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ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. ENVIRONMENTAL ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. To prepare students for successful careers in Environmental Engineering field that meets the needs of National and International organisations.

II. To develop the confidence and ability among students to synthesize data and technical concepts and thereby apply it in real world problems.

III. To develop students to use modern techniques, skill and mathematical engineering tools for solving problems in Environmental Engineering.

IV. To provide students with a sound foundation in mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyse environmental problems and to prepare them for graduate studies.

V. To promote students to work collaboratively on multi-disciplinary projects and make them engage in life-long learning process throughout their professional life.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering related to environmental issues.
2. Graduates will demonstrate an ability to identify, formulate and solve environmental engineering problems.
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.

PEOs & POs

The B.E. Environmental Engineering Program outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme Educational Objectives	Programme Outcomes									
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**
I	X	X		X		X	X	X		X
II	X	X	X	X	X	X				
III	X	X	X			X				
IV	X	X	X	X		X				X
V					X			X	X	X

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
YEAR 1	SEM 1	Communicative English				✓				✓		
		Engineering Mathematics – I	✓									
		Engineering Physics	✓	✓	✓	✓	✓	✓				
		Engineering Chemistry	✓	✓	✓		✓	✓	✓			
		Problem Solving and Python Programming	✓	✓	✓		✓	✓	✓		✓	✓
		Engineering Graphics	✓	✓			✓	✓	✓			
		Problem Solving and Python Programming Laboratory	✓	✓			✓	✓	✓			
		Physics and Chemistry Laboratory	✓	✓			✓	✓	✓			
	SEM 2	Technical English				✓				✓		
		Engineering Mathematics – II	✓									
		Environmental Science and Engineering	✓									
		Basic Civil and Mechanical Engineering	✓				✓					
		Basic Electrical and Electronics Engineering					✓					
		Engineering Mechanics	✓	✓	✓							
		Engineering Practices Laboratory	✓	✓	✓		✓					
YEAR 2	SEM 3	Environmental Chemistry	✓									
		Basics of Chemical Engineering	✓				✓					
		Strength of Materials			✓		✓					
		Mechanics of Fluids			✓		✓					
		Surveying			✓		✓					
		Probability and Statistics	✓		✓							
		Strength of Materials Laboratory										
		Surveying Laboratory			✓		✓	✓				
		Interpersonal Skills / Listening and Speaking							✓	✓		✓
	SEM 4	Environmental Policy and Legislations		✓					✓		✓	✓
		Environmental Microbiology	✓									
		Water Supply Engineering		✓		✓		✓				

		Construction Materials				✓						
		Basic Structural Analysis		✓		✓	✓	✓				
		Hydraulics and Hydraulic Machinery			✓	✓	✓	✓				
		Environmental Chemistry and Microbiology Laboratory			✓		✓					
		Hydraulic Engineering Laboratory			✓		✓					
		Advanced Reading and Writing							✓	✓	✓	✓
YEAR 3	SEM 5	Municipal Solid Waste Management	✓	✓		✓		✓	✓		✓	
		Wastewater Engineering	✓	✓		✓		✓	✓			
		Soil Mechanics		✓	✓		✓					
		Basic Structural Design		✓	✓		✓					
		Professional Elective I										
		Open Elective I										
		Environmental Engineering Laboratory			✓		✓					
		Environmental Engineering Drawing										
	SEM 6	Environmental Equipment and Instruments						✓				
		Hydrology and Water Resources Engineering			✓		✓	✓				
		Design of Environmental Engineering Structures			✓	✓		✓				
		Industrial Wastewater Management	✓	✓							✓	
		Foundation Engineering		✓			✓					
		Air and Noise Pollution Control	✓	✓		✓		✓	✓		✓	
		Professional Elective II										
		Environmental Instrumentation Laboratory			✓		✓					

YEAR 4	**SEM 7**	Hazardous Waste Management				✓			✓		✓	
		Environmental Health and Safety		✓		✓	✓				✓	
		Environmental Impact Assessment		✓		✓			✓		✓	
		Open Elective II										
		Professional Elective III										
		Professional Elective IV										
		Environmental Structural Design and Drawing using CAD						✓				
		Industrial Safety Laboratory			✓		✓					
		Industrial Training (4 weeks During VI Semester – Summer)						✓			✓	
	SEM 8	Estimation and Costing				✓		✓				
		Professional Elective V										
		Project Work		✓	✓	✓	✓	✓	✓	✓	✓	

ANNA UNIVERSITY, CHENNAI
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B.E. ENVIRONMENTAL ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA & SYLLABI
SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics – I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
			TOTAL	**31**	**19**	**0**	**12**	**25**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics – II	BS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4.	BE8252	Basic Civil and Mechanical Engineering	ES	4	4	0	0	4
5.	BE8251	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
PRACTICALS								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
			TOTAL	**27**	**21**	**2**	**4**	**24**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA8391	Probability and Statistics	BS	4	4	0	0	4
2.	EN8301	Environmental Chemistry	PC	3	3	0	0	3
3.	EN8302	Basics of Chemical Engineering	PC	3	3	0	0	3
4.	CE8303	Mechanics of Fluids	PC	3	3	0	0	3
5.	CE8393	Strength of Materials	PC	4	4	0	0	4
6.	CE8351	Surveying	PC	3	3	0	0	3
PRACTICALS								
7.	CE8481	Strength of Materials Laboratory	PC	4	0	0	4	2
8.	CE8361	Surveying Laboratory	PC	4	0	0	4	2
9.	HS8381	Interpersonal Skills / Listening and Speaking	EEC	2	0	0	2	1
			TOTAL	**30**	**20**	**0**	**10**	**25**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EN8401	Environmental Policy and Legislations	PC	3	3	0	0	3
2.	EN8402	Environmental Microbiology	PC	3	3	0	0	3
3.	EN8403	Basic Structural Analysis	PC	3	3	0	0	3
4.	EN8491	Water Supply Engineering	PC	3	3	0	0	3
5.	CE8391	Construction Materials	PC	3	3	0	0	3
6.	CE8405	Hydraulics and Hydraulic Machinery	PC	3	3	0	0	3
PRACTICALS								
7.	EN8411	Environmental Chemistry and Microbiology Laboratory	PC	4	0	0	4	2
8.	CE8461	Hydraulic Engineering Laboratory	PC	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
			TOTAL	**28**	**18**	**0**	**10**	**23**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EN8501	Basic Structural Design	PC	4	2	2	0	3
2.	EN8591	Municipal Solid Waste Management	PC	3	3	0	0	3
3.	EN8592	Wastewater Engineering	PC	3	3	0	0	3
4.	CE8491	Soil Mechanics	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Open Elective I*	OE	3	3	0	0	3
PRACTICALS								
7.	EN8511	Environmental Engineering Laboratory	PC	4	0	0	4	2
8.	EN8512	Environmental Engineering Drawing	PC	4	0	0	4	2
			TOTAL	**27**	**17**	**2**	**8**	**22**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EN8601	Environmental Equipment and Instruments	PC	3	3	0	0	3
2.	EN8602	Design of Environmental Engineering Structures	PC	3	3	0	0	3
3.	EN8603	Industrial Wastewater Management	PC	3	3	0	0	3
4.	EN8604	Air and Noise Pollution Control	PC	3	3	0	0	3
5.	CE8591	Foundation Engineering	PC	3	3	0	0	3
6.	CE8091	Hydrology and Water Resources Engineering	PC	3	3	0	0	3
7.		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
8.	EN8611	Environmental Instrumentation Laboratory	PC	4	0	0	4	2
			TOTAL	**25**	**21**	**0**	**4**	**23**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EN8701	Hazardous Waste Management	PC	3	3	0	0	3
2.	EN8702	Environmental Health and Safety	PC	3	3	0	0	3
3.	EN8703	Environmental Impact Assessment	PC	3	3	0	0	3
4.		Open Elective II*	OE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
7.	EN8711	Environmental Structural Design and Drawing using CAD	PC	4	0	0	4	2
8.	EN8712	Industrial Safety Laboratory	PC	4	0	0	4	2
9.	EN8713	Industrial Training (4 weeks During VI Semester –Summer)	EEC	0	0	0	0	2
			TOTAL	**26**	**18**	**0**	**8**	**24**

SEMESTER VIII

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EN8801	Estimation and Costing	PC	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
PRACTICALS								
3.	EN8811	Project Work	EEC	20	0	0	20	10
			TOTAL	**26**	**6**	**0**	**20**	**16**

TOTAL NO. OF CREDITS: 182

*Course from the curriculum of other UG Programmes.

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3

BASIC SCIENCES (BS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics – I	BS	4	4	0	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics – II	BS	4	4	0	0	4
6.	MA8391	Probability and Statistics	BS	4	4	0	0	4

ENGINEERING SCIENCES (ES)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8251	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
5.	BE8252	Basic Civil and Mechanical Engineering	ES	4	4	0	0	4
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EN8301	Environmental Chemistry	PC	3	3	0	0	3
2.	EN8302	Basics of Chemical Engineering	PC	3	3	0	0	3
3.	CE8393	Strength of Materials	PC	4	4	0	0	4
4.	CE8303	Mechanics of Fluids	PC	3	3	0	0	3
5.	CE8351	Surveying	PC	3	3	0	0	3
6.	CE8481	Strength of Materials Laboratory	PC	4	0	0	4	2
7.	CE8361	Surveying Laboratory	PC	4	0	0	4	2

8.	EN8401	Environmental Policy and Legislations	PC	3	3	0	0	3
9.	EN8402	Environmental Microbiology	PC	3	3	0	0	3
10.	EN8403	Basic Structural Analysis	PC	3	3	0	0	3
11.	EN8491	Water Supply Engineering	PC	3	3	0	0	3
12.	CE8391	Construction Materials	PC	3	3	0	0	3
13.	CE8405	Hydraulics and Hydraulic Machinery	PC	3	3	0	0	3
14.	EN8411	Environmental Chemistry and Microbiology Laboratory	PC	4	0	0	4	2
15.	CE8461	Hydraulic Engineering Laboratory	PC	4	0	0	4	2
16.	EN8591	Municipal Solid Waste Management	PC	3	3	0	0	3
17.	EN8592	Wastewater Engineering	PC	3	3	0	0	3
18.	CE8491	Soil Mechanics	PC	3	3	0	0	3
19.	EN8501	Basic Structural Design	PC	4	2	0	2	3
20.	EN8511	Environmental Engineering Laboratory	PC	4	0	0	4	2
21.	EN8512	Environmental Engineering Drawing	PC	4	0	0	4	2
22.	EN8601	Environmental Equipment and Instruments	PC	3	3	0	0	3
23.	EN8602	Design of Environmental Engineering Structures	PC	3	3	0	0	3
24.	EN8603	Industrial Wastewater Management	PC	3	3	0	0	3
25.	EN8604	Air and Noise Pollution Control	PC	3	3	0	0	3
26.	EN8611	Environmental Instrumentation Laboratory	PC	4	0	0	4	2
27.	CE8091	Hydrology and Water Resources Engineering	PC	3	3	0	0	3
28.	CE8591	Foundation Engineering	PC	3	3	0	0	3
29.	EN8701	Hazardous Waste Management	PC	3	3	0	0	3
30.	EN8702	Environmental Health and Safety	PC	3	3	0	0	3
31.	EN8703	Environmental Impact Assessment	PC	3	3	0	0	3
32.	EN8711	Environmental Structural Design and Drawing using CAD	PC	4	0	0	4	2
33.	EN8712	Industrial Safety Laboratory	PC	4	0	0	4	2
34.	EN8801	Estimation and Costing	PC	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8381	Interpersonal Skills / Listening and Speaking	EEC	2	0	0	2	1
2.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
3.	EN8713	Industrial Training (4 weeks During VI Semester –Summer)	EEC	0	0	0	0	2
4.	EN8811	Project Work	EEC	20	0	0	20	10

PROFESSIONAL ELECTIVE

SEMESTER V
ELECTIVE - I

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EN8001	GIS for Environmental Engineering	PE	3	3	0	0	3
2.	EN8002	Urban and Rural Sanitation	PE	3	3	0	0	3
3.	EN8003	Sustainable Development	PE	3	3	0	0	3
4.	CE8392	Engineering Geology	PE	3	3	0	0	3
5.	GE8071	Disaster Management	PE	3	3	0	0	3
6.	GE8074	Human Rights	PE	3	3	0	0	3

SEMESTER VI
ELECTIVE - II

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EN8004	Air and Water Quality Modeling	PE	3	3	0	0	3
2.	EN8005	Renewable Energy Engineering	PE	3	3	0	0	3
3.	EN8006	Operation and Maintenance of Water and Wastewater Treatment Plants	PE	3	3	0	0	3
4.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3

SEMESTER VII
ELECTIVE - III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EN8007	Environmental Risk Management	PE	3	3	0	0	3
2.	EN8008	Environmental Toxicology	PE	3	3	0	0	3
3.	EN8009	Soil and Groundwater Remediation	PE	3	3	0	0	3

SEMESTER VII
ELECTIVE - IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EN8010	Environmental Management System	PE	3	3	0	0	3
2.	EN8011	Project Formulation and Implementation	PE	3	3	0	0	3
3.	EN8012	Coastal Zone Management	PE	3	3	0	0	3
4.	EN8013	Fate And Transport of Contaminants	PE	3	3	0	0	3
5.	GE8077	Total Quality Management	PE	3	3	0	0	3

SEMESTER VIII
ELECTIVE - V

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EN8014	Environmental Biotechnology	PE	3	3	0	0	3
2.	EN8015	Climate Change, Adaptation and Mitigation	PE	3	3	0	0	3
3.	EN8016	Resource Recovery From Waste	PE	3	3	0	0	3
4.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3
5.	GE8073	Fundamentals of Nano Science	PE	3	3	0	0	3

SUMMARY

S.No	Subject Area	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1	**HS**	4	7							**11**
2	**BS**	12	4	4						**20**
3	**ES**	9	13							**22**
4	**PC**			20	22	16	20	13	3	**94**
5	**PE**					3	3	6	3	**15**
6	**OE**					3		3		**6**
7	**EEC**			1	1			2	10	**14**
	Total	**25**	**24**	**25**	**23**	**22**	**23**	**24**	**16**	**182**
8	**Non-Credit/Mandatory**									

HS8151 **COMMUNICATIVE ENGLISH** **L T P C**
4 0 0 4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- **Writing**- completing sentences- - developing hints. **Listening**- short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development**- Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development-**- prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening**- telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking**- asking about routine actions and expressing opinions. **Language development**- degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines **Writing**- letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening**- listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development**- synonyms-antonyms- phrasal verbs.

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –**Writing**- brainstorming -writing short essays **–** developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions.

