JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

INSTITUTE OF SCIENCE & TECHNOLOGY
DEPARTMENT OF SCHOOL OF HEALTH SCIENCES & RESEARCH

COURSE STRUCTURE & SYLLABUS M.Tech

ENVIRONMENTAL OCCUPATIONAL HEALTH & SAFETY

Programme

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
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1 Year –I SEMESTER

S. NO	SUBJECT	T	P	CREDITS
1	Fundamentals of Basic Sciences	3	-	3
2	Orientation & Management Of Safety, Health And Environment	3	-	3
3	Basic Principles Of Environment And Air Pollution	3	-	3
4	Water And Water Pollution & Health	3	-	3
5	Epidemiology & Bio-Statistics	3	-	3
6	Fundamentals Of Basic Sciences Laboratory	-	3	2
7	Orientation & Management Of Safety, Health And Environment Laboratory	-	3	2
8	Basic Principles Of Environment And Air Pollution Laboratory	-	3	2
9	Water And Water Pollution & Health Laboratory	-	3	2
10	Epidemiology & Bio-Statistics Laboratory	-	3	2
TOTAL CREDITS				**25**

1 Year – II SEMESTER

S. NO	SUBJECT	T	P	CREDITS
1	Occupational Health & Hygiene	3	-	3
2	Construction Safety	3	-	3
3	Safety At Different Industries-I	3	-	3
4	Disaster Management	3	-	3
5	Safety In Engineering Activities	3	-	3
6	Occupational Health & Hygiene Laboratory	-	3	2
7	Construction Safety Laboratory	-	3	2
8	Safety At Different Industries-I Laboratory	-	3	2
9	Disaster Management Laboratory	-	3	2
10	Safety In Engineering Activities Laboratory	-	3	2
TOTAL CREDITS				**25**

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II Year – I SEMESTER

S. NO	SUBJECT	T	P	CREDITS
1	Fire & Explosions	3	-	3
2	Industrial Psychology And Behavioural Modifications	3	-	3
3	Safety At Different Industries -II	3	-	3
4	Hazard Analysis &Risk Assessment	3	-	3
5	Acts & Laws, Ilo's Conventions & Recommendations	3	-	3
6	Fire & Explosions Laboratory	-	3	2
7	Industrial Psychology And Behavioural Modifications Laboratory	-	3	2
8	Safety At Different Industries –II Laboratory	-	3	2
9	Hazard Analysis &Risk Assessment Laboratory	-	3	2
10	Acts & Laws, Ilo's Conventions & Recommendations Laboratory	-	3	2
TOTAL CREDITS				**25**

II Year – II SEMESTER

S. No	Subject	Presentation	Evaluation	Credits
1	PROJECTS	10	15	25

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I Year - I Semester		L	T	P	C
		3	0	0	3
FUNDAMENTALS OF BASIC SCIENCES					

Unit 1 - Basic Health Sciences:- Anatomy and physiology of Musculo skeletal system (Types of skeleton, Classification of joints, Musculo skeletal disorders, Ergonomics & Ergonomic posture), Anatomy and Physiology of Lungs, Skin and Occupational dermatitis, Ears, Eyes Structure of Spinal cord, Nutrition (Probiotics), Micro nutrients, energy balance, Water metabolism.

Unit2- Toxicology: Definition of Toxicology, Basics of Toxicology, Routes of Entry(Inhalation, Absorption, Ingestion), Anatomy and Physiology of Respiratory System, Skin and Digestive system, Metabolism, Excretion. Acute & Chronic exposure and its effects on human body, identifying the toxic substances at work place and measuring of toxic substances, prevention of entry of toxic substances in to the human body, List of Antidotes for different chemicals, TLV(Threshold limit value), LD (Lethal Dose), Lethal Concentration (LC), IDLH (Immediately Dangerous to life and Health), Emergency treatment for toxic substances.
Case studies - Minamata disease, Xylene exposure (Human Carcinogen) etc.

Unit3- Assessment of health risks:

- Introduction hazard and risk
- Assessment of health risks
- Define the extent of the assessment
- Gather information
- Assess the health risk(s), specify any action required
- Record the risk assessment, carry out the actions
- Review the risk assessment

Unit4- Industry and Your Health (Public Health point of view) – Definitions, Protection of employee and employer health, Protection of the health of the families of the workers who are living inside industry premises, Assessment of Health Risks (Assess, Specify required action, Record, Review), Protection of ecology and neighborhood health, Health promotion and Health education in industry, statistics in different occupations in different industries. Exposure to different toxic materials and their controls. Introduction to Industrial Hygiene. Epidemiological exposure and industrial toxic substances a case study.

Unit 5 - Skills- Inter personality Development Skills, Paper writing Skills, Presentation Skills, Communication Skills, Morals & ethics, Plagiarism and its impact on present day academics and skills. Patents and intellectual property protection**,** Behavioral Modification (STOP Programme), group dynamics, etiquette, Commercial awareness, time management, planning and organizing, Goals setting skills, leadership quality, personal impact and confidence, coping with stress, honesty and integrity, decision making, team work, in basket training.

Labs:-JNTUK, Factory visits, (Use RMC/ Government General Hospital and Bio Chemistry and Physiology labs as we have official permission.)

1. Specimen Reading, cardio pulmonary resuscitation,. Musculo Skeletal Assessment (First Aid and CPR)
2. Demonstration of musculo skeletal system.(Physiology lab at RMC)
3. Toxicology- How to identify the toxic material (Measuring toxicity levels in blood and urine)
4. Measuring of Toxic gases in different Scenarios using gas detectors
5. Pulmonary function test and Liver function test
6. Health Manual Preparation for the above topics
7. Industry and Your Health- Noise and Dust measurements in public places
8. Different gases detection in public places
9. Exercises : Paper writing
10. weekly Presentations(every Saturday)

Reference Books:

1. Gray's Anatomy, Principles of Anatomy by Gerard J. Tortora, and Bryan H. Derrickson,
2. Cunningham Manuals 1-3,
3. Introduction to Poditr Neale's disorders of the foot- diagnosis and management, Editor Donold L. Lorimer, Gwen French.
4. Industrial Toxicology by Irving Sax
5. Hamilton and Hardy Industrial Toxicology
6. Basic Principles in Occupational Hygiene By, Steve Bailey, GSK
7. Current topics in Occupational Epidemiology edited by Katherine Vanables
8. Epidemiology Public Health Medicine by Norman Vetter, Ian Matthews
9. Industrial Toxicology by Irving Sax
10. Personality Development and Soft Skill, by Varun K.Mitra.
11. The Ace of Soft Skills, Gopala Swamy Ramesh.

