

Course Contents

Category	Title	Code	Credits 4C			Theory Paper
DC(E) -1	Structures Behavior Under Fire	FT –701(A)	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	0	

Unit I Principles of fire, mechanism & mode of fire spread in a building, development & growth of fire, Fully, developed fire, flash over, fire hazardous properties of solids, liquid, gaseous & volatile fluids, Time temperature grading curves, Heat balance for an enclosure during a fire, Fire severity & factors controlling fire severity, thermal properties of wall fixtures & geometrical properties of a room compartment, Thermal insulation heat transfer & radiation, calculation of fire resistance of a compartment, fire spread within, outside and between the buildings due to Propagation of heat, Flames outside buildings, Reduction of risk of fires Explosions.

Unit II Effect of fire, Natural ventilation, Smoke movement in buildings, smoke moment 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 & their types, Design of smoke control pressurization system for a building.

Unit III Fire protection to buildings, Building considered as whole, Fire planning & design, confinement of fire site planning access to fire fighting appliances, Exposure hazard, severity of exposure, its classification and factors affecting severity of exposure, Contribution of external walls & roof covering, Aspects of internal planning, reduction of fire spread, Concept of compartments & types, Construction of compartments, space and circulation, Principles and types of Fire & roof venting, Effect of wind on roof vent, Industrial building ventilation.

Unit IV Active Fire protection : Detection of fire & smoke, automatic fire extinction, sprinklers & spray, Foam system & chemical extinction, fire suppression.

Unit V Means of escapes & escape routes, Their design, planning and construction, Evacuation time & speed of movement, Escape staircase, Doors, halls and corridors to final exits, other means like high level access, Ramps existing in buildings, Fire resistance of doors and windows, Glazing, floor tiles, Plaster, use of Plastics in building.

Unit VI Functional aspects of fire planning and designing in relation to thermal & sound insulation services, Lighting heating ventilation and water supply assessment of fire risk, Insurance.

References:

1. National Building Code of India – 1984 Part - IV
2. N.F.P.A. Handbook
3. Building Construction for the Fire Service by F. Barmigan
4. Fire Safety in Buildings by C.J. Langdon Thomas
5. Manual of Fireman ship.

List of Experiments(Expandable)

- To study of development of fire effect.
- To study the behaviour of materials.
- To study means of escape routes, escape staircases
- To study smoke and heat venting
- To study of fire resistance tests of structural components (IS 1641: 1960
- To study smoke movement and stack effect in high rise building
- To study natural ventilation and mechanical ventilation
- To study about the compartmentation
- To study about actual design of smoke control pressurization

Course Content

Category	Title	Code	Credits-6C			Theory Paper
DC(E) 1	Operations Research and Supply Chain	FT 701 (B)	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	2	

Unit 1 Linear system and distribution models: Mathematical formulation of linear systems by LP, solution of LP for two variables only, special cases of transportation and assignment and its solution, Vogel's forward looking penalty method, cell evaluation degeneracy, use of SW Lindo, Tora, Excell.

Unit 2 Supply chain (SCM): Definition, importance, expenditure and opportunities in SCM; integration of inbound, outbound logistics and manufacturing to SCM, flow of material money and information, difficulties in SCM due to local v/s system wide (global) optimization and uncertainties in demand and transportation; Bull-whip effect; customer value; IT, info-sharing and strategic partnerships; plant and warehouse-network configuration; supply contracts and revenue sharing; outsourcing; transportation, cross docking and distribution, forecasting models in SCM; coordination and leadership issues; change of purchasing role and vendor rating, variability from multiple suppliers.

Unit 3 Inventory models: Necessity of inventory in process and safety stock, problem of excess inventory and cycle time (=WIP/ Throughput), JIT/ lean mfg; basic EOQ/ EPQ models for constant review Q-system(S,s); periodic review, base stock P-system; service level, lead time variance and safety stock;; ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

Unit 4(a) Waiting Line Models Introduction, Input process, service mechanism, Queue discipline, single server (M/M/1) average length and times by Little's formula, optimum service rate; basic multiple server models (M/M/s)

(b) **Competitive strategy:** concept and terminology, assumptions, pure and mixed strategies, zero sum games, saddle point, dominance, graphical, algebraic and LP methods for solving game theory problems.

