

**AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI
Regulations - 2009
Curriculum
M.E. INDUSTRIAL SAFETY ENGINEERING**

SEMESTER I

S No.	Subject Code	Subject	L	T	P	C
Theory						
1	MA9317	Probability and Statistics	3	1	0	4
2	IS 9311	Principles of Safety Management	3	0	0	3
3	IS 9312	Environmental safety	3	1	0	4
4	IS 9313	Occupational health and Industrial Hygiene	3	0	0	3
5	IS 9314	Industrial Safety, Health and Environment (SHE) acts	4	0	0	4
6		Elective I	3	0	0	3
Total						21

LIST OF ELECTIVES

S No.	Subject Code	Subject	L	T	P	C
Theory						
1	IS 9001	Quality Engineering	3	0	0	3
2	IS 9002	Artificial Intelligence and Expert systems	3	0	0	3
3	IS 9003	Work Study and Ergonomics	3	0	0	3
4	IS 9004	Dock Safety	3	0	0	3
5	IS 9005	Safety in Construction	3	0	0	3
6	IS 9006	Transport Safety	3	0	0	3
7	IS 9007	Fireworks safety	3	0	0	3
8	IS 9008	Safety in Powder Handling	3	0	0	3
9	IS 9009	Nuclear Engineering and Safety	3	0	0	3
10	IS 9010	Safety in Textile Industry	3	0	0	3
11	IS 9011	Safety in Mines	3	0	0	3
12	IS 9012	Safety in Engineering Industry	3	0	0	3
13	IS 9013	Plant Layout and Materials Handling	3	0	0	3
14	IS 9014	Disaster Management	3	0	0	3
15	IS 9015	OHSAS 18000 and ISO 14000	3	0	0	3
16	IS 9016	Human Factors Engineering	3	0	0	3

UNIT II SAFETY AUDIT - INTRODUCTION 10

Components of safety audit, types of audit, audit methodology, non conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor.

UNIT III ACCIDENT INVESTIGATION AND REPORTING 10

Concept of an accident, reportable and non reportable accidents, reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident.

UNIT IV SAFETY PERFORMANCE MONITORING 8

ANSI (Z16.1) Recommended practices for compiling and measuring work injury experience – permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

UNIT V SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.
2. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, 1997.
3. Lees, F.P., “Loss Prevention in Process Industries” Butterworth publications, London, 2nd edition, 1990.
4. John Ridley, “Safety at Work”, Butterworth and Co., London, 1983.

REFERENCES:

1. Dan Petersen, “Techniques of Safety Management”, McGraw-Hill Company, Tokyo, 1981.
2. Relevant India Acts and Rules, Government of India.
3. Relevant Indian Standards and Specifications, BIS, New Delhi.
4. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, 1973.
5. “Safety and Good House Keeping”, N.P.C., New Delhi, 1985.
6. “Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, 1982.
7. Journal by Insurance company surveyors and loss assessors – Mumbai – published by Insurance companies.

UNIT I AIR POLLUTION 10

Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution-hazards of air pollution-concept of clean coal combustion technology - ultra violet radiation, infrared radiation, radiation from sun-hazards due to depletion of ozone - deforestation-ozone holes-automobile exhausts-chemical factory stack emissions-CFC.

UNIT II WATER POLLUTION 10

Classification of water pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal -advanced wastewater treatment - effluent quality standards and laws- chemical industries, tannery, textile effluents-common treatment.

UNIT III HAZARDOUS WASTE MANAGEMENT 8

Hazardous waste management in India-waste identification, characterization and classification-technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-incineration and vitrification - hazards due to bio-process-dilution-standards and restrictions – recycling and reuse.

UNIT IV ENVIRONMENTAL MEASUREMENT AND CONTROL 10

Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – lux meter-pH meter – gas chromatograph – atomic absorption spectrometer.

Gravitational settling chambers-cyclone separators-scrubbers-electrostatic precipitator - bag filter – maintenance - control of gaseous emission by adsorption, absorption and combustion methods- Pollution Control Board-laws.