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I Year - I Semester		L	T	P	C
		3	0	0	3
ORIENTATION & MANAGEMENT OF SAFETY, HEALTH AND ENVIRONMENT					

Unit-1: Introduction to Occupational Health & Safety (modern safety concept and techniques) General Principles of Health, Safety & Environment ,Top Management Commitment to NIOH, ILO and DGFASLI role and functioning., Introduction to factory act 1948, Introduction to OSHA

Equipping students with skills and techniques for:
1. Role of safety Professional to develop Safety culture in industry.
2. To get familiar with Accidents and its causes (direct and indirect), theories of accident. Take measures to prevent Accidents and loss prevention
3. Introduction to EOHS related statutory provisions and standards
4. Orientation and Training of general EOHS topics and related terminology

Unit-2: Safety management & its Responsibilities

- Definition of Safety management and its Types
- Safety Management roles and responsibilities
- Process Safety Management & Risk Management
- Safety policy and commitment
- Roles of management, workers/trade unions and government towards EOHS
- Role of competent persons
- Strategic planning and purpose, scope

Unit-3:- Safety Organization & Safety committee formation

- Principles of organization
- Role of organizations
- EOHS Department:- Structure & functions
- Safety Officer – roles and responsibilities
- Safety committee formation and conducting meetings
- Formulating EOHS plans and programs for the organization
- Monitoring of EOHS plans through periodic Audits, Inspections, Surveys
- Review of EOHS performance

Unit- 4 Safety education and Training:-

- Definitions, Elements of Safety Training
- Identification of training needs and purpose
- Objectives of training and Techniques of training
- Design and development of training program
- Training methods & strategies types of training
- Training for different levels of employees
- Integration of safety training with job training
- Types of training aids and materials
- Evaluation & Review of training programs
- Role of Safety in Sustainable development

Unit- 5: Systems, Tools & Techniques to be followed for safe execution of works – Introduction to HAZARD, RISK, RISK ASSESMENT, PTW, JSA, HAZOP, HAZAN, HAZID HAZWOPER, ALARP etc.., , Approaches to compliance and violations.

LABS:-

Lab1: Factories visit to study Safety Procedures (OHSMS) and submit report
Lab2: Drafting HSE Policy and commitment for a specific industry for approval
Lab3: Formation of Safety committee, preparation of agenda and recording of minutes of safety committee meeting
Lab4: Preparation of annual HSE (Health, Safety & Environment) action plan for an Organization.
Lab5: Draft a general work permit format covering different activities.

REFERENCE BOOKS:

1. Industrial Safety management. By L.M Deshmuk.
2. Safety management, By R.S. Rathore and S, Changeriya.
3. Safety Security and Risk Management, By UK. Singh
4. Fundamentals of Industrial Safety and Health by Dr.K.L.Mistry, Siddharth Prakashan, Gujarat
5. Industrial Accident Prevention, by:H.W.Heinrich, McGraw-Hill Book Co
6. Accident Prevention Manual for Industrial Operations by National Safety Council, USA

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I Year - I Semester		L	T	P	C
		3	0	0	3
BASIC PRINCIPLES OF ENVIRONMENT AND AIR POLLUTION					

Unit1- General Principles of Environment: Introduction to Ecosystem, kinds of Ecosystem, structure and function of ecosystem, Bio Remediation, Bio diversity, flora & fauna of India, medicinal plants, conservation of species in India.,

Major world environmental disasters and lessons learnt:- Bhopal gas tragedy India, Piper Alpha Disaster, Chernobyl Disaster.
Ecological Balance: De forestation, Conservation of national resources, Reforestation, Desertification, Agro forestry, wetlands in India, Mangroves in India.

Unit2: **Environmental Pollution**: Introduction to pollution, what is pollution, why pollution is harm to your health. carbon monoxide, sulfur dioxide, chlorofluorocarbons (CFCs) and nitrogen ,ozone , smog, hydrocarbons, Particulate matter, PM_{10}, $PM_{2.5}$. Light pollution: includes light trespass, over-illumination and astronomical interference , Litter pollution, Noise pollution, Soil contamination heavy metals, herbicides, pesticides and chlorinated hydro carbons. Radioactive contamination, Radon Gas, Thermal pollution, Water pollution, eutrophication, Plastic pollution, sound pollution

Unit3-Air pollution: Chemical composition of atmosphere - reactions in troposphere, stratosphere, mesosphere, ionosphere. Classification : Out Door and Indoor Air Pollution, Air pollutants, sources and affects of particulates, NO_x ,SO_x , CO, CO_2, hydrocarbons on human, cattle, crops & vegetation and materials, Air pollution disasters (LA SMOG, London Smog, Bhopal Disaster,), Odor air pollution: sources and control methods. Automobile pollution: Exhaust Emissions and its control. Plume behavior

Unit 4: **Pollution Control**: Safety Measures in view of Industrial Pollution, Automobile pollution, Identification of Pollutants, sampling and sampling techniques, Measures to take pollution control - Gravitational settling chambers-cyclone separators-scrubbers-electrostatic precipitator - fabric filters, Industrial wastewater treatment, ambient air quality standards and air monitoring, Carbon credits and its benefits.

Unit5- Global warming & Protocols: Major sources of Green House Gases, green house effect and climate change, global temperature, global warming and its effects on agriculture and health. Ozone layer, mechanism of ozone depletion. Effects and control of ozone holes, Environmental Health: Global Health and Global warming in relation to environment changes and impact on Human Health. Information Technology applications pertinent to Environment. Environment impact assessment, sustainable development.