OUTCOMES: At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1. Board of Editors. **Using English** A Coursebook for Undergarduate Engineers and Technologists**.** Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

REFERENCES

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish.** Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills,** Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
5. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005

MA8151 ENGINEERING MATHEMATICS – I L T P C
4 0 0 4

OBJECTIVES :

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.

- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

PH8151 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER **9**

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND FIBER OPTICS **9**

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS **9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, “Introduction to Computation and Programming Using Python’’, Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,, 2015.

GE8152 ENGINEERING GRAPHICS L T P C
2 0 4 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data **from/to files in Python.**

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL :60 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists**,** tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

BS8161	PHYSICS AND CHEMISTRY LABORATORY (Common to all branches of B.E. / B.Tech Programmes)	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

HS8251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES:

The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing**- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development**- technical vocabulary **Language Development** –subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing**- interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talkls on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing**- email etiquette- job application – cover letter –Résumé preparation(via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development**- finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech

TOTAL :60 PERIODS

OUTCOMES:

At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS – II

L	T	P	C
4	0	0	4

OBJECTIVES :

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c$, cz, $\frac{1}{z}$, z^2 - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES :

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

BE8252 BASIC CIVIL AND MECHANICAL ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials

UNIT III BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

TOTAL: 60PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.

- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

1. Shanmugam Gand Palanichamy MS,"Basic Civil and Mechanical Engineering",Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,"Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,"Basic Civil Engineering",Anuradha Agencies,2005.
4. ShanthaKumar SRJ.,"Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.
5. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam,2000.

BE8251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 9

Fundamental laws of electric circuits– Steady State Solution of DC Circuits – Introduction to AC Circuits –Sinusoidal steady state analysis– Power and Power factor – Single Phase and Three Phase Balanced Circuits. Classification of instruments – Operating Principles of indicating Instruments

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Introduction - Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.
Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 9

Binary Number System – Boolean Algebra theorems– Digital circuits - Introduction to sequential Circuits– Flip-Flops – Registers and Counters – A/D and D/A Conversion –digital processing architecture.

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 9

Introduction – Elements of Communication Systems– Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Digital Communication - Communication Systems: Radio, Antenna, TV, Fax, ISDN, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 45 PERIODS

OUTCOMES:

- ability to identify the electrical components and explain the characteristics of electrical machines.
- ability to identify electronics components and understand the characteristics

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson India, 2011
3. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006

REFERENCES:

1. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
2. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
3. Leonard S Bobrow, " Foundations of Electrical Engineering", Oxford University Press, 2013
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
6. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.

GE8292 ENGINEERING MECHANICS L T P C
3 2 0 4

OBJECTIVES:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I STATICS OF PARTICLES 9+6

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES 9+6

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9+6

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9+6

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS 9+6

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 45+30=75 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

GE8261 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE **18**

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE **13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE **16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and
- fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools:	
(a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

MA8391 PROBABILITY AND STATISTICS

L	T	P	C
4	0	0	4

OBJECTIVES :

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXTBOOKS :

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES :

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

EN8301 ENVIRONMENTAL CHEMISTRY L T P C
3 0 0 3

OBJECTIVE:

- The objectives of the course are to study the basics of environmental chemistry, chemical reactions involved in water and electro kinetic properties.

UNIT I INTRODUCTION 9

Fate of Chemicals in environment, Stoichiometry and mass balance-Chemical equilibria, acid base, solubility product(Ksp) order of reactions Chemical kinetics, Principles of green chemistry.

UNIT II AQUATIC CHEMISTRY 9

Water quality parameters- environmental significance and determination; chemicals in water and wastewater, volatilization, hydrolysis, photochemical transformation– Degradation of chemicals-Metals, complex formation, oxidation and reduction , pE – pH diagrams, redox zones – sorption- Colloids, electrical properties, double layer theory, environmental significance of colloids, coagulation .

UNIT III ATMOSPHERIC CHEMISTRY 9

Atmospheric structure –-chemical and photochemical reactions – photochemical smog. Ozone layer depletion – greenhouse gases and global warming, – Acid rain- origin and composition of particulates. Air quality parameters-effects and chemistry in air pollutants analysis.

UNIT IV SOIL CHEMISTRY 9

Nature and composition of soil-Clays- cation exchange capacity-acid base and ionexchange reactions in soil – Agricultural chemicals in soil-Reclamation of contaminated land; salt by leaching- Heavy metals by electrokinetic remediation.

UNIT V ENVIRONMENTAL CHEMICALS 9

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 PERIODS

OUTCOMES:

The students completing the course will have

- an insight in to the chemical reactions in water, air and soil environment.
- the ability to apply chemistry principles in analysing pollution of water, air and soil environment.
- an understanding on the fate of chemicals on the environment and suggest relevant interventions.

TEXTBOOKS:

1. Stanley E.Manohar, Environmental Chemistry, Williard Grant, 1975.
2. John H.Seinfield and Spyros H. Phandis “Atmphpheric chemistry and Physics – From Air Pollution to climate change “ Third Edition , Wiley, New Jersey ,2016.
3. Donald L.Sparks “Environmental Soil Chemsitry “Academic Press,Newyork ,1995.

REFERENCES:

1. Sawyer, C.N. and McCarty, P.L., and Parkin, G.F. “Chemistry for Environmental Engineers",3rd Edition. Tata McGrawHill, NewDelhi,2013
2. Glasstone and Ceuris.D,"Elements of Physical Chemistry",1997.
3. AlbaigoJ., "Analytical Techniques in EnviromentalChemistry", Pergamon Press, NewYork, 1980.

EN8302 BASICS OF CHEMICAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To prepare the students to solve material and energy balances, kinetics and chemical transformations on environmental process.

UNIT I INTRODUCTION 9

System of Units - Chemical process data representation and analysis – Mass-Volume- Flow rate-Chemical composition- Gas law –Vapour Pressure and Temperature – Material balance in reactor system and processes – Application to single phase and multiphase systems-Energy balance – Forms and laws of thermodynamics – Energy balance in closed, open system and nonreactive, reactive processes.

UNIT II PRINCIPLES OF TRANSPORT PROCESSES 9

Mass transfer and diffusion- Diffusion in gases, liquids, solids, biological solutions, gels - Mass transfer coefficient calculation - Diffusion of gases in porous solids and capillaries. Heat transfer – Mechanism –Conduction-Radiation heat transfer-Heat transfer in non-Newtonian fluids – Specific heat transfer co-efficient-Momentum transfer – Flow measurements –Pumps and gas moving equipment's and requirements- Agitation and mixing of fluids – Boundary layer flow and turbulence – Dimensional analysis.

UNIT III CHEMICAL KINETICS AND TRANSFORMATIONS 9

Chemical reactions and equilibrium - Rate expression in reversible reactions- Effect of temperature on chemical reactions – Activation energy- Reaction of chemical species in the excited states – Application to photochemical and advanced oxidation processes - Homogeneous and heterogeneous catalysis – Catalysis by transition metals and complexes – Enzyme catalysis-Adsorption and surface reactions – Reactions in electrode surface- - Electro chemical kinetics.

UNIT IV BIOCHEMICAL ENGINEERING 9

Cell growth in batch and continuous system - Growth kinetics , Biomass and product yields – Material balance in a chemostat and fed batch culture - Enzyme reaction kinetics- Mechanism of single enzyme with dual substrate – Substrate and product inhibitions analysis - Non-competitive inhibition rate model – Reaction mechanism with competitive inhibition- Mixing and measurement of gases – aeriation , agitation and mixing phenomena –Types of agitator - Dissolved oxygen – Oxygen transfer rate – Respiration quotients- Effect of agitation on dissolved oxygen – Air sparer-Biofilms –Biofilm kinetics .

UNIT V ENVIRONMENTAL PROCESSES AND REACTORS 9

Batch and Continuous reactors –CSTR, Plug flow tubular reactor and fluidized bed reactor – comparison between batch, CSTR, PFTR- Semi-batch reactors- Autocatalytic reactors –- Membrane reactors- Trickling bed reactors - Air lift pressure cycle bioreactor – Loop bioreactor-Types of separation process and methods – Gas-liquid separation- vapour separation-Liquid-liquid and fluid-solid separation- Membrane separation – Mechanical-Physical separation- Evaporation and Drying process.

TOTAL : 45 PERIODS

OUTCOMES:

- Will have a basic understanding of thermodynamics and basic chemical engineering.
- Basic ability to gain knowledge on heat and mass transfer.
- An understanding on the chemical reactions and Advanced oxidation processes.
- an insight in to the various biochemical processes.
- Will get a basic knowledge of reactor's model and its applications.

TEXTBOOKS:

1. Scott Fogler, H., "Elements of Chemical Reaction Engineering. Prentice- Hall of India, New Delhi, 2009.
2. Treybal ,R.E., Mass- Transfer operations,McGraw Hill ,2012
3. Bailey, J and Ollis D.F, Biochemical Engineering Fundamanetals, McGraw Hill, 1986.
4. McCabe, W. and Smith J.C, Unit Operations in Chemical Engineering, McGraw Hill, 2014.

REFERENCES:

1. Levenspiel, O., Chemical Reaction Engineering, Wiley, 2006.
2. Bird, R.B., Transport Phenomena, Wiley 2006.
3. Green W.D and Perry R.H., Perry's Chemical Engineer's Handbook, McGraw Hill, 2007.
4. GeabKoplis, C.J., Transport Processes and Separation Process Principles, Prentice Hall 2003.
5. Cussler, E.L, "Diffusion: Mass Transfer In Fluid Systems, "Cambridge University press, 1994

CE8303 MECHANICS OF FLUIDS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyse and appreciate the complexities involved in solving the fluid flow problems.

UNIT I FLUID PROPERTIES AND FLUID STATICS 9

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges- forces on planes – centre of pressure – bouncy and floatation.

UNIT II FLIUD KINEMATICS AND DYNAMICS 9

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter and Pitot tube. Linear momentum equation and its application.

UNIT III FLOW THROUGH PIPES 9

Viscous flow - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -Weisbach's equation - pipe roughness -friction factor- Moody's diagram- Major and minor losses of flow in pipes - Pipes in series and in parallel.

UNIT IV BOUNDARY LAYER 9

Boundary layer – definition- boundary layer on a flat plate – thickness and classification – displacement , energy and momentum thickness – Boundary layer separation and control – drag in flat plate – drag and lift coefficients.

UNIT V DIMENSIONAL ANALYSIS AND MODEL STUDIES 9

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.

TEXTBOOKS:

1. Modi P.N and Seth S.M.," Hydraulics and Fluid Mechanics including Hydraulic Machines",Standard Book House New Delhi. 2003
2. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 2001.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5th edition, Laxmi publications Pvt. Ltd, New Delhi, 2008.

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 2000.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 1995.
3. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010
4. Roberson J.A and Crowe C.T., " Engineering Fluid Mechanics", Jaico Books Mumbai, 2000.
5. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2003.

CE8393 STRENGTH OF MATERIALS L T P C
4 0 0 4

OBJECTIVE:

- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains - Thin shells - circumferential and longitudinal stresses in thin cylinders - deformation of thin cylinder – stresses in spherical shells – Deformation of spherical shells.

UNIT II ANALYSIS OF PLANE TRUSSES 12

Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

UNIT III TRANSVERSE LOADING AND STRESSES IN BEAM 12

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over-hanging beams. Theory of simple bending– bending stress distribution – Shear stress distribution - Flitched beams – carriage springs.

UNIT IV TORSION 12

Torsion formula - stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

UNIT V DEFLECTION OF BEAMS 12

Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay‟s method – Area moment method – Conjugate beam method.

TOTAL : 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behaviour of simple structures.
- Critically analyse problem and solve the problems related to structural elements and analyse the deformation behaviour for different types of loads.

TEXTBOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Egor. P.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series,2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing „co. Ltd., New Delhi, 2005.

CE8351 SURVEYING L T P C
3 0 0 3

OBJECTIVES :

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass - Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing - Levelling- Principles and theory of Levelling – Datum- - Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling- Booking – Reduction - Sources of errors in Levelling- Curvature and refraction.

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING 9

Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometry surveying - Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring - Contour gradient – Uses of contour plan and map

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control – Methods – specifications – triangulation- baseline – satellite stations – reduction to centre- trigonometrical levelling – single and reciprocal observations – traversing – Gale’s table. - Errors Sources- precautions and corrections – classification of errors – true and most probable values - weighed observations – method of equal shifts –principle of least squares - normal equation – correlates- level nets- adjustment of simple triangulation networks.

UNIT IV ADVANCED TOPICS IN SURVEYING 9

Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem – Strength of fix – astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods –.Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems - different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method

UNIT V MODERN SURVEYING 9

Total Station : Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station GPS Surveying : Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to understand

- The use of various surveying instruments and mapping
- Measuring Horizontal angle and vertical angle using different instruments
- Methods of Leveling and setting Levels with different instruments
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- Concept and principle of modern surveying.

TEXTBOOKS :

1. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
4. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
5. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993
6. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

REFERENCES :

1. Alfred Leick, “GPS satellite surveying”, John Wiley & Sons Inc., 3rd Edition, 2004.
2. Guocheng Xu, “GPS Theory , Algorithms and Applications”, Springer – Berlin, 2003.
3. SatheeshGopi, rasathishkumar, N. madhu, “Advanced Surveying, Total Station GPS and Remote Sensing” Pearson education, 2007
4. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. Arora K.R.,"Surveying Vol I & II", Standard Book house, 10th Edition 2008

CE8481 STRENGTH OF MATERIALS LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS

1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL: 60 PERIODS

OUTCOME:

- The students will have the required knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES:

1. 1. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.
2. IS1786-2008 (Fourth Revision, Reaffirmed 2013), 'High strength deformed bars and wires for concrete reinforcement – Specification', 2008.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine	1
3.	Izod impact testing machine	1
4.	Hardness testing machine Rockwell Vicker's } (any 2) Brinnel	1 each
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	Few
9.	Le Chatelier's apparatus	2
10.	Vicat's apparatus	2
11.	Mortar cube moulds	10

CE8361 **SURVEYING LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- At the end of the course the student will posses knowledge about Survey field techniques

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Compass Survey

3. Compass Traversing – Measuring Bearings & arriving included angles

Levelling - Study of levels and levelling staff

4. Fly levelling using Dumpy level &Tilting level
5. Check levelling

Theodolite - Study of Theodolite

6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when base is accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

11. Traverse using Total station and Area of Traverse
12. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL: 60 PERIODS

OUTCOME:

- Students completing this course would have acquired practical knowledge on handling basic survey instruments including Theodolite, Tacheometry, Total Station and GPS and have adequate knowledge to carryout Triangulation and Astronomical surveying including general field marking for various engineering projects and Location of site etc.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Total Station	3 Nos
2.	Theodolites	Atleast 1 for every 5 students
3.	Dumpy level / Filling level	Atleast 1 for every 5 students
4.	Pocket stereoscope	1
5.	Ranging rods	1 for a set of 5 students
6.	Levelling staff	
7.	Cross staff	
8.	Chains	
9.	Tapes	
10.	Arrows	
11.	Prismatic Compass	10 nos
12.	Surveyor Compass	2 nos
13.	Survey grade or Hand held GPS	3 nos

HS8381 INTERPERSONAL SKILLS/LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The Course will enable learners to**:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES:

At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES:

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

EN8401 ENVIRONMENTAL POLICY AND LEGISLATIONS L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the policies, legislations, institutional frame work and enforcement mechanisms for environmental management in India.