UNIT V POLLUTION CONTROL IN PROCESS INDUSTRIES 7

Pollution control in process industries like cement, paper, petroleum-petroleum products-textile-tanneries-thermal power plants – dyeing and pigment industries - eco-friendly energy.

L:45 T:15 TOTAL: 60 PERIODS

REFERENCES:

1. Rao, CS, "Environmental pollution engineering:", Wiley Eastern Limited, New Delhi, 1992.
2. S.P.Mahajan, "Pollution control in process industries", Tata McGraw Hill Publishing Company, New Delhi, 1993.
3. Varma and Braner, "Air pollution equipment", Springer Publishers, Second Edition.

UNIT I PHYSICAL HAZARDS 9

Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs- vibration, types, effects, instruments, surveying procedure, permissible exposure limit.

Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard- non-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control

UNIT II CHEMICAL HAZARDS 9

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard.

Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling

Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education

UNIT III BIOLOGICAL AND ERGONOMICAL HAZARDS 9

Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design.

Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries.

UNIT IV OCCUPATIONAL HEALTH AND TOXICOLOGY 9

Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests.

Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems

UNIT V OCCUPATIONAL PHYSIOLOGY**9**

Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.

TEXT BOOK

1. Hand book of “Occupational Safety and Health”, National Safety Council, Chicago, 1982

REFERENCE

1. Encyclopedia of “Occupational Health and Safety”, Vol.I and II, published by International Labour Office, Geneva, 1985

**IS 9314 INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENT ACTS L T P C
3 0 0 3****UNIT I FACTORIES ACT – 1948 10**

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948

UNIT II ENVIRONMENT ACT – 1986 10

General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board.

Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

UNIT III MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989 10

Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets.

UNIT IV OTHER ACTS AND RULES 20

Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules – hazardous wastes (management and handling) rules, 1989, with amendments in 2000-the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules-Explosives Act 1983-Pesticides Act

UNIT V INTERNATIONAL ACTS AND STANDARDS**10**

Occupational Safety and Health act of USA (The Williames-Steiger Act of 1970) – Helath and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).

TOTAL: 60 PERIODS**REFERENCES:**

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000
2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
3. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New Delhi.
4. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
5. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
6. The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
7. The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai.
8. National seminar on hazardous waste management organized by National Safety council, Ministry of environment and forests, Government of India, United States – Asia environmental partnership, Tamilnadu pollution control board and Indian chemical manufacturers association, April 2001.

IS 9001

QUALITY ENGINEERING

L T P C

3 0 0 3

UNIT I STATISTICAL PROCESS CONTROL 10

Quality objectives – Quality control – Quality Assurance – Process variability – Control charts for variables and attributes, multivarichart - demerit control chart – process capability studies.

UNIT II ACCEPTANCE SAMPLING 8

Economics of sampling – Acceptance sampling by variables and attributes – Single, double and sequential plans – OC curves – ATI, ASN, AOQL – Standard sampling tables.

UNIT III DESIGN OF EXPERIMENTS 10

Factorial experiments – single factor, multi factor, 2^k design– Taguchi methods – use of orthogonal arrays.

UNIT IV QUALITY MANAGEMENT 9

ISO 9000 and TQM concepts - Quality circles, tools – Zero defect management, 6 sigma – Quality Function Deployment (QFD).

UNIT V RELIABILITY 8

Reliability concepts - Reliability prediction – Series and Parallel systems – Reliability testing.

TOTAL : 45 PERIODS

REFERENCES:

1. Logothetis, N, “Managing for total quality from Deming to Taguchi and SPC”, PHI ,1997.
2. Douglas, C.Montgomery, “Introduction to Statistical quality control”, Second Edition, John Wiley and Sons, 1991.
3. Srinath L S, “Reliability Engineering”, Affiliated East-West Press Pvt Ltd, New Delhi, 1998.
4. Grant E L, “Statistical Quality Control”,

IS 9002

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L T P C

3 0 0 3

UNIT I INTRODUCTION 9

Intelligence – Definition, types cognitive aspect approach, measuring intelligence – early efforts, IQ and AI: aspects of intelligence – learning, problem solving, creativity, behaviour and biology. Artificial intelligence: Historical background, applications of AI, objections and myths, AI languages: Introduction to PROLOG and LISP.