LABS

Lab-1 Measurement of Air Quality in Indoor and Out Door – STATE POLLUTION BOARD LABS AT VISAKHAPATNAM)

Lab-2 Automobile pollution test – mobile van

Lab-3 Air Quality Monitoring of Various Substances in Air (We have equipment in our Lab)

Lab-4 Case study of particulate control equipment in Industries (factory visit)

Reference Books:

1. Environment and plant Ecology by Etherington JR.
2. Ecology and Environment By PD Sharma
3. Environment Concerns and Strategies KHOSHOO TN
4. Introduction of Environment by Y. Anjaneyulu
5. Air Pollution: Impacts, Analysis and Control Strategies – Bernie Goldman

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I Year - I Semester		L	T	P	C
		3	0	0	3
WATER AND WATER POLLUTION & HEALTH					

Unit1- Water : What is Water, Composition of water, Components of water, types of water, Sources and standards of Water, availability and quality of surface water (streams, aquifer, lakes, ponds, springs, artisans and impound reservoirs) water Quality standards for horticulture / agriculture and industrial use. Specifications for drinking water.

Unit2- Quality of water: For domestic, institutional, Industrial, fire fighting, commercial, recreational purposes. Population forecasting by the following methods arithmetical, geometrical incremental increase methods. Per capita demand of water in rural Indian villages, the various factors affecting the demand of water.

Unit3 – Water Treatment: Principle and application of the following unit operations in water treatment aeration, flocculation, sedimentation, filtration, disinfections, advanced water treatment methods (a) demineralization (b) ultra filtration (c) reverse osmosis (d) color and odor removal by activated carbon (e) iron and manganese removal, copper vessel water storage, desalination process.

Unit4- Waste Water Treatment : Physical constituents in waste water and Biological treatment processes of waste water activated sludge process, trickle bed filters, rotating biological contactors, stabilization ponds, aerated lagoons, anaerobic treatment, Biological Testing, (BOD, COD, TOC, Micro Organisms) primary, secondary, territory and advanced specific treatment systems.

Unit5 - Hazardous waste: definition. Physical and biological routes of transport of Hazardous substances – sources and characterization categories and control. Sampling and analysis of Hazardous wastes – analytical approach for Hazardous waste characterization – proximate analysis – survey analysis – directed analysis – analytical methods. Biomedical waste.

LABS (JNTUK CIVIL DEPARTMENT AND POLLUTION CONTROL BOARD Visakhapatnam)
Lab-1 Water analysis – pH, conductivity, BOD, COD, DO, Hardness, TDS
Lab-2 Industrial water treatment process during factory visit.

Reference Books:

1. Water Engineering 1 By BC Punmaiah, Ashok Jain
2. Water Engineering treatment
3. Disposal and Re use Metcalf and Eddy
4. waste water treatment for pollution control Dr.Arceivala, Tata McGraw Hill

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		3	0	0	3
EPIDEMIOLOGY & BIO-STATISTICS					

Unit-1 Epidemiology: - Introduction to Epidemiology and Epidemiologist, Areas of epidemiological study, Diseases causation, transmission, investigation, disease surveillance, environmental factors, forensic factors, occupational factors and compressions
What is Descriptive Epidemiology?
What are the 5 W's of epidemiology?
What does descriptive epidemiology mean?
What is the most common occupational injury?
What is the difference between occupational injury and occupational illness?
What is an occupational injury?
What is the most common reported occupational health problem?
Unit-2 Modern Era, Types of studies: - Case series, control studies, Case series, Case control studies, Cohort studies, Outbreak investigation, Cross sectional studies, Longitudinal studies, legal interpretation.
Field Studies (On Request).
Pre Planned Large scale studies.(eg: Lead Poisoning)
OSHA Standards for Occupational epidemiology (hazards, Specific OSHA Standards, Employee medical records, record keeping, (General industry, Shipyard Industry)

Intervention studies in Occupational Epidemiology
Environmental and Occupational Epidemiology
Physical Ergonomics and Musculoskeletal Disorders:
GENERAL OBSERVATIONS AND FUTURE DIRECTIONS

Unit-3 - Introduction and scope of biostatistics and its Applications. Concept of primary and secondary data. Methods of collection and editing of primary and secondary data. Designing a questionnaire and schedule. Source of secondary data, Population, Sampling unit, Sample, Parameter, Notation for a population and sample value, Sources and Presentation of Data Graphical representation, Histogram and bars.

Unit-4 - Measures of central tendency: computation of mean, median and mode from grouped and ungrouped data. Measures of dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation-Coefficient of Variation, standard error and their coefficients. Measures of Skewness: Karl pearson and Bowley's coefficient. Probability rules. Binomial, poison and normal distributions.

Unit-5 - Hypothesis testing & large sample tests: Student't' test, F-test, Z-test & Chi square test, Analysis of variance. Correlation and Regression Analysis. Non- parametric tests, run, sign, median, mann whitney. Experimental designing, planning of an experiment, replication and randomization.

Labs:

Laboratory-1 Use SPSS / STATA Package

Laboratory-2 Perform two sample comparisons of means and create confidence intervals for the population mean differences and Compare proportions amongst two independent populations

Laboratory-3 Interpret output from the statistical software package STATA related to the various estimations and Hypothesis testing procedures covered in the course.

Laboratory-4 Epidemiological case studies of hazards and injuries and studies of Bio Stat analysis

Reference Books:

1. Biostatistics by Arora
2. Basic Bio Statistics for Public Health Practice By B Burt Gers
3. Bio statistics for Health and Life Sciences by Surya
4. Applied statistics in occupational safety and health by Christopher A. janicak

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		3	0	0	3
OCCUPATIONAL HEALTH & HYGIENE					

Unit1- Industrial Hygiene
Introduction to industrial hygiene, definitions, routes of entry to human system. Assessment Recognition, evaluation (biological and environment), and control of hazards, Definition of House Keeping, 5S (Japanese System), Plant layout and provision of housekeeping, maintaining and monitoring. Concept of TLV.

Unit 2- Recognition of Occupational Hazards
Introduction to occupational hazards, types of occupational hazards – physical, chemical, biological and ergonomic.
Gases, vapors, Solvents, particulates, Industrial Noise, Ionizing and Non Ionizing, Thermal Stress, Cold Stress, Biological Hazards, Evaluation of hazards(Air Sampling), Control of Hazards(Methods of Control, Local exhaust ventilation, Dilution of Ventilation of Industrial work places)

Unit3- Occupational Diseases:
Occupations involving risk of contracting these diseases - mode of causation of the diseases and its effects - diagnostic methods.