UNIT I INTRODUCTION 9

Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration

UNIT II WATER (P&CP) ACT, 1974 8

Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT III AIR (P&CP) ACT, 1981 8

Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT IV ENVIRONMENT (PROTECTION) ACT 1986 13

Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards

UNIT V RECENT RULES AND NOTIFICATIONS 7

National Green tribunals- recent environmental rules and notifications-e-waste management-construction and demolition waste management, etc.,.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the Indian policies and legislations pertaining to prevention and control of water pollution, air pollution and waste management
- an insight into the Environmental Protection Act and the associated Rules knowledge on the Institutional setup for Environmental management and pollution control.

TEXTBOOKS:

1. Shyam Divan and Armin Roseneranz “Environmental law and policy in India “Oxford University Press, New Delhi, 2001.
2. Greger I. Megregor, “Environmental law and enforcement”, Lewis Publishers, London. 1994.

REFERENCE:

1. CPCB, “Pollution Control acts, Rules and Notifications issued there under “Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.

EN8402 ENVIRONMENTAL MICROBIOLOGY L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to study the basics of environmental microbiology involved in water, soil and air.

UNIT I MICROBIOLOGY: INTRODUCTION 9

Classification of living organisms with special emphasis on micro-organisms - characteristics - application in environmental engineering - DNA & RNA.

UNIT II METHODS OF STUDY 9

Culture of micro-organisms - media preparation - sterilization, pure culture - maintenance of cultures – stains and staining - estimation of bacterial numbers.

UNIT III GROWTH AND METABOLISM OF MICRO-ORGANISMS 9

Growth curves - factors affecting growth - nutritional requirements of micro-organisms - metabolism of micro-organisms - carbohydrates, proteins, fat metabolisms and the role of enzymes.

UNIT IV RESPIRATIONS 9

Aerobic and anaerobic - role of enzymes - bacterial respiration - fermentation and saprogenic action - basic concepts of molecular biology.

UNIT V BIODEGRADATION AND BIOLOGICAL TREATMENT 9

Microbiology of wastewater treatment (domestic and industrial), indicator microorganisms, biodegradation of xenobiotics, bioaugumentation, microbial leaching of heavy metals.

TOTAL:45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into type, growth metabolism and culturing techniques of micro organisms and their application to environmental engineering
- the ability to perform estimation of bacterial numbers
- the ability to apply micro morganisms for the treatment of wastes, bioleaching and bioaugmentation

TEXTBOOKS :

1. McKinney R.E. and Gall M. "Microbiology for Sanitary Engineers", McGraw Hill Book Co.Inc. New York, 1962
2. Gainey and Lord, "Microbiology of Water and Sewage", Prentice Hall Inc., New York, 1975

REFERENCES:

1. Raina, M.Maier, Ian L. Pepper, Charles P. Gerba. "Environmental Microbiology", Academic Press, 2000.
2. Bhatia, S.C., "Handbook of Environmental Microbiology", Vol. I, II & III, Atlantic Publ. & Dist. Ltd., 2008.

EN8403 BASIC STRUCTURAL ANALYSIS L T P C
3 0 0 3

OBJECTIVE:

- To learn the methods of analysis of beams and frames.

UNIT I ENERGY PRINCIPLES 9

Strain energy and strain energy density – strain energy due to axial load, shear, flexure and torsion – Castigliano's theorems – Principle of virtual work – application of energy theorems for computing deflections in beams and trusses.

UNIT II INDETERMINATE BEAMS 9

Concept of Analysis - Propped cantilever and fixed beams - fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III SLOPE DEFLECTION METHOD 9

Slope deflection equations- Analysis of continuous beams and rigid frames - Support settlements.

UNIT IV MOMENT DISTRIBUTION METHOD 9

Stiffness and carry over factors – Distribution and carry over of moments - Analysis of continuous Beams - Plane rigid frames with and without sway – Support settlement.

UNIT V COLUMNS AND THICK CYLINDERS 9

Short and long columns - Euler's theory – critical loads for prismatic columns with different end conditions - Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core of section – Thick cylinders – Compound cylinders.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into the stress - strain energy principles, slope deflection method and moment distribution method
- ability to model loads on structures and analyse structural elements including beams, columns and cylinders
- ability to determine deflections of beams and frames

TEXTBOOKS:

1. Bhavikatti,S.S, "Structural Analysis", Vol.1 and 2, Vikas Publishing House Pvt. Ltd., New Delhi, 2003.
2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, " Theory of structures", Laxmi Publications, New Delhi, 1999.
3. Hibbeler, R.C., "Structural Analysis", 7th Edition, Prentice Hall, 2008.

REFERENCES:

1. William Weaver, Jr & James M.Gere, "Matrix analysis of framed structures", CBS Publishers & Distributors, Delhi, 1995
2. Ashok K.Jain, "Advanced Structural Analysis", Nem Chand & Sons, 1996
3. Pandit G.S. and Gupta S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Company Ltd., 2006
4. Reddy .C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2005.

EN8491 WATER SUPPLY ENGINEERING L T P C

3 0 0 3

OBJECTIVE:

- To equip the students with the principles and design of water treatment units and distribution system.

UNIT I SOURCES OF WATER 9

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II CONVEYANCE FROM THE SOURCE 9

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management – Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances - MBR process

UNIT V WATER DISTRIBUTION AND SUPPLY 9

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Analysis of distribution networks -Computer applications – Appurtenances – Leak detection.

Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
- the knowledge in various unit operations and processes in water treatment
- an ability to design the various functional units in water treatment
- an understanding of water quality criteria and standards, and their relation to public health
- the ability to design and evaluate water supply project alternatives on basis of chosen criteria.

TEXTBOOKS:

1. Garg, S.K. Environmental Engineering, Vol.IKhanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2014.

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

CE8391 CONSTRUCTION MATERIALS L T P C

3 0 0 3

OBJECTIVE:

- To introduce students to various materials commonly used in civil engineering construction and their properties.

UNIT I STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks.

UNIT II LIME – CEMENT – AGGREGATES – MORTAR 9

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – fine aggregates – river sand – crushed stone sand – properties – coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading

UNIT III CONCRETE 9

Concrete – Ingredients – Manufacturing Process – Batching plants –mixing – transporting – placing – compaction of concrete –curing and finishing – Ready mix Concrete – Mix specification.

UNIT IV TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermocol – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

UNIT V MODERN MATERIALS 9

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles– Geomembranes and Geotextiles for earth reinforcement.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course the students will be able to

- Compare the properties of most common and advanced building materials.
- understand the typical and potential applications of lime, cement and aggregates
- know the production of concrete and also the method of placing and making of concrete elements.
- understand the applications of timbers and other materials
- Understand the importance of modern material for construction.

TEXT BOOKS:

1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015.
2. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
3. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
4. Duggal.S.K., "Building Materials", 4th Edition, New Age International , 2008.

REFERENCES:

1. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
2. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. IS456 - 2000: Indian Standard specification for plain and reinforced concrete, 2011
4. IS4926 - 2003: Indian Standard specification for ready–mixed concrete, 2012
5. IS383 - 1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete, 2011
6. IS1542-1992: Indian standard specification for sand for plaster, 2009
7. IS 10262-2009: Indian Standard Concrete Mix Proportioning –Guidelines, 2009

CE8405 HYDRAULICS AND HYDRAULIC MACHINERY L T P C

3 0 0 3

OBJECTIVE:

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

UNIT I UNIFORM FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS 9

Dynamic equations of gradually varied and spatially varied flows - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method - Applications. UNIT III

UNIT III RAPIDLY VARIED FLOWS 9

Application of the energy equation for RVF - Critical depth and velocity - Critical, Sub-critical and Super-critical flow - Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation - Surges.

UNIT IV TURBINES 9

Turbines - Classification - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Runaway speed - Similarity laws.

UNIT V PUMPS 9

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
- They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
- They will have knowledge in hydraulic machineries (pumps and turbines)

TEXTBOOKS:

1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
3. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000.

REFERENCES:

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Rajesh Srivastava, Flow through open channels, Oxford University Press, New Delhi, 2008.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2005.

EN8411 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY LABORATORY L T P C
0 0 4 2

A: ENVIRONMENTAL CHEMISTRY

1. Estimation of hardness and Chloride in Water sample by volumetric titration
2. Spectrophotometric / Colorimetric determination of sulphate and phosphate
3. Determination of Solids, COD and BOD in wastewater sample

TOTAL: 30 PERIODS

B: ENVIRONMENTAL MICROBIOLOGY

1. Preparation of culture media, Isolation and Culturing of Microorganisms
2. Gram Staining of bacteria
3. Bacteriological analysis of wastewater (Coliforms & Streptococcus) – MPN and MF Techniques

TOTAL: 30 PERIODS

REFERENCES:

1. APHA, "Standard Methods for the Examination of Water and Wastewater", 22nd Ed. Washington, 2012

2. "Laboratory Manual for the Examination of water, wastewater soil, Rump, H.H. and Krist, H. – Second Edition, VCH, Germany, 3rd Edition, 1999.
3. Charles P. Gerba, "Environmental Microbiology: A laboratory manual", Elsevier Publications, 3rd, 2014

CE8461 HYDRAULIC ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS

A. Flow Measurement

1. Calibration of Rotameter
2. Calibration of Venturimeter / Orificemeter
3. Bernoulli's Experiment

B.Losses in Pipes

4.Determination of friction factor in pipes
5. Determination of min or losses

C.Pumps

6.Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D.Turbines

10.Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine/Kaplan turbine

E.Determination of Metacentric height

12.Determination of Metacentric height of floating bodies

TOTAL: 60 PERIODS

OUTCOMES:

- The students will be able to measure flow in pipes and determine frictional losses.
- The students will be able to develop characteristics of pumps and turbines.

REFERENCES:

1. Sarbjit Singh."Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2009.
2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
3. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
4. Subramanya K. "Flow in open channels", Tata McGraw Hill Publishing.Company, 2001.

LIST OF EQUIPMENTS

1. One set up of Rotometer
2. One set up of Venturimeter/Orifice meter
3. One Bernoulli's Experiment set up
4. One set up of Centrifugal Pump
5. One set up of Gear Pump
6. One set up of Submersible pump
7. One set up of Reciprocating Pump
8. One set up of Pelton Wheel turbine

9. One set up of Francis turbines/one set of kaplon turbine
10. One set up of equipment for determination of Metacentric height of floating bodies
11. One set up for determination of friction factor in pipes
12. One set up for determination of minor losses.

HS8461	ADVANCED READING AND WRITING	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT I

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV

Reading- Genre and Organization of Ideas- Writing- Email writing- visumes – Job application-project writing-writing convincing proposals.

UNIT V

Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course Learners will be able to:

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011

REFERENCES

1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012

3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

EN8501 BASIC STRUCTURAL DESIGN L T P C
2 2 0 3

OBJECTIVE:

- This course aims at providing students with a solid background on the principles of structural engineering design. Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels.

UNIT I INTRODUCTION TO STEEL DESIGN 6+6

Introduction - Properties of structural steel – Indian standard Structural steel sections - Loads on Structures – Design approaches - Introduction to Limit state Design - Connections using rivets, welding, bolting – Design of bolted and welded joints – Eccentric connections - Efficiency of joints

UNIT II DESIGN OF STEEL MEMBERS 6+6

Design of Tension Members - Design of compression Members - Design of Laterally supported Beams.

UNIT III DESIGN FOR REINFORCED CONCRETE FLEXURAL MEMBERS 6+6

Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.

UNIT IV DESIGN OF REINFORCED CONCRETE COLUMNS AND FOOTINGS 6+6

Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending - Design of wall footing – Design of axially loaded pad footing.

UNIT V DESIGN O F LIQUID STORAGE STRUCTURES 6+6

RC Water Tanks- Circular and Rectangular – Design and Drawing – Hemispherical Bottomed Steel Water Tank – Design and Drawing.

TOTAL: 60 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the structural design fundamentals and limit state design
- ability to design and detail liquid storage structures, retaining walls and industrial structures

TEXTBOOKS:

1. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
2. Subramanian,N.,"Design of Steel Structures",Oxford University Press, New Delhi, 2013.

REFERENCES:

1. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee, 1998
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002
3. Krishnaraju N, "Structural Design and Drawing", Universities Press, 2009.
4. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2003.
5. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.

EN8591 MUNICIPAL SOLID WASTE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) –- Role of public and NGO‟s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 8

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

UNIT III COLLECTION AND TRANSFER OF WASTES 8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

UNIT IV PROCESSING OF WASTES 12

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V WASTE DISPOSAL 8

Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will demonstrate

- understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- Reduction, reuse and recycling of waste.
- ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.
- knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.
- Design and operation of sanitary landfill.

TEXTBOOKS:

1. William A. Worrell, P. Aarne Vesilind (2012) Solid Waste Engineering, Cengage Learning, 2012.
2. John Pitchel (2014), Waste Management Practices-Municipal, Hazardous and industrial – CRC Press, Taylor and Francis, New York.

REFERENCES:

1. CPHEEO (2014), “Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi.
2 George Tchobanoglous and FrankKreith(2002).Handbook of Solid waste management, McGraw Hill, New York.

EN8592 WASTEWATER ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage-Storm runoff estimation – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping-drainage in buildings-plumbing systems for drainage - Rain Water Harvesting.

UNIT II PRIMARY TREATMENT OF SEWAGE 9

Objectives – Unit Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 9

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor(SBR) – Membrane Bioreactor - UASB – Waste Stabilization Ponds – - Other treatment methods -Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

UNIT IV DISPOSAL OF SEWAGE 9

Standards for– Disposal - Methods – dilution – Mass balance principle - Self purification of river-Oxygen sag curve – deoxygenation and reaeration - Streeter–Phelps model - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

UNIT V SLUDGE TREATMENT AND DISPOSAL 9

Objectives - Sludge characterization – Thickening - Design of gravity thickener- Sludge digestion – Standard rate and High rate digester design- Biogas recovery – Sludge Conditioning and Dewatering – Sludge drying beds- ultimate residue disposal – recent advances.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- An ability to estimate sewage generation and design sewer system including sewage pumping stations
- The required understanding on the characteristics and composition of sewage, self-purification of streams
- An ability to perform basic design of the unit operations and processes that are used in sewage treatment
- Understand the standard methods for disposal of sewage.
- Gain knowledge on sludge treatment and disposal.

