SYLLABI FOR M. TECH. ENVIRONMENTAL ENGINEERING

Dr. Babasaheb Ambedkar Technological Unievsrity, Lonere
Proposed Teaching and Examination Scheme for M. Tech. Environmental Engineering (July 2021 onwards)
M.Tech. Environmental Engineering Course Structure
(Credit based Programme)

Sr. No.	Subject Code and Name	Scheme			Credits	Examination Scheme				
		L	P	T		Theory		CA	PR/OR	TOTAL
						Theory	Test			
First Semester										
1	MEN 101 Environmental Management	3	-	1	4	60	20	20	-	100
2	MEN 102 Industrial Pollution Control – Water	3	-	-	3	60	20	20	-	100
3	MEN 103 Industrial Pollution Control – Air	3	-	1	4	60	20	20	-	100
4	MEN 104 Environmental Chemistry	3	-	1	4	60	20	20	-	100
5	MEN 105 Elective I	3	-	-	3	60	20	20	-	100
6	MEN 106 Communication Skills	2	-	-	2	-	-	25	25	50
7	MEN 107.Environmental Monitoring Laboratory	-	2	-	1	-	-	25	25	50
	Total for Semester 1	17	2	3	21	300	100	150	50	600

L : Lecture, T: Tutorial, P: Practical
Elective I: A. Bioinformatics B. Process Engineering Principles C. Enzyme Engineering, D. Accident Prevention and Safety

Second Semester										
1	MEN 201 Wastewater Treatment Plant Design	3	-	1	4	60	20	20	-	100

2	MEN 202 Advanced Wastewater Treatment	3	-	-	3	60	20	20	-	100
3	MEN 203 Energy Conversion and Environment	3	-	-	3	60	20	20	-	100
4	MEN 204 Air Pollution Control Equipment Design	3	-	-	3	60	20	20	-	100
5	MEN 205 Seminar	-	4	-	2	-	-	50	50	100
6	MEN 206 Open Elective**	3	-	-	3	60	20	20	-	100
7	MEN 207 Mini Project	-	4	-	2	-	-	50	50	100
	Total for Semester 2	15	8	1	20	300	100	200	100	700

Third Semester										
1	MEN 301 Project Management and Intellectual property Rights	-	-	-	2	-	-	50	50	100
2	MEN 302 Project Work(Stage I)	-	-	-	10	-	-	50	50	100
	Total for Semester 3	-	-	-	12	-	-	100	100	200

Fourth Semester										
1	MEN 401 Project Work (Stage –II)	-	-	-	20	-	-	100	100	200
	Total for Semester 4	-	-	-	20	-	-	100	100	200

GRADUATE ATTRIBUTES

The Graduate Attributes are the knowledge, skills and attitudes which the students have at the time of graduation. These attributes are generic and are common to all engineering programs. These Graduate Attributes are identified by National Board of Accreditation.

1. Scholarship of Knowledge: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
2. Critical Thinking: Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
3. Problem Solving: Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
4. Research Skill: Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
5. Usage of modern tools: Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.
6. Collaborative and Multidisciplinary work: Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open- mindedness, objectivity and rational analysis in order to achieve common goals

and further the learning of themselves as well as others.

7. Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

8. Communication: Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
9. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
10. Ethical Practices and Social Responsibility: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
11. Independent and Reflective Learning: Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1	Pursue successful industrial, academic and research careers in specialized fields of Environmental Engineering.
PEO2	Apply the knowledge of advanced topics in Environmental Engineering to meet contemporary needs of industry and research.
PEO3	Use modern software tools for design of processes and equipment.
PEO4	Identify issues related to ethics, society, safety, energy and environment in the context of Environmental Engineering applications.
PEO5	Pursue self-learning to remain abreast with latest developments for continuous professional growth.