Unit 5: (a) Decision analysis: decision under certainty, risk probability and uncertainty; Hurwicz criteria; AHP- assigning weight and consistency test of AHP

(b) **Meta-heuristics** Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search, Simulated Annealing and Genetic algorithms and solution of traveling salesman and non linear optimization problems.

References:

- 1.Hillier FS and Liberman GJ; Introduction to Operations Research concept and cases; TMH
- 2.Simchi-Levi, Keminsky; Designing and managing the supply chain; TMH.
- 3.Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning
- 4.Mohanty RP and Deshmukh SG; Supply Chain Management; Wiley India
- 5.Taha H; Operations research; PHI
- 6.Sen RP; Operations Research-Algorithms and Applications; PHI Learning
- 7.Ravindran , Philips and Solberg; Operations research; Wiley India
- 8.Vollman, Berry et al; Manufacturing planning and control for SCM; TMH.
- 9.Bowersox DJ, Closs DJ, Cooper MB; Supply Chain Logisti Mgt; TMH
10. Burt DN, Dobler DW, StarlingSL; World Class SCM; TMH
11. Bronson R ;Theory and problems of OR; Schaum Series; TMH

Contents

Category	Title	Code	Credits – 6C			Theory Paper
DC(E) 2	Disaster Management	FT – 702(A)	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	0	

Unit I Types & consequence of major accident hazards, Role of management, Local authorities and public, Disaster Management Cycle – Prevention, Mitigation, Preparedness, Disaster impact, Response, Restoration, Reconstruction, Onsite & offsite emergency planning; Emergency preparedness, rehearsal & exercises.

Unit II Role of Insurance in Disaster Management, Role of International co-operation (i.e. NGO & UN Agencies), affected factors on environment due to disaster. Need for National Capacity Building and Disaster Knowledge Network

Unit III The Disaster Management Act:: Need for technological input in disaster mitigation, community based disaster preparedness program; Preparation of Disaster Management; Plan Early Warning System; Role of Information Technology (IT)

Unit IV Natural Disaster like Earthquake, Mine fire, flood etc, Man-Made Disaster – Industrial Disaster due to toxic gas release, Fire or Explosion; Case – Study.

Unit V Accident related Disasters (Forest fires, Air, road, & Rail Accidents, Rural & Urban Fires, Oil Spills, Major building collapse etc. Community based Disaster preparedness program.

References :-

1. Disaster Management Act 2005
2. Industrial Security Management S.C. Dey
3. Dangerous Properties of Industrial Material – Irvin Sex.
4. Encyclopedia of occupational Health & Safety (OSHA) IV edition.
5. Safe Handling of Hazardous Chemicals by Rohatgi.
6. Industrial Fire Hazards Hand Book (NFPA)
7. Major Hazard Control I.L.O. Geneva.
8. What went wrong-Trevor Kletz.
9. Chemical process safety – Daniel . A. Crawl, Joseph F Louver.
10. Madhya Pradesh Control of Industrial Major Accident Hazards rules 1999.

Course Contents

Category	Title	Code	Credits-4			Theory Paper
DC(E)-2	Simulation and Process Modeling	FT 702 (B)	L	T	P	Max. Marks-100
			3	1		Min. Marks-40 Duration: 3 hrs.

Unit 1: Introduction to modeling and simulation: Modeling and simulation methodology, system modeling, concept of simulation; gaming; static, continuous and discrete event simulation.

Unit 2: Basic concept of probability, generation and characteristics of random variables, continuous and discrete variables and their distributions; mapping uniform random variables to other variable distributions; linear, nonlinear and stochastic models

Unit 3: Introduction to Queuing Theory: Characteristics of queuing system, Poisson's formula, birth-death system, equilibrium of queuing system, analysis of M/M/1 queues. Introduction to multiple server Queue models M/M/c Application of queuing theory in manufacturing and computer system

Unit 4: System Dynamics modeling: Identification of problem situation, preparation of causal loop diagrams and flow diagrams, equation writing, level and rate relationship, Simulation of system dynamics models.

Unit 5: Verification and validation: Design of simulation experiments, validation of experimental models, testing and analysis. Simulation languages comparison and selection, study of simulation software – Arena, Pro-model, SIMULA, DYNAMO, STELLA, POWERSIM.