UNIT II COGNITIVE PSYCHOLOGY 11

The mind – informative and cybernetics, components for thought, modes of perception – visual, auditory and other systems: memory mechanisms, problem solving – planning, search, the GPS systems; types of learning – rote, parameter, method and concept: Game playing, reasoning, Artificial Vision – picture processing – identifying real objects; Vision programs, factory vision systems.

UNIT III KNOWLEDGE ENGINEERING 9

Introduction – role of knowledge engineer, knowledge representation – psychology, production rules, logic and programming, Common sense and fuzzy logic, semantic networks, learning systems.

UNIT IV EXPERT SYSTEMS 9

Introduction, knowledge acquisition for Expert system, features of Expert systems – System structure, inference Engines, uncertainties, memory mechanisms, range of applications, actual expert systems – VP expert. Assignment – Development of a simple expert system.

UNIT V INTRODUCTION TO NEURAL NETWORKS 7

Neural Network Architecture – Learning methods – Architecture of a Back Propagation Network – Selection of parameters – Simple variations of BPN.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Elaine R., and Kevin, “Artificial Intelligence”, 2nd Edition, Tata McGraw Hill, 1994.

REFERENCES:

1. Rajasekaran S and Vijayalakshmi Pai, G.A, “Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications”, PHI, 2003.
2. Charnaik, E., and McDermott, D., “Introduction to Artificial Intelligence”, Addison Wesley, 1985.
3. Dan W.Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India, 1992.
4. Winston, P.H., “Artificial Intelligence”, Addison Wesley, 1990.
5. Nilsson, N.J., “Principles of AI”, Narosa Publishing House, 1990.
6. Schalkoff, R.J., “Artificial Intelligence” – An Engineering Approach”, McGraw Hill International Edition, Singapore, 1992.

**IS 9003 WORK STUDY AND ERGONOMICS L T P C
3 0 0 3**

UNIT I WORK STUDY 9

Study of operations – work content – work procedure – breakdown – human factors – safety and method study – methods and movements at the workplace – substitution with latest devices – robotic concepts – applications in hazardous workplaces – productivity, quality and safety (PQS).

UNIT I HISTORY OF SAFETY LEGISLATION 9

History of dock safety statues in India-background of present dock safety statues- dock workers (safety, health and welfare) act 1986 and the rules and regulations framed there under, other statues like marking of heavy packages act 1951 and the rules framed there under - manufacture, storage and import of hazardous chemicals. Rules 1989 framed under the environment (protection) act, 1989 – few cases laws to interpret the terms used in the dock safety statues.

Responsibility of different agencies for safety, health and welfare involved in dock work – responsibilities of port authorities – dock labour board – owner of ship master, agent of ship – owner of lifting appliances and loose gear etc. – employers of dock workers like stevedores – clearing and forwarding agents – competent persons and dock worker. Forums for promoting safety and health in ports – Safe Committees and Advisory Committees. Their functions, training of dock workers.

UNIT II WORKING ON BOARD THE SHIP 9

Types of cargo ships – working on board ships – Safety in handling of hatch beams – hatch covers including its marking, Mechanical operated hatch covers of different types and its safety features – safety in chipping and painting operations on board ships – safe means of accesses – safety in storage etc. – illumination of decks and in holds – hazards in working inside the hold of the ship and on decks – safety precautions needed – safety in use of transport equipment - internal combustible engines like forklift trucks-pay loaders etc. Working with electricity and electrical management – Storage – types, hazardous cargo.

UNIT III LIFTING APPLIANCES 9

Different types of lifting appliances – construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances – portainers – transtainers – toplift trucks – derricks in different rigging etc.

Use and care of synthetic and natural fiber ropes – wire rope chains, different types of slings and loose gears.

