

Course Contents

Category	Title	Code	Credits 4 C			Theory Paper
DC (E)-3	Safety in Refinery, Petrochemical Plant & Gas terminals	FT-801(A)	L	T	P	Max Marks 100
			3	1	0	Min Marks 35 Duration 3 Hrs.

SAFETY IN REFINERY, PETROCHEMICAL PLANT & GAS TERMINALS

Unit I Crude oil, its properties & Characteristics, Classification of petroleum & its products, MSDS of crude oil, diesel, gasoline, kerosene, LPG, Natural Gas, naphtha, Ammonia, Benzene, toluene, Acetylene.

Unit II Refining Processes: - Primary Distillation, catalytic cracker, polymerization, reforming, steam cracking, sulphur recovery, Lubricating oil treating. Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types. Layout of Refineries - simplified flow diagram of a typical refinery.

Unit III Fire protection & emergency planning :- Major fire risks, design criteria for selection of fire water network, fire fighting installations such as hydrant, mobile water monitors, foam pourer, DCP fixed, subsurface injection & steam snuffing systems. Storage tanks protection. Use of various media in petroleum & gas fires such as water, foam, DCP.

Unit IV Fighting refinery & petrochemical fires: - Potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks. Fire fighting facilities for depots, terminals, on-shore, off-shore drilling platforms, and pipelines for transportation of petroleum products & Gas.

Fighting Gas terminal fires: - Fire fighting & procedures in case of BLEVE, LPG hazards, spillage, vehicles using LPG & CNG as a fuel. Fire fighting facilities at LPG bottling plants. Water Injection into LPG vessel (water bottoming)

Unit V Statutory provisions pertaining to refineries, petrochemical plants & gas terminals:- Oil Industry Safety Directorate (OISD), Petroleum Act 1934, Petroleum Rules 2002, Petroleum & Natural Gas Regulatory Board (PNGRB) drafts, Explosive Act 1884, Explosive Rules 1983 and Gas cylinders Rules 2004. Application of advance technologies used in refineries & petrochemical plants such as SCADA, SAP and various simulation modeling.

References: -

1. Fire Service Manual (Volume 2) Fire Service Operations – Petrochemical Incidents
2. Manual of Firemanship, Part 6-A by H.M.S.O.
3. Oil Industry Safety Directorate (OISD) Norms & Rules
4. Petroleum & Natural Gas Regulatory Board (PNGRB) drafts
5. Loss prevention in Process of Industries, Vol 1,2, & 3, Frank P. Lees.
6. NFPA Codes

Course Contents

Category	Title	Code	Credits 4C			Theory Paper
DC (E)-3	Safety in Mines	FT-801(B)	L	T	P	Max Marks 100
			3	1	0	Min Marks 35 Duration 3 Hrs.

Unit-I Minerals, rocks ores and non metallic minerals; classification of rock coal classification, mine atmosphere neat and humidity, Composition of mine atmosphere: Mine gases; generation, properties and effects; sampling and analysis of mine air; methane content; types and characteristic selection and location.

Unit II Mining tools & machinery, drilling machinery, including blast hole drills, ladders, excavators, dumpers, transportation equipment and conveyors and other related tools & equipments used in mining.

UNIT III Safety in Mines: Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; cause-wise analysis; basic causes of accident occurrence; in-depth study into various causes of accidents; measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; contribution of human elements in mine safety; tripartite and bipartite committees; mine environment monitoring and control.

UNIT IV Lighting: general principles of artificial lighting; lighting standards and their assessment. Sanitation and health in mines, Safety related issues in coal beneficiation and transport, Development and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Unit-V Health and Safety Laws: The Mines Act, 1952; Mines Rules, 1955; Coal Mine Regulation, 1957; Mines Rescue Rules, 1985; provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966; other rules and legislation applicable to coal mines. Economic Impact of Mining: Economics of mining, effect on community – before, during and after mining; corporate social responsibility (CSR).

References:

1. Mine Safety - Law Regulation Policy by Neil Gunningham
2. Understanding Human Error in Mine Safety by Geoff Simpson, Tim Horberry, and Jim Joy
3. Mine Health and Safety Management by Michael Karmis
4. Race against Time - Building a Culture of Mine Safety by Gregory M. Anderson & Stephen R. Rosene

Course Contents

Category	Title	Code	Credits 6C			Theory Paper
DC -19	Fire Fighting Installations & Automation	FT – 802	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	2	

UNIT-I Grouping of Fixed-Fire-fighting Installations, Provisions of First Aid Fire-Fighting Arrangements, External Hydrants, Ring-Mains.

Rising Mains: Down Comer, Dry-riser, Wet-riser and specifications of each types, their relevant code of practices.

