



IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Department of Chemical Engineering

Honors' in Chemical Engineering

(To be offered to the students of Chemical Engineering Department)

List of subjects from Semester V to VIII

S. No.	Semester	Subject Code	Subject Name	Contact Hours per week			Total Credits
				L	T	P	
1	V		Environmental pollution and sustainable development	4	-	-	4
2	VI		Environmental Policies and Legislation	4	-	-	4
3	VII		Industrial Wastewater Pollution Prevention and Control	4	-	-	4
4	VIII		Pollution Control Equipment Design	3	-	-	4
			Total	15	-	-	16



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Course Code	Semester	Course Title	Load	Credit
	V	Environmental pollution and sustainable development	3L:1T: (04 hrs)	Credits:04

Course Objective: To Study the basics of environmental pollution and their mitigation towards sustainable development.

Module I Environmental Pollution: 8 hrs

Concept of pollution, causes of environmental pollution, Environmental problems due to pollution, concept of Development, Major conflicts of Development and Environment, Mining and Environment.

Module II Air Pollution: 9 hrs

Sources and effect of air pollution, classification of air pollutants, emission standard of air pollution. Meteorological condition influencing air pollution, Chemical inversion,

Module III Water Pollution: 9 hrs

Sources and effect of water pollution, water born diseases, classification of water pollutants, physical, chemical and bacteriological analysis of water; pollution laws and limits, effluent standards,;

Module IV Solid & Noise Pollution: 9 hrs

Sources and effects of solid waste and Nature of domestic, municipal, agricultural, industrial, Hospital, Nuclear Wastes; collection, treatment and disposal of solids waste; waste recovery system, solid waste management; Sources and effects of noise pollution noise pollution, noise measurement and control; noise mitigation measures.

Module VI Sustainability and Development Challenges: 10 hrs

Definition of sustainability; environmental, economical and social dimensions of sustainability, sustainable development models; strong and weak sustainability, defining development millennium development goals, mindsets for sustainability, earthly, analytical, precautionary, action and collaborative; syndromes of global change, utilization syndromes, development syndromes, core problems and cross cutting issues of the century, global, regional and local environmental issues, social insecurity, resource degradation , climate change, desertification.

Course Outcomes:

After completion of this course, the students are

1. Knowledge about the environmental pollution and their mitigation.
2. Able to understand source and effect of air pollution.
3. Able to understand source and effect of water pollution.
4. Knowledge about the solid & noise pollution.
5. Able to understand basic knowledge of sustainability and their implementation for benefits of society.

References:

1. Rao C S; Environmental Pollution Control Engineering; New Age India Ltd.
2. Mahajan S P; Pollution Control in Process Industries
3. Canter Lary; Environmental Impact Assessment; TMG
4. Keily; Environmental Engineering; TMG
5. Miller GT Jr; Environmental sciences-working with earth; Cengage Pub



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Course Code	Semester	Course Title	Load	Credit
	VI	Environmental Policies and Legislation	3L:1T: (04 hrs)	Credits:04

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

Module I Introduction;

8 hrs

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, environmental protection act, water (P&CP) act, air (P&CP) act, nstitutional framework (SPCB/CPCB/MOEF)

Module II Water (P&CP) ACT, 1974;

9 hrs

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.

Module III AIR (P&CP) ACT, 1981;

9 hrs

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.

Module IV Environment (Protection) Act 1986;

10 hrs

Genesis of the act, delegation of powers, role of central government, eia notification, siting 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, authorization, biomedical waste rules, responsibilities of generators and role of pollution control boards

Module V Other Topics;

8 hrs

Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC, Public Interest Litigation, Writ petitions, Supreme Court Judgments in Landmark cases.

Course Outcomes:

After completion of this course, the students are

1. Knowledge about the Indian constitution and environmental protection.
2. .Depth study of the Water (Prevention and Control of Pollution) Act, 1974.
3. Depth study of the Air (Prevention and Control of Pollution) Act, 1981.
4. Depth study of the Environment (Protection) Act, 1986.
5. Knowledge about the different rules and regulations related to the environmental protection.

References:

1. CPCB “Pollution Control acts, Rules and Notifications issued there under “Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997
2. Shyam Divan and Armin Roseneranz “Environmental law and policy in India “Oxford University Press, New Delhi, 2001.
3. Greger I.Megregor “Environmental law and enforcement”, Lewis Publishers, London. 1994.



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Course Code	Semester	Course Title	Load	Credit
	VII	Industrial Wastewater Pollution Prevention and Control	3L:1T: (04 hrs)	Credits:04

Course Objective: To impart knowledge on the concept and application of Industrial pollution prevention, technologies, industrial wastewater treatment and residue management.

Understand principles of various processes applicable to industrial wastewater treatment

Module I Introduction;

8 hrs

Industrial scenario in India, industrial activity and environment, uses of water by industry, sources and types of industrial wastewater, nature and origin of pollutants, industrial wastewater and environmental impacts, regulatory requirements for treatment of industrial wastewater, industrial waste survey, industrial wastewater monitoring and sampling, generation rates, characterization and variables, toxicity of industrial effluents and bioassay tests, major issues on water quality management

Module II Industrial Pollution Prevention and Waste Minimization;

8 hrs

Prevention and control of industrial pollution, benefits and barriers, waste management hierarchy, source reduction techniques, periodic waste minimization assessments, evaluation of pollution prevention options, cost benefit analysis, pay-back period, implementing and promoting pollution prevention programs in industries.