UNIT IV TRANSPORT EQUIPMENT 9

The different types of equipment for transporting containers and safety in their use-safety in the use of self loading container vehicles, container side lifter, fork lift truck, dock railways, conveyors and cranes.

Safe use of special lift trucks inside containers – Testing, examination and inspection of containers – carriage of dangerous goods in containers and maintenance and certification of containers for safe operation

Handling of different types of cargo – stacking and unstacking both on board the ship and ashore – loading and unloading of cargo identification of berths/walking for transfer operation of specific chemical from ship to shore and vice versa – restriction of loading and unloading operations.

UNIT IV CONSTRUCTION MACHINERY 9

Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling.

UNIT V SAFETY IN DEMOLITION WORK 9

Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents.

TOTAL : 45 PERIODS

REFERENCES:

- 1 Hudson, R., "Construction hazard and Safety Hand book, Butter Worth's, 1985.
2. Jnathea D.Sime, "Safety in the Build Environment", London, 1988.
3. V.J.Davies and K.Thomasin "Construction Safety Hand Book" Thomas Telford Ltd., London, 1990.
4. Handbook of OSHA Construction safety and health charles D. Reese and James V. Edison

**IS 9006 TRANSPORT SAFETY L T P C
3 0 0 3**

UNIT I TRANSPORTATION OF HAZARDOUS GOODS 9

Transport emergency card (TREM) – driver training-parking of tankers on the highways-speed of the vehicle – warning symbols – design of the tanker lorries -static electricity-responsibilities of driver – inspection and maintenance of vehicles-check list- loading and decanting procedures – communication.

UNIT II ROAD TRANSPORT 8

Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians-design, selection, operation and maintenance of motor trucks-preventive maintenance-check lists-motor vehicles act – motor vehicle insurance and surveys.

UNIT III DRIVER AND SAFETY 9

Driver safety programme – selection of drivers – driver training-tacho-graph-driving test-driver's responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving incentives-slogans in driver cabin-motor vehicle transport workers act- driver relaxation and rest pauses – speed and fuel conservation – emergency planning and Haz mat codes

UNIT IV ROAD SAFETY 10

Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.-factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds- Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading-concentration of driver.

Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices.

UNIT V SHOP FLOOR AND REPAIR SHOP SAFETY 9

Transport precautions-safety on manual, mechanical handling equipment operations-safe driving-movement of cranes-conveyors etc., servicing and maintenance equipment-grease rack operation-wash rack operation-battery charging-gasoline handling-other safe practices-off the road motorized equipment.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.
2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.

REFERENCES

1. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.
2. Motor Vehicles Act, 1988, Government of India.
3. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
4. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.
5. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"

**IS 9007 FIRE WORKS SAFETY L T P C
3 0 0 3**

UNIT I PROPERTIES OF FIREWORKS CHEMICALS 9

Fire properties – potassium nitrate (KN₃), potassium chlorate (KClO₃), barium nitrate (BaNO₃), calcium nitrate (CaNO₃), Sulphur (S), Phosphorous (P), antimony (Sb), Pyro Aluminum (A1) powder-Reactions-metal powders, Borax, ammonia (NH₃) – Strontium Nitrate, Sodium Nitrate, Potassium per chloride. Fire and explosion, impact and friction sensitivity.

UNIT II STATIC CHARGE AND DUST 9

Concept-prevention-earthing-copper plates-dress materials-static charge meter lightning, Causes-effects-hazards in fire works factories-lightning arrestor :concept-installation-earth pit-maintenance-resistance-legal requirements-case studies.

Dust: size-respirable, non-respirable-biologicalbarriers-hazards-personal protective equipment-pollution prevention.

UNIT II METAL POWDERS AND CHARACTERIZATION 10

Atomization, types – milling – electro deposition – spray drying, Production of iron powder, Aluminium powder, Titanium – screening and cleaning of metals – Explosivity and pyrophoricity – toxicity

Particle size and size distribution – measurement, types and significance – particle shape analysis, methods, surface area, density, porosity, flowrate – testing.

Metal powders, applications as fuel, solid propellants, explosives, pyrotechnics.