TEXTBOOKS:

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
3, Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

REFERENCES:

1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, Washington D.C.,2010
4. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.

CE8491 SOIL MECHANICS L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

History – formation and types of soil – composition - Index properties – clay mineralogy structural arrangement of grains – description – Classification – BIS – US – phase relationship – Compaction – theory – laboratory and field technology – field Compaction method – factors influencing compaction.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– – Permeability – Darcy's law – Determination of Permeability – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems Sheet pile and wier.

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution in homogeneous and isotropic medium – Boussines of theory – (Point load, Line load and udl) Use of Newmarks influence chart –Components of settlement –– Immediate and consolidation settlement – Factors influencing settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. –- $\sqrt{t}$ and log t methods. e-log p relationship consolidation settlement N-C clays – O.C clays – Computation.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influences shear strength of soil.

UNIT V SLOPE STABILITY 9

Infinite slopes and finite slopes –– Friction circle method – Use of stability number –Guidelines for location of critical slope surface in cohesive and c - φ soil – Slope protection measures.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- classify the soil and assess the engineering properties, based on index properties.
- Understand the stress concepts in soils
- Understand and identify the settlement in soils.
- Determine the shear strength of soil
- Analyze both finite and infinite slopes.

TEXTBOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017(Reprint).
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics" New Age International Publication, 3rd Edition, 2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt. Ltd. New Delhi, 2010.
3. Braja M Das, "Principles of Geotechnical Engineering", Cengage Learning India Private Limited, 8th Edition, 2014.
4. Palanikumar.M., "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2013.
5. Craig.R.F., "Soil Mechanics", E & FN Spon, London and New York, 2012.
6. Purushothama Raj. P., "Soil Mechanics and Foundations Engineering", 2nd Edition, Pearson Education, 2013.
7. Venkatramaiah.C., "Geotechnical Engineering", New Age International Pvt. Ltd., New Delhi, 2017

EN8511 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVE:

- To understand the sampling and preservation methods and significance of characterization of wastewater.

LIST OF EXPERIMENTS:

1. Determination of Ammonia Nitrogen in wastewater.
2. Coagulation and Precipitation process for treating waste water
3. Determination of suspended, volatile, fixed and settleable solids in wastewater.
4. B.O.D. test
5. C.O.D. test
6. Nitrate in wastewater.
7. Phosphate in wastewater.
8. Determination of Calcium, Potassium and Sodium.
9. Heavy metals determination - Chromium, Lead and Zinc.
   (Demonstration only)

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	*Quantity*
1.	Oxygen analyzer	1
2.	Spectrophotometer	1
3.	Ion – selective electrode	1
4.	Sodium Potassium Analyzer – Flame Photometer	1
5.	Gas Chromatography	1
6.	Atomic absorption spectroscopy (Ni, Zn, Pb)	1
7.	Nephlo - turbiditymeter	1
8.	BOD Analyser	1
9.	COD Analyser	1
10.	Jar Test Apparatus	1

OUTCOME:

- The students completing the course will have ability to conduct a performance evaluation of wastewater and able to do treatability studies.

EN8512 ENVIRONMENTAL ENGINEERING DRAWING

L	T	P	C
0	0	4	2

OBJECTIVE:

- To train the students on preparing layout of water and wastewater treatment plants as well as general arrangement diagrams for units in water and wastewater treatment.

LIST OF EXPERIMENTS:

Environmental Engineering Systems 1 (Design and Drawing)

1. Layout of water treatment plant from source to distribution system.
2. Various types of intake structures.
3. Ground level reservoirs and elevated service reservoirs.
4. Plain sedimentation tank
5. Clariflocculator.
6. Slow sand gravity filter.
7. Rapid sand gravity filter.
8. Zeolite water softener.
9. Rain water harvesting system.
10. Pumping station.

Environmental Engineering Systems 2 (Design and Drawing)

1. Layout of domestic wastewater treatment plant.
2. Screen chamber
3. Grit chamber
4. Skimming tank
5. Plain sedimentation tank
6. Trickling filter
7. Activated sludge process
8. Oxidation pond
9. Septic tank
10. Grey water treatment system.

TOTAL : 60 PERIODS

OUTCOMES:

The students completing the course will have

- ability to prepare flow charts and layouts of water and wastewater treatment plants
- ability to design and detail structures and reactors required for water and wastewater treatment

REFERENCES:

1. Birde.G.S and Birde. J.S,"Water supply and sanitary Engineering", Dhanpat Rai Publications Pvt.Ltd New Delhi, 2001.
2. Rangwala.S.C, "Fundamentals of water supply and sewerage engineering", Charotar Publishing, 2000.
3. Mannual on wastewater and treatment CPHEECO, Ministry of Urban Affairs and Eemployment, Govt. of India, New Delhi, 1990.
4. Shah.C. S., "Water supply and Sanitation", Galgotia publishing company, New Delhi, 1994.
5. Metcalf and Eddy, "WasteWater Engineering – Treatment and reuse", Tata McGraw-Hill, New Delhi, 2003.

EN8601 ENVIRONMENTAL EQUIPMENT AND INSTRUMENTS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the principles and application of different instruments used for performance monitoring and testing of equipment in wastewater treatment, air pollution control, effluent analysis and emission monitoring.

UNIT I GENERAL 9

Study of machinery, electric motors types and characteristics, other prime covers, pumps, capacity, operation and maintenance of pumping machinery, air compressors preventive maintenance, break-down maintenance, schedules – Factors to be considered in the selection of the equipments.

UNIT II INSTRUMENTATION 9

pH meter - Flame Emission Spectrometry. Absorption spectrometry - Nephelometry - Atomic Absorption Spectrometry - Gas chromatography – working principle and components.Total carbon analyser – Mercury Analyser polar graph for metal estimation and organic compounds - Ion selective Electrode -SO2 and CO analyser – Instrument components and its working principle.

UNIT III WATER SUPPLY MACHINERY AND WASTEWATER MACHINERY 9

Drilling equipment, pumping equipment for wells. Machinery required for primary and secondary treatment, sewage pumps , sludge pumps, vaccum filtration equipment.

UNIT IV EQUIPMENTS FOR TREATMENT UNITS 9

Equipment for treatment unit - electrically and mechanically operated agitators, mixers, aerators, chlorinators, Surface aerators. Meters for measurement of flow, head, electricity.

UNIT V AIR POLLUTION CONTROL EQUIPMENTS 9

Working principles of electrostatic precipitator – cyclone separators – settling chamber – operation and Maintenance. Machinery for solid waste collection and disposal incineration – compactors – magnetic separators- incinerators.

TOTAL:45 PERIODS

OUTCOMES:
The students completing the course will have

- an understanding of various instruments and equipments used in measurement and monitoring for environmental engineering applications
- ability to describe the operation of a range of sensors and transducers with particluar reference to monitoring of water and air quality

TEXTBOOKS:

1. Trivedy R. K. & Goel P.K., Chemical and Biological methods for water pollution studies, Environmental publication, Karat, 1986.
2. Cox C.R., Operation and Control of Water Treatment Processes, World Health Organisation, Geneva, 1964.

REFERENCES

1. Course Manual on Preventive Maintenance of Water Distribution System, NEERI, 1973.
2. Standards Methods for the Examination of Water and Waste Water, 17th Edition, WPCF, APHA and AWWA, USA, 1989.

EN8602 DESIGN OF ENVIRONMENTAL ENGINEERING STRUCTURES L T P C
3 0 0 3

OBJECTIVES:

- To educate the structural design principles
- To educate the students on aspects of water retaining structures design
- Educating the design of masonry and steel structures used in environmental engineering

UNIT I INTRODUCTION AND DESIGN OF PIPES 9

Environmental Engineering structures - Introduction -Concept of elastic method, ultimate load method and limit state method – Advantages of Limit State method over other methods – Limit State philosophy as detailed in current IS Code. Structural design of - Concrete, Prestressed Concrete, Steel and Cast-iron piping mains, - anchorage for pipes - massive outfalls

UNIT II DESIGN OF WATER RETAINING STRUCTURES 9

IS Codes for the design of water retaining structures - Design of concrete roofing systems – Design of circular, rectangular tanks and Spherical tanks - Design of prestressed concrete cylindrical tank, Clariflocculators, Filters

UNIT III DESIGN OF WASTEWATER RETAINING STRUCTURES 9

Structural design of wastewater treatment units - Grit chamber, Parshall flume, Aeration tank, Anaerobic baffle reactor, Sludge digester, UASBR, Sludge thickener, Sludge drying beds.

UNIT IV STORAGE STRUCTURES 9

Design of Square bunker and Storage structures – IS codal provisions – Design of cylindrical silo. Design of various types of foundation like isolated, combined and raft foundation for a Water tanks, Bunkers and Silo‟s.

UNIT V SPECIAL STRUCTURES 9

Design of masonry walls, pillars and footings as per NBC and IS Codes -Structural design of underground reservoirs and swimming pools, Intake towers - effect of earth pressure and uplift considerations – design of - Cyclone separator – Scrubber

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to apply the principle of limit state design.
- Ability to do structural design of concrete and steel pipes
- Ability to do the structural design of a complete water and wastewater treatment plant.
- Ability to do air pollution control devices design
- Ability to design underground water storage structures

TEXTBOOKS:

1. Krishna Raju, "Prestressed Concrete" Tata McGraw Hill Publishing Co. 2nd Edition, 1988.
2. Sinha N.C. &.Roy S.K "Reinforced Concrete" S.Chand and Co., 1985
3. Ramaswamy, G.S., “Design and Construction of Concrete shell roofs", CBS Publishers, India,1986.

REFERENCES:

1. Green, J.K. and Perkins, P.H., “Concrete liquid retaining structures", Applied Science Publishers, 1981.
2. Rajagopalan K.,"Storage structures", Tata McGraw Hill, New Delhi, 1989.
3. Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, New Delhi, 1988

EN8603 INDUSTRIAL WASTEWATER MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control

UNIT I INTRODUCTION 8

Sources and characteristics of various industrial, process and wastes – Population equivalent – Effects of industrial effluents on streams, sewer, land, sewage treatment plants and on human health – Environmental legislations and standards related to prevention and control of industrial pollution and hazardous wastes.

UNIT II CLEANER PRODUCTION 8

Volume reduction - Strength reduction - Material and process modifications - Recycle, reuse and byproduct recovery – Applications – Waste minimization

UNIT III TREATMENT TECHNOLOGIES 11

Equalisation - Neutralisation - Removal of suspended, floating and dissolved organic solids - Chemical oxidation - Adsorption - Removal of dissolved inorganic - Combined treatment of industrial and municipal wastes - Residue management - Dewatering – Disposal.

UNIT IV POLLUTION FROM MAJOR INDUSTRIES 9

Sources - Characteristics - Waste treatment flow charts for selected industries such as Textiles - Tanneries - Pharmaceuticals - Electroplating industries - Dairy - Sugar - Paper - distilleries - Steel plants – Refineries – Fertilizer - thermal power plants - Wastewater reclamation and reuse concepts.

UNIT V HAZARDOUS WASTE MANAGEMENT 9

Hazardous wastes – Types – Sources - Collection - Physico chemical treatment – Solidification – Incineration – Secured landfills.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into the pollution from major industries including the sources and characteristics of pollutants
- ability to plan minimization of industrial wastes
- ability to design facilities for the processing and reclamation of industrial wastewater

TEXTBOOKS:

1. M.N. Rao & A. K.Dutta, “Wastewater Treatment”, Oxford - IBH Publication, 1995.
2. Eckenfelder W.W. Jr., “Industrial Water Pollution Control”, McGraw Hill Book Company, New Delhi, 2000.
3. Patwardhan. A.D., Industrial Wastewater Treatment", Prentice Hall of India, 2010.

REFERENCES:

1. Shen T.T., “Industrial Pollution Prevention”, Springer, 1999.
2. Stephenson R.L and .Blackburn J.B, Jr.,“Industrial Wastewater Systems Hand book”, Lewis Publisher, New York, 1998
3. Freeman H.M., “Industrial Pollution Prevention Hand Book”, McGraw Hill Inc., New Delhi, 1995.
4. Bishop P.L., “Pollution Prevention: Fundamental & Practice”, McGraw Hill, 2000.
5. Pandey, "Environmental Management" Vikas Publications, 2010.
6. Industrial Wastewater Management, Treatment and Disposal",(WEF Manual of practice - FD3) McGraw Hill, 2008.

EN8604 AIR AND NOISE POLLUTION CONTROL L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.

UNIT I INTRODUCTION 7

Atmosphere and Air Pollution–Sources and classification of air pollutants - Effects on human beings, plants and animals- Effects on property and visibility- Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

UNIT II SAMPLING, METEOROLOGY AND AIRQUALITY MODEL 7

Sampling and measurement of particulate and gaseous pollutants -Ambient air sampling- Stack sampling. - Meteorology -Horizontal and vertical motion in the atmosphere- temperature lapse rate and stability–Adiabatic lapse rate- Wind Rose–Fumigation, stagnations, Inversion–Wind velocity and turbulence-Plume behavior - Dispersion of air pollutants, Gaussian Plume Model.

UNIT III AIR POLLUTION CONTROL MEASURES 13

Control- Source correction methods - Control equipment’s-Particulate control methods–Bag house filter-Settling chamber- cyclone separators-inertial devices- Electrostatic precipitator-scrubbers- Control of gaseous emissions- Absorption- Absorption equipment’s- adsorption and combustion devices– Control of VOC, Sulphur Dioxide, Nitrogen Oxides, Indoor air quality .

UNIT IV NOISE POLLUTION SOURCE MEASUREMENT AND EFFECTS 9

Sources of noise– Units and Measurements of Noise–Standards-Effects of noise pollution-Control of Noise Pollution

UNITV INDOOR AIR POLLUTION AND ITS CONTROL 9

Indoor air pollution-Sources of Indoor air pollution-Effects-Sick building syndrome-building related Illness-Control Measures

TOTAL:45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- ability to identify, formulate and solve air and noise pollution problems
- ability to design stacks and particulate air pollution control devices to meet applicable laws.

TEXTBOOKS:

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2000.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993
3. Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", Allied publishers Pvt. Ltd., 2002.

REFERENCES:

1. Stern A.C.,"Air Pollution"(vol.I),"Air Pollution and its effects"(vol.II), "Analysis, Monitoring and Surveying" (vol.III),"Sources of Air Pollution and their control", Academicpress, NewYork,1968.
2. HowardS.Peavy, DonaldR. Rowe and George Tchobanoglous, "Environmental Engineering", McGraw- Hill Co., 1988.
3. Kenneth wark, CecilF. Warner, "Air Pollution its Origin and Control", Harperand Row Publishers, NewYork,1981.
4. Henry C Perkins, Air pollution, McGraw-Hill PvtLtd, NewDelhi, 1974.
5. NoelDeNevers, Air pollution control Engineering, McGraw-Hill International Edition, McGrawHill Inc, New Delhi, 2000.
6. Air Pollutionact,1981(India).
7. Petersonand E.GrossJr., "Hand Book of Noise Measurement" (5thEdn1963).
8. AntonyMilne, "Noise Pollution:Impact and Counter Measures" , David & Charles PLC,1979.

