

## **MMIS 301 (A) System Safety & Reliability**

### **Unit-I** System Reliability-

Series Systems. Parallel systems, failures, Mean Time Between Failures (MTBF), Definition of Reliability, Failure Distribution, Reliability of Standard System & Complex System, Reliability in Design, Reliability in Prediction, Baye's Theorem, Renewal Theory.

### **Unit-II** Definitions- Hazard, Risk & Danger, System Safety, System Theory & Design, System Safety Engineering, Failure Mode & Effect analysis (FMEA), Methodology Critical Analysis, Corrective Action.

### **Unit-III** Basic Quantitative Risk Assessment (QRA)

Principles of QRA, Logic tree approach, Fault tree analysis (FTA), Probability Theory & Event Tree Analysis (ETA)

### **Unit-IV** Probabilistic System Reliability –

System Analysis, System Reliability, formulation & Idealization, Computational Approaches, Numerical Methods, Analytical & bounding Methods. System Reliability & Load process.

### **Unit-V** Statistical process control: Sample size and frequency of sampling and control, Design and application of control charts for variable and attribute, Process capability studies, six sigma concepts and implementation

### **Reference:**

1. Process Safety Analysis- by Bob Skelton
2. Manual of Environment, Health & Safety Management- Dr. Ram S. Hamsagar
3. Lees, F.P. "Loss Prevention in Process Industries" Butterworth's and Company, 1996.
4. Engineering Safety- By David Blockley.
5. Kanpur K.C. and Lamberson; Reliability in Engg. Design; Wiley Eastern.
6. O' Conner Patrick DT; Practical Reliability Engg. Wiley

## **301 (B) Air, Water Pollution & Control Systems**

### **Unit-I** Sources & classification of water Pollutants-

Water Resources, Origin of waste water, waste water composition, types of water pollutants, Oxygen demanding waste, diseases causing agent, Synthetic organic compound, Plant nutrients, Inorganic chemicals, Sediments.

### **Unit-II** Waste Water Sampling & Analysis- Sampling, Methods of analysis, Determination of organic matters, determination of inorganic Substances like nitrogen, Phosphorous & risk elements, water quality standards & parameters.

### **Unit-III** Conventional waste treatment Primary treatment, Secondary treatment, Role of micro organism, decomposition of organic waste, Bacterial solution dynamics, Kinetic growth. The Monod equation, Aerobic Biological Treatment, Activated sludge process, sludge treatment & disposal. Advance waste water treatment- Such as removal of suspended solids & dissolved solids, removal of nitrogen, Phosphorus, recovery of material.

### **Unit-IV** Air pollution sources- Definition & Scale of concentration, classification and properties of air Pollution, Emission sources- classification according to source size, major emissions from global sources. Air Pollution control Methods & Equipments- Air control Methods – Controls Methods, Source Correction Method, particulate Emission control, Particulate Control Equipment, Such as Gravitational Settling Chamber, Cyclone Separator, Filters, Electrostatic precipitator, Weight Scrubbers

### **Unit-V** Environmental Impact Assessment (EIA) - Origin of EIA, EIA Procedure, project Screening for EIA, Preparation of Environment Impact Statement (EIS), Review of EIS.

#### Reference:

1. Water Pollution Control in Industries. By- T.K. Ray
2. Environmental Pollution Control Engineering – By C.S. Rao
3. Environmental Engineering – By 1. Arcadio. P. Sincero      2. Gregoria.A. Sincero
4. Air Pollution Control in Industries. By- T.K. Ray
5. Environmental Pollution Control Engineering – By C.S. Rao
6. Environmental Engineering – By Arcadio. P. Sincero Gregoria.A. Sincero
7. Air Pollution Control Engineerin; Lawrence. K. Wang, Norman. C Perelra, Yung-Tse-Hung
8. Air Pollution Control Engineering; Noel de Nevers,. McGraw Hill, New York

## **MMIS 302 (A) Industrial Noise And Vibration Control**

Unit-I INTRODUCTION: Basic definitions and terminology used in Vibrations and acoustics, Mathematical concepts and degrees of freedom in vibratory systems, Natural frequencies and vibration modes –continuous systems and wave theory concept, wave equation and relation to acoustics -theory of sound propagation and terminology involved, Plane wave and spherical waves –Concepts of free field and diffuse field, nearfield and farfield, frequency analysis and, vibration and noise spectrum; Signature analysis and condition monitoring.

Unit-II INSTRUMENTATION AND AUDITORY: Sensors used in vibration and measurements – Frequency and spectrum analyzers –Weighting networks – Hearing mechanism – relation between subjective and objective sounds – Auditory effects of noise and audiometric testing – Speech interference levels and its importance.

Unit-III SOURCES OF NOISE AND RATINGS: Mechanism of noise generation and propagation in various machinery and machine components, vehicles etc. – Directivity index – Concept of Leq and estimation – Noise ratings and standards for various sources like industrial, construction, traffic, aircraft community etc. – industrial safety and OSHA regulations – Noise legislations and management.

Unit-IV NOISE CONTROL: Energy transferring and dissipating devices Source: Structure borne and flow excited Vibration, isolation and absorption. Spring and damping materials, Dynamic absorbers, Mufflers and silencers, Path: Close filter and loosely covered enclosures – Acoustic treatment and materials – Transmission loss and absorption coefficient of materials and structures and their estimation – Reverberation time and room constant – Design of rooms /industrial halls/ auditorium for minimum noise. Receiver: Measure to control at the receiver end – use of enclosures, ear muffs and other protective devices.

Unit-V ABATEMENT OF NOISE: Active noise attenuators and scope for abatement of industrial noise.

### **References:**

1. Irwin, J.D and Graf, E. R, Noise and Vibration Control, Prentice Hall Inc. New Jercey, 1979.
2. Irwing B Crandall, Theory of Vibrating Systems and Sound, D. Van Nostrand Company, New Jercey,
3. Cyril M. Harris, Hand Book of Noise Control, McGraw Hill Book Company, New York, 1971.
4. White R. G. Walker J. G, "Noise and Vibration", John Wiley and sons New York, 1982.
5. Ambekar AG; Mechanism and Machine Theory; PHI

## **MMIS 302 (B) Safety In Chemical Industries**

Unit-I SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN: Design process, conceptual design and detail design, assessment, inherently safer design chemical reactor, types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities. Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal- flare and vent systems failures in pressure system.

Unit-II PLANT COMMISSIONING AND INSPECTION: Commissioning phases and organization, pre-commissioning documents, process, commissioning, commissioning problems, post commissioning documentation, Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure, testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission-pipe line inspection.

Unit-III PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING: Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices- modification of plant, problems- controls of modifications. Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL

Unit-IV STORAGES AND TRANSPORTATION: General consideration, petroleum product storages, storage tanks and vessel- storages layout segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG Hazards during transportation – pipeline transport

Unit-V PLANT OPERATIONS: Operating discipline, operating procedure and inspection, format, emergency procedures and over and permit system- start up and shut down operation, refinery units- operation of, fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel, Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petrochemical, rubber, fertilizer and distilleries.

### **References**

1. Lees, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996.
2. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety.
3. Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley
4. "Accident Prevention Manual for Industrial Operations" NSC, Chicago, 1982.
5. GREEN, A.E., "High Risk Safety Technology", John Wiley and Sons,. 1984.
6. Petroleum Act and Rules, Government of India.
7. Carbide of Calcium Rules, Government of India