Occupational diseases: Recognized occupational diseases (as per ILO 28 Occupational Diseases), occupational cancer, dermatitis, asthma, lung disease, and biological monitoring methods, medical examinations (pre employment, Medical Surveillance, post employment, periodical, and isolation, specific)., occupational health services, Preventive and control measures.

Unit4-Introduction to Ergonomics Physiology and Ergonomics at Work:
Definition of ergonomics, Matching person and task, Human capacity for work, Engineering anthropometry, Dexterity, Biomechanics, Handling loads: lifting, lowering, pushing, Pulling, carrying, Design of work task and workplace
Hand tools, Workstation design, Workplace design, Office (VDU) workstations, Controls and displays

Unit5- PPE: Need for personal protection equipment, selection, applicable standards, and supply, use, care & maintenance respiratory and non-respiratory personal protective equipment.
Non-respiratory personal protective devices: Head protection, Ear protection. Face and Eye protection. Hand protection, Foot protection, body protection.
Respiratory personal Protective devices: Classification of Hazards. Classification of respiratory personal protective devices. Selection of respiratory personal protective devices Instructions and training in the use, Maintenance and care of self-contained breathing apparatus. Training in the use of breathing apparatus (open circuits and close unit).Testing Procedures and Standards.

LABS (EOHS DEPT/RMC/FACTORY VISITS):

Lab1- Measuring of Physical Hazards (Heat, Humidity, Noise, illumination, Radiation) and equipment usage.

Lab2- Donning and Demonstration of Personal Protective Equipment.

Lab3- Biological monitoring and sampling, chest X-ray

Lab4- Ergonomic training

Reference Book:

1. Industrial Hazards and safety Hand Book By King and Magrid, Bulterworth
2. The Hazards of Work; How to fight them, By Patrick Kinnersly, Pluto Press London
3. Accident Prevention manual for industrial operations by National Safety Council, USA.
4. Industrial Safety Hand Book by William Handley

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I Year -II Semester		L	T	P	C
		3	0	0	3
CONSTRUCTION SAFETY					

Unit 1 : Legal provisions related to Construction Safety (Building & Other Constriction workers) Site Selection, layout, applicable statutory permissions for project to come, Design safety, Site clearance for commencing project works, Soil testing, Excavation, leveling, back filling , and compaction, Civil Construction and buildings and facilities (high raise building). Lighting & Illumination.
Working at different levels: Inspection and use of ladders, scaffolds their types, standards, steps, ramps, elevators and escalators, PPE.

Unit 2: Transportation safety: causes of accidents & preventive measures to be followed, driver's requirements and responsibilities vehicle road worthiness, training needs and types of training, journey management, accident reporting and investigation procedures, motor vehicles inspection checklist, motor vehicle insurance, transportation of hazardous goods- trem card, warning symbols, safe loading and decanting procedures, communication, emergency planning, road condition and traffic signals, statutory provisions(motor vehicles act, hazmat codes).
Unit 3 : Construction –Hazards & Prevention : Hazards associated with Excavation works precautions to be taken, Electrical hazards, Mechanical hazards, Fire Hazards, Hazards associated and safety measures to be followed while working at different levels, platforms, erection, dismantling., Fall prevention, Falling objects hazards and Fall protection- safety belts, safety nets, fall arrestors, safety monitoring systems.

Unit 4: Confined spaces: Definition and classification of confined spaces, hazards associated with confined space entry and work inside. Precautions to be taken for confined space safe entry and work. Control procedures to be followed to prevent possible accidents related to Confined space, and entry permit, Training details for persons involved in confined space work. Monitoring duties and responsibilities of persons involved in Confined Space work. Safety equipment used while entering and working in the confined space. Emergency response system, communication and procedure to be followed by Confined Space Working Crew in case of emergency.

Unit 5: Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist, hoist, winches, chain pulley blocks, conveyors., Half yearly/ Annually - inspection and certification, color coding for the lifting gear and equipments. Safety in Abrasive blasting & painting, welding machines, grinding tools. Safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps. Mechanical fabrication, erection, material handling and transportation using cranes and lifting tackle. Safe demolition.
Pre commissioning, preparation of punch lists and check lists during inspections and follow up actions until completion, Commissioning and handing over.

LABS ON SITE AT CONSTRUCTION AREA)

Lab 1- Table top exercise of Proper layout of Large & Medium size construction project.
Lab 2- Table top exercise of planning for obtaining permits to start a large size construction project.
Lab 3- Table top exercise on Planning the SHE (Safety, Health and Environment) Department for a Major Industry.

Lab 4- Confined space assessment and planning necessary trainings

Lab 5- Industrial visit (different types of ladders, scaffolds, excavation works, confined spaces, different cranes, lifting gear, road safety, fire prevention and control methods etc...)

Reference Books:

1. Construction Safety Handbook, By V. J. Davies, Ken Tomasin
2. Handbook of OSHA Construction safety and health charles D. Reese and James V. Edison
3. Principles of Construction Safety, By Allan St John Holt
4. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering
5. Handbook of OSHA Construction Safety and Health, Second Edition By Charles D. Reese, James Vernon Eidson
6. Hudson, R.,"Construction hazard and Safety Hand book, Butter Worth's
7. The Building and Other Construction Workers Act, 1996

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I Year -II Semester		L	T	P	C
		3	0	0	3
SAFETY AT DIFFERENT INDUSTRIES-I					

UNIT 1: SAFETY IN STEEL INDUSTRY: Introduction**,** Need of safety in steel industry**,** safe steel making operations: (physical, chemical, ergonomic hazards). Coke ovens and by-product plants (hazard control on by- product coke batteries, hazard control in non recovery batteries, and hazard control in by-product recovery plants). During steel making (safety provisions, preventing fires and explosions, lighting furnaces, prevention co poisoning, preventing steam explosion, handling molten metals)**.** Steel foundries (safety specifications, safety inspection of ladles, tapping, bottom drop, abrasive blasting, abrasive wheels). Health and welfare measures (occupational health hazards, control measures, PPE).