CE8591 FOUNDATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Bore log report and Selection of foundation.

UNIT II SHALLOW FOUNDATION 9

Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS 9

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum thickness for rigid behaviour – Applications – Compensated foundation – Seismic force consideration – Codal provision

UNIT IV PILE FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity-Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Cohesive – expansive – non expansive – Cohesionless soils – Codal provisions.

UNIT V RETAINING WALLS 9

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann's Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provisions.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Understand the site investigation, methods and sampling.
- Get knowledge on bearing capacity and testing methods.
- Design shallow footings.
- Determine the load carrying capacity, settlement of pile foundation.
- Determine the earth pressure on retaining walls and analysis for stability.

TEXTBOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition 2017.

REFERENCES:

1. Braja M Das, "Principles of Foundation Engineering" (Eigth edition), Cengage Learning 2014.
2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2014.
3. Joseph E bowles, "Foundation Analysis and design", McGraw Hill Education, 5th Edition, 28th August 2015.
4. IS Code 6403 : 1981 (Reaffirmed 1997) "Bearing capacity of shallow foundation", Bureau of Indian Standards, New Delhi.
5. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) "Deep foundations subjected to symmetrical static vertical loading", Bureau of Indian Standards, New Delhi.
7. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) "Concrete Piles" Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi.

10. IS Code 2911 (Part 4) : 1979 (Reaffirmed 1997) “Load Test on Piles”, Bureau of Indian Standards, New Delhi.
11. IS Code 1904: 1986 (Reaffirmed 1995) “Design and Construction of Foundations in Soils”, Bureau of Indian Standards, New Delhi.
12. IS Code 2131: 1981 (Reaffirmed 1997) “Method for Standard Penetration test for Soils”, Bureau of Indian Standards, New Delhi.
13. IS Code 2132: 1986 (Reaffirmed 1997) “Code of Practice for thin – walled tube sampling for soils”, Bureau of Indian Standards, New Delhi.
14. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.
15. IS Code 14458 (Part 1) : 1998 “Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall” , Bureau of Indian Standards, New Delhi.
16. IS Code 14458 (Part 2) : 1998 “Retaining Wall for Hill Area – Guidelines, Design of Retaining/Breast Walls” , Bureau of Indian Standards, New Delhi.
17. IS Code 14458 (Part 3) : 1998 “Retaining Wall for Hill Area – Guidelines, Construction Of Dry Stone Walls” , Bureau of Indian Standards, New Delhi.

CE8091 HYDROLOGY AND WATER RESOURCES ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton’s equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton’s equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange’s table and SCS methods – Stage discharge relationships-flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts-Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments,

- ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge
- ability to conduct Spatial analysis of rainfall data and design water storage reservoirs
- Understand the concept and methods of ground water management.

TEXTBOOKS:

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

REFERENCES:

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

EN8611 ENVIRONMENTAL INSTRUMENTATION LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To train the students on the use of different instruments used for performance monitoring and testing of equipment in wastewater treatment, air pollution control, effluent analysis and emission monitoring.

LIST OF EXPERIMENTS:

A. Sample Collection, Handling and Preservation

- Sampling Protocol: Planning a Sampling Strategy
- The Representative Sample: Random vs. Judgmental Sampling
- Sampling Equipment: Devices and Containers for soil, air and water.
- Sampling Techniques: soil and water
- Sampling Techniques: gases and vapors
- Sample Documentation and Preservation, Chain of Custody (COC)

B. Methods of Analysis

- Sample Preparation: Interferences and Detection Limits
- Quality Control
- Field Quality Control: Duplicate Samples
- Quality Control in the Laboratory: Equipment Calibration, Matrix spike and Blank
- samples.

C. Electrode (potentiometric) Methods:

- Use of bench top and field model pH meters
- Use of Dissolved Oxygen Meters.
- Use of TDS Meters.

D. Spectrophotometry

- Estimation of Phosphate.
- Estimation of Hydrocarbon.
- Estimation of Nitrogen.
- Estimation of Heavy Metals.

E. Chromatography

- Liquid/Gas Chromatography.

TOTAL : 60 PERIODS

OUTCOMES:

The students completing the course will have

- ability to collect, handle, preserve and analyse water, wastewater and solid samples
- ability to conduct potentiometric measurements
- ability to use spectrophotometer, liquid/gas chromatograph for analysis of environmental samples

REFERENCES:

1. Douglas A. Skoog and Donald M. West, Analytical chemistry: An introduction, CBS publishing Japan Ltd. New York, 1986.
2. Sawyer.C.N.and McCarty P. L. Chemistry for environmental engineering, McGraw Hill Publications, 4th edition, 1994.
3. Standards Methods for the Examination of Water and Waste Water, 17th Edition, WPCF, APHA and AWWA, USA, 1989.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	Sampling devices for water, wastewater and soil	1
2.	pH meter	3
3.	DO meter	1
4.	EC meter	2
5.	UV - Visible spectrophotometer	1
6.	HPLC	1
7.	Flame Photometer	1
8.	AAS	1
9.	GC	1
10.	Glasswares such as Pipette, Burette etc	1 for each student

EN8701 HAZARDOUS WASTEMANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- At the end of the course the student shall be able to understand the type, nature and treatment of hazardous wastes.

UNIT I INTRODUCTION 10

Hazardous waste definition- Regulatory aspects of Hazardous Waste Management in India – Sources, characterization, categories - Analysis of hazardous waste -Physical and biological routes of transport of hazardous substances

UNIT II HAZARDOUS WASTES MANAGEMENT 10

Handling, collection, storage and transport- TSDF concept -Hazardous waste treatment technologies-Physical, chemical and thermal treatment of hazardous waste–Solidification-Chemical fixation–Encapsulation-Pyrolysis and Incineration–Biological Treatment of Hazardous Waste, Hazardous waste landfills-Site selections-design and operation-HW reduction- Recycling and reuse–Hazardous Site remediation – onsite and offsite Techniques

UNIT III BIOMEDICAL WASTE MANAGEMENT 9

Biomedical waste–Definition– Regulatory aspects of Biomedical Waste. Sources–Classification–Waste Handling and Collection–Segregation and labeling- Treatment – autoclaving, Incineration, Chemical Disinfection - ,disposal. Infection control Practices.

UNIT IV RADIOACTIVE WASTE MANAGEMENT 8

Radioactive waste: Definition–Measurement of Radiation -Sources- Effects -Low level and high level radioactive wastes-Transuranic Waste-and their management–Uranium Mine and Tailings, Characterization – Treatment and Control - Radiation standard by ICRP and AERB.

UNIT V E-WASTE MANAGEMENT 8

Regulatory aspects of E-l Waste management, Waste characteristics- Generation–- Collection - Material Composition-Transport– Treatment and disposal. Recycling and Recovery – intergraded e-waste management

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have

- an insight into the characterization of hazardous wastes and the role of different stakeholders under the national legal framework
- ability to plan minimization of hazardous wastes
- ability to design facilities for the storage, transport, processing and disposal of hazardous wastes

TEXT BOOKS:

1. Hazardous waste management CharlesA.Wentz.Second edition 1995.McGraw Hill nternational.
2. Hazardous waste management Michael D. La Gerga, PhilipL Buckingham, Jeffrey C. Evans, Second edition 2010.Waveland Press.
3. Criteria for hazardous waste landfills–CPCBguidelines2000

REFERENCES

1. Basic Hazardous waste management, "William C.Blackman.Jr", Third Edition, 2001, Lewis Publishers ,
2. Integrated solidwaste management George Techobanoglous, Hilary Theisen & Sammuel A.Vigil.
3. Criteria for hazardous waste landfills–CPCB guidelines 2000..
4. Standard handbook of Hazardous waste treatment and disposal by Harry M. Freeman, McGraw Hill 1997.
5. Management of Solidwaste in developing countries by Frank Flint off, WH Oregional publication.

EN8702 ENVIRONMENTAL HEALTH AND SAFETY L T P C
3 0 0 3

OBJECTIVE:

- To educate the students the health hazards expected and the safety measures to be followed in the industry.

UNIT I INTRODUCTION 9

Need for developing Environment, Health and Safety systems in work places. Status and relationship of Acts, Regulations and Codes of Practice. Role of trade union safety representatives. International initiatives. Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE 9

Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances. Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks. Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 9

Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

UNIT IV TECHNIQUES OF ENVIRONMENTAL SAFETY 9

Elements of a health and safety policy and methods of its effective implementation and review. Functions and techniques of risk assessment, inspections and audits. Investigation of accidents- Principles of quality management systems in health and safety management. Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organisation for health and safety. Industry specific EHS issues.

UNIT V EDUCATION AND TRAINING 9

Requirements for and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

TOTAL:45 PERIODS

OUTCOMES:

- Introduction the concept of EHS and their international standardization.
- A basic knowledge of how the humans are affected and their management methodologies.
- Will gain a basic understanding of the workplace safety and safety systems and an in depth knowledge of the safety technologies
- Will gain an in depth understanding of the safety audits and how they are implemented.
- Will understand the need of training and education of EHS.

TEXT BOOKS:

1. Environmental and Health and Safety Management by By Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995
2. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005
3. The Facility Manager's Guide to Environmental Health And Safety by Brian Gallant, Government Inst Publ., 2007.

REFERENCES:

1. Slote. L, Handbook of Occupational Safety and Health, JohnWilleyand Sons, NewYork.
2. Heinrich H.W, Industrial Accident Prevention, McGrawHill Company,NewYork,1980.

EN8703 ENVIRONMENTAL IMPACT ASSESSMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on Environmental management and Environmental Impact Assessment.

UNIT I INTRODUCTION 8

Impact of development projects–EIA Notifications-Urbanization–Meaning– Activities involved– Effects on environment-Environmental Impact Assessment(EIA)-Environmental Impact Statement(EIS) –

UNIT II METHODOLOGIES 9

Methods of EIA–Checklists–Matrices–Networks–Cost-benefit analysis–Analysis of alternatives – Uncertainty in EIA

UNIT III PREDICTION ANDASSESSMENT 9

Assessment of Impact on land, water, air, social & cultural activities and on flora& Fauna-Mathematical models-Public participation–SIA Judgment authorities-Rapid EIA.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on environment–Options for mitigation of impact on water, air, land and on flora& fauna- Addressing the issues related to the Project Affected People.

UNIT V CASESTUDIES 10

EIA for infrastructure projects–Dams–Highways–Multi-storey Buildings–Water Supply and Drainage Projects–Waste water treatment plants, STP.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have ability to

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment
- plan environmental impact assessments and environmental management plans
- evaluate environmental impact assessment reports

TEXTBOOKS:

1. Canter,R.L.,“Environmental Impact Assessment”, McGraw-Hill Inc.,New Delhi,1996.
2. Richard K. Morgan., “Environmental Impact Assessment” Kluwer Academic Publications, London, 2002

REFERENCES:

1. John G. Rauand David C Hooten (Ed).,“Environmental Impact Analysis Handbook”, McGraw-Hill BookCompany,1990.
2. “Environmental Assessment Sourcebook”,Vol.I,II&III. The World Bank, Washington, D.C., 1991.
3. Judith Petts,“Handbook of Environmental Impact Assessment Vol.I&II”, Blackwell Science, 1999.

EN8711 ENVIRONMENTAL STRUCTURAL DESIGN AND DRAWING USING CAD L T P C
0 0 4 2

OBJECTIVE:

- To train the students on preparing layout of water and wastewater treatment plants as well as general arrangement diagrams for units in water and wastewater treatment.

LIST OF EXPERIMENTS:

1. Principles of design and drawing of water supply and treatment units from source to distribution system.
2. Principles of design and drawing of wastewater treatment units.
3. Detailed design and drawings of various types of intake structures, conduits and pipes
4. Detailed design and drawings of ground level reservoirs and elevated service reservoirs.
5. Preparation of drawings for various house plumbing fixtures.
6. Design and drawings of various types of distribution systems and various methods of analysis of distribution networks

TOTAL: 60 PERIODS

OUTCOMES:

The students completing the course will have

- ability to prepare flow charts and layouts of water and wastewater treatment plants
- ability to design and detail structures and reactors required for water and wastewater treatment

TEXTBOOKS:

1. Duggal K N: Element of Public Health Engineering, S. Chand and Company Ltd., New Delhi, 1996.
2. Hussain, SK; “Text Book of Water Supply and Sanitary Engineering”; Oxford and IBH Publishing Co, New Delhi

REFERENCES:

1. Birde.G.S and Birde. J.S,“Water supply and sanitary Engineering”, Dhanpat Rai Publications Pvt.Ltd New Delhi, 2001.
2. Rangwala.S.C, “Fundamentals of water supply and sewerage engineering”, Charotar Publishing, 2000.
3. Manual on wastewater and treatment CPHEECO, Ministry of Urban Affairs and Eemployment, Govt. of India, New Delhi, 1990.
4. Shah.C. S., “Water supply and Sanitation”, Galgotia publishing company, New Delhi, 1994.
5. Metcalf and Eddy, “WasteWater Engineering – Treatment and reuse”, Tata McGraw-Hill, New Delhi, 2003.

NOTE TO QUESTION PAPER SETTER:

30% weightage for planning, while the rest 70% for drafting skill.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	Computer system of Pentium IV or equivalent	1 for each student
2.	AUTOCAD	1 copy for a set of 3 students

EN8712 INDUSTRIAL SAFETY LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To impart knowledge on measurement and analysis of noise, ambient air pollution, exhaust gas, as well as on the use of personal protective equipment and fire extinguishers.

UNIT I NOISE LEVEL MEASUREMENT AND ANALYSIS 12

Measurement of noise level - Instrument – Precision type of Noise level meter with frequency and spectrum analyzer - Various sources – Continuous and intermittent noises – Impact identification - Frequency and spectrum analysis of noise - Measurement of whole body vibration for various acceleration- Instrument – vibration simulator and vibration analyzer.

UNIT II AMBIENT AIR POLLUTION AND EXHAUST GAS MEASUREMENTAND ANALYSIS 12

Measurement of Exhaust gas measurement of IC engines: Instrument – Gas analyzer Measurement of breathing zone concentration of dust and fumes: Instrument – Personal air sampler Measurement of respirable and non-respirable dust in ambient air - Measurement of gaseous pollutants in ambient air: Instrument – High volume sampler - Soft computing skills on developing effects of fire & explosion and dispersion: Software – PHAST 1 and ALOHA.

