

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Fire Technology & Safety Engineering, VIII-Semester

FT 801- Environment Protection and Waste Management

COURSE OBJECTIVE:

To learn the various engineering techniques and management approaches for the prevention and control of air pollution, water pollution and pollution due to urban solid waste and hazardous waste.

COURSE CONTENT:

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.

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.

SOLID HAZARDOUS WASTE MANAGEMENT: 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.

ENVIRONMENTAL MANAGEMENT: Principles and requirements of ISO 14001 EMS, Environmental auditing and Auditing of waste minimization. Environment Impact Assessment, Environment Management Plan. EIA, EMP and Environmental Auditing Environmental impact assessment, base line for existing data collection and identification of impact, prediction of impacts, Evaluation of impacts.

HEALTH CARE WASTE: 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.

COURSE OUTCOME

1. Students will be able to attain ability to choose the most suitable technique for air pollution monitoring and control technique for a given application.
2. Students will be able to describe suitable techniques for water treatments and control technique for water pollution management.
3. Students will be able to identify the techniques for the disposal and management of urban solid wastes and hazardous wastes
4. Students will be able to demonstrate the ability to recognize the tools for environmental management in industries.
5. Students will be able to demonstrate an ability to recognize the type of health care waste and processes involved in Transport & storage of waste treatment and disposal of health care waste

LABORATORY

1. To find out the inlet gas velocity and collection efficiency for a given cyclone separator
2. To determine the dissolved oxygen (D.O.) of the given water sample
3. To measurement of turbidity of the given water sample using turbidity meter
4. To determine the pH Value of given Solution Using pH meter
5. To determine the B.O.D (biological oxygen demand) value of the given water sample.
6. To determine the C.O.D (chemical oxygen demand) value of the given water sample
7. To study the ambient concentrations of gases and particulate matter by using high Volume sampler (HVS).
8. To study the salient features of environmental audit.
9. To study the salient features of ISO 14001.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

Environmental Management Handbook by Marcel Dekker.
Environmental Management Handbook for Hydrocarbon Processing Indus.; James B. Wall.
Environmental Safety and Health Engineerings by Gayle wood side and Dianna Koeurek.
Waste Management by Rajiv K. Sinha.
Hazardous Waste Management by J.M. Dewan.
Perspectives in Nuclear Toxic and Hazardous Waste by Kadambari Sharma.
Water Pollution, Causes Effects & Control by P.K. Goel.
A to Z of Environmental Audit, A. Mehrotra.
Elements of Biotechnology -P.K. Gupta

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Fire Technology & Safety Engineering, VIII-Semester

Departmental Elective FT 802(A) Hazardous Material Management

COURSE OBJECTIVE:

To learn fundamentals of various hazardous materials exposure with their source and dispersion models, chemical risk analysis, storage and handling consideration.

COURSE CONTENT:

EXPOSURE AND RESPONSE: General Principle of Chemical exposure and toxic response- Chemical exposure and cancer, chemical exposure and hypersensitivity, toxic response of lungs, liver, kidney, skin chemical exposure and health risk assessment.

DISPERSION MODEL: Toxic release and dispersion models-Design basis, Introduction to Source Models, source model, Flashing Liquids, Liquid Pool Evaporation or Boiling, Conservative Analysis, dispersion model, Pasquill- Gifford model, effect of release momentum, Buoyancy, Dense Gas Dispersion, Toxic Effect Criteria, Release Mitigation.

CHEMICAL RISK ANALYSIS: Flammability-vapour pressure, limits of flammability, Flash points, auto-ignition temperature. Stability- Experimental methods of determination, classifications of instability risk, quantitative approach. Toxicity- Evaluation parameter, level of toxic risk, problem posed by determination of toxicity risk level, Quantative estimation method.

EXPLOSION HAZARDS: Gas and vapor cloud explosion & means of preventing and mitigating in the process industry, Explosion in clouds of liquid droplets in air (spray/mist explosions), Dust Explosion. Stability and sensitivity tests, Classification of materials with explosive potential, Hazard prediction by thermodynamic calculations, Prevention and control of explosions and detonations- diluting a release, purging and inerting, venting, explosion relief, flame arrestors, explosion suppression.

STOREAGE AND HANDLING: Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief- relief valve sizing calculations- storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation- pipe line transport- safety in chemical laboratories. Safety provisions like level and flow indicators- alarms, colour coding for pipe lines and cylinders.

COURSE OUTCOME

1. Students will be able to explain chemicals exposure and their response in human body.
2. Students will be able to describe various source and dispersion models for any hazardous material leakage.
3. Students will be able to demonstrate chemical risk analysis for a given environment.
4. Students will be able to analyze impact of explosions in different conditions.
5. Students will be able to explain storage and handling requirement of different hazardous material.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

Chemical process safety, fundamental with application- Daniel A Crowl/ Joseph F Louver
Chemical exposure and toxic response- Edited by- Stephen K. Hall, Joana Chakraborty Randall J. Ruch.
Chemical Risk analysis- Bernard Martel
Explosion hazards in the process industries. - Rolf K. Eckhoff.
Chemical process Industries Shreve R.N.
Chemical Engineers handbook peoy JHJ & Chitten (Ed)
Hazardous materials emergency planning guide-NSC India.
Loss prevention in the process Industries F.P. Lees.
Major hazard control - A practical manual (ILO)
Chemical Process safety - Daniel A Crawl, Joseph Flouvar.