UNIT III DUST EXPLOSION 9

Industrial dust, dust explosion accidents – explosibility characteristics, minimum explosive concentration, minimum ignition energy, explosion pressure characteristics, maximum permissible oxygen concentration- explosibility tests, Hartmann vertical tube apparatus, horizontal tube apparatus, inflammatory apparatus, Godbert and Greenward furnace. Explosibility classification – Hybrid test – gas mixtures – Dust ignition sources – Dust explosion prevention – Dust explosion protection – Dust explosion venting, vent coefficient, various methods of design – venting of ducts and pipes – dust fire.

UNIT IV DUST HANDLING PLANTS AND ELECTRO STATIC HAZARDS 9

Grinding mills, conveyors, bucket elevators, dust separators, dust filters, cyclones, driers, spray driers, silos, grain elevators, typical applications, hazards.

Electrostatic charges-energy released-type of discharge-spark-carona-insulating powders-propagating brush discharge-discharge in bulk lightning hazards in powder coating-electroplating.

UNIT V DUST EVALUATION AND CONTROL 9

Evaluation, methodology, Quantitative, sampling, measurements – control approaches and strategies – control of dust sources, dust transmission – role of workers, PPE and work practice – House keeping – storage –labelling – warning sign – restricted areas - Environmental protections.

Evaluation procedures and control measures for particulates (Respirable), Asbestos and other fibres, silica in coal mine - NIOSH guide to the selection and use of particulate respirators – case studies.

TOTAL : 45 PERIODS

REFERENCES:

1. Martin Glor, "Electro Static Hazard in Powder Handling" Research studies Press Ltd., England, 1988.
2. Major hazard control-ILO Geneva, 1987.
3. Seminar on "Hazard recognition and prevention in the work place-airborne dust" Vol.I and 2, SRMC, Chennai, 4/5, Sept.2000.
4. ASM Metals hand book, Ninth edition, Vol.7, Powder Metallurgy.

UNIT I INTRODUCTION 9

Binding energy – fission process – radio activity – alpha, beta and gamma rays radioactive decay – decay schemes – effects of radiation – neutron interaction – cross section – reaction rate – neutron moderation – multiplication – scattering – collision – fast fission – resonance escape – thermal utilization – criticality.

UNIT II REACTOR CONTROL 9

Control requirements in design considerations – means of control – control and shut down rods – their operation and operational problems – control rod worth – control instrumentation and monitoring – online central data processing system.

UNIT III REACTOR TYPES 9

Boiling water reactors – radioactivity of steam system – direct cycle and dual cycle power plants-pressurized water reactors and pressurized heavy water reactors – fast breeder reactors and their role in power generation in the Indian context – conversion and breeding – doubling time – liquid metal coolants – nuclear power plants in India.

UNIT IV SAFETY OF NUCLEAR REACTORS 9

Safety design principles – engineered safety features – site related factors – safety related systems – heat transport systems – reactor control and protection system – fire protection system – quality assurance in plant components – operational safety – safety regulation process – public awareness and emergency preparedness. Accident Case studies- Three Mile island and Chernobyl accident.

UNIT V RADIATION CONTROL 9

Radiation shielding – radiation dose – dose measurements – units of exposure – exposure limits – barriers for control of radioactivity release – control of radiation exposure to plant personnel – health physics surveillance – waste management and disposal practices – environmental releases.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M.M.E.L.Wakil, "Nuclear Power Engineering", International Text Book Co.
2. Stermann U.S."Thermal and Nuclear Power Stations", MIR Publications, Moscow, 1986.

REFERENCES:

1. "Loss prevention in the process Industries" Frank P.Lees Butterworth-Hein-UK, 1990.
2. M.M.E.L.Wakil, "Nuclear Energy Conversion", International Text Book Co.
3. R.L.Murray, "Introduction to Nuclear Engineering", Prentice Hall.
4. Sri Ram K, "Basic Nuclear Engineering" Wiley Eastern Ltd., New Delhi, 1990.
5. Loffness, R.L., "Nuclear Power Plant" Van Nostrand Publications, 1979.

