Course code	Course Name	L-T-P -Credits	Year of Introduction
FS208	FIRE ENGINEERING FUNDAMENTALS	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To get basic idea about the fundamentals of fire and fire fighting.
- To provide the students an illustration of significance of the Fire Engineering profession in the protection life, property and environment.
- To understanding the working of various fire fighting tools and equipments.

Syllabus

Introduction, Diffusion flames, premixed flame. Explosion, Special kinds of combustion, Product of combustion, Effect of heat exposure to human body, Smoke, Toxicity of smoke, Fires in chemicals, commercial articles, Use, operation and maintenance of fire service equipments and accessories, Uses and maintenance of small gear, Fire stream, Friction losses in pipes, Fire ground operations, Ventilation and salvage operations.

Expected outcome

At the end of this course the course, the students will have

i. exposed to fundamentals of Fire engineering

ii. gained idea about nature, scope and applications of Fire engineering principles.

Reference Book

Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975

- Barendra Mohan Sen, "Fire *protection and prevention the essential handbook".*
- Clark, W.E., "*Fire fighting principles & practices* "
- Gupta R.S., "*A Hand Book of Fire Technology*", Universities Press.
- HMSO, "*Manual of Firemanship 1 to 13",*
- Jain V.K., "*Fire Safety in Buildings*", New Age International (P) Ltd., New Delhi, 1996
- James F Cassey, "*Fire service hydraulics*".
- Kevin Cassidy, "*Fire Safety and loss Prevention*".
- M. Ya. Roytman, *"Principles of Fire Safety Standards for Building Construction".*
- N F P A, " *Fire Protection Hand Book".*
- N. Shesha Prakash, "*Manual of Fire Safety*", CBS Publishers and distributors Pvt. Ltd.
- NSC, "*Accident Prevention Manual for Industrial Operation*".
- Ron Hirst, "*Underdowns Practical Fire Precautions*", Gower Publishing Company Ltd., England, 1989.

Web

- **www.fullsafety.weebly.com**
- **http://www.slideshare.net**
- **http://www.iafss.org**

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction- temperature, heat, specific heat, flash point, fire point, ignition, combustion; Ignition- pilot ignition, spontaneous ignition, ignition sources; Types of combustion-rapid, spontaneous, explosion;. Effects of humidity, temperature, and	6	15%

	atmospheric pressure on combustion. Fire triangle, tetrahedron. Development of fire-HRR; Diffusion flames-zones of combustion, smouldering combustion, characteristics of diffusion flame; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion;		
II	Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spill over, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material. Theory of fire extinguishment. Product of combustion-flame, heat, smoke, fire gases; Flame and its characteristics, spread of flames in solids and liquids, linear and three dimensional fire propagation; spread of fire in rooms and buildings; Effect of heat exposure to human body, body burns.	7	15%
FIRST INTERNAL EXAMINATION			
III	Smoke – constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke, smoke movement in buildings, modeling of smoke movement; Smoke control in buildings-natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design. Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO2, HCN, SO2, NH3, Nitrogen oxide.	6	15%
IV	Fires in chemicals-industrial application, storage and transport, dangerous properties, fire fighting, medical effects and treatments of Acetic acid, Acetylene, NH_3, Ammonium Nitrate, Benzene, CaO, Carbon Black, Cl_2, Glycerin, HCL, H_2, Hg, HNO_2, $COCL_2$, Paraffin, S, H_2SO_4, Xylene. Common characteristics, storage, fire hazard and fire-fighting of some commercial articles-paper, jute, wool, wood, rubber, naphthalene, drying oils, mineral oils,, coal, linoleum, paint and varnishes. Fire involving plastics including celluloid. Metal fires, Vehicle fire, forest fire, Radioactive materials fire risk, sugar fires	7	15%
SECOND INTERNAL EXAMINATION			
V	Use, operation and maintenance of fire service