UNIT 2: SAFETY IN MINING: Introduction to Mining industry, mining types – opencast and underground, Need of safety in Mining industry, development of safety engineering approaches for mines, hazards - Atmospheric pollution, trapping, transport, electrical hazards, noise and vibration from: pneumatic tools and other machines, ventilation and lighting, health hazards., Hazard identification and risk assessment related to mining, emergency preparedness, ppe required for mining operations.

UNIT 3: SAFETY IN FOOD & AGRICULTURE INDUSTRY:
FOOD : Introduction, importance of food safety, food borne effects and illness, food hazards, hygiene-work place and personal, GMP (good manufacturing practices) & NON – GMP sections, solid & liquid waste management, principles of food safety and risk assessment, food colouring, additives and preservatives, scientific approaches for assessing risks , bio technology risk assessment, sensitivity analysis, Health hazards and controls, HACCAP

AGRICULTURE: Introduction to Agriculture. What is agriculture farming, Ploughing, seed selection, Seedling preparation, Planting seed lings into the fields, Growing stage, Crop in hand, Cutting the grown crop, Harvest, Collect the paddy or harvested product., hazards in ploughing, safety in using of machinery for harvesting and processing and packing of agricultural products, usage of artificial fertilizers & Pesticides and their effects on human health.

UNIT 4: DRUG & PHARMACEUTICAL INDUSTRY:
Introduction- safe design and layout of the plant and facilities, storage and handling of different chemicals (raw materials, intermediates and finished goods), fire safety, emergency planning and response, health hazards, specific trainings, safety in unit operations and processes, PPE.

UNIT 5: DOCK SAFETY:
Introduction to dock safety, dock lifting appliances and loose gear, competent person, safety and health in ports, training of dock workers, container handling, loading, unloading. Types of cargo vessels, Handling of hatch coverings and beams, cargo handling, dock railways, testing, examination and inspection of containers-carriage of dangerous goods in containers and maintenance and certification of containers for safe operations, container side lifters, cranes.
Illumination of decks and holds – hazards in working inside the holds and on deck, mechanical and electrical hazards

LABS (VISIT DIFFERENT FACTORIES ONE DAY VISIT)

Lab 1- safety in mining – health and safety evaluation visit, Practical Health Examination, case studies
Lab 2- safety in steel industry- factory visit, case studies
Lab 3- safety in pharmaceutical – factory visit, case studies
Lab 4- safety in food and agriculture- factory visit, case studies
Lab 5- Dock safety – KSPL visit, case studies

Reference Books:

1. Accident prevention Manual for Industrial Prevention N.S.C. Chicago
2. Code of practice on Safety and Health in Steel industry by International labour organization
3. Kejiriwal, B.K. Safety in Mines, GyanPrakashan,
4. Mine Health and Safety Management", Michael Karmis ed., SME, Littleton
5. Safety and Health in Dock work, ILO
6. Dock Safety" Thane Belapur Industries Association
7. Principles of Health and Safety in Agriculture - James A. Dosman, Donald W. Cockcroft
8. Fundamentals of Industrial Hygiene by NSC
9. Food science, nutrition and safety – Anita malhotra, pearson education india
10. Food safety management – practical gude for food industry, yasmine motarjemi
11. Safety assesment for pharmaceuticals (Industrial Health & Safety)- shayne C. Gad-van nostrand reinhold
12. Pharmaceutical industrial safety by Namdeo G. Shindey

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		3	0	0	3
DISASTER MANAGMENT					

Unit1- Introduction Disaster management, definitions, Types of Disasters, Fundamentals of disaster management, overview of disaster management , Principles of Disaster Management, Organizational structure for Disaster Management, Vulnerability, Mitigation., major Industrial and chemical disasters, road/rail accidents fire incidents, epidemics, Levels of emergencies, Difference between emergency and a disaster situation.

Unit2- Disaster management cycles, Mitigation and strategies, Hazard identification and vulnerability analysis, disaster risk reduction, emergency preparedness and response plan, people protection, response and recovery, response aims and activities.

Unit3- Emergency health service in disasters, evacuation procedures, Infrastructure and procedures in accessing emergency situations, governmental and nongovernmental (Indian Medical Association (IMA) and Municipal Corporation Authority(MCA) etc…) roles in disaster management, Common communicable diseases in disaster, Risk factors and spread of diseases-its outbreaks, Preventing and reducing outbreaks, Monitoring and evaluation of communicable disease control program, GIS and statistics in disaster management, Technology in disaster management, Emergency management cycles in disaster management systems, Responsible persons in EMS, Geographic management systems in disaster management, GIS and open source software and GIS advantages, Global Positioning System(GPS) applications in disaster management, Remote sensing and disaster management, Remote sensing fundamentals

Unit4- Disaster management in India, key Hazards in India, Vulnerabilities, Disaster response mechanism in India, onsite and offsite emergency plans, chemical emergencies (chemical emergency rules 1986, manufacture storage and import of hazardous rules) and related statutory provisions, training(community training and awareness), drills and exercises.

1. Oil Spill response plans, Role of Indian Cost Guards
2. Nuclear power plants- Uncontrolled nuclear reactions

Unit5- Disaster management Act,2005 and its analysis, Standard operating procedure for responding to natural disasters in India, Preparedness and emergency operation centers, Objections communication network of EOC's, National Disaster Response Force, Disaster communication, Ham radio, Community training & Awareness, Knowledge of radio operation.

LABS

Lab1- Procedures involved in earthquake Measurement – Disaster Management Authority (AP).

