
To de	evelop pr	ofessional skills abreast with contemporary	teach	ning		
learn	ing meth	odologies				
INSTRUCTIONAL OBJECTIVES						
At the end of the course the student will be able to						
1	acquire knowledge on planning, preparing and designing a learning					
	program					
2	prepare effective learning resources for active practice sessions					
3	facilitate active learning with new methodologies and approaches					
4	create balanced assessment tools					
5	hone teaching skills for further enrichment					

UNIT I- DESIGN

(2 hrs)

 \triangleright

Planning & Preparing a learning program.

\triangleright	Planning & Preparing a learning session	
UNI	Г II – PRACTICE	(2 hrs)
\triangleright	Facilitating active learning	
\triangleright	Engaging learners	
UNI	Г III – ASSESSMENT	(2 hrs)
\triangleright	Assessing learner's progress	
۶	Assessing learner's achievement	
UNI	Γ IV – HANDS ON TRAINING	(10 hrs)
\succ	Group activities – designing learning session	
\triangleright	Designing teaching learning resources	
\triangleright	Designing assessment tools	
۶	Mock teaching session	
UNI	ΓV – TEACHING IN ACTION	(14 hrs)
\triangleright	Live teaching sessions	
≻	Assessments	

ASSESSMENT (Internal)

Weightage:

Design - 40% Practice - 40% Quiz - 10% Assessment - 10%

REFERENCES

Cambridge International Diploma for Teachers and Trainers Text book by Ian Barker - Foundation books Whitehead, Creating a Living Educational Theory from Questions of the kind: How do I improve my Practice? Cambridge J. of Education

AMENDMENTS

S.No.	Details of Amendment	Effective from	Approval with date