PROGRAM OUTCOMES: At the end of the program, the student will be able to:

PO1	Model Environmental engineering related processes including air pollution control, water pollution control, advanced wastewater treatment etc.
PO2	Apply modern experimental, computational and simulation tools to address the challenges faced in Environmental and allied engineering industries.
PO3	Implement techniques for minimizing cost and energy requirements in process plants related to environmental engineering.
PO4	Design measures to take care of environment, health and safety issues pertaining to Chemical and allied industries.
PO5	Communicate effectively and demonstrate leadership skills
PO6	Carry out research work independently and innovate novel processes and products
PO7	Practice professional ethics
PO8	Pursue life-long learning as a means of updating knowledge and skills

M. Tech. Environmental Engineering Course Structure
(Credit based Program)

1st Semester

Course Code	Name of the Course	Teaching Scheme (Hours per week)			Credits
		L	T	P	
MEN 101	Environmental Management	3	1	-	**4**
MEN 102	Industrial Pollution Control : Water	3	-	-	**3**
MEN 103	Industrial Pollution Control : Air	3	1	-	**4**
MEN 104	Environmental Chemistry	3	1	-	**4**
MEN 105	Elective I	3	-	-	**3**
MEN 106	Communication Skills	2	-	-	**2**
MEN 107	Environmental Monitoring laboratory	-	-	2	**1**
	Total	**17**	**3**	**2**	**21**

L: Lecture, T: Tutorial, P: Practical

List of Elective Courses

Elective I: A. Bioinformatics B. Process Engineering Principles C. Enzyme Engineering D. Accident Prevention and Safety

2nd Semester

Course Code	Name of the Course	Teaching Scheme (Hours per week)			Credits
		L	T	P	
MEN 201	Wastewater Treatment Plant Design	3	1	-	**4**
MEN 202	Advanced Wastewater Treatment	3	-	-	**3**
MEN 203	Energy Conversion and Environment	3	-	-	**3**
MEN 204	Air Pollution Control Equipment Design	3	-	-	**3**
MEN 205	Seminar	-	-	4	**2**
MEN 206	Open Elective**	3	-	-	**3**
MEN 207	Mini Project	-	-	4	**2**
	Total	**15**	**1**	**8**	**20**

L: Lecture, T: Tutorial, P: Practical

- **Research Methodolgy, Syllabus as prepared by the department offering the course

3rd Semester

Course Code	Name of the Course	Teaching Scheme (Hours per week)			Credits
		L	T	P	
MEN 301	Project Management and Intellectual Property Rights (Self Study)*	-	-	-	**2**
MEN 302	Project Work (Stage –I)	-	-	-	**10**
	Total	-	-	-	**12**

*Evaluation at the end of semester.

4th Semester

Course Code	Name of the Course	Teaching Scheme (Hours per week)			Credits
		L	T	P	
MEN 401	**Project Work (Stage – II)**	-	-	-	**20**

MEN 101 **Environmental Management**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the analogous Environmental quality criteria and standards significant sources of water and air Pollution
CO2	Students should learn to apply the Environmental Engineering concepts to control and management of various types of pollutants.
CO3	Understand the Economic evaluation of Environmental management programs
CO4	Students should learn to control significance of solid and hazardous wastes

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Unit 1

Methodology of Environmental management Review of National and International protocols.

Unit 2

Environmental quality criteria and standards significant sources of water and air Pollution and indices of Environmental quality – Survey and hot spot identification, preparation of management plan – Case studies of major river basin and metropolitan air quality improvement plans.

Unit 3

Noise control significance of solid and hazardous wastes, pesticide residuals and banned chemicals.

Unit 4

Economic evaluation of Environmental management programs – Economic incentives and disincentives as instruments for Environmental management – Tax, subsides, fee, tradable permits.

Units 5&6

Policies on Management of Forests, Coastal Zones and Land use planning.

Text / References:

A. Osencranz, S. Divan, M. L. Noble : Environmental law and policy in India Cases, Materials and Statues, Tripathi Pvt Ltd., Bombay, 1992.