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Fire Technology & Safety Engineering, VIII-Semester

Departmental Elective FT 802(B) Structure's Behavior Under Fire

COURSE OBJECTIVE:

To learn and understand the burning building collapse due to failure of structures at elevated temperature during fire.

COURSE CONTENT:

CONSTRUCTION TERMS OF BUILDING DESIGN AND TYPES OF LOADS: General collapse information, General causes of collapse and its types, Constructive terms of building design-Arch, Beam and its types, Buttress, Deck, Façade, Fire cut beam, Girder gusset plate, types of wall, Lintel joist, suspended ceiling and braced frame construction. Types of loads and methods of application, Hierarchy of structural framing and zone of danger.

FIRE EFFECTS ON BUILDING: Effect of Fire, Natural ventilation, Smoke movement in buildings, Smoke movement in tall buildings, Stack effect, Wind effects, Influence of openings in tall buildings, Smoke shaft, Smoke control during building design, Control of smoke spread, Mechanical ventilation, Pressurization system and their types, Design of smoke control pressurization system for a building.

ANALYSIS OF STRUCTURAL DAMAGE: Wall collapse- Masonry wall, Concrete wall and wood frame walls. Roof collapse- Sloping peak roof, Timber truss roof, Flat roof and steel roof, Stairway collapse, Floor collapse-Terrazzo floor, wooden I beam, Precast concrete slabs, Column collapse.

POST FIRE ANALYSIS: Post fire analysis and fire protection to buildings Rain roof, Fire Retarding compartmentation, fire fact sheet, the fire diagram and fire photographic documentation, Fire planning and design, Confinement of fire site planning access to fire fighting appliances, Contribution of external walls and roof covering, Aspects of internal planning, reduction of fire spread, Concept of compartments and types, Construction of compartments, Space and circulation, Principles and types of fire and roof venting, Effect of wind on roof vent, Industrial building ventilation.

BUILDING CONSTRUCTION AND HAZARDS: Five standard types of building construction and their collapse hazards. Time temperature grading curves, Heat balance for an enclosure during a fire, Fire severity and factors controlling fire severity, Thermal properties of wall fixtures & geometrical properties of a room compartment, Thermal insulation heat transfer and radiation, Calculation of fire resistance of a compartment, fire spread within, outside and between the buildings, Flames outside buildings, Reduction of risk of fires explosions.

COURSE OUTCOME:

1. Students will be able to identify the constructive terms of building design and general causes of collapse.
2. Students will be able to describe effect of fire, smoke movement and smoke control pressurization system for a buildings.
3. Students will be able to analyze structural damage for different load bearing and non load bearing elements..
4. Students will be able to distinguish between post fire analysis and planning/design for reduction of fire spread.
5. Students will be able to explain types of building construction with their collapse hazard.

EVALUATION:

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES:

Vincent Dunn, Collapse of Burning Buildings: A guide to fire ground safety, Penn well corporation.
Howard J. Hill, Failure Point: How to determine Burning building stability, Penn well corporation.
Glenn. P corbeti, Builidng construction for the fire service, Jones & Barl.
T Z Harmathy, Fire Safety Design and Concrete, Longman Group UK Limited.
Bernard J. "Ben" Klaene, Structural Fire Fighting, National Fire Protection Association.
J.A. Purkiss, Fire Safety Engineering Design of Structures, Butterworth Heinemann.

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Open Elective FT 803(A) Salvage Evaluation of Fire Situation

COURSE OBJECTIVE:

1. To teach the significance of salvage and smoke movement in fire investigation process.
2. To learn the fundamental of compartment fire and its application in fire investigation process.
3. To calculate the fire loss by different methodology and application of data in identification of fire trends.
4. To understand the evacuation process with different models of evacuation.
5. To learn the role of insurance agency in legal and claim aspect.

COURSE CONTENT:

SALVAGE AND SMOKE CONTROL

Concept of salvage, salvage operation, equipments, apparatus and methodology used in salvage operations, case studies in different types of occupancies. Mass flow rate, temperature, soot protection. Smoke generation, smoke flow & dispersion, prediction of smoke flow patterns, scaling of smoke proportion, smoke impact in visibility, smoke control system, pressure differences in ventilation system, calculation of discharge rate of air blowers, smoke extraction.

COMPARTMENT FIRE

Stage of fire development, fire induced flows, compartment flow dynamics, single room fire analysis, Model of enclosures fires, theory & concepts of zone models, Dynamics of enclosure fire: Heat release, fire generated flows, heat transfer & flow through openings. Zone modeling of pre flashover enclosures fire: Flame & burning object, source terms, fire plume source terms. Hot layer source terms, product of combustion source terms one zone modeling of pool flash fire.