UNIT I INTRODUCTION 9

Introduction to process flow charts of i) short staple spinning, ii) long staple spinning, iii) viscose rayon and synthetic fibre, manufacturer, iv) spun and filament yarn to fabric manufacture, v) jute spinning and jute fabric manufacture-accident hazard, guarding of machinery and safety precautions in opening, carding, combing, drawing, flyer frames and ring frames, doubles, rotor spinning, winding, warping, softening/spinning specific to jute.

UNIT II TEXTILE HAZARDS I 9

Accident hazards i) sizing processes- cooking vessels, transports of size, hazards due to steam ii) Loom shed – shuttle looms and shuttless looms iii) knitting machines iv) non-wovens.

UNIT III TEXTILE HAZARDS II 9

Scouring, bleaching, dyeing, punting, mechanical finishing operations and effluents in textile processes.

UNIT IV HEALTH AND WELFARE 9

Health hazards in textile industry related to dust, fly and noise generated-control measures-relevant occupational diseases, personal protective equipment-health and welfare measures specific to textile industry, Special precautions for specific hazardous work environments.

UNIT V SAFETY STATUS 9

Relevant provision of factories act and rules and other statues applicable to textile industry – effluent treatment and waste disposal in textile industry.

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Safety in Textile Industry" Thane Belapur Industries Association, Mumbai.

REFERENCES:

1. 100 Textile fires – analysis, findings and recommendations LPA
2. Groover and Henry DS, "Hand book of textile testing and quality control"
3. "Quality tolerances for water for textile industry", BIS
4. Shenai, V.A. "A technology of textile processing", Vol.I, Textile Fibres
5. Little, A.H., "Water supplies and the treatment and disposal of effluent"

UNIT II PRINCIPLES OF MACHINE GUARDING 9

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.

Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearing-presses-forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

UNIT III SAFETY IN WELDING AND GAS CUTTING 9

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT IV SAFETY IN COLD FARMING AND HOT WORKING OF METALS 9

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes.

Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes , hazards and control measures.

Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

UNIT V SAFETY IN FINISHING, INSPECTION AND TESTING 9

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

TOTAL: 45 PERIODS

REFERENCES:

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.
3. "Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. "Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

UNIT I PLANT LOCATION 9

Selection of plant locations, territorial parameters, considerations of land, water, electricity, location for waste treatment and disposal, further expansions

Safe location of chemical storages, LPG, LNG, CNG, acetylene, ammonia, chlorine, explosives and propellants

UNIT II PLANT LAYOUT 9

Safe layout, equipment layout, safety system, fire hydrant locations, fire service rooms, facilities for safe effluent disposal and treatment tanks, site considerations, approach roads, plant railway lines, security towers.

Safe layout for process industries, engineering industry, construction sites, pharmaceuticals, pesticides, fertilizers, refineries, food processing, nuclear power stations, thermal power stations, metal powders manufacturing, fireworks and match works

UNIT III WORKING CONDITIONS 9

Principles of good ventilation, purpose, physiological and comfort level types, local and exhaust ventilation, hood and duct design, air conditioning, ventilation standards, application.

Purpose of lighting, types, advantages of good illumination, glare and its effect, lighting requirements for various work, standards- House keeping, principles of 5S.

UNIT IV MANUAL MATERIAL HANDLING AND LIFTING TACKLES 9

Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects – accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows – storage of specific materials - problems with hazardous materials, liquids, solids – storage and handling of cryogenic liquids - shipping and receiving, stock picking, dock boards, machine and tools, steel strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading – personal protection – ergonomic considerations

Fiber rope, types, strength and working load inspection, rope in use, rope in storage - wire rope, construction, design factors, deterioration causes, sheaves and drums, lubrication, overloading, rope fitting, inspection and replacement – slings, types, method of attachment, rated capacities, alloy chain slings, hooks and attachment, inspection

UNIT V MECHANICAL MATERIAL HANDLING 9

Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules, inspection and inspection checklist – conveyors, precautions, types, applications.

Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks – power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types- Escalator, safety devices and brakes, moving walks – man lifts, construction, brakes, inspection.