S. Musharraf : Legal aspect of Environmental Pollution and its management. C. B. S. Publishers, Delhi 1992.

W. J. Banmol and W. E. Dates : The Theory of Environmental Policy – Cambridge University Press, 1988.

MEN 102 Industrial Pollution Control – Water

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the Industrial wastewater characterization
CO2	Understand chemical oxidation, sludge dewatering and disposal methods
CO3	Understand method of Control of pollutants
CO4	Understand Control of water, Pollution from organic chemicals

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Units 1

Industrial wastewater characterization,

Unit 2

Treat ability studies – Segregation, battery limit treatment – Pretreatment standards.

Units 3

Control of pollutants – Coagulation, sedimentation, thickening, precipitation, biological oxidation biomethanation, adsorption, ion exchange, membrane separation,

Unit 4

chemical oxidation, sludge dewatering and disposal methods.

Units 5&6

Control of water, Pollution from organic chemicals, refinery, petrochemical, distillery, pulp and paper, textile, fertilizer, tanneries, food and pharmaceutical industries, coke ovens and steel plants.

Text / References:

W. W. Eckenfelder: Industrial Pollution Control, McGraw Hill Int. Edition, 1990.

Metcalf and Eddy: Wastewater Engineering and treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill, 1991

Central Pollution Control Board, India: Comprehensive Industry Document Series.

COINDS / 3 /1980 – 81, COINDS / 8/ 1980 – 81,

COINDS / 10 / 80 / 81, COINDS /24, 25 / 85.

COINDS / 27/ 89, COINDS / 36/89,

COINDS / 35/92, COINDS / 36/91.

COINDS / 38/92.

MEN 103 Industrial Pollution Control – Air

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the Air Quality and emission standards

CO2	Understand the Sources and classification of air Pollutants.
CO3	Understand the Source and control of air Pollution from selected industries
CO4	Understand the Air Pollution control system

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	✓	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Units 1

Air Quality and emission standards

Sources and classification of air Pollutants.

Unit 2

Nature and characteristics of gaseous and particulate pollutants.

Units 3

Control of Gaseous emission by absorption, adsorption, condensation, chemical transformation and combustion methods.

Unit 4

Control of particulate emission by mechanical connectors, bag filter, electrostatic precipitators and wet scrubbers.

Units 5

Source and control of air Pollution from selected industries – fertilizer, cement, paper, refinery, mineral and metallurgical processes etc.

Unit 6

Air Pollution control system.

Text / References:

H. E. Hesketh: Air Pollution control Second Ed., Ann Arbor Science, 1992.

S. Calvert and H. M. Englund: Handbook of Air Pollution Engineering, John Wiley, 1984.

A. J. Buonicore and W. T. Davis: Air Pollution Engineering manual, Van Nostrand, 1993.

M. N. Rao and H. V. N. Rao: Air Pollution, Tata McGraw Hill, 1989.

MEN 104 **Environmental Chemistry**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the Environmental Chemistry of water, water pollution, water treatment
CO2	Understand the Soil Chemistry
CO3	Understand the Toxicological Chemistry
CO4	Understand the Basic concept of instrumental methods of pollutants analysis

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	✓	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Unit 1

General Chemistry

Unit 2

Environmental Chemistry of water, water pollution, water treatment.

Unit 3

Geochemistry, Soil Chemistry, Atmospheric Chemistry, Inorganic and Organic air Pollutants,

Unit 4

Chemistry of hazardous substances, Toxicological Chemistry,

Unit 5&6

Basic concept of instrumental methods of pollutants analysis such as Ion Selective Electrode, Atomic Absorption Spectrometry, Flame Photometry, Chromatography, Mercury Analyzer, Total Organic Carbon Analyzer.

Text / References:

S. E. Mnahan: Fundamentals of Environmental Chemistry, Lewis Publisher, 1993.

C. N. Sawyer and P. L. McGraw Hill Book Co. 1978.

W. S. Stumm and J. J. Morgan: Aquatic Chemistry, Wiley- Interscience, 1971.

J. H. Seinfeld: Air Pollution McGraw Hill Book Co. 1986..

H. H. Willard, L. L. Merrit and J. A. Dean : Instrumental Methods of Analysis, Van Nostrand Reinhold, 1976.

MEN 105 Elective I

A) **Bioinformatics**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	They should be able to understand basic knowledge about enzyme technology.
CO2	They should understand role of biotechnology in medical field and industrial genetics.
CO3	hey should know importance of biotechnology in agricultural, food and beverage industries, environment, energy and chemical industries.
CO4	They should understand to how to recover biological products. Course Outcomes