References:

1. Law AM and Kelton WD; Simulation Modeling and Analysis; TMH
2. Gordon G., System simulation, PHI Learning
3. Banks J; Hand book of Simulation; John Wiley.
4. Taha H, Operations Research; PHI.
5. Hillier FS, Liberman GJ; Introduction to OR; TMH.
6. Deo N; System Simulation with Digital Computer; PHI Learning
7. Harrell C, Ghosh B, Bowden R; Simulation Using Promodel; MG Hill
8. Seila, Ceric and Tadikmalla; Applied Simulation Modeling, Cengage
9. Payer T., Introduction to system simulation, McGraw Hill.
10. Sushil, System Dynamics, Wiley Eastern Ltd.
11. Spriet JA; Computer Aided Modeling and Simulation, Academic Press INC; USA

Contents

Category	Title	Code	Credits – 4C			Theory Paper
DC(E)-2	Process Safety & Risk Assessment	FT – 702(C)	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	0	

- Unit I** Concept of Risk: Definition, Accepted & Imposed risk, perception and qualification of risk, ALARP, cost Benefit analysis.
- Unit II** Basic Quantitative Risk Assessment (QRA): The logic tree Approach, principles of QRA, fault tree analysis, probability Theory, Combination of Frequencies, Event Tree analysis (ETA) .
- Unit III** Safety in Design and operation: Safety in Design safety assurance in design, safety in operation, maintenance, organizing for safety, Accident Investigation and reporting.
- Unit IV** HAZOP: Introduction to HAZOP, conducting a HAZOP study, computerized reporting systems. HAZOP of batch process, Extensions of HAZAOP, Failure Mode & Effect Analysis (FMEA): Methodology of FMEA, criticality analysis, corrective action and follow-up.
- Unit V** Consequence Modeling: Gas dispersion, Toxicity, Explosions and fires, fires.
Human Factors:- The role of the operator, control room design, Human Error Assessment Methods, Application of HAZOP to human reliability, data on operator reliability.

References:

1. Process safety analysis – An introduction by Bob Skelton.
2. An introduction to Risk Analysis by Robert E. Megill.
3. Risk Assessments Questions and Answers a practical approach by Pat Perry.
4. Safety sharing the experience - BP Process Safety Series- by www.icheme.org.
5. Fire Safety Risk Assessment- HM Government.

Contents

Category	Title	Code	Credits – 6C			Theory Paper
DC – 14	Heat Transfer, Combustion & Explosives	FT – 703	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	2	

UNIT-I: Study state heat conduction with and without heat generation, thermal insulation, selection criteria, critical and optimum thickness determination, extended surfaces and unsteady state heat transfer.

UNIT-II : Fluid flow over flat plate and heat transfer, convective heat transfer in laminar flow and turbulent flow inside tubes, film wise condensation and drop wise condensation nucleate and film boiling. Classification of heat exchangers and fired heaters, radioactive heat transfer, radiation laws, emissivity and intensity of radiation.

UNIT-III : Combustion: Modes & Types of combustion, Fire Characteristics of gaseous combustible: types for gaseous Flames ,chemical mechanism of combustion, Radiation from flames, Fire Characteristics of Liquids combustible; Category of liquid fire, burning rate of liquid pools, flame spread rate, Fire Characteristics of solid combustible: gasification, ignition, charring & melting, Fire Retardants.

UNIT-IV: Combustion Products; Understandings the hazards to human of Smoke, Carbon monoxide, hydrogen cyanide, hydrogen sulphide & carbon di oxide, toxicity of fire products Evaluation of smoke Toxicity & various models.

UNIT-V: Classification of explosives and their characteristics, chemistry of explosives, Explosion and its effect, fire ball, kinetics and mechanisms of detonation, lower flammability limit, upper flammability limit,

References:

1. Heat & Mass Transfer By D.S. Kumar
2. Heat & Mass Transfer By S.P. Sukhatme
3. Principals of fire protection chemistry & Physics – Raymond friedman.
4. Fire fundamentals & control –Walter M Haeessler.
5. Advance in combustion Toxicology – Gordon E Hartzell
6. Engg. Chemistry By RGopalan, D. Venkeappoyya, S Nagrajn
7. Engg. Chemistry By P.C. Jain & Monika

List of experiments (Expandable):

Determination of the Flash & Fire Point of lubrication oil by Pensky – Martin's Appratus
Determination of the Flash & Fire Point of lubrication oil by Able's Appratus
Determination of the Flash & Fire Point of lubrication oil by Cleiveland's Appratus
Determination of the Calorific Value(Liquid) by Boy's Calorimeter
Determination of the Calorific Value(Liquid) by Bomb Calorimeter
Determination of Moisture content of given Coal sample
Determination of Ash content in given Coal sample
Determination of Volatile material of given Coal sample
Determination of the percentage of the CO₂, CO, O₂ and N₂ in Flu gas by Orsat's Appratus
Determination of N₂ in Coal Sample by Kjeldhalmetgods
Determination of Sulpher content of given sample of Coal