TEXT BOOKS

1. "Encyclopedia of occupational safety and health", ILO Publication, 1985
2. "Accident prevention manual for industrial operations" N.S.C., Chicago, 1982.
3. Alexandrov. M.P. "Material handling equipment" Mir Publishers, Moscow, 1981
4. APPLE M. JAMES "Plant layout and material handling", 3rd edition, John Wiley and sons.

REFERENCES

1. Spivakosky, "Conveyors and related Equipment", Vol.I and II Peace Pub. Moscow, 1982.
2. Rudenko, N., "Material handling Equipments", Mir Publishers, 1981.
3. Reymond, A.Kulwice, "Material Handling Hand Book - II", John Wiley and Sons, New York, 1985.
4. "Safety and good house keeping", N.P.C. New Delhi, 1985.
5. "Industrial ventilation (A manual for recommended practice), American conference of Governmental Industrial Hygiene, USA, 1984.

IS 9014

DISASTER MANAGEMENT

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UNIT I

10

Philosophy of Disaster management-Introduction to Disaster mitigation-Hydrological, Coastal and Marine Disasters-Atmospheric disasters-Geological, meteorological phenomena-Mass Movement and Land Disasters-Forest related disasters-Wind and water related disasters-deforestation-Use of space technology for control of geological disasters-Master thesis

UNIT II

10

Technological Disasters-Case studies of Technology disasters with statistical details-Emergencies and control measures-APELL-Onsite and Offsite emergencies-Crisis management groups-Emergency centers and their functions throughout the country-Softwares on emergency controls-Monitoring devices for detection of gases in the atmosphere-Right to know act

UNIT III

8

Introduction to Sustainable Development-Bio Diversity-Atmospheric pollution-Global warming and Ozone Depletion-ODS banking and phasing out-Sea level rise-EI Nino and climate changes-Eco friendly products-Green movements-Green philosophy-Environmental Policies-Environmental Impact Assessment-case studies-Life cycle

UNIT IV

8

Offshore and onshore drilling-control of fires-Case studies-Marine pollution and control-Toxic, hazardous and Nuclear wastes-state of India's and Global environmental issues-carcinogens-complex emergencies-Earthquake disasters-the nature-extreme event analysis-the immune system-proof and limits-

UNIT V**10**

Environmental education-Population and community ecology-Natural resources conservation-Environmental protection and law-Research methodology and systems analysis-Natural resources conservation-Policy initiatives and future prospects-Risk assessment process, assessment for different disaster types-Assessment data use, destructive capacity-risk adjustment-choice-loss acceptance-disaster aid- public liability insurance-stock taking and vulnerability analysis-disaster profile of the country-national policies-objectives and standards-physical event modification-preparedness, forecasting and warning, land use planning

REFERENCES:

1. Introduction to Environmental Engineering and Science, Gilbert, M. Masters
2. Environmental Science, Miller, G. Tylor
3. Environmental Science sustaining the earth, G. Tylor, Miller
4. Principles of Environmental Science and Engineering, Bagad Vilas.
5. Principles of Environmental Science and Engineering, R. Sivakumar

IS9015**OHSAS 18000 AND ISO 14000****L T P C****3 0 0 3****UNIT I****OHSAS STANDARD****9**

Introduction – Development of OHSAS standard – Structure and features of OSHAS 18001 – Benefits of certification-certification procedure – OH and S management system element, specification and scope - correspondence between OHSAS 18001, ISO 14001:1996 and ISO 9001:1994 – Guidelines (18002:2000) for implementing OHSAS 18001.

UNIT II**OHSAS 18001 POLICY AND PLANNING****9**

Developing OH and S policy– Guidelines – Developments - procedure - Content of OH and S policy – General principle, strategy and planning, specific goals, compliance – methodology.

Planning – Guidelines, methodology steps developing action plan – Analysis and identify the priorities, objective and Targets, short term action plan, benefits and cost of each option, Development of action plan.