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	✓-	-	-	-	-	-
CO4	✓	✓	✓	✓	-	-	-	-

A) **Bioinformatics**

Unit 1

Overview of bioinformatics, introduction to molecular biology, DNA, RNA, proteins, their structural profiles and properties

Unit 2

Use of Linux operating system and Perl, understanding and using biological databases, alignment of pairs of sequences

Unit 3

Tools of sequence alignment, alignment of multiple sequences, phylogenetic analysis

Unit 4

Gene prediction methods, visualization and prediction of protein structure, gene mapping, gene expression

Unit 5 and 6

DNA micro arrays, proteomics, metabolic pathways, metabolic flux analysis, genetic networks, problem solving in bioinformatics.

Books

1) Krawetz and Womble, "Introduction to Bioinformatics : A Theoretical and practical approach"
2) Rastogi and Mendivatta, "Bioinformatics : Concepts, skills and applications"

B) **Process Engineering Principles**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Students will demonstrate ability to design process equipments as heat exchanger, distil-lation column, high pressure vessels.
CO2	Students will learn engineering calculations
CO3	To provide experience in the process of original chemical engineering design in the areas of equipment design, process design and plant design through the process of formulating a design solution to a perceived need and then executing the design
CO4	Students will learn analogous mechanism of momentum Transport for steady and unsteady flow.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	✓	-	-	-	-	-
CO4	✓	✓	✓	✓	-	-	-	-

Unit 1

Brief overview of fundamentals of chemical engineering - concepts of unit operation & unit processes

Unit 2

Introduction to engineering calculations; variables, their dimensions and units

Unit 3 and 4

Dimensionally homogenous and Non-homogenous equations; standard conditions and ideal gases; Physical and chemical property data; Basics of Material and energy balances in a macroscopic view point.

Unit 5 and 6

Fluid mechanics :
Fluids vs solids, Fluid statics and applications including manometer; Mass and energy balances in fluid flow, Bernoullis equation, its applications including pump work. Newton's law of viscosity, flow curves for Non-Newtonian fluids, Pressure drop due to skin friction, significance of friction factor and Reynold's number. Flow machinery, overview of valves and pumps.

Text Books:

1. "Unit operations of Chemical Engineering" 5th ed. by W L McCabe, J C Smith and P. Harriot Mc Graw-Hill (1993).
2. D.M. Himmelblau, "Basic Principles and Calculations in Chemical Engineering", 6th Edition Prentice Hall of India, 1997.
3. B. I. Bhat and S. M. Vora, “Stoichiometry” Tata McGraw-Hill, New Delhi

C) Enzyme Engineering

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To learn the principles of bioprocessing for the design and development of processes involving biocatalyst
CO2	To study engineering principles in the development of products based on living cells or subcomponents of such cells.
CO3	To learn and develop quantitative models and approaches related to bioprocesses like To learn and develop quantitative models and approaches related to bioprocesses.
CO4	To learn mechanisitic models for enzyme catalyzed reactions for large scale production of bioproducts

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	✓	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Unit 1

Enzymes : Introduction, Free and immobilized enzymes: Applications in Industrial, Medical, Analytical, Chemical, Pharmaceutical and Food sectors.

Unit 2

Enzyme isolation, purification and immobilization methods, Enzyme kinetics in free and immobilized enzymes: Michaelis-Menten kinetics, kinetics for reversible reactions.

Unit 3

Effect of various types of inhibition, Evaluation of kinetic parameters, Micro environmental effects on enzyme kinetics, Enzyme deactivation.

Unit 4

Design and Analysis of enzyme reactors: To learn and develop quantitative models and approaches related to bioprocessesUnit 5 and 6

Internal and external mass transfer effects in immobilized-enzyme reactors. Intra-particle diffusion and reaction, operational stability and optimization, general design considerations, Enzyme reactions in organic media.

