GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree: Industrial Process Safety
Subject Code: N114AA01
Semester – IV (w.e.f. AY 2024-25)
Subject Name: Fundamental of Fire Engineering

Type of course: Minor degree course

Prerequisite: A good understanding regarding basics of physics & chemistry,

Rationale:
The main objective of this subject is to study the fundamentals of fire, its occurrence fire fighting system, its installation. It also provide platform to analyse the conditions for fire occurrence and reparability studies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	0	30	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction: History of fire service, Basic physics, Units, Guidelines for writing the units, Force, resultant force, Laws of force, Laws of motion, Mass and weight, work, power, energy, Law of conservation of energy, Mechanics – rest and motion, Distance and displacement, Speed and velocity, Acceleration, retardation, Acceleration due to gravity, Newton laws of motion, Machines and engines, Efficiency, Friction	6
2	Basic Chemistry and physics of fire, Atomic structure, Elements, compounds, Pure substance and mixture, Physical and chemical changes, Condition for the changes, Energy changes, Effects of heat on matter, Combustion, Temperature, Specific heat capacity, Catalyst, Neutralization, Sublimation, Heat of decomposing, Chemical reaction, Exothermic reaction and endothermic reaction, Transmission of heat, Flash and fire point, Ignition temperature, Flammables and combustible chemicals, Spontaneous combustion, Triangle of combustion, Tetrahedron fire, Spread of fire	8
3	Classification of fire, General Causes of fire, Detection of fire, extinguishing methods, first aid firefighting equipment's, Fire bucket, Fire beater, hose real hose, Portable extinguisher, depends on weight, depends on operating method, depends on content, Depends on position of nozzle, Construction, Operation, Maintenance, Refilling, Importance of passive fire protection system for occupants life safety and buffer time to emergency responders.	7
4	Fixed firefighting installations using water, Hydrant or fire water system, Classification of hydrant system, Sprinkling system, Major foam pourer system, Steam drenching system, Emulsification, Special fires and firefighting, Air craft fire, Ships fire	6
5	Approximate method for calculating the fire resistance of structures. Fire resistance limits of structures, coefficient of fire resistance, fire duration.	4

6	Reparability of fire damaged structures: Assessment of fire severity - assessment of damage-concrete, steel, masonry, timber - feasibility of repair -Repair techniques: Columns, beams, floors, etc. - a case study on building reinstatement	6
7	Fire risk assessment structure and layout, Means of escape principles: Basic requirements and what to look for, Fire signage: National requirements, Fire Alarms & fire detection: Basic components, and testing, Emergency lighting: When it is required, Basic components, and testing, Alternatives to emergency lighting	8

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**20**	**10**	**10**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. T. Z Harmathy - Fire Safety Science and engineering.
2. Jain V K – Fire Safety in Building Dr. Thank Singh Sharma- Fundamental of fire safety in building.
3. BIS, "IS 2189:2008 –Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of practice" Bureau of Indian Standards, New Delhi, 2008.
4. BIS, NBC Part IV – Fire and Life Safety", Bureau of Indian Standards, New Delhi, 2016.

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	To understand the basics of fire and governing laws.	20%
CO-2	To understand the fire occurrence, triangular and tetrahedron fire.	15%
CO-3	To classify different fire prevention method and its application	25%
CO-4	To get idea about the fire hydrant systems.	15%

CO-5	To implement fire risk assessment.	15%
CO-6	Determine building material fire resistant level and can advise to use minimizing fire spread, fire severity or for minimum loses.	10%

List of Practical/Tutorials:

1. Demonstration of different types of fire extinguisher
2. Demonstration of different types of fire hydrant systems
3. Numerical based on calculation of fire resistance limits of structures
4. Numerical based on fire duration
5. Demonstration of fire alarm system and fire detection
6. Determination of flash and fire point by Pensky – Martin Apparatus
7. Determination of flash and fire point by Able's apparatus
8. Demonstration of first aid fire equipment

Major Equipments:

Fire hydrant system, Fire extinguisher, Pensky Martin apparatus, Able's apparatus.

List of Open Source Software/learning website:

Reference to NIST, NFPA and NPTEL can be made for a better understanding regarding fire studies, codes for fire protection and application of active and passive fire suppression system.