UNIT-II Water Supply & Hydrant System: Grading, Requirement of water supply, Total requirement of water for different hazards pressure tanks water supply, Designing of Fire Hydrant System for different occupancies.; Designing of HVWSS/MVWSS/Sprinklers System: Types of Sprinklers system and its specification New Standard for the installation of sprinklers and Hazard classification. Multiple Jet-sprinklers, Water spray projector system, MVWSS and HVWSS-Drenchers: Different types of Drenchers, Rules for spacing sprinklers and drencher's heads.

UNIT-III Mechanical Foam Installations: Determination of foam compound for fire-fighting in oil tanks, Methods of application. Top application Base injection, Sub-surface Injection. Foam inlets and Risk for which foam is used. Premix foams, Installation characteristics of foam. Different types of foam, Low expansion, Medium expansion and High expansion foam, their special application, advantage and disadvantages of various types and the storage of foam concentrates.

UNIT-IV Installations Involving Carbon-di-oxide and Dry powder: Their special features, Characteristics, Designing, arrangements, operation, extinguishing action, risks and specification.

UNIT-V Fire Alarm & Detection System: Designing, Calculations, Installation, Testing and Maintenance, Working principle of smoke detectors, heat detectors, Flame detectors & optical beam type detectors.

References:

1. Standard Installation of sprinkler system by NFPA.
2. A Study of Performance of Automatic Sprinkler System by NFPA.
3. National Fire Code of Sprinklers by NFPA.
4. Care and Maintenance of Sprinkler System by NFPA.
5. Fire and Fire Risers by UNISEF Publication.
6. Relevant Indian Standards and Code of Practices.

List of Experiments (Expandable)

1. To Study the General Requirements of Different type of Occupancy as per NFPA 101-Life Safety Code
2. To study the fixed DCP Installation as per NFPA Code 17
3. To study the Fire Fighting Properties of Foam Concentrate
 - a. Fuel Tolerance (b) Burn back resistance (c) Induction Ratio (d) Fluidity (e) Film Formation
4. To Study the CO₂ Total Flooding System as per IS Specification

Course Contents

Category	Title	Code	Credits – 6C			Theory Paper
DC -20	Environmental Protection & Waste Management	FT-803	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	2	

Unit I Air Pollution Management Air Pollution, Air pollution Measurement, Air quality monitoring, Air pollution modeling, Air pollution control Technology & method, Equipment Selection, Equipment design, Particulate emission control, Sources corrective methods, Air quality management concept.

Unit II Water pollution Management Concept of water pollution, characteristic of waste water, standards of pollution parameters methodology of waste water treatment, Water Treatment process, Sedimentation, coagulation and flocculation, Filtration, Advanced Water Treatment processes, Industrial Water pollution management.

Unit III Solid & hazardous waste management & risk analysis: Sources, Classification and composition of MSW (Municipal Solid Waste), Waste Minimization of MSW, Thermal Treatment (Combustion) of MSW, Hazardous Waste Transport & treatment facilities, Treatment systems for hazardous waste & handling of treatment plant residues.

Unit IV Environmental management in industries, Principals & requirements of ISO 14001 EMS, Environmental auditing & Auditing of waste minimization. Environment Impact Assessment, Environment Management Plan. EIA, EMP and Environmental Auditing Environmental impact assessment, base line for existing data collection & identification of impact, prediction of impacts, Evaluation of impacts.

Unit V Handling storage and transportation of health care waste, Waste segregation packaging on site collection Transport & storage of waste treatment and disposal of health care waste. Incineration chemical infection wet and dry thermal treatment, microwave irradiation, land disposal, winterization treatment and disposal method from pharmaceutical & chemical waste; Training for health care personal and waste management operators.

References:

1. Environmental Management Handbook by Marcel Dekker.
2. Environmental Management Handbook for Hydrocarbon Processing Indus.; James B. Wall.
3. Environmental Safety and Health Engineerings by Gayle wood side and Dianna Koeurek.
4. Waste Management by Rajiv K. Sinha.
5. Hazardous Waste Management by J.M. Dewan.
6. Perspectives in Nuclear Toxic and Hazardous Waste by Kadambari Sharma.
7. Water Pollution, Causes Effects & Control by P.K. Goel.
8. A to Z of Environmental Audit, A. Mehrotra.
9. Elements of Biotechnology -P.K. Gupta
10. A text book on biotechnology by – H.D. Kumar

List of Experiments (Expandable)

1. Collection of waste water test
2. Study of solid waste material
3. Study of noise level & its control
4. Study of environmental audit
5. Study of Environment Impact Assessment
6. Study of soil test

Course Contents

Category	Title	Code	Credits 6 C			Theory Paper
DC-21	Industrial Hygiene & Occupational Health	FT-804	L	T	P	Max Marks – 100 Min Marks - 35 Duration - 3 Hrs.
			3	1	2	

Unit I Basic concepts of Industrial Hygiene, Environmental factors of stress- Chemical Hazards, Physical Ergonomically Biological Hazards, Threshold limit values (TLV) Short term exposure limit (STEL), Maximum Tolerable exposure Limit (MTEL), LC-50, LD-50, MSDS of Hazardous chemicals

Unit II Recognition of hazards: Industrial toxicology, gases, vapors, solvent, dust, fibers, particulates, Industrial noise, Ionizing & non-Ionizing radiation thermal, Ergonomics.