Text Books:

1. "Biochemical Engineering" by James M. Lee , Prentice Hall (1992).
2. "Priciples of Biochemistry" by A.Lehninger (1987).
3. "Design and Analysis of immobilized Enzyme Flow Reactors" by W.R.Vieth et al.

D) Accident Prevention and Safety

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To study Engineering ethics, Accident and loss statistics
CO2	To study government regulations ,Identification , Evaluation
CO3	To study The fire triangle. Distinction between fires and explosions
CO4	To study various Hazards identification and Accident Prevention and Safety

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	✓	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Unit 1

Introduction: Safety program; Engineering ethics; Accident and loss statistics; Acceptable risk; Public perception; The nature of the accident process, The accident process; Three significant disasters.**Toxicology:** How toxicants enter biological organisms; How toxicants are eliminated from biological organisms; The effect of toxicants on biological organisms; Toxicological studies; Dose versus response; Models of dose: Response curves; Relative toxicity; Threshold limit values.

Unit 2

Industrial hygiene: Government regulations; Identification; Evaluation; Control.

Source models: Flow of liquid through a hole; Flow of liquid through a hole in a tank; Flow of liquids through pipes; Flow of vapors through holes; Flow of vapors through pipes; Flashing liquids.

Unit 3

Toxic release and dispersion models: Design basis; Source models; Dispersion models; Pasquill – Gifford model; Effect of release momentum and buoyancy; Effect of buildings and structures; Release mitigation.**Fires and explosions:** The fire triangle; Distinction between fires and explosions; Definitions; Flammability characteristics of liquids and vapors; MOC and inerting; Ignition energy; Auto ignition; Auto oxidation; Adiabatic compression; Ignition sources; Sprays and mists; Explosions.

Unit 4

Designs to prevent fires and explosions: Inerting: Explosion proof equipment and instruments; Ventilation; Sprinkler systems; Miscellaneous designs for preventing fires and explosions.**Introduction to relief's:** Relief concepts; Definitions; Location of reliefs; Relief types; Relief scenarios; Data for sizing reliefs; Relief systems.

Unit 5

Relief sizing: Conventional spring operated reliefs in liquid; Conventional spring operated reliefs in vapor or gas service; Rupture disc relefs in liquid, vapor or gas service; Two phase low during runaway reactions- reliefs; Reliefs for thermal expansion of process.

Hazards identification: Process hazards checklists; Hazard surveys; HAZOP safety reviews **Risk assessment:** Review of probability theory; Event trees; Fault trees.

Unit 6

Accident investigations: Leaving for accidents; Layered investigations; Investigation process; Investigation summary; Aids for diagnosis.

Case histories: Static electricity; System designs; Procedures.

TEXT BOOK

D. A. Crowl and J.F. Louvar – Chemical Process Safety (Fundamentals with Applications), Prentice Hall (1990)

REFERENCE BOOKS:

1. H.H. Fawcett and W.S. Wood – Safety and Accident prevention in Chemical Operations, 2nd Edition, John Wiley &Sons, New York, 1982.

2. Coulson & Richardson's Chemical Engineering – Vol. 6 – R.K. Sinnott, Butterworth – Heinmann Ltd., 1996.

MEN 106 Communication Skills

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	The graduates are expected to possess ability to function on multi disciplinary teams.
CO2	The graduates are expected to have an understanding of professional and ethical responsibility.
CO3	The graduates are expected to engage themselves in lifelong learning.
CO4	The graduates are expected to posses ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	✓	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	-	✓	-	-	-	-

Detailed Syllabus:

Unit 1: English Language Enhancement: Verbs and tenses, Phrasal verbs, Synonyms, Antonyms, Homonyms - Descriptive Words, Combining Sentences, Business Idioms, Indianisms in English.

Unit 2: Art of Communication, Communication process- Non-verbal Communication- Effective Listening.

Unit 3: Interpersonal and Intra Personal Communication Skills- Self-Awareness- Self-Esteem and Confidence- Assertiveness and Confidence- Dealing with Emotions-Team Concept- Elements of Teamwork- Stages of Team Formation- Effective Team-Team Player Styles-Leadership.