UNIT III**IMPLEMENTATION AND OPERATION, CHECKING AND REVIEW****9**

Guidelines for structure and Responsibilities, Top Management, middle level management, co-ordinator and employees - Developing procedures, identifying training needs, providing training, documentation of training, Training methodology consultation and communications.

Checking and Review; performance measurement and monitoring, Proactive and Reactive monitoring, measurement techniques, inspections, measuring equipment - Accidents reports, Process and procedures, recording, investigation corrective action and follow up - records and records management. Handling documentation, information, records.

UNIT IV ISO 14001 9
 EMS, ISO 14001, specifications, objectives, Environmental Policy, Guidelines and Principles (ISO 14004), clauses 4.1 to 4.5. Documentation requirements, 3 levels of documentation for a ISO 14000 based EMS, steps in ISO 14001.
 Implementation plan, Registration, Importance of ISO 14000 to the Management. Auditing ISO14000-General principles of Environmental Audit, Auditor, steps in audit, Audit plan.

UNIT V ENVIRONMENT IMPACT ASSESSMENT 9
 ISO 14040(LCA), General principles of LCA, Stages of LCA, Report and Review. ISO 14020 (Eco labeling) – History, 14021, 14024, Type I labels, Type II labels, ISO 14024, principles, rules for eco labeling before company attempts for it. Advantages. EIA in EMS, Types of EIA, EIA methodology EIS, Scope, Benefits.
 Audit-methodology, Auditors Audit results management review-Continual improvement.

REFERENCE:

1. ISO 9000 to OHSAS 18001, Dr. K.C. Arora, S.K. Kataria and Sons, Delhi.

IS 9016 HUMAN FACTORS ENGINEERING L T P C 3 0 0 3

UNIT I ERGONOMICS AND ANATOMY 9
 Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics

Anatomy, Posture and Body Mechanics: Some basic body mechanics, anatomy of the spine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioural aspects of posture, effectiveness and cost effectiveness, research directions

UNIT II HUMAN BEHAVIOR 9
 Individual differences, Factors contributing to personality, Fitting the man to the job, Influence of difference on safety, Method of measuring characteristics, Accident Proneness.

Motivation, Complexity of Motivation, Job satisfaction. Management theories of motivation, Job enrichment theory.

Frustration and Conflicts, Reaction to frustration, Emotion and Frustration.

Attitudes-Determination of attitudes, Changing attitudes

Learning, Principles of Learning, Forgetting, Motivational requirements.

UNIT III ANTHROPOMETRY AND WORK DESIGN FOR STANDING AND SEATED WORKS 9

Designing for a population of users, percentile, sources of human variability, anthropometry and its uses in ergonomics, principals of applied anthropometry in ergonomics, application of anthropometry in design, design for everyone, anthropometry and personal space, effectiveness and cost effectiveness

Fundamental aspects of standing and sitting, an ergonomics approach to work station design, design for standing workers, design for seated workers, work surface design, visual display units, guidelines for design of static work, effectiveness and cost effectiveness, research directions

UNIT V MAN - MACHINE SYSTEM AND REPETITIVE WORKS AND MANUAL HANDLING TASK 9

Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Man vs Machine.

Ergonomics interventions in Repetitive works, handle design, key board design- measures for preventing in work related musculoskeletal disorders (WMSDs), reduction and controlling, training

Anatomy and biomechanics of manual handling, prevention of manual handling injuries in the work place, design of manual handling tasks, carrying, postural stability

UNIT V HUMAN SKILL AND PERFORMANCE AND DISPLAY, CONTROLS AND VIRTUAL ENVIRONMENTS 9

A general information-processing model of the users, cognitive system, problem solving, effectiveness.

Principles for the design of visual displays- auditory displays- design of controls- combining displays and controls- virtual (synthetic) environments, research issues.

REFERENCES:

1. Introduction to Ergonomics, R.S. Bridger, Taylor and Francis
2. Ergonomic design for organizational effectiveness, Michael O'Neill
3. Human factors in engineering and design, MARK S.SANDERS
4. The Ergonomics manual, Dan McLeod, Philip Jacobs and Nancy Larson