NIRMA UNIVERSITY
School of Engineering, Institute of Technology
B.Tech. in Chemical Engineering
Semester VII

L	T	P	C
3	0	0	3

Course Code	**XXXXX (Open Elective)**
Course Title	**Introduction to Fire and Safety Engineering**

Course Outcomes (CO):

At the end of the course, student will be able to-

1. explain the fire process and its chemistry
2. choose fire protection system
3. analyze fire accident
4. select fire insurance and policies

Syllabus:

		Teaching Hours
Unit I	**Introduction** Fire in history, fire losses, fire causes, interested parties in fire safely, fire protection standards and practice.	**03**
Unit II	**The Fire Process** Introduction, fire triangle, fire tetrahedron, fuels, smouldering, metal fires, combustion of dusts, ease of ignition, heat, ignition processes, thermal feedback, fire stages, structure of flames, flame height/length, fire plume, plume features, flame progression.	**05**
Unit III	**Chemistry of Fire** Matter around us, Avogadro's hypothesis, work versus energy, energy in chemical reactions, oxidation and reduction, chemical chain reaction in fire, flame chemistry, reducing atmosphere, vapor pressure of liquids, flammability limits and flammable range, estimating lower flammability limit (LFL), flash point, fire point, ignition point, ignition energy, different type of combustion processes (Rapid, Spontaneous, Explosive combustions).	**03**
Unit IV	**Heat Transfer in Fires** Fundamentals of heat, heat transfer and heat flux, modes of heat transfer, temperatures versus heat in fire, severity and growth of fire, spontaneous heating and spontaneous combustion, heat release rate.	**04**
Unit V	**Fire Detectors and Alarms** Introduction, basics of detectors and alarms, detector types based on effects, heat detectors, smoke detectors, optical flame detectors, gas-sensing detectors, application-specific detectors, selection of detectors, alarm systems, fire alarm systems and control panel, principle of operation, selecting detectors and alarm systems.	**04**
Unit VI	**Fire Extinguishers** Fire fighting fundamentals, first-aid fire fighting extinguishers, common features of extinguishers, types of extinguishers, classification of fires (Class A, B, C, D,	**06**

	E and F) and suitability of extinguishers, rating of extinguishers, hazard categorization and placement of extinguishers Practical demonstration and Revision.	
Unit VII	**Fixed Fire Protection Systems** Introduction, water-based fixed fire protection systems, automatic sprinklers, foam systems, water spray systems, water mist systems, carbon dioxide flooding systems, clean agents, draining out fire water.	**08**
Unit VIII	**Risk Management and Fire Insurance** Origins of general insurance and emergence of risk management, hazard versus risk, hazard identification and analysis, risk assessment and control, principles of insurance, fire insurance policy, covers available, insurance value, reinsurance, emergency preparedness, features of emergency plans, line of action.	**05**
Unit IX	**Investigating Fire Incidents** Background to fire investigation, practice of investigation, arson, evidence, witnesses, bum patterns, sketches. Photographs and diagrams, material or sequence evidence, records or paper evidence, interpreting evidence and report writing.	**07**

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Suggested Readings:

1. Das, Akhilkumar, *Principles of Fire safety engg*, PHI publication.
2. *Handbook of Fire and Explosion Protection Engineering Principles*, William Andrew an imprint of Elsevier.
3. *Fire Hazards in Industry*, Norman Thomson, Butterworth-Heinemann is an imprint of Elsevier.
4. Robert Burke, *Fire Protection Systems and Response,* CRC Press
5. John A. Purkiss, *Fire Safety Engineering Design of Structures*. Butterworth-Heinemann is an imprint of Elsevier.
6. R. Craig Schroll, Industrial Fire Protection Handbook, CRC Press.

L= Lecture, T=Tutorial, P= Practical, C=Credit