Unit 4: Campus to Company- Dressing and Grooming- The Corporate Fit- Business Etiquette- Communication; media etiquette- Group Discussions, Interviews, and Presentation Skills.

Unit 5: Interview Handling skills- Effective Resume-- Common Interview Mistakes- Body-language-

Unit 6: Content Aid, Visual Aids- Entrepreneurial Skills Development.

Text / References:

1. Robert M.Sherfield, Developing Soft Skills, Montgomery and Moody 4th Ed. Pearson, 2009.
2. K. Alex, Soft Skills: Know Yourself & Know The world, S. Chand; 2009.
3. Robert Bramson, Coping with Difficult People, Dell, 2009

MEN 107 Environmental Monitoring Laboratory

The experiments based on following topics will be covered.

1. Air Quality Monitoring: Ambient Monitoring Gases, Suspended particulate matter and its characterization, source Monitoring, stack Monitoring, and exhaust measurement. Noise Pollution Monitoring, Metrological data collection and analysis.
2. Water quality Monitoring: Mineral analysis, Demand analysis, Nutrient analysis, Metal analysis, Organic analysis.
3. Microbiological examination: Rapid detection method, Heterotrophic plate counts. Multiple tube fermentation technique, Membrane filters technique.

Text / References:

L. S. Clesceeri, A. E. Greenberg and R. R. Trussell: standard methods for the examination of water and wastewater, APHA Publishing, 17th Ed. 1989.

H. H. Ramp and H. Krist: Laboratory Manual for the Examination of water, Wastewater and soil, VCH Publishers, 1989.

I. S. Codes: IS 5182, IS 11255, IS 8829, IS 3028.

Semester II

MEN 201	**Wastewater Treatment Plan Design**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand principles of various processes applicable to industrial wastewater treatment
CO2	Identify the best applicable technologies for wastewater treatment from the perspective of yield production
CO3	To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management
CO4	Understand principles of Unit Operation and design

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	✓	✓	-	-	-	-

Unit 1

Introduction to Wastewater Treatment Plant Design:

Impact of Flow rate and Mass Loading Factors on Design, Evaluation and Selection of Design Flow rates, Evaluation and Selection of Design Mass Loading, Process Selection, Elements of Conceptual Process Design.

Unit 2

Physical Unit Operation:

Flow Measurement, Screening, Flow Equalization, Mixing, Sedimentation, Accelerated Gravity Separation, Flotation, Granular Medium Filtration, Gas Transfer, Volatilization and gas stripping of Volatile Organic Compounds (VOCs) from Wastewater Management Facilities.

Unit 3

Chemical Unit Processes:

Chemical Precipitation, Adsorption, Disinfection, Disinfection with Chlorine, Dechlorination, Disinfection with Chlorine Dioxide, Disinfection with Bromine Chloride, Disinfection with Ozone, Disinfection with Ultraviolet Light, Other Chemical Applications.

Unit 4

Biological Unit Operation:

Overview of Biological Wastewater Treatment, Introduction to Microbial Metabolism, Important Microorganisms in Biological Treatment, Bacterial Growth, Kinetics of Biological Growth,

Unit 5 and 6

Biological Treatment Process, Aerobic Attached Growth Treatment Process, Anaerobic Attached Growth Treatment Process, Biological Nutrient Removal, Pond Treatment Processes.

Physical and Chemical Treatment of Wastewater:

Bar Racks and Screen, Combination, Grit Removal, Flow Equalization, Other Preliminary Treatment Operations, Primary Sedimentation Tanks, Other Solids – Removal Operation, Chemical Precipitation, Disinfection with Chlorine Compounds, Other means of Disinfection, Post Aeration, Odor Control, Control of VOCs Released from Wastewater Management Facilities.