Lab2- Case studies

Lab3- Disaster management – emergency preparedness and response (mok drills-during factory visit)

Reference Books:

1. Security Manager's Guide to Disasters By Anthony D. Manley (Author)
2. Workplace Disaster Preparedness, Response, and Management By R. Paul Maiden, Rich Paul, Christina Thompson
3. Occupational Health: Management and Practice for Health Practitioners By Jenny Acutt, Susan Hattingh

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

I Year -II Semester		L	T	P	C
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SAFETY IN ENGINEERING ACTIVITIES					

Unit1- Need for Safety:
Safety in the use of Machines: Periodic inspections, maintenance for safe operations, Hazards associated.
Safety in the use of, 1) Power Presses (all types), 2) Shearing, 3) Bending, 4)Rolling, 5) Drawing,6) Turning, 7) Boring, 8) Milling, Shaping, 9) Planning broaching, planting, 10) Grinding,11) CNC's.
Machine guarding: Principles in machine guarding. Ergonomics of machine guarding. Type of guards, their design and selection. Guarding during maintenance,. Built-in-safety devices, maintenance and repairs of guards, benefits of good guarding systems.

Unit2- Material Handling and Storage of Materials:
Manual: Kinetics of manual handling. Maximum loads that could be carried. Lifting and carrying of objects of different shapes, size and weight. Safe use of accessories for manual, handling Storage of materials. Safety in stacking and un-stacking, floor loading conditions. Layout condition for safety in storage. Common injuries and preventive measures
Mechanical: safety aspects in design and construction, testing, use and care, signaling, inspection and maintenance of lifting tackles, hoisting equipment and conveyors, industrial trucks and elevators.
Hazards associated with material handling (manual & mechanical).

Unit3- Hand Tools and Power Tools:
Safe use of various types of hand tools used for metal cutting, woodcutting, miscellaneous cutting, other hand tools such as torsion tools, shock tools, non-sparking tools. Portable power tools and their selection, inspection, maintenance - condition monitoring (non destructive testing (N.D.T), High pressure hydro testing, High pressure pneumatic testing).
Housekeeping, Ventilation and heat stress, industrial lighting and illumination, industrial noise and vibration

Unit 4- Electrical safety:
Introduction, electrostatics, electro magnetism, energy radiation and electromagnetic interference, Working principles of electrical equipment, static electricity, electrical hazards- shock, burns., electrical causes of fire and explosion-ionization, spark and arc-ignition energy, lightning hazards., electrical safety devices – Overload and short circuit protection (GFCI, fuse, surge protectors, circuit breakers, relays..)., Earthing, lightning arrestors, safety in handling electrical equipments, ppe required, LOTO, statutory provisions.

Unit 5-: Welding and gas cutting types and procedures, selection and maintenance of associated equipments, safety precautions to be taken while handling and storage of gas cylinders, leak detection, flash back arrestors, ppe required for welding and gas cutting operations.,
electro plating, galvanizing, sheet metal works, abrasive blasting (surface preparation) and painting., safety in radiography, personal monitoring, radiation hazards (nuclear safety), engineering and administrative controls.

Labs: Factory visit
Laboratory1- Machine Guards, ppe, house keeping
Laboratory2- Safety in welding, cutting, pneumatic and hydraulic testing, NDT
Laboratory3- Safety in hand told and power tools, electrical safety, material handling

Reference Books:-
1. Industrial Safety by R.P.Blake
2. Accident prevention Manual for Industrial Operations By N.S.C
3. Non Destructive Testing Hand Book By Mc Master. R
4. Safety Engineering - John W. Mroszczyk
5. Electrical safety, fire safety engineering and safety management - S.Rao, R K Jain

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KAKINADA – 533 003, Andhra Pradesh, India

II Year -I Semester		L	T	P	C
		3	0	0	3
FIRE & EXPLOSIONS					

Unit1- Definition of FIRE, Nature of Fire, Need of Fire Safety, Chemistry and Pyramid of Fire, Stages of Fire, Spread of fire, factors contributing to Fire, Common Causes of Industrial Fire., Classification of fires, fire preventive techniques.

Unit2- Standards: Statutory Provisions, Indian Standards Vs Western standards, NBC (national building code), NFPA Code.

Unit3- Design for Fire safety: , Fire Resistance of Building materials, Fire Safety of Buildings, Plants, Fire safety and Exit plan, Firefighting Equipment, Fire Prevention and Protection Systems, General Control measures, fire Detection and Alarm Systems, Fire Load Determination, Fire Suppression or Extinguishing Systems, portable Fire Extinguishers, Fixed Fire installations- (Hydrants, sprinklers, water spray, Foam, Carbon Dioxide, D.C.P and other systems), Automatic Fire Detection Systems, Fire Emergency action plan and Drills.

Unit4- Explosion phenomena: Explosion, Types of explosion, Definition of Implosion, Dust explosion, Deflagration, Detonation, Confined and Unconfined Vapor Cloud Explosion (VCE).Boiling liquid expending vapor explosion (BLEVE),fire and explosion preventive measures, fire drills, Firefighting systems.

Unit5- Inspection, Maintenance and related standards, Training for Fire Protection. Personal protective equipment, Major Fire Accidents and lessons learned. Health Hazards due to Fire accidents. Fire fighters – training, health, safety

LABS (WITH THE HELP OF KAKINADA FIRE DEPARTMENT), Factory visit
Lab1- Demonstration of different classes of fire (fire extinguishers)
Lab2- factory visit – (fire emergency plan, fire fighting systems)
Lab3-.Fire safety training
Lab4- case studies

Reference Books:

1. Accident prevention Manual for Industrial Prevention N.S.C. Chicago
2. Fire protection Manual Factory Manual Systems H.M.S.O London
3. Flammable Hazardous Materials By James. H. MEDIL
4. Electrical safety, fire safety engineering and safety management - S.Rao, R K Jain.

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II Year -I Semester		L	T	P	C
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INDUSTRIAL PSYCHOLOGY AND BEHAVIOURAL MODIFICATIONS					

Unit-1 Organisational behavior- Definitions, fundamentals of organizational behavior, dynamics of people and organization. Theoretical frame works, models and approaches of organizational behavior.

Unit – 2 Individual in the organization – Social perception, learning, personality, abilities, motivation theories , attitudes, job satisfaction, commitment prejudice.

Unit -3 Group processes, STOP Program by DuPont Influencing others – Socialization, careers, group dynamics, team work, communication, decision making, pro social and deviant behavior, influence, power and politics in organizations, leadership.

Unit – 4 Organizational processes – culture, structure, design, technology, strategic planning and organizational development, change, career development, communication, Diversity ethics, across cultures, teams, change professional competencies, human resources management employee problems.