Course Contents

Category	Title	Code	Credits 6C			Theory Paper
DC-15	Safety Engineering and Its Industrial Application	FT-704	L	T	P	Max. Marks – 100 Min. Marks - 35 Duration – 3 hrs.
			3	1	2	

- Unit-I Theory and principals of accident causation, unsafe Act and unsafe conditions, case studies, Accident- Investigation Procedure, Safety Committee organization & functions.; Safety performance measurement; Safety policy, Safety in material handling.
- Unit-II Good housekeeping and safety, personal protective equipments needs & limitations, Hazards & risk assessment techniques, job safety analysis, fault tree analysis Ergonomic concept, local exhaust ventilation, plant inspection procedure, safe working in confined space, work permit system.
- Unit-III Control of industrial noise, lighting, heat & ventilation, safety officer- role, responsibilities, power & duties, role of management, supervisor, trade- union, workers & Government, safety in use of hoists, lifts, & lifting machines, safety in pressure plants, principles of machine guarding, types & selection of machine guards.
- Unit-IV Safety in industries involving hazardous processes, safety in industries involving highly flammable liquids & flammable compressed gases, safety in chemical works, application of safety in handling corrosive substances, safety audit in various types of factories, types of safety audit, its methodology and reporting..
- Unit-V Hazards & their control in the manufacture of articles from refractory materials, hazards in solvent extraction plants & their control, safety in industries, manufacturing rayon by viscose process, hazards & their control in fertilizer industries, hazards & control in LPG bottling plant.

References:

1. Fundamentals of Industrial safety & health by K.U. Mistry.
2. Safety at work by Jhon Ridley
3. Less loss prevention in the process industries- volume – I, II, III
4. Safety Legislations related to industries.

List of experiments (Expandable):

1. Case study on FF and Safety
2. Practicals on layout and house keeping
3. Noise measurement and prevention

Course Contents

Category	Title	Code	Credits 6 C			Theory Paper
DC - 16	Chemical Safety	FT - 705	L	T	P	Max Marks 100
			3	1	2	Min Marks 35 Duration 3 Hrs.

Unit I 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.

Unit II Toxic release and dispersion models:-

Design basis, source model, dispersion model, Pasquill- Gifford model, effect of release momentum, Buoyancy.

Unit III 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.

Unit IV Explosion Hazards:-

Gas and vapour cloud explosion & means of preventing and mitigating in the process industry, Explosion in clouds of liquid droplets in air (spray/mist explosions), Dust Explosion.

Unit V Methodology for Hazard and Risk analysis: Hazards survey or inventories, hazards and operability studies (HAZOP), failure mode and effect analysis (FMEA), fault tree analysis (FTA), Event tree analysis (ETA).

References:

1. Chemical process safety, fundamental with application- Daniel A Crowl/ Joseph F Louver
2. Chemical exposure and toxic response- Edited by- Stephen K. Hall, Joana Chakraborty, Randall J. Ruch.
3. Chemical Risk analysis- Bernard Martel
4. Explosion hazards in the process industries. – Rolf K. Eckhoff.
5. Chemical process Industries Shreve R.N.
6. Chemical Engineers handbook peoy JHJ & Chitten (Ed)
7. Hazardous materials emergency planning guide-NSC India.
8. Loss prevention in the process Industries F.P. Lees.
9. Technical guidance for hazard analysis – NSC India.
10. Process equipment design – MV Joshi
11. Major hazard control – A practical manual (ILO)
12. Chemical Process safety – Daniel A Crawl, Joseph Flouvar.

List of Experiments (Expandable)

1. Study of toxic Chemicals
2. Study of runaway reactions
3. Study of flammability & Explosion
4. Study of corrosive Materials

Course Contents

Category	Title	Code	Credits 4C			Practical
DC 17	Minor Project	ME 706	L	T	P	Max. Marks-50
			0	0	4	Min. Marks-25-

Provision of Minor project is made as preparation phase-I for major project or to take it as an independent small project. For details of project see FT-805- Major project

Course Contents

Category	Title	Code	Credits 2C			Practical
DC 18	Industrial Training	ME 707	L	T	P	Max. Marks-30
			0	0	2	Min. Marks-15

Objective of Industrial Training

The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem and possibly an industry guide for their Major Project in final semester.