UNIT III STUDY ON PERFORMANCE MONITORING OF WATER AND WASTEWATER TREATMENT PLANTS 12

Study of performance monitoring in wastewater treatment plants – CETPs of industrial units – domestic wastewater treatment plant.

UNIT IV STUDY OF PERSONAL PROTECTIVE EQUIPMENTS 12

Safety helmet – Belt - hand gloves – Goggles - Safety shoe - Gum boots - Ankle shoes - Face shield - Nose mask - Ear plug - ear muff - Apron and leg guard.

UNIT V STUDY OF FIRE EXTINGUISHERS 12

Selection and demonstration of first-aid fire extinguishers: soda acid, foam, carbon dioxide (CO_2), dry chemical powder, halon.

TOTAL : 60 PERIODS

OUTCOMES:

The students completing the course will have ability to

- conduct noise level measurement and exhaust gas measurement
- assess the performance of wastewater treatment plants
- identify and use appropriate personal protective equipments
- use first aid and fire extinguishers

REFERENCES:

1. “Accident Prevention Manual for Industrial Operations” NSC, Chicago, 1982. 4. GREEN, A.E., “High Risk Safety Technology”, John Wiley and Sons,. 1984.
2. Petroleum Act and Rules, Government of India, 1934
3. Carbide of Calcium Rules, Government of India, 1987

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	Noise level meter	2
2.	High volume sampler with impinger attachment facility	1
-3.	Lab scale fire extinguishers	1 in each type
4.	Personal protective equipment	1 in each type for demo
5.	Gas analyser	1

EN8713 **INDUSTRIAL TRAINING**
(4 WEEKS DURING VI SEMESTER –SUMMER) **L T P C**
0 0 0 2

OBJECTIVE:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

SYLLABUS:

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

EN8801 **ESTIMATION AND COSTING** **L T P C**
3 0 0 3

OBJECTIVE:

- To offer knowledge in estimation, tender practices, contract procedures, and valuation.
- The student will be able to prepare estimates, call for tenders and execute works.

UNIT I QUANTITY ESTIMATION 9

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, roads, canals and hydraulic structures using computer softwares.

UNIT II RATE ANALYSIS AND COSTING 9

Standard Data – Observed Data – Schedule of rates – Market rates – Assessment of Man Hours and Machineries for common civil works – Rate Analysis – Cost Estimates using Computer softwares

UNIT III SPECIFICATIONS AND TENDERS 9

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering-Digital signature certificates- Encrypting -Decrypting – Reverse auctions.

UNIT IV CONTRACTS 9

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

UNIT V VALUATION 9

Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings – Valuation of plant and machineries.

TOTAL: 45 PERIODS

OUTCOMES:

The student will be able to

- Estimate the quantities for buildings,
- Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
- Understand types of specifications, principles for report preparation, tender notices types.
- Gain knowledge on types of contracts
- Evaluate valuation for building and land.

TEXTBOOKS:

1. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006.
2. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Estern Law House, 1998.

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD.
2. Tamil Nadu Transparencies in Tenders Act, 1998.
3. Arbitration and Conciliation Act, 1996.
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996.
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003.

EN8811 PROJECT WORK L T P C
0 0 20 10

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

- The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

OUTCOME:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

EN8001 GIS FOR ENVIRONMENTAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the fundamentals of remote sensing and its applilcations in the field of environmental engineering.

UNIT I FUNDAMENTALS OF REMOTE SENSING 9

Introduction to remote sensing – Principles of Electro – Magnetic Radiation – Energy /Matter interaction with Atmosphere and land surface – spectral reflectance of earth materials and vegetation – Data products.

UNIT II AERIAL PHOTOGRAPHY AND SATELLITE REMOTE SENSING 9

Aerial Photography – Photogrammetry And Visual Image Interpretation. Various satellites in orbit and their sensors – Resolutions – Multispectral Remote Sensing system (MSS) and design – VISIBLE - NIR remote sensing - Thermal IR Radiation properties, systems and application – Microwave and LIDAR remote sensing – Principles and applications.

UNIT III DATA ANALYSIS AND GIS 9

Data Analysis – Visual interpretation and digital image processing – Classification. Introduction to GIS, concepts and data base structure, various GIS software.

UNIT IV REMOTE SENSING AND GIS APPLICATIONS 9

Applications of Remote sensing and GIS – Management and Monitoring of Land, air, water and pollution studies – conservation of resources – coastal zone management – Limitations.

UNIT V LABORATORY PRACTICES 9

Data sources – Visual interpretation - digital image processing – Introduction to ENVI image processing software – GIS / Data Analysis in ARC GIS.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the fundamentals of remote sensing, aerial photography and digital image processing
- ability to carryout data analysis using GIS for management and monitoring of land, air, water and pollution studies including conservation of resources
- ability to use image processing software and analysis in ARC GIS

TEXTBOOKS:

1. Anji Reddy,"Remote Sensing and Geographical Information system", B S publications 2001.
2. Srinivas M.G. "Remote sensing applications", Narosa publishing house, 2001.
3. Chandra. A M and Ghosh S.K. "Remote Sensing and Geographical Information System", Narosa Publishing House, 2006.

REFERENCES:

1. Lintz, J.and Simonet, Remote Sensing of Environment, Addison Wesley Publishing Company, 1994.
2. Burroughs P.A, Principles of Geographical Information System, Oxford University Press, 1998.
3. Thomas M Lille sand, Rupiah W. Kiefer & Jonathan W.Chip man "Remote sensing and Image Interpretation" John Wiley Sons, 2004.
4. Kumar S. , Basics of Remote Sensing and GIS, Firewall Media, 2005

EN8002 URBAN AND RURAL SANITATION L T P C
3 0 0 3

OBJECTIVE:

- To expose the students the various aspects of urban and rural sanitation.

UNIT I PRINCIPLES OF HEALTHFUL HOUSING 9

Control of environment – Engineering methods - Modes of transmission of diseases – Mosquitoes and Flies - Life cycle, important characteristics and control measures of carriers. Basic principles of healthful housing - heating - ventilation - lighting - air conditioning – noise control in residential buildings.

UNIT II PLUMBING AND SWIMMING POOL SANITATION 9

Scope of plumbing - definition of plumbing terms - general principles of good plumbing system – water seal - types of traps, siphonage – design of plumbing system for multistory buildings - plumbing codes and standards. Transmission of diseases in swimming pools - quality standards of pool water - design features of pools and their appurtenances.

UNIT III REFUSE AND FOOD SANITATION 9

Refuse characteristics in urban and rural areas - conditions and factors affecting collection, quantity and conveyance of solid waste - disposal methods - incineration - design of incinerators sanitary landfill - composting - waste recycling - biogas and gobar gas plants. Food borne and food caused diseases – food poisoning - food preservation – precautions in the design of kitchen - bactericidal treatment of kitchen utensils - Bacteriological contents of milk borne diseases - essential of milk sanitation - dairy barn sanitation - pasteurization methods - milk tests.

UNIT IV URBAN AND RURAL WATER SUPPLY SYSTEM 9

Water supply arrangements in urban buildings - design of water supply systems for multistoried buildings - consideration in the development of water supply programmes for rural areas - health and economical aspects in the design and installation of rural water supply systems - methods of construction and development of different types of wells - sanitation of rural wells - pumps for rural wells - treatment methods for rural water supply.

UNIT V RURAL SANITATION 9

Layout of drainage systems in urban domestic areas - methods of disposal of night soil in rural areas - different privies - Twinpit pourflush toilets, VIP latrines - water carriage method of sewage disposal - cesspools and seepage pits - septic tank systems - oxidation ponds - aerated lagoons.

TOTAL:45PERIODS

OUTCOMES:

The students completing the course will have the ability to

- describe basic principles of healthful housing, plumbing systems, rural water supply and sanitation
- plan appropriate water supply and sanitation systems for multistoried buildings and rural areas

TEXTBOOKS:

1. Salvato, "Environmental Sanitation", John Wiley & Sons, New York, 1982.
2. Ehler and Steel, “Municipal Rural Sanitation”, McGraw Hill Book Co.,New York, 1964.
3. Wagner E.G. and Lanoix J.N., “Water supply for rural areas and small communities”, World Health Organisation Publication, Geneva, 1958.

REFERENCE:

1. Babbit H.E and Donald J.J., Water supply Engineering, McGraw Hill Book Co., New York, 1962.

EN8003 SUSTAINABLE DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the principles for balancing social, economic and environmental dimensions of development and the associated international and national frameworks

UNIT I INTRODUCTION 9

Status of environment – Environmental, Social and Economical issues – Need for sustainability – Nine ways to achieve sustainability – population, resources, development and environment.

UNIT II CHALLENGES OF SUSTAINABLE DEVELOPMENT AND GLOBAL ENVIRONMENTAL ISSUES 9

Concept of sustainability – Factors governing sustainable development – Linkages among sustainable development- Environment and poverty – Determinants of sustainable development – Case studies on sustainable development - Population, income and urbanization – Health care – Food, fisheries and agriculture – Materials and energy flows.

UNIT III SUSTAINABLE DEVELOPMENT INDICATORS 9

Need for indicators – Statistical procedures – Aggregating indicators – Use of principal component analysis – Three environmental quality indices.

UNIT IV ENVIRONMENTAL ASSESSMENT 9

National environmental policy act of 1969 – Environmental Impact Assessment – Project categories based on environmental impacts – Impact identification methods – Environmental impact assessment process.

UNIT V ENVIRONMENTAL MANAGEMENT AND SOCIAL DIMENSIONS 9

Revisiting complex issues – Sector policies concerning the environment – Institutional framework for environmental management - Achievements in environmental management - People's perception of the environment – Participatory development – NGOs – Gender and development – Indigenous peoples – Social exclusion and analysis.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have ability to

- describe the national and global environmental, economic and social issues and the principles of different sustainable development frameworks
- apply the sustainable development principles during the planning of developmental activities

TEXTBOOKS:

1. Sayer, J. and Campbell, B., "The Science of Sustainable Development: Local Livelihoods and the Global Environment" (Biological Conservation, Restoration &Sustainability), Cambridge University Press, London, 2003.
2. Kirkby, J., O'Keefe P. and Timberlake, "Sustainable Development", Earth scan Publication, London, 1993.
3. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, "An introduction to sustainable development", Glen Educational Foundation, 2008.

REFERENCES:

1. Jennifer A. Elliott, "An introduction to sustainable development". London: Routledge: Taylor and Francis group, 2001.
2. Low, N. Global ethics and environment. London: Routledge. 1999.
3. Douglas Muschett, Principles of Sustainable Development, St. Lucie Press, 1997.

CE8392 **ENGINEERING GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

UNIT II MINEROLOGY 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III PETROLOGY 9

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings - Hydrogeological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing this course

- Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.
- Will get basics knowledge on properties of minerals.
- Gain knowledge about types of rocks, their distribution and uses.
- Will understand the methods of study on geological structure.
- Will understand the application of geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbor

TEXT BOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
3. Gokhale KVGK, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.
4. Chenna Kesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
5. Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009.

REFERENCES:

1. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
2. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
3. Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.

GE8071 DISASTER MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13**:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE8074 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVE:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi

EN8004 AIR AND WATER QUALITY MODELLING L T P C
3 0 0 3

OBJECTIVE:

- After completing the course, the students will be knowing the modeling concept of air and water quality and its applicability in the Control of Air and Water pollution

UNIT I MODELING CONCEPTS 9

Casual and statistical models-Characteristics- Steps in model development - Importance of model building- conservation of mass and mass balance –calibration and verification of models.

UNIT II AIR QUALITY MODELLING 9

Modelling for nonreactive pollutants, single source, short term impact, multiple sources and area sources, Metrological Modelling – Diagnostic Models –Prognostic Models - diffusion models, modifications of Gaussian plume equation -long term average- receptor oriented and source oriented air pollution models ,Numerical Models, model performance, accuracy and utilization.

UNIT III WATER QUALITY MODELS 9

Mass balance equation –Mathematics of Pollutant Transport – Advection- dispersion-In-Water Transformation- Waste load allocations – Basic mechanisms of river self-purification, Dissolved Oxygen dynamics Streeter-Phelps and Dobbins models, Pollutant and nutrient dynamics, Temperature dependence and transport, Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modelling - Contaminant solute transport equation, Numerical methods.

UNIT IV COMPUTER BASED SIMULATION 9

Formulation of linear optimization models. Linear programming. Sensitivity testing and duality. Solution techniques and computer programming; Formulation of linear optimization models. Finite difference and finite element method of pollutant dispersion – Optimization river pollutant and management models -Application of models- simulation, parameter estimation and experimental design. Model Uncertainty and reliability.

UNIT V SOFTWARES 9

Air quality Model -ARMOD, CALPUFF. - UNAMAP– BLP-RAM-ISCMPTER-CRSTER-Surface water quality models -HSPF, QUAL2K,

TOTAL: 45 PERIODS

OUTCOMES:

- Describe the modeling concepts.
- Will be able to understand the importance of Diagnostic Models.
- The students will learn the mass balance equation and knowing the water quality models.
- The ability to apply the linear programming models and experimental design.
- Will get an unsight on air quality model softwares.

REFERENCES :

1. Deaton, M.L and Winebrake, J.J., Dynamic Modelling of Environmental Systems, Verlag, 2000.
2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, 2008.
3. Arthur C.Stern., Air Pollution (Third Ed.) Volume I – Air Pollutants, their transformation and Transport, (Ed.), Academic Press, 2006.
4. Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley & Sons Inc., New York, 2013
5. Dykes, A.P., Mulligan, M., and Wainwright, J, Monitoring and Modelling dynamic environment, Wiley – Blackwell 2015.
6. PaoloZannetti ., “Air Pollution Modelling – Theories, computation Methods and available Software “ Springer. Newyork , 1990
7. M.Benedini .,G.Tsakiris “Water Quality Modelling for Rivers and streams “ Springer , New York , 2013

EN8005 RENEWABLE ENERGY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide knowledge about various renewable energy technologies
- To provide knowledge about various possible hybrid energy systems
- To gain knowledge about application of various renewable energy technologies

UNIT I INTRODUCTION 9

Primary energy sources, renewable vs. non-renewable energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

UNIT II SOLAR ENERGY 9

Solar Radiation and its measurements, Solar Thermal Energy Conversion from Plate Solar Collectors-Applications of Solar Thermal Energy use of low and medium, high temperature and recent advances in industry and buildings

UNIT III WIND ENERGY 9

Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications. Hybrid systems - safety and environmental aspects,

UNIT IV BIO-ENERGY 9

Energy from biomass, Principle of biomass conversion technologies/process and their classification, Bio gas generation, types of biogas plants, selection of site for biogas plant, classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies,

UNIT V OTHER TYPES OF ENERGY 9

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini hydel power plants.

OUTCOME: TOTAL: 45 PERIODS

- This subject gives a brief knowledge about the various renewable energy technologies and their applications.