Unit -5 Health issues- Health psychology, enhancing Health preventing illness and illness and medical treatment, stress conflict management counseling behavior modification, coping, management of ill and yoga.
(Legal Issues of in Employee Selection, Employee selection (Recruiting & Interviewing, Evaluating employee performance, Employee motivation, Employee satisfaction and Commitment, Leadership, Group behavior), concept of coaching.

LABS
Case Study:-1
Case Study:-2
Case Study:-3

Reference Books:

1. Behaviour Modification: Principles and Procedures 5th Edition by Raymond G. Miltenberger
2. Occupational Psychology by Gail Steptoe-Warren
3. The Psychology of People in Organisations by Melanie Ashleigh, Angela Mansi

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II Year -I Semester		L	T	P	C
		3	0	0	3
3. SAFETY AT DIFFERENT INDUSTRIES -II					

Unit 1: CHEMICAL SAFETY: Introduction, Identification & Classification of chemicals, Material Safety Data Sheets (MSDS), Hazard Communication System Need of safety in chemical industry, CHIP- chemical hazard information for packing and supply, statutory provisions and Indian standards, types of chemical hazards and their controls, Safe storage, Handling & transportation of Chemicals, Work Permits for Hazardous work. Transfer of chemicals by pipelines within and outside installations, above and underground and submarines. Color coding and identification of contents, safety precautions for working on pipelines, safety in preventive and emergency maintenance operations.

Unit 2 : SAFETY IN TEXTILE INDUSTRY: Need of Safety in Textile Industry, statutory provisions and Indian Standards, Textile process- Preparatory and Spinning Processes, and associated Hazards and Safety measures, Preparatory and Weaving process and associated Health hazards and Safety Measures, finishing and folding machines- Hazards & Safety Measures. Fire hazards, Health hazards and controls, Effluent treatment and Waste disposal.

Unit 3:
SAFETY IN PAINT INDUSTRY:- Need of Safety in Paint Industry, Process Safety management, Health hazards & Controls, Fire & explosions hazards, maintenance safety.

SAFETY IN CEMENT INDUSTRY:- Need of Safety in Cement Industry, Process Safety management, Health hazards & Controls, Fire & explosions hazards.

Unit 4: PETROCHEMICAL SAFETY: Introduction, brief description on downstream operations, Downstream process safety, emergency response and planning. SOP's, Safety and health hazards associated with petro chemical activities, safety in vessels and pipelines operations, fire and explosions, accident prevention program in petrochemical industry.

Unit 5: PETROLEUM SAFETY: Introduction, brief description on upstream activities, petroleum and petroleum products(fuels, petroleum solvents, petroleum wax, greases, lubricating oils), petroleum industry operations- onshore & offshore, rig and pipeline construction, maintenance and repair activities, safety and associated hazards, drilling operations-work position, working condition, associated hazards, lighting and its effects, petroleum extraction and transportation by sea-crude oil hazards, operations, transportation of crude oil, statutory provisions.

LABS
Lab 1- Factory visit (chemical detectors, safety in storage, handling and transportation chemicals)
Lab 2-. Case studies
Lab 3- Petroleum tankforms facility visit (ONGC/ HPCL OR IOCL)

Reference Books:

1. Site Safety Handbook for the Petroleum Industry - Chidi Venantius Efobi
2. Safety & Health for the Oil & Gas Industry - Csp Cpp, Cmiosh Lutchmedial
3. Process Safety Management in Petrochemical Industries - Parin Shah**,** Reema Padiyar
4. Guidelines for Fire Protection in Chemical, Petrochemical, and Hydrocarbon Processing Facilities - CCPS
5. Chemical Process Safety - Daniel A. Crowl
6. Safety in Textile Industry , Thane balupur, Industries Associations
7. Accident prevention Manual for Industrial Prevention N.S.C. Chicago

Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries

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II Year -I Semester		L	T	P	C
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HAZARD ANALYSIS &RISK ASSESSMENT					

Unit-1:- Hazard and Risk Assessment:-
Definition of Hazard & risk with examples, Hazard and risk detection techniques, Hazard and risk progression chart, risk analysis, assessment and management, preliminary Hazard analysis (PHA) & Hazard analysis(HAZAN), failure mode and effect analysis (FMEA), Hazard and operability (HAZOP) study, Hazard Rating, Fault. Tree analysis (F.T.A), Event Tree Analysis(E.T.A) Accident or cause sequence analysis, Maximum Credible Accident Assessment (MCAA), Vulnerability Analysis and 'What if ' analysis, HAZID, HAZWOPER, job safety analysis.

Unit- 2:- Risk Safety appraisal, analysis and control techniques: objectives, safety appraisal system, technique for human error prediction (THERP) PERT and CPM. Development and applications of risk assessment in different industries**.**

Unit-3:- Plant safety inspections & Audits:-
Definition and objectives, types & procedures, safety check lists, safety surveys, safety tour, safety study, safety review, safety sampling, good manufacturing practices (G.M.P), recommendations & follow up actions (compliance) responsibility for inspections. Definition of Audits, Difference between Audits and Inspection, Internal audits, external audits, audit plan, audit meetings, audit report and closeout

Unit-4:- Accident investigations, Analysis Reporting:-
Philosophy, purpose of investigations & report, process and types of investigations, agencies investigating the accidents, accident analysis (Classification) industrial classification(NIC 1987) , Accident investigation report & its content, methods of collecting and tabulating data, follow up for corrective action, record keeping.

Unit-5:- Major Accident Hazard Control (MAH):
Concept of Major Accident (MAH), types and consequences of MAH, criteria (identification) for plant to be under MAH unit, Role of Management, role of Authorities, Role Of Workers, Role of Public, Safe Reports, Safety Audit Reports And Risk Assessment Reports need and types of Emergency Plans, Statutory provisions, Onsite Emergency plan, offsite Emergency Plan.