Text / References:

W. W. Eckenfelder: Industrial Pollution Control, McGraw Hill Int. Edition, 1990.

Metcalf and Eddy: Wastewater Engineering and treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill, 1991

MEN 202	**Advanced Wastewater Treatment**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To educate the students in detailed design concepts related to water transmission
CO2	To impart knowledge on the transformation of chemicals in the environment
CO3	Perform Advanced Wastewater Treatment, Treatment Technologies Used for Advanced Wastewater Treatment
CO4	Understand the Need for Advanced Wastewater Treatment

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	✓	✓	-	-	-	-

Unit 1 and 2

Biological Treatment of Wastewater:
The Activated-Sludge Process, Selection and Design of physical Facilities for Activated-Sludge Process, Activated-Sludge Process Design, Aerated Lagoons, Trickling Filters, Rotating Biological Contactors, Combined Aerobic Treatment Process, Stabilization Ponds.

Unit 3 and 4

Need for Advanced Wastewater Treatment, Treatment Technologies Used for Advanced Wastewater Treatment, Removal of Residual Suspended Solids by Granular- Medium Filtration, Removal of Residual Suspended Solids by Micro screening, Control of Nutrients, Conversion of Ammonia by Biological Nitrification

Unit 5 and 6

Removal of Phosphorous by Biological Nitrification / Denitrification, Removal of Phosphorous Biological Methods, Combined Removal of Nitrogen and Phosphorous by Biological Methods, Removal of Nitrogen by Physical and Chemical Process, Removal of Phosphorous by Chemical Addition, Removal of Toxic Compounds and Refractory Organics, Removal of Dissolved Inorganic Substances.

Text / References:

W. W. Eckenfelder: Industrial Pollution Control, McGraw Hill Int. Edition, 1990.

Metcalf and Eddy: Wastewater Engineering and treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill, 1991

MEN 203	Energy Conversion and Environment

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To provide training to solve problems relevant to the energy conservation..
CO2	To provide students the knowledge in planning conducting energy audit, energy survey, and evaluate energy conservation opportunities.
CO3	To provide knowledge to design and evaluate energy efficient technologies.such as heat exchanger networks, multiple effect evaporators, co-generation, etc.
CO4	Students should learn to Principles and source of energy conservation

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	✓	-	-	-	-	-	-	-
CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	✓	-	-	-	-	-
CO4	✓	✓	✓	✓	-	-	-	-

Unit 1 and 2

Principles and source of energy conservation methods:

Thermal, nuclear, hydro, solar. An introduction to fuels, combustion fundamentals, Thermodynamics of combustion rates and properties of combustion products; Formation of Pollutants, Measurement and controls,

Unit 3 and 4

Fundamentals of engine processes, source of emissions from automobiles, effect of operating and design parameters on emission, recent trends in design of non-polluting power units, control methods

Unit 5 and 6

Exhaust reactor problem and prospects, Exhaust emission test, procedures, standards and legislation, Combustion in stationary sources, Power Production, Cogeneration. Alternative energy sources utilization, economics, Environmental impacts and Management.

Text / References:

A. M. Kanury : Introduction to Combustion Phenomena, Gordon and Beach Science Publishers, 1975.

E. Starkman : Combustion Generated Air Pollution, Plenum Press, 1971.

G. S. Springer and D. J. Patterson : Engine Emmision, Pollution Formation and Measurement, Plenum Press, 1973.

J. M. Fowler, Energy and the Environment, McGraw Hill, 1975.

MEN 204	**Air Pollution Control Equipment Design**

Pre-requisites: **None**

Course Outcomes: At the end of the course, the student will be able to:

CO1	To learn design a energy system to meet the desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability and sustainability.
CO2	To learn catalyst Conversion
CO3	To understand the basics for design as per the codes & standards for the mechanical design of equipments used in the process industry.
CO4	To learn Pollution control by absorption, adsorption, condensation

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	✓	-	-	-	-	-	-	-

CO2	✓	✓	-	-	-	-	-	-
CO3	✓	✓	-	-	-	-	-	-
CO4	✓	✓	✓	✓	-	-	-	-

Unit 1 and 2

Air Pollution in the chemical process industries: Pollution control by absorption, adsorption, condensation, oxidation and catalyst Conversion

Unit 3 and 4

Particulate emission, control by internal impaction, interception, stack height criteria,

Unit 5 and 6

Exhaust systems, Dispersion heights and plume characteristics.