REFERENCES:

1. Non-Conventional Energy Sources /G.D. Rai, Khanna Publishers
2. Renewable Energy Resources – Twidell & Wier, CRC Press(Taylor & Francis)
3. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non-Conventional Energy Systems / K Mittal /Wheeler
6. Renewable energy sources and emerging technologies by D.P.Kothari, K.C.Singhal, P.H.I.

EN8006 OPERATION AND MAINTENANCE OF WATER AND WASTEWATER TREATMENT PLANTS **L T P C**
3 0 0 3

OBJECTIVE:

- To educate the student on the various Operation & Maintenance aspects of Common Effluent Treatment Plants.

UNIT I ELEMENTS OF OPERATION AND MAINTENANCE OF TREATMENT PLANTS 8

Introduction - Plant operation roles - Plant Maintenance program- Knowledge of process and equipment - Proper and adequate tools - Spare units and parts - Laboratory control- Records and Reports- Housekeeping - Safety measures - Corrosion prevention and control

UNIT II SAMPLING AND ANALYSIS OF EFFLUENTS 10

Introduction - Sampling procedures - Analysis of samples- Determination of pH using pH meter – Colour – Conductivity – Solids - Estimation of dissolved oxygen (D.O) – winkler's method - Estimation of biochemical oxygen demand (BOD) - Estimation of biochemical oxygen demand (COD) - Estimation of chloride (Mohr's method) - Estimation of Sulphate (turbidimetric method) - Code of practice for analytical laboratories - Work tables – Glassware – Safety - Handling in laboratory - Pipetting and others - Laboratory equipment and glassware's – Equipments - Glassware's – Case Studies.

UNIT III OPERATION AND MAINTENANCE OF TREATMENT UNITS 10

Screening - Bar screens - Equalisation - Equalisation basins - Strategy for operation – Physico-chemical treatment- processes- - Flash mixer – Clarifiers - Operation guidelines for clarifier - Operation and maintenance - Start-up and maintenance inspection –Chemical feed systems - Rapid mix and flocculators – Clarifiers - Normal operation - Chemical feed system - Flash mixer - Flocculation tanks – Clarifiers - Abnormal operation - Safe working habits - Jar test for selection of coagulant and their dosages- Sludge management – Case Studies.

UNIT IV OPERATION AND MAINTENANCE OF COLLECTION AND CONVEYANCE SYSTEMS 9

Operation and Maintenance of water/wastewater collection and conveyance systems - Functions of collection system – Components of collection system – Conduits or pipes – Manholes – Ventilating shaft – Maintenance of collection system – Problems generally faced – Clogging of pipes – Hazards – Precautions – Precautions against gas hazards – Precautions against infections – Devices for cleaning the conduits – Preventive maintenance – Corrective maintenance – Case Studies.

UNIT V OPERATION AND MAINTENANCE OF MECHANICAL AND ELECTRICAL EQUIPMENT IN TREATMENT PLANTS 8

Operation of General Mechanical and electrical equipment in treatment plants- metering-online line monitoring systems of units, pumps- Motors and Divers-paddles, skimmer

TOTAL: 45 PERIODS

OUTCOMES:

- Will get an basic concepts on operation and maintenanace of waste water treatment plants.
- The ability to gain the knowledge on effluent analysis and sampling techniques.
- Will get the clear concepts and knowledge on the operation of treatment plants.
- The students will learn the collection system and its safety precautions.
- Will get an insight of maintenance of treatment plants.

REFERENCES:

1. Ghose D.N. (1991) "Operation and Maintenance of Sewage treatment plants CBS publishers and distributors, Delhi.
2. Kenneth D. Kerri, Bill B. Dendy, John Brady and Willam Crooks (1996) "Industrial Waste Treatment – A field study training program" Third edition, prepared by California sate University in Cooperation with the California water pollution on control association for the USEPA.

3. Metcalf and Eddy (1996) “Wastewater Engineering – Treatment – Disposal – Reuse” Tata McGraw Hill. 3rd Edition.
4. Sawyer C.N. Mccarty P.L. and Parkin G.F. (1994) “Chemistry for Environmental Engineering” McGraw Hill publishers.
5. UNIDO (1999) “Manual on Design, Operation and Maintenance of Tannery Effluent Treatment Plant” UNIDO, regional workshop, 13 – 14 October

GE8075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, “Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

EN8007 ENVIRONMENTAL RISK MANAGEMENT

L T P C
3 0 0 3

OBJECTIVE:

- 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

Sources of Environmental hazards – Environmental and ecological risks – Environmental risk assessment framework – Regulatory perspectives and requirements – Risk Analysis and Management and historical perspective; Social benefit Vs technological risks; Path to risk analysis; Perception of risk, risk assessment in different disciplines.

UNIT II ELEMENTS OF ENVIRONMENTAL RISK ASSESSMENT 10

Hazard identification and accounting – Fate and behaviour of toxics and persistent substances in the environment – Properties, processes and parameters that control fate and transport of contaminants – Receptor exposure to Environmental Contaminants – Dose Response Evaluation – Exposure Assessment – Exposure Factors, Slope Factors, Dose Response calculations and Dose Conversion Factors – Risk Characterization and consequence determination – Vulnerability assessment – Uncertainty analysis.

UNIT III TOOLS AND METHODS FOR RISK ASSESSMENT 10

HAZOP and FEMA methods – Cause failure analysis – Event tree and fault tree modeling and analysis – Multimedia and multipathway exposure modeling of contaminant migration for estimation of contaminant concentrations in air, water, soils, vegetation and animal products – Estimation of carcinogenic and non carcinogenic risks to human health – Methods in Ecological risk assessment – Probabilistic risk assessments – radiation risk assessment – Data sources and evaluation.

UNIT IV RISK MANAGEMENT 8

Risk communication and Risk Perception – comparative risks – Risk based decision making – Risk based environmental standard setting – Risk Cost Banefit optimization and tradeoffs – Emergency Preparedness Plans – Emergency planning for chemical agent release – Design of risk management programs – risk based remediation; Risk communication, adaptive management, precaution and stake holder involvement.

UNIT V APPLICATIONS 9

Case studies on risk assessment and management for hazardous chemical storage – Chemical industries – Tanneries – Textile industries – Mineral processing and Petrochemical plants – Hazardous waste disposal facilities – nuclear power plants – contaminated site remediation – Case histories on Bhopal, Chernobyl, Seveso, Three Mile Island.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will gain the knowledge related to the broad field of environmental risk assessment.
- Describe the elements on environmental behavior of toxics.
- The ability to apply the methods for the risk assessment.
- Will have a basic understanding of environmental risk management.
- Will get insight on risk assessment case studies related to the industrial waste.

REFERENCES:

1. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York,1996.

3. Kofi Asante Duah “Risk Assessment in Environmental management”, John Wiley and sons, Singapore, 1998.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.
5. Risks and Decisions for Conservation and environmental management, Mark Burman, Cambridge University Press.
6. Susan L |Cutter “Environmental Risks and Hazards” Prentice Hall of India, New Delhi 1999.
7. Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997

EN8008 ENVIRONMENTAL TOXICOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on toxicology, risk assessment and remediation.

UNIT I BIOCHEMICAL TOXICOLOGY 10

Toxicants, Distribution, Metabolism of toxicants, sites of action, classification of toxicity – acute and sub-acute toxicity bioassay, Factors influencing toxicity, Elimination of toxicants, Methods of toxicity testing – Evaluation - statistical assessment, sediment toxicity, Bio- chemical markers/indicators, Toxicokinetics, Bioconcentration, Bio-accumulation and Bio magnification in the environment.

UNIT II GENETIC TOXICOLOGY 10

Xenobiotics – Chemical carcinogenesis – Genotoxicity assays – Neurotoxicity, Skin toxicity, Immunotoxicity. Renal toxicity, Endocrine disruptors, hormones, receptors.

UNIT III INDUSTRIAL TOXICOLOGY 9

Toxicity of monomers, solvents, intermediates, products – toxic substrates – Metals and other inorganic Chemicals, Organic Compounds – Persistent chemicals.

UNIT IV RISK ASSESSMENT AND REMEDIATION 9

Procedures for assessing the risk – Risk measurement and Mitigation of environmental disorders – Factors in risk assessment.

UNIT V CASE STUDIES IN RISK ASSESSMENT 7

Pharmaceutical, Petroleum, Carbide industry, Textile and Leather Industry Case study.

TOTAL:45 PERIODS

OUTCOMES:

- To gain knowledge on Toxicology.
- Will able to inderstand the genetic toxicity and its effects.
- The students will learn the toxicity of chemicals from industrial effluents.
- describe the risk measurement and reclamation.
- Will get an insight on risk assessment case studies related to the industries.

REFERENCES:

1. Crosby, D.G.1998. Environmental Toxicology and Chemistry, Oxford University Press, New York.
2. Hodgson, A. 2004, A text book of Modern Toxicology, John Wiley and Sons, Inc.NJ.
3. Walker, C. H. et al., 1996. Principles of Ecotoxicology, Taylor and Francis, Inc, ISBN 074803557.
4. Ballantyne, B. Marrs, T. M and Syversen, T. 1999. General and Applied Toxicology 2nd ed. Mac Millan Reference Ltd.
5. Hodson, E. and R.C. Smart, 2001, Introduction to Bio-chemical toxicology, Wiley Interscience, New York.

EN8009 SOIL AND GROUNDWATER REMEDIATION L T P C
3 0 0 3

OBJECTIVE:

- The student acquires the knowledge on problem associated with soil contamination, safety disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

UNIT I PHYSICS AND CHEMISTRY OF SOIL 8

Soil formation – composition – soil fabric – mass-volume relationship – Index properties and soil classification – hydraulic and consolidation characteristics – Chemical properties – soil pH – Surface charge and point of zero charge – Anion and Cation exchange capacity of clays– Specific surface area- bonding in clays-soil pollution-factors governing soil-pollutant interaction.

UNIT II INORGANIC AND ORGANIC GEOCHEMISTRY 9

Inorganic geochemistry – Metal contamination – Distribution of metals in soils – Geochemical processes controlling the distribution of metals in soils – Chemical analysis of metal in soil – Organic geochemistry – Organic contamination – Distribution of NAPLs in soils – Process controlling the distribution of NAPLs in soil – Chemical analysis of NAPLs in soils.

UNIT III CONTAMINANT FATE AND TRANSPORT IN SOIL 9

Transport processes – advection – diffusion – dispersion – chemical mass transfer processes – sorption and desorption – precipitation and dissolution – oxidation and reduction – acid base reaction – complexation – ion exchange – volatilization – hydrolysis – biological process-microbial transformation of heavy metals.

UNIT IV GROUND IMPROVEMENT TECHNIQUES IN WASTE MANAGEMENT 9

Role of Ground Improvement-Drainage and Ground Water Lowering-Electro osmotic Methods-Diaphragm walls-Thermal and Freezing methods - Insitu Densification - Deep Compaction - Dynamic Compaction -Blasting Sand piles pre-loading with sand drainsStone Columns Lime piles-Earth reinforcement -rock bolts Cables and guniting Geotextiles as reinforcement Filtration. Drainage and Erosion control.

UNIT V SOIL REMEDIATION TECHNOLOGIES 10

Contaminated site characterization – Containment – Soil vapour extraction - Soil washing – Solidification and Stabilization – Electro-kinetic remediation – Thermal desorption – Vitrification – In-situ and Ex-situ Bioremediation – Phytoremediation – Soil fracturing – Biostimulation – Bioaugmentation –Chemical oxidation and reduction.

TOTAL: 45 PERIODS

OUTCOMES:

- students obtain the knowledge on properties of soil.
- describe the inorganic and organic Geochemistry.
- Will have a fundamental concepts on transport processes in soil.
- Will gain ability to apply idea on ground improvement techniques.
- The students will learn the soil remediation methods.

REFERENCES:

1. Calvin Rose, An Introduction to the Environmental Physics of Soil, Water and Water Sheds, Cambridge University Press, 2004.
2. Paul Nathanail C. and Paul Bardos R., Reclamation of Contaminated Land, John Wiley & Sons Limited, 2004.
3. Hari D. Sharma and Krishna R. Reddy, Geo-Environmental Engineering: Site Remediation, Water Contaminant and Emerging Water Management Technologies, John Wiley & Sons Limited, 2004.
4. Marcel Vander Perk, Soil and Water Contamination from Molecular to Catchment Scale, Taylor & Francis, 2006.
5. William J. Deutsch, Groundwater Geochemistry : Fundamentals and Applications to Contamination, Lewis Publishers, 1997.

EN8010 ENVIRONMENTAL MANAGEMENT SYSTEM L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge of systems approach to Environmental Management and skills for environmental performance in terms of legal compliance, pollution prevention and continual improvement.
- To enable the students to develop environmental management systems for organisations as per ISO 14001 and also to carry out Environmental Audit.

UNIT I ENVIRONMENTAL MANAGEMENT PRINCIPLES 9

Unique characteristics of Local, Regional and Global Environmental Problems – *PDCA Cycle and* Systems approach to Corporate environmental management – Business and Sustainability - Business Charter for Sustainable Production and Consumption –Environmental Stewardship – National policies on environment, abatement of pollution and conservation of resources – Charter on Corporate responsibility for Environmental protection

UNIT II ENVIRONMENTAL PERFORMANCE EVALUATION 9

Environmental quality objectives – Environmental performance evaluation: Operational Performance Indicators, Management Performance Indicators – Environmental condition Indicators- benchmarking Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards – ISO 14000 Standards

UNIT III PREVENTIVE ENVIRONMENTAL MANAGEMENT 9

Pollution control Vs Pollution Prevention - Four Stages and nine approaches of Pollution Prevention - source reduction, raw material substitution, toxic use reduction and elimination, process modification –Material balance – Technical, economical and environmental feasibility evaluation of Pollution Prevention options in selected industries – Design for the Environment over Product cycle.

UNIT IV ENVIRONMENTAL MANAGEMENT SYSTEM 10

EMS as per ISO 14001– benefits and barriers of EMS – Environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements-objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

UNIT V ENVIRONMENTAL AUDIT 8

Environmental management system audit as per ISO 19011 – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to be able to

- understand the elements of Corporate Environmental Management system complying to international environmental management system standards
- critically evaluate strategies within Environmental Management from a systems perspective.
- Lead pollution prevention assessment team and implement waste minimization options
- develop, Implement, maintain and audit Environmental Management systems for Organizations.

TEXT BOOKS:

1. Marek Bugdol and Piotr Jedynak, Integrated Management Systems, Springer International, 2015.
2. Ken Whitelaw, ISO 14001 Environmental Systems Handbook, Elsevier Butterworth-Heinemann, 2004

REFERENCES:

1. ISO 14001/14004/: Environmental management systems – Requirements and Guidelines – International Organization for Standardization, 2015
2. ISO 19011:, "Guidelines for quality and/or Environmental Management System
3. Auditing, Bureau of Indian Standards, New Delhi, 2015
4. Barrow, C. J.. Environmental Management for Sustainable Development. Taylor & Francis, Oxon, UK, 2006
5. Paul L Bishop 'Pollution Prevention: Fundamentals and Practice', McGraw- Hill
6. International, Boston, 2004.
7. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001
8. dol and Piotr Jedynak, Integrated Management Systems, Springer International Publishing.