LABS – Factory visit: TO OBSERVE
Labs1. Hazard Identification and assesment (risk matrix) for different activities(welding, cutting, confined space entry etc…..)
Lab 2. Accident investigation and analysis
Lab 3. Planning and conducting safety inspections and audits

Reference Books:

1. Risk assesment Theory Methods and applications, By Marvin Rausand
2. Risk Assesment Tools Tehnics and applicatiions., By Lee T. Ostrom
3. System Safety Engineering and Risk Assesment, By Nicholas J. Bahr

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II Year -I Semester		L	T	P	C
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ACTS & LAWS, ILO'S CONVENTIONS & RECOMMENDATIONS					

Unit1- Factory Act 1948, (amended 1987) and corresponding safety rules and regulations, Mining Act 1952 (amended 1984) and rules, Electricity Act 2003, Drugs & Cosmetic Act 1955, Dock Workers Act (Safety Health and Welfare) Act 1986 , Boilers Act 1923, (amended 1950). Indian Boilers Regulations 1950 (amended 1997), Boiler Rules, Laws on Transportation Safety, the building and other construction workers act 1996. Insecticides Act, 1968, Motor Vehicles Act 1988, Statutory clearness safe operations:- 1. Director General of Mines Safety (DGMS) 2. PESO 3.Central Pollution Control Board(CPCB) and State PCB, DGFASLI, AP Factories department.

Unit2- The petroleum act 1934, the petroleum rules 2002, the calcium carbide rules 1987, The inflammable substances act 1952, Explosives Act 1984, Laws on Insecticides & pesticides (Toxic Chemicals), Laws on Atomic Energy & Radiation. The explosive act 1980 (amended 1983), the explosive rules, the static and mobile pressure vessel rules, the gas cylinder rules (2004) Laws on Fire & Explosion Safety.

Unit3- The water act (prevention of control of pollution) Act 1974 and water rules, the air (prevention and control of pollution) Act 1981 (amended 1987) and air rules, environmental protection act 1986, Hazardous waste management act 2005, the public liability insurance act 1991 (amended 1992), Laws on Construction Safety.

Unit-4 Introduction to ILO, Origins and History, the member countries, Labor Standards. ILO'S conventions and recommendations, Tripartis- Main bodies, employers' and workers' representatives, International labor Conference , social dialogue and decent work agenda. Strategic Policy framework, Program and Budget, Programme Implementation Report, Management and Evaluation. Working areas of ILO, ILO supervisory system. The Committee of Experts on the Application of Conventions and Recommendations , The International Labor Conference's Tripartite Committee on the Application of Conventions and Recommendations , Internationally accepted/ practices and procedures on Occupational Health & Saftey

Unit-5 ISO : What is ISO, why ISO is needed?, What are the benefits of ISO International Standards?, Preview ISO standards, ISO Standards in action, ISO and Consumers, Conformity assessment, Developing countries, Education & Training, Services ISO9001, ISO18001, ISO 45001 and ISO 14001.

LABS

Lab-1 What are the statutory requirements to be met to start a Chemical plant
Lab-2 What are the statutory requirements to be met with regard to environment for starting a Paper industry
Lab-3 What are the statutory requirements to be met to start a Food industry
Lab-4 What are the statutory requirements to be met to start a Pharmaceutical Industry
Lab-5 What are the statutory requirements to be met to start a Mining operation

Reference Books:

1. Factories Act, 1948 (With Latest Amendments Indian Standards (B.S.I)
2. All the Relevant Acts, Laws applicable (25 No) to Industrial Safety and Health
3. I.L.O's Conventions & Recommendations applicable to occupational Health and Safety Geneva.

STUDENTS SCHEDULE FOR THREE SEMESTER COURSE WORK

Students Are Going To Factories From Monday to Friday between 8.30 Am to 12.30 Pm, as per given time table 12.30 to 1.30 Pm is Lunch (Monday to Friday)

THEORY CLASSES STARTS FROM 1.30 Pm to 5.30Pm (Four Hours /Day and Four classes will be conducted)

This classes schedule is Monday to Friday

SATURDAY IS THE PRESENTATIONS

Starts each Saturday by 8.30 Am to 1.30Pm

Each students must give PPP that what they learned in that week from Factory visit & Lectures.

In some Saturdays Expert Lectures will be conducted. Each student must Write 3 paper per Subject. One Paper before 1st Mid Examination, The Second Paper before 2nd Mid Term examination and Third Paper is before End examination of that particular semester. So totally for each semester student is writing 15 Papers of two to five pages of the topics given by the Faculty. Totally 45 papers in three semesters.
Paper writing have 10% marks from the 40% of the Mid exams. Each student must develop on Prototype design of his/ her innovative ideas pertaining to the EOHS Subject.

Factory Observer ship attendance as well as fourth semester Project work attendance is mandatory, if student is fails to submit the attendance to the department, that student is not allowed to any semester examinations.

ALLTHE ABOVE ARE MANDATORY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
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II Year -II Semester		L	T	P	C
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PROJECTS					

PROJECTS

1. Power plants & disaster
2. Industrial accidents – Causes & Controls
3. resent industrial scenarios
4. Epidemiology of Occupational Health
5. Safety of the residents living around the Hazardous substance manufacturing factories
6. Occupational diseases – Agricultural, Chemical, Solid Particles, Gaseous, Health screening Methods, ESI Hospital and Workers Health., Physical Injuries & Burns, Industrial accidents
7. Industrial house Keeping
8. Hazardous Materials and Recycling
9. Agro Occupation Hazards
10. Disaster Management (Wild Fires, Earth Quake, Gas Leaks, Tsunami, Floods etc.,
11. Shipping Industry and Hazards
12. Oil and Gas Industry upstream and downstream safety
13. Incident Investigation and Reporting
14. Permit to work system
15. Hazard Identification and Risk Assessment
16. Audits and Inspections
17. Industrial hygiene
18. Safety in paints and pigments.
19. Safety in fire cracker industry
20. Safety in pharmaceutical industry.
21. Safety in Heavy chemicals
22. Safety Management
23. A study on job safety Analysis (JSA)
24. Safety in material handling other than manual material handling
25. A study on machine guarding
26. Hazard operability and Hazard analysis Study
27. Effluent Treatment in different industries and how do you save and re use
28. Safety involving work in Confined Space
29. Safety in storage, Handling and Transportation of Hazard materials
30. A study on Fire prevention System in Industries
31. A study on personal protective equipment