LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Chemical Engineering (708)

Bachelor of Engineering (B.E.) – Semester – IV

Course Code:	**017083404**
Course Name:	**Pollution Control, Safety and Health Management**
Category of Course:	Professional Core Course (PCC)
Prerequisite Course:	Environmental Science

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
4	**0**	**0**	**4**	**40**

Syllabus

Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Introduction**			**3 (7.5%)**
	1.1 Concept of environment, biosphere and ecology			
	1.2 Various natural cycles in environment and ecology; Hydrological cycle, Carbon cycle, Nitrogen cycle, Phosphorus cycle & Sulfur cycle			
	1.3 Effect of human activities on environment and ecology			
02	**Environmental Pollution**			**3 (7.5%)**
	2.1 Air, Water & Soil pollution by Coal mining, Fossil fuel, Nuclear energy, Chemical pollution and marine pollution			
	2.2 environmental pollution in chemical and allied industries			
	2.3 Sources and causes of environmental pollution, effect of pollution on environment			
03	**Air pollution**			**4 (10%)**
	3.1 Classification and properties of air pollutants; PM, SO_x, NO_x, CO & HC			
	3.2 Emission sources			
	3.3 Behavior and fate of air pollutants with special reference to chemical reactions in atmosphere			
	3.4 Reactions at the earth's surface, photochemical smog etc., air pollution meteorology (generation, transportation and dispersion of air pollutants)			
	3.5 Effects of Air pollution; on human health, on vegetation and on materials			
04	**Equipment for Pollution Control and Particulate control**			**5 (12.5%)**
	4.1 Selection, design and performance analysis; cyclone separator (design & performance), fabric filters (Working &Construction), gravity settling chambers (design & performance), ESPs (Working &Construction), wet scrubbers (Working &Construction)			
	4.2 Control of gaseous emissions Stack sampling;			
	4.3 Analysis of air pollutants; SO_2, NO, CO, Oxidants, O_3, HC & PM			
05	**Water pollution**			**3 (7.5%)**
	5.1 Sources and classification of water pollutants			
	5.2 Physico-chemical characterization of wastewater			
	5.3 Water quality standards			
06	**Industrial water pollution management**			**4 (10%)**
	6.1 Introduction of Wastewater treatment processes			
	6.2 Primary treatment processes; Pretreatment, Sedimentation, Flotation			
	6.3 Secondary treatment processes; Aerobic Biological Treatment, Activated Sludge Process & Trickling Filter			
	6.4 Advanced wastewater treatment processes; Removal of suspended solids, Removal of dissolved Solids, Nitrogen Removal, Phosphorus removal & Chemical oxidation			
	6.5 Design of sedimentation tanks and biological treatment processes			
07	**Solid waste management**			**3 (7.5%)**
	7.1 Sources and classification,			
	7.2 Public health aspects, methods of collection			
	7.3 Potential methods of disposal: sanitary landfill, incineration, composting, recovery and recycling.			
08	**Introduction to Material Safety Data Sheet (MSDS)**			**6 (15%)**
	8.1 Sources of exposure, exposure evaluation, exposure-hazard control			
	8.2 Fire and explosion: types of fire, detonation and deflagration, UVCE and BLEVE			

	8.3 Regulatory bodies and regulations; Safety by design-sizing of specific devices such as, safety release valves, vents, flare systems			
	8.4 Instrumentation for safety - specific devices such as alarms, interlocks, shutdown systems			
	8.5 Hazard Identification Checklist procedure, Preliminary hazard analysis, What if analysis, Failure mode effect analysis, Hazard and operability (HAZOP) studies			
	8.6 Hazard analysis techniques: Fault tree analysis, Event tree analysis, General outline of DOW index			
09	**Industrial Rules and Regulations**			**6 (15%)**
	9.1 Rules, regulations, laws etc. regarding environmental protection, pollution prevention and control, waste disposal etc.			
	9.2 Standards and legislation EIA, EIS and EMP			
	9.3 Air and water pollution management through waste minimization.			
	9.4 Industrial air pollution management, Role of government, semi/quasi govt. and voluntary organizations. Industries Factory act, concept of energy audit, environment Audit.			
10	**Remedies to overcome current environmental scenario**			**3 (7.5%)**
	10.1 Concept of Cleaner Production(CP)			
	10.2 End of Pipe Solution, Good House Keeping checklist			
	10.3 CP Methodology, Barriers and Drivers in cleaner production, Principles of sustainable developments			
	10.4 List of Principles of green chemistry			
	10.5 atom economy, waste prevention and minimization of waste generation			

Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)

L:	4	T:	0	P:	0

Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory	4	4	MCQ	100%	100
Theory			Theory Descriptive	0%	0
Theory			Formulas and Derivation	0%	0
Theory			Numerical	0%	0
Expected Theory %	**100%**		**Calculated Theory %**	**100%**	**100**
Practical	0		Individual Project	0%	0
Practical			Group Project	0%	0
Practical			Internal Practical Evaluation (IPE)	0%	0
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**0%**		**Calculated Practical %**	**0%**	**0**
Overall %	**100%**			**100%**	**100**

Course Outcome	
	Upon completion of course, student will be able to
1	Understand environmental concepts, natural cycles, pollution sources, and their impacts on ecosystems and human well-being and to understand different types of pollution caused by human activities.
2	Develop knowledge about various air pollution control devices. Also, classify common water pollutants and understand their sources and effects along with wastewater treatment processes.
3	Understand the sources and classification of hazardous materials, and their potential impacts on health and environment and to identify major process and health hazards and apply hazard analysis techniques for risk assessment.
4	To acquire knowledge about the various environmental and safety standards and legislations and to understand remedies for environmental pollution.

Suggested Reference Books	
1	Environmental Pollution Control Engineering, C.S.Rao, New Age International Publishers, New Delhi.
2	Safety and Hazard Management in Chemical Industries, Prof. M. N. Vyas, Atlantic Publishers & Distributers (P) LTD
3	Chemical Process Safety Fundamentals with Applications, Daniel A. Crowl/Joseph F. Lowar.
4	Wastewater Engineering: Treatment & Reuse, Metcalf and Eddy, McGraw Hill Publication.
5	Pollution control in process industries, S P Mahajan, Tata McGraw Hill Publishing Company, New Delhi
6	Safety and Accident Management in the Chemical Process Industries Ed, H. Heinmann, M. Dekker Instrumental Methods of Analysis, B. K. Sharma, Goel Publishing house.
7	Loss Prevention in Process Industries, Frank P Lees, Volume 1, 2 & 3.

List of Open Source Software/Learning website	
1	https://nptel.ac.in/courses/103/107/103107084/
2	https://nptel.ac.in/courses/110/105/110105094/
3	https://cpcb.nic.in/env-protection-act/
4	https://cpcb.nic.in/7thEditionPollutionControlLawSeries2021.pdf
5	https://pib.gov.in/newsite/printrelease.aspx?relid=138591

6	http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/GuidanceManual.htm
7	https://cpcb.nic.in/mandate-4/
8	https://www.researchgate.net/publication/332406411_The_Role_of_Government_in_Protecting_the_Environment_Quality_of_Government_and_the_Translation_of_Normative_Views_absout_Government_Responsibility_into_Spending_Preferences
9	https://www.mei.edu/publications/role-ngos-tackling-environmental-issues#:~:text=Environmental%20NGOs%20can%20play%20a,people%20live%20more%20sustainable%20lifestyles.
10	https://www.diva-portal.org/smash/get/diva2:604269/FULLTEXT01.pdf
11	https://labour.gov.in/sites/default/files/TheFactoriesAct1948.pdf
12	https://beeindia.gov.in/sites/default/files/1Ch3.pdf
13	http://iced.cag.gov.in/wp-content/uploads/2013/02/ASOSAI-GUIDANCE-FoR-ENVIRONMENTAL-AUDITING.pdf
14	https://www.un.org/esa/sustdev/sdissues/technology/cleanerproduction.pdf