Module III Industrial Wastewater Treatment;

10 hrs

Flow and load equalization, solids separation, removal of fats, oil and grease, neutralization, removal of inorganic constituents precipitation, heavy metal removal, nitrogen and phosphorous removal, ion exchange, adsorption, membrane filtration, eletrodialysis and evaporation, removal of organic constituents, biological treatment processes, chemical oxidation processes, advanced oxidation processes, treatability studies.

Module IV Wastewater Reuse and Residual Management;

9 hrs

Individual and common effluent treatment plants, joint treatment of industrial and domestic wastewater, zero effluent discharge systems, quality requirements for wastewater reuse, industrial reuse , present status and issues, disposal on water and land, residuals of industrial wastewater treatment, quantification and characteristics of sludge, thickening, digestion, conditioning, dewatering and disposal of sludge, management of rejects.

Module V Case Studies;**8 hrs**

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for textiles, tanneries, pulp and paper, metal finishing, oil refining, pharmaceuticals, sugar and distilleries.

Course Outcomes:

After completion of this course, the students are

1. Knowledge about water treatment and need of regulation.
2. Able to understand the industrial pollution prevention and waste minimization.
3. Basic knowledge of different treatment techniques for industrial wastewater.
4. Knowledge about wastewater reuse and residual management.
5. Ability to overcome industrial problem related to the waste water.

References:

1. Industrial wastewater management, treatment & disposal, Water Environment Federation Alexandria Virginia, Third Edition, 2008.
2. Lawrence K. Wang, Yung . Tse Hung, Howard H.Lo and Constantine Yapijakis, “ handbook of Industrial and Hazardous waste Treatment”, Second Edition, 2004.
3. Metcalf & Eddy/ AECOM, water reuse Issues, Technologies and Applications, The Mc Graw-Hill companies, 2007.
4. Nelson Leonard Nemerow, “ Industrial waste Treatment - contemporary practice and vision for the future”, Elsevier, Singapore, 2007.
5. W.Wesley Eckenfelder, “ Industrial Water Pollution Control”, Second Edition, Mc Graw Hill, 1989.
6. Paul L. Bishop, “Pollution Prevention: - Fundamentals and Practice”, Mc-Graw Hill International, Boston, 2000.



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Course Code	Semester	Course Title	Load	Credit
	VIII	Pollution Control Equipment Design	3L:1T: (04 hrs)	Credits:04

Course Objective: To educate the students on the principles and process designs of various treatment systems for wastewater polluted air and solid waste.

Module I Design of Water Purification Equipments; 8 hrs

Design of treatment plant units, selection of process, upgrading existing plants, ultimate residue disposal, aerators, chemical feeding, flocculator, clarifier, filters, rapid sand filters, pressure filter, dual media filters, disinfectors, design of softeners, demineralisers, reverse osmosis plants, process flow chart Layout and Hydraulic profiles for treatment plants.

Module II Design of Wastewater Treatment Plants - I; 9 hrs

Design of treatment units, screens, grit chamber, settling tanks, design of aerobic treatment systems, activated sludge process and variations, sequencing batch reactors, membrane biological reactors-trickling filters, bio-tower, RBC-moving bed reactors,

Module III Design of Wastewater Treatment Plants – II; 10 hrs

Aerated lagoons, natural treatment systems, waste stabilization ponds, constructed wet land, disinfection, reclamation and reuse, recent trends, design of anaerobic treatment system, UASB, up flow filters, septic tanks, nutrient removal systems, process flow chart layout and hydraulic profiles for treatment plants.

Module IV Air Pollution Controlling Equipment; 8 hrs

Working principle and Design of control equipment for particulate emission and gaseous pollutants like cyclone separator, gravity settling chamber, multi-tray settling chamber, bag filter, scrubber, E.S.P.

Module V Landfill Liners and Cover Systems; 8 hrs

Landfill barrier system components, Landfill cover systems, Design of Cover Systems, Daily Cover, Intermediate Cover, Final Cover, Flow through Landfill Covers, Design and Analysis of Slope Stability, Anchor Trenches, Access ramps, Erosion control.

Course Outcomes:

After completion of this course, the students are

1. Basic knowledge of purification system of water
2. Able to design primary waste water treatment plant.

3. Able to design secondary waste water treatment plant.
4. Able to design Air Pollution Controlling Equipment
5. Able to design landfill covers systems

References:

1. Rao C S; Environmental Pollution Control Engineering; New Age India Ltd.
2. Mahajan S P; Pollution Control in Process Industries
3. Canter Lary; Environmental Impact Assessment; TMG
4. Keily; Environmental Engineering; TMG
5. Miller GT Jr; Environmental sciences-working with earth; Cengage Pub
6. Robert M. Koerner and Donald H Gray (2002), Geotechnical aspects of Landfill Design and Construction, Prentice Hall, New Jersey.