FIRE LOSS INVESTIGATION

Fire Risk analysis methods, Quantitative Deterministic methods, Quantitative probabilistic methods, Monte Carlo Technique, Safety Index Method, Ranking method, Fire Risk Index Method, Initial observation and Examination of the Scene, Use of Fire Incident data, Approaches to fire data analysis, top down & topic driven analysis, analysis by fire causes and property type, Analysis of small data sets, application of data trends identification.

PYROLYSIS

Importance of Pyrolysis in Fires, Pyrolysis process, Physico Chemical Description of Pyrolysis Process, Pyrolysis of Cellulose, Pyrolysis of Hemicellulose, Pyrolysis of Lignins, Pyrolysis of Wood, Characteristics & location of fire causalities, nature of Injuries, causality rate per fire, Process of emergency evacuation, Evacuation modeling, model-1 EXIT, model-2 EGRESS, model-3 SIMULEX.

ECONOMICS AND INSURANCE

Computation of Loss, Fire Insurance Claims, Legal provisions for Fire Loss, Economics of Loss Prevention, Cost of Losses, Cost of Prevention, Level of Loss Prevention Expenditure, Insurance of Process Plant, Damage Insurance, Business Interruption Insurance, Other Insurance Aspects.

COURSE OUTCOME

1. Students will able to demonstrate salvage equipments and apparatus with evaluation of smoke control parameter in occupancy.
2. Students will able to design compartment fire zone and formulate the fire dynamics of given problem.
3. Students will able to explain fire loss investigation process and prepare fire investigation report.
4. Students will able to prepare evacuation plan of a given occupancy.
5. Students will able to explain the role of insurance agency in fire loss.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

V.K. Jain. Fire Safety in Buildings. Taylor & Francis

D.J. Rasbash. Evaluation of Fire Safety, Willey.

Fire protection handbook volume-I section-III, NFPA.

Fire protection handbook volume-II section-IX, NPFA

Fundamental of fire fighting skills, NFPA

Scand Power. Handbook for Fire calculation and fire risk assessment in the process industry, AS Sintef-NBL.

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Open Elective FT 803(B) Safety in Rail and Road Transport

COURSE OBJECTIVES:

To learn the basic working principles involved in various transportation systems and their safety aspects and to be able to identify defects in planning and design of transportation systems.

COURSE CONTENT:

Railway Engineering: Permanent way- components. Rails- Functions, requirements, defects, rail joints and fastenings, check and guard rails, coning of wheels, creep of rails. Sleepers- functions, requirements, types, density. Ballast- functions, requirements types.

Geometric Design- Horizontal curves, Super- elevation, Negative super elevation in branches, Length of transition curves- Grade compensation on curves, Widening of Gauge on curves.

Railway operation Control: Points and crossings- Design features of a turn out –Types of Railway track- Points- Details of Station Yards and Marshalling Yards- Signaling and interlocking- Principles of track circuiting- Control of train movement by absolute block system- Automatic block system- Centralized traffic control Systems.

Classification of highways- Historical development of road construction- Typical cross section of roads - Definition of various cross- sectional elements- Requirements & factors controlling alignment of roads - Basic Geometric design.

Traffic Engineering: Traffic characteristics- various traffic studies and their applications – Traffic Regulations and Controls- Traffic Control devices- Traffic signals- Classification of signals- carriage- way markings- Traffic islands- Highway intersections- Principles of highway lighting.

COURSE OUTCOMES:

On successful completion of this course the student will develop a broad understanding of the:

1. Students will be able to understand working of railways and safety aspects in railway operation.
2. Students will be able to familiarize with basic geometric design features of roads.
3. Students will be able to know about traffic studies and traffic safety.
4. Students will be able to understand basic layout and facilities of docks.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

Railway Engineering, Rangwala, S. C. (2012).. Charotar Book Distributors, Anand.
Railway Engineering, Chandra, S. & Agarwal, M. M. (2007).. Oxford University Press, New Delhi.
Highway Engineering, Khanna, S. K. and Justo, c. E. G. (2001). (9th ed). Nem Chand & Brothers, New Delhi.
Traffic Engineering and Transport Planning, Kadiyali, L. R. (2004).. Kharna Publishers, New Delhi
Dock and Tunnel Engineering, Srinivasan, R. (2013). Harbour,. Charotar Publishing House Pvt. Ltd, Anand

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FT 804- Fire Fighting Skills

COURSE OBJECTIVE:

To command, practice and conduct squad and fire fighting drills associated with national fire service.

COURSE CONTENT

LABORATORY:

1. To command, practice and conduct different appliance drills used in fire service.
2. To command, practice and conduct hose drills associated with fire service.
3. To command, practice and conduct different types of hydrant drills.
4. To command, practice and conduct different types of ladder drills.
5. To command, practice and conduct different types of BA set drills.
6. To command, practice and conduct different types of trailer pump drills.
7. To command, practice and conduct different types of emergency evacuation drills.
8. To command, practice and conduct different types of first aid fire fighting appliances drills.

COURSE OUTCOME

Students will able to command, practice and conduct squad and fire fighting drills associated with fire service.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

AFS – Drill Manual
Drill manual for Fire Services of India by Govt. of India.
Fire Fighters Skill drill manual by NFPA.