Unit III Evaluation of hazard: General principals, Air sampling, Analysis, methods of air sampling various equipments for sampling, direct reading instruments for gases, vapors and particulates, Asbestos fibers, sampling & analysis..

Unit IV Control of hazards: Methods of control local exhaust ventilation, dilution ventilation of Industrial work places, respiratory protection, ventilation norms requirements & measurements,.

Unit V Occupational health: Occupational diseases of skin, respiratory system, diseases from metals, pesticides, solvents & gases occupational cancer, Biological Monitoring.

References: -

1. Fundamentals of Industrial Hygiene by Barbara A. Plog & particia J. Quinlan.
2. Safety at work by John ridby & John Channing.
3. Occupational Health & Safety in manufacturing Industries – M K Potty.
4. Diseases of occupation – D. Hunter.
5. Code of Practice for Hazardous goods by NFPA
6. Dangerous properties of Industrial materials by Irvin Sex.
7. Handbook of occupation Health & Safety NSC Chicago 1982
8. Encyclopedia of occupational Health & Safety Vol I & II I.L.O. Geneva 1985.
9. Human Factors in Engineering & Design Tata McGraw-Hill 1982

List of Experiments (Expandable)

1. Sampling of air monitoring
2. Study of gas detection system
3. Study of chlorine detection & control measures
4. Study of ammonia detection & control measures
5. Study of portable gas monitoring equipments
6. Study of flammable gas detection monitor
7. Study of dust monitoring System

Course Contents

Category	Title	Code	Credits 8C			Practical
DC 22	Major Project	ME 805	L	T	P	Max. Marks 100
			0	0	8	Min. Marks-50

Objectives of the course Minor/Major Project are:

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
- To give students an opportunity to do some thing creative and to assimilate real life work situation in institution.
- To adapt students for latest development and to handle independently new situations.
- To develop good expressions power and presentation abilities in students.

The focus of the Major Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any)

Working schedule The faculty and student should work according to following schedule: Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

Action plan for Major Project work and its evaluation scheme #(Suggestive)

Task/Process	Week	Evaluation	Marks For Term Work#
Orientation of students by HOD/Project Guide	1st	-	-
Literature survey and resource collection	2nd	-	-
Selection and finalization of topic before a committee*	3rd	Seminar-I	10
Detailing and preparation of Project (Modeling, Analysis and Design of Project work)	4th to 5th	-	10
Development stage			
Testing, improvements, quality control of project	6th to 10th 11th	-	25
Acceptance testing	12th	-	10
Report Writing	13th to 15th	-	15
Presentation before a committee (including user manual, if any)	16th	- Seminar-II	30

* Committee comprises of HOD, all project supervisions including external guide from industry (if any)

The above marking scheme is suggestive, it can be changed to alternative scheme depending on the type of project, but the alternative scheme should be prepared in advance while finalizing the topic of project before a committee and explained to the concerned student as well.

NOTE: At every stage of action plan, students must submit a write up to the concerned guide:

Course Contents

Category	Title	Code	Credits 1C		
DC 23	Squad Drills	FT 806	L	T	P
			0	0	2

SQUAD DRILLS

DRILL WILL BE CONDUCTED BY FINAL YR STUDENT TO PLAY A ROLE OF INSTRUCTOR

Unit I

Squad Drill : aim of squad drill-Principles of good instruction-sequence of teaching- words of command technique of instruction.

Unit II

Attention – stand – easy-stand at ease-Turning and including-Forming up in three ranks – Numbering – Proving – Open and close order March Dismission and Falling out-sixing getting on Parade-Length of Paceand time of marching. Halting-side-space paces forwarded and to the Rear-Wheeling-changing step in quick and slow time-making time-turning on marching-saluting-salute at the halts and on the marching.

Unit III

Marching Marking time and halting in Double time-barking into slow, quick and double time marching in line in slow time.

Unit IV

Report salute and salute with Message-Changing Direction-Forming of squad at halt march-wheeling in file-marching off in single file-reforming three on march and at the halt.