Scheme of Studies:

Duration: Minimum 2 weeks in summer break after VI semester, assessment to be done in VII semester

Scheme of Examination:

For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term Work in Industry	Marks Allotted
Attendance and General Discipline	5
Daily diary Maintenance	5
Initiative and participative attitude during training	10
Assessment of training by Industrial Supervisor	10
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Total	30*
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(b) Practical/Oral Examination (Viva-Voce) in Institution	Marks Allotted
1. Training Report	15
2. Seminar and cross questioning (defense)	15
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Total	30
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* - Marks of various components in industry should be awarded by the I/c of training in Industry but in special circumstances if not awarded by the industry then faculty in charge /T.P.O. will give the marks.

During training students will prepare a first draft of training report in consultation with section in charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute.

Learning through Industrial Training

During industrial training students must observe following to enrich their learning:

- Industrial environment and work culture.
- Organisational structure and inter personal communication.
- Machines/equipment/instrument-their working and specifications.
- Product development procedure and phases.
- Project Planning, monitoring and control.
- Quality control and assurance.
- Maintenance system
- Costing system
- Stores and purchase systems.
- Layout of Computer/EDP/MIS centers.
- Roles and responsibilities of different categories of personnel.
- Customer services.
- Problems related to various areas of work etc.

Students are supposed to acquire the knowledge on above by-

- Direct Observations without disturbing personnel at work.
- Interaction with officials at the workplace in free/ tea time
- Study of Literature at the workplace (e.g. User Manual, standards, processes, schedules, etc.)
- "Hand's on" experience
- Undertaking/assisting project work.
- Solving problems at the work place.
- Presenting a seminar
- Participating in group meeting/discussion.
- Gathering primary and secondary data/information through various sources, storage, retrieval and analysis of the gathered data.
- Assisting official and managers in their working
- Undertaking a short action research work.
- Consulting current technical journals and periodicals in the library.
- Discussion with peers.

Daily Diary- Industrial Training

Name of the Trainee..... College
Industry / work place Week No.....
Department /Section Date

Dates Brief of observations made, work done, problem/project undertaken,
discussion held, literature consulted etc.

Signature of Supervisor
(TPO/Faculty)

Signature of Trainee

Signature of Official in
charge for Trg. In Indutry.

Supervision of Industrial Training

Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above area in the field.

One faculty member or TPO will plan industrial training of students in consultation with training manager of the industry (work place) as per the predefined objectives of training.

Monitoring visits will be made by training and placement officer/faculty in-charge for the group of students, of the college during training.

Guidance to the faculty / TPO for Planning and implementing the Industrial Training

Keeping in view the need of the contents, the industrial training program, which is spread to minimum 2 weeks duration, has to be designed in consultation with the authorities of the work place; Following are some of the salient points:

- Spelling out the objectives of the industrial training in behavioral terms and same is informed in advance to the 1) students, 2) authorities of the work place and 3) supervising faculty members.
- Discussing and preparing students for the training for which meetings with the students has to be planned.
- Meeting with industrial personnel and orienting them regarding the objective of the training and the expectations of the program.
- Correspondence with the authorities of the work place.
- Orientation classes for students on how to make the training most beneficial- monitoring daily diary, writing weekly reports, how to interact with various categories of industrial personnel, how to behave and undertake responsibilities, how to gather information from the workplace, ethics etc.
- Guiding students to make individual plans (week wise/ day wise) to undertake industrial training.,
- Developing a system of maintaining training records, by teachers for every batch of students for convenient retrieval.
- Inviting industrial personnel to deliver lectures on some aspects of training.

Action plan for planning stages at the Institutional Level

S.No.	Activity	Commencing Week	Finishing week	Remark
1.	Meeting with Principal			
2.	Meeting with colleagues			
3.	Correspondence with work place(Industry concerned)			
4.	Meeting with authorities of work place			
5.	Orientation of students for industry training			
6.	Scrutinizing individual training plan of students.			
7.	Commencement of individual training			
8.	First monitoring of industrial training			
9.	Second monitoring of industrial training			
10.	Finalization of Training report			
11.	Evaluation of performance at industry level			
12.	Evaluation of Industry Program in the Institutions.			