Text / References:

Noel De Nevers: Air Pollution Control Engineering, McGraw Hill International Ed. 1993.

H. E. Hesekh: Air Pollution Control Second Edition, Ann Arbor Science, 1992.

S. Calvert and H. M. Englund: Handbook of Air Pollution Engineering, John Wiley, 1984.

A. J. Buonicore and W. T. Davis: Air Pollution Engineering manual, Van Nostrand, 1993.

M. N. Rao and H. V. N. Rao : Air Pollution, Tata McGraw Hill, 1989.

MEN 205 SEMINAR

GUIDELINES:

The seminar work shall consist of preferably study of certain phenomena, system, equipment, process design, in depth review of certain research work; Compilation and analysis of certain engineering / management activity including costing, administration, market study, field study etc. that is any topic which may have importance on Environmental Engineering.

The student is expected to keep a search for suitable topic for seminar right from 1st semester. It is permissible to assign the topic of the seminar such that the complete work can be done in the industry.

The report shall be a bound journal of about 50 typed pages written in technical format with illustrations by graphs, charts, tables, photographs etc. about the specific work undertaken by the student.

The number of copies of the report shall be such that the Examiners, Departmental Library, Central Library and concerned student shall have one copy each.

The examination of the seminar includes presentation of the work by way of lecture cum-demonstration followed by a question – answer session. The audience shall include the students, staff and invitees (if any) from the industries. They are expected to ask questions to the examinees on relevant points. The technological and grammatical correctness, art of explanation, confidence and the quality and quantity of work shall be the major points for

evaluation. Appropriate grade will be awarded by the panel of internal/external examiners set up by the Head of the Department.

MEN 302 & MEN 401 PROJECT (Stage I and II)

GUIDELINES:

The project work shall consist of experimentation, fabrication, testing of equipment, process design, in depth review of certain research work, compilation and analysis of certain Engineering / management activity, phenomenon, Designing, drawing and prototype modeling of certain equipment, instrument and testing there of etc. on any topic which may have importance on Environmental Engineering.

The student is expected to keep a search for suitable topic for the project right from the 1st semester. He has also to submit a list of topics and the names of guides, one each from the industry as well as from institution. It is permissible to assign the topic for the project such that the complete work of project preparation can be done in industry. The time table in the institution may be suitable framed to spare 2 or 3 days for this purpose. The presentation of the project is generally done in the institution. However in special circumstances the presentation may be permitted in the industry.

The report shall be a bound journal of about 150 typed pages written in technical format with illustrations by graphs, charts, tables, photographs etc. about the specific work undertaken by the student. If the work is somewhat more involved two or three students may work on the same project. In this case part of the topic may be split up suitably for individual exercise and to avoid any repetition in this case. The report shall not be less than 100 pages.

The number of copies of the report shall be such that the Examiners, Departmental Library, Central Library and concerned student shall have one copy each.

The examination of the project includes presentation of the work by way of lecture cum-demonstration followed by a question – answer session. The audience shall include the students, staff and invitees (if any) from the industries. They are expected to ask questions to the examinees on relevant points. The technological and grammatical correctness, art of explanation, confidence and the quality and quantity of work shall be the major points for evaluation. Appropriate grade will be awarded by panel of internal/external examiners based on the overall performance of the student. Project stage I (MEN 301) will comprise of about 40% of the total work of the project. At the end of stage I students should submit three copies of progress report in soft bound (or spiral bound) form. The students will

give a power point presentation of the progress of Project stage I before a panel of internal examiners set up by the Head of the Department. Students will continue the remaining work of their Project under Project stage II (MEN 01) and at the end of which they have to submit complete report of their Project work in the prescribed format specified by the Department in soft/spiral/hard bound form as per the instructions of Guide/s. Students will give a power point presentation of their Project work before a panel of internal and external examiners set up by the Head of the Department.