AMSE21 HAZARD IDENTIFICATION AND RISK ASSESSMENT

UNIT-1 HAZARD AND RISK

1.1 Types of hazards- fire, explosion and toxic gas release,
1.2 Structure of hazard identification and risk assessment.
1.3 Identification of hazards : Inventory analysis,
1.4 Fire and explosion hazard rating of process plants
1.5 The Dow Fire and Explosion Hazard Index, The Mond Index,
1.6 Plant layout and unit hazard rating, Preliminary hazard analysis,
1.7 Hazard and Operability study (HAZOP), What If analysis, Case studies.

UNIT-2 PLANT AVAILABILITY AND PROCESS RELIABILITY

2.1 Ways of improving plant availability, MTBF and MTTF, the reliability function, failure rate, bathtub curve, probability relationships, simple reliability estimation.
2.2 Estimation of frequency of occurrence of a hazard:
2.3 The logic tree approach, set theory and Boolean algebra, application to probability,
2.4 Boolean manipulation. Fault tree analysis- logic symbols, minimal cut set, logic gates, fault tree quantification.
2.5 Event tree analysis – notation, event tree construction, advantages and disadvantages of ETA.
2.6 Failure mode and Effect Analysis (FMEA)–methodology, criticality analysis, corrective action and follow up.

UNIT-3 CONSEQUENCE MODELLING

3.1 Source models – discharge rate models, flash and evaporation, dispersion models.
3.2 Explosions and fires – vapour cloud explosions, flash fires, physical explosions, BLEVE and fire ball, confined explosions, pool fires, jet fires.
3.3 Effect models –dose-response functions, probity functions, toxic gas effects, thermal effects, explosion effects – Software application for effect and damage calculations.

UNIT-4 QUANTIFICATION OF RISK

4.1 QRA, Vulnerability analysis, accepted and imposed risk, perception of risk, risk indices, individual risk and societal risk, acceptance criteria for risk, ALARP,
4.2 Presentation of measures of risk – risk contour, F-N curve.
4.3 Calculation of individual risk and societal risk. Human reliability analysis (HRA) :
4.4 Factors leading to human error, characteristics of HRA techniques, Technique for Human Error Rate Prediction (THERP), Accident Sequence Evaluation Program (ASEP), Techniques using expert judgment, Operator Action tree (OAT).

References Books:

1. AIChE/CCPS, Guidelines for Hazard Evaluation Procedures second edition. Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 1992.
2. Lees F.P. Loss Prevention in the Process Industries second edition. Butterworth's, London, 1996.