EN8011 PROJECT FORMULATION AND IMPLEMENTATION L T P C
3 0 0 3

OBJECTIVES:

- To Examine the techniques and procedures relevant for project planning and implementation in developing countries, especially infrastructure projects pertaining to environmental sector
- To enable the students to understand about project identification, feasibility analysis, design, financing, implementation, monitoring and evaluation

UNIT I INTRODUCTION TO PROJECT FORMULATION 9

Overview of the project cycle – Planning Process and project planning – Search for Project ideas – Strategies in Capital allocation – Key elements in project formulation – Methods and tools for Project formulation – Project identification and selection – Preparation of feasibility reports as per Government policies (AMRUT / JnNURM)

UNIT II PROJECT ANALYSIS 8

Capital Cost Estimation – Market and demand analysis – Technical analysis – Environmental analysis – Financial and economic analysis – Cash flow generation

UNIT III PROJECT APPRAISAL 10

Time and value of money – Investment Criteria – Internal Rate of Return – Net Present Value, Cost Benefit Analysis, and social cost benefit analysis – Project risk analysis – Appraisal of marketing strategy – Pricing and credit worthiness and management capabilities

UNIT IV PROJECT FINACING AND IMPLEMENTATION 10

Funding options for urban and rural development projects – Tender Procedure – Transparency in Government Tender rules – Organizational aspects in Project management – Network techniques for project management – Resource management - Risk management

UNIT V PROJECT MONITORING AND EVALUATION 8

Need and techniques for monitoring – Service Level Benchmark Performance and process monitoring – Monitoring Schedules – Penalty and Bonus points

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to be able to

- Develop knowledge on important aspects of project formulation, criteria for project appraisal, know about the funding agencies and project management
- Get an idea about service level bench mark performances, Penalty & bonus clauses and its importance in project execution

REFERENCES:

1. Clifford F Gray, Erik W Larson , “Project Management-The Managerial Process” Tata Mcgraw-Hill Publishing Co Ltd
2. Jack Meredith, Samuel J. Mantel Jr. “Project Management- A Managerial Approach”John Wiley and Sons
3. John M Nicholas “Project Management For Business And Technology” Prentice Hall Of India Pvt Ltd
4. James P Lewis “ Project Planning ,Scheduling And Control” Tata Mcgraw-Hill
5. Detailed Project Report : Preparation Toolkit (Sub-mission for Urban Infrastructure and Governance), Government of India
6. www.india.gov.in national portal for India

EN8012 COASTAL ZONE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES :

- At the end of the semester, the student shall be able to understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.

UNIT I COASTAL PROCESSES AND RESOURCES 9

Coastal zone – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Erosion and depositional shore features – Methods of protection – Littoral currents Living resources – Non living resources.

UNIT II WAVE DYNAMICS 9

Wave classification – Airy’s Linear Wave theory – Deep water waves – Shallow water waves – Wave pressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles.

UNIT III WAVE FORECASTING AND TIDES 9

Need for forecasting - SMB and PNJ methods of wave forecasting – Classification of tides – Darwin’s equilibrium theory of tides – Effects on structures – seiches- Surges and Tsunamis .

UNIT IV COASTAL POLLUTION 8

Coastal Pollution – Causes – Effects - Coastal aquifers – Sea water intrusion – Marine Outfall - Impact of sewage disposal in seas.

UNIT V COASTAL ZONE MANAGEMENT 9

Pollution Control strategies – National and International Treaties, Coastal Zone Regulation – Total Maximum Daily Load applications – Protocols in Marine Pollution – ICZM and Sustainable Development

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have ability to

- describe the Coastal zone regulations, coastal processes and wave dynamics
- forecast waves and tides and plan coastal structures including harbours

TEXTBOOKS:

1. Richard Sylvester, "Coastal Engineering, Volume I and II", Elseiner Scientific Publishing Co., 1999
2. Quinn, A.D., "Design & Construction of Ports and Marine Structures", McGraw Hill Book Co., 1999

REFERENCES:

1. Ed. A.T. Ippen, "Coastline Hydrodynamics", McGraw-Hill Inc., New York, 1993
2. Dwivedi, S.N., Natarajan, R and Ramachandran, S.,"Coastal Zone Management in Tamilnadu", Madras, 1991

EN8013 FATE AND TRANSPORT OF CONTAMINANTS L T P C
3 0 0 3

OBJECTIVE:

- To educate the students on the mechanism of transport and fate of contaminants in the geosphere of the environment.

UNIT I EQUILIBRIUM AND TRANSPORT MECHANISMS 10

Concentration and Phase density – air-water equilibrium, Soil-water equilibrium, Earthen solid-air equilibrium. Liquid-chemical equilibrium – thermal equilibrium at environmental interfaces. Diffusion and mass transfer – molecular diffusion- Fick's Law – eddy diffusion – mass transfer theories -fundamentals of heat transfer –heat and mass transfer.

UNIT II EXCHANGE RATES BETWEEN AIR AND WATER 8

Desorption 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 III EXCHANGE RATES BETWEEN WATER AND THE EARTHERN MATERIAL 9

Dissolution of chemicals -natural convection dissolution – 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 IV EXCHANGE RATES BETWEEN AIR AND SOIL 9

Turbulence above the air – soil interface – the Richardson number – chemical flux rates through the lower layer of the atmosphere –evaporation of liquid chemicals spilled on land – chemical flux rates through the upper layer of earthen material.

UNIT V CONTAMINANT TRANSPORT ANALYSIS 9

Potential theory- Potential Functions- Stream Function – Travel time along with Stream Functions- Residential Time Distribution Theory- Analysis of Chemical Spills and Contaminant plumes – Fourier analysis of Initial value – point spill analysis- vertically mix spill analysis- Horizontal Plane Source analysis

TOTAL: 45 PERIODS

OUTCOMES:

- understanding the mechanisms on air,soil and water equilibrium.
- Will have a knowledge of gas exchange rates between air and water
- Will have a knowledge of gas exchange rates between water and soil
- Will have a knowledge of gas exchange rates between air and soil.
- Students will gain on potential analysis and its functions.

TEXT BOOKS:

1. Thibodeaux, L.J, "Environmental Chemo dynamics: Movement Of Chemicals In Air, Water and Soil", 2NDedition ., Wiley - Intercedence, New York, 1996.
2. Schnoor, J.L., Environmental Modelling Fate and Transport of Pollutants in Water, Air and Soil, John Wiley & Sons Inc., New York, 1996.
3. Walton, J.C., Fate and Transport of Contaminants in the Environment, College Publishing 2008.
4. Charbeneau, R.J., Groundwater Hydraulics and Pollutant Transport, Waveland Press, 2006

REFERENCES:

1. Zheng, C., and Bennett, G.D., Applied Contaminants Transport Modelling, Wiley-Blackwell, 2002.
2. Samiullah, Y., Prediction of the Environmental Fate of Contaminants, Springer 2011.
3. David Chin., Water Quality Engineering in Natural Systems: Fate and Transport Process in the Environment, Wiley-Blackwell, 2013.
4. Hemond, H.F., and Fechner, E.J., Chemicals Fate and Transport in the Environment, Academic Press, 2014.
5. Cussler, E.L, "Diffusion: Mass Transfer In Fluid Systems, "Cambridge University press, 1994

GE8077 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOME:

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

EN8014 ENVIRONMENTAL BIOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To educate the students on the principles and application of biotechnology in remediation of pollutants.

UNIT I BASIC CONCEPTS 9

Energy flow and material cycling in ecosystems – productivity in ecosystems. Principles and concepts of environmental biotechnology –Important Microorganisms - Applications – Current status.

UNIT II BIODEGRADATION OF TOXIC WASTES 9

Xenobiotic compounds and recalcitrance – Biodegradation of Xenobiotics – adaptation of microorganisms for nutrients removal – microbial systems – cell and enzyme immobilization – degradation of toxic pollutants – hydrocarbons: non halogenated and halogenated – industrial application and concerns.

UNIT III MECHANISM OF DETOXIFICATION 9

Environmental fate of organic pollutants – mechanisms of detoxification – oxidation, reduction, and dehydrogenation – Microbial system for Heavy metal accumulation - Biotransformation of metals – Biosorption - Microbial leaching of metals – role of extracellular polymers to detect pollutants.

UNIT IV BIO REMEDIATION 9

Biotechnological remedies for environmental pollution – soil, water and air remediation – reclamation concepts bioremediation – biogas technology – Energy and fuel using microorganisms – utilization of energy – waste recovery – microalgal biotechnology and applications in agriculture – alternative strategies, Air Pollution and Deordorization process in Industry – Applications - Case study success stories.

UNIT V RECOMBINANT DNA TECHNOLOGY AND INTELLECTUAL PROPERTY 9

Concepts of rDNA technology, Isolation of DNA, Hybridization, Nucleic acid labeling – Plasmids, Cosmids – Expression vectors – cloning of DNA – transformation and expression – Mutation – Protoplast – isolation – purification – Growth and division of protoplast – protoplast fusion – applications, intellectual property rights – patents and trade marks.

TOTAL:45 PERIODS

OUTCOMES:

- understanding the fundamental concepts of ecosystems.
- The students will get the skills on degradation of toxic wastes.
- will obtain knowledge on biological mechanisms.
- Basic ideologies of energy and reclamation will be known.
- Introduction to the concepts of DNA.

REFERENCES:

1. Martin, A.M. (Ed.), Biological degradation of wastes, Elsevier Applied Science, London, 1991.
2. Purchit, S.S., Biotechnology – Fundamentals and Applications, Student Edition, India, 2004.
3. Manahan, S.E., Environmental Science and Technology, lewis Publ., New York, 1997.
4. Foster, C.F. and D.A.J. Wase, Environmental Biotechnology, Jogdand Environmental Biotechnology.

EN8015 CLIMATE CHANGE, ADAPTATION AND MITIGATION L T P C
3 0 0 3

OBJECTIVES:

- To understand the Earth's Climate System and the concept of Global Warming.
- To comprehend the impact of climate change on society and its mitigation measures.

UNIT I EARTH'S CLIMATE SYSTEM 9

Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies – Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation –The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

UNIT II OBSERVED CHANGES AND ITS CAUSES 9

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling**.**

UNIT III IMPACTS OF CLIMATE CHANGE 9

Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES 9

Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

UNIT V CLEAN TECHNOLOGY AND ENERGY 9

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Biofuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

TOTAL : 45 PERIODS

OUTCOMES:

- The students can understand the concept of climate change and its consequences.
- The students can adopt the methodologies in finding the changes in climate

REFERENCES:

1. Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003
2. Al core ‘inconvenient truth” – video form
3. IPCC Fourth Assessment Report – The AR4 Synthesis Report,
4. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007

EN8016 RESOURCE RECOVERY FROM WASTE L T P C
3 0 0 3

OBJECTIVE:

- To understand the principles and design of recovering materials and energy from wastes through mechanical, biological and thermal methods and manage the undesirable by-products.

UNIT I MECHANICAL PROCESSING FOR MATERIAL RECYCLING 10

Resource recovery for a sustainable development- Material and energy flow management and analysis - Systems and processes for reduction, reuse and recycling -Objectives of Waste Processing-Source Segregation and Hand Sorting-Waste Storage and Conveyance – Shredding – Pulping - Size Separation by Screens- Density Separation by Air Classification –magnetic and electromechanical separation processes- Design Criteria and Equipment selection

UNIT II BIOLOGICAL PROCESSING FOR RESOURCE RECOVERY 10

Mechanisms of Biological Processing – Aerobic Processing of Organic fraction - Composting methods and processes- factors affecting- Design of Windrow Composting Systems- In Vessel Composting- Compost Quality Control- Vermiculture: definition, scope and importance - common species for culture - Environmental requirements - culture methods- Applications of vermiculture- Potentials and constraints for composting in India-Largescale and decentralized plants.

UNIT III BIO-CHEMICAL CONVERSION OF WASTE TO ENERGY 9

Principles and Design of Anaerobic Digesters – Process characterization and control- The biochemistry and microbiology of anaerobic treatment - Toxic substances in anaerobic treatment - Methane generation by Anaerobic Digestion- Anaerobic reactor technologies - Commercial anaerobic Technologies- Single stage and multistage digesters- Digester design and performance- Gas collection systems-Methane Generation and Recovery in Landfills – Biofuels from Biomass

UNIT IV THERMO-CHEMICAL CONVERSION OF WASTE TO ENERGY 8

Principles and Design of Energy Recovery Facilities -Types and principles of energy conversion processes - Incinerator design - Mass Burn and RDF Systems- Composition and calorific value of fuels and waste, Determination of the stoichiometric air consumption, Calculation of the flue gas composition - grate firing designs, boiler design, removal of bottom ash, heat recovery- Emission Controls – flue gas cleaning, de-dusting, flue gas scrubbers, DeNOx processes, dioxins and furans - Alternative thermal processes: co-incineration, pyrolysis, gasification, plasma arc - Process characterization and control- waste heat recovery- Bottom ash: Quantity, quality, treatment, utilization, disposal- Facility design- decentralized mobile plants- Planning and construction of incineration plants

UNIT V CASE STUDIES ON WASTE RECYCLING 8

Recycling technologies for paper, glass, metal, plastic – Used Lead Acid Battery Recycling –End of Life Vehicle Recycling – Electronic Waste Recycling – Waste Oil Recycling – Solvent Recovery - Drivers and barriers for material recycling: social, legal and economic factors - Environmental impacts of waste recycling - Design for the environment: the life cycle approach

TOTAL: 45 PERIODS

OUTCOMES:

On Completion of the Course, the Candidate should:

- Understand the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of materials and energy from waste;
- Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.
- Be able to analyse and describe the potential of solid waste as a secondary raw material, and the associated problems and possibilities in a sustainable society.

REFERENCES:

1 Aarne Veslind and Alan E Rimer (1981), “Unit operations in Resource Recovery Engineering “, Prentice Hall Inc., London
2 Manser A G R, Keeling A A (1996). Practical handbook of processing and recycling on municipal waste. Pub CRC Lewis London, ISBN 1-56670-164
3 Chiumenti, Chiumenti, Diaz, Savage, Eggerth, and Goldstein , *Modern Composting Technologies* JG Press October 2005
4 Charles R Rhyner (1995),Waste Management and Resource Recovery, Lewis Publishers
5 Gary C. Young (2010) Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons , John Wiley & Sons

GE8076 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt. Ltd., New Delhi 2013
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

GE8073 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

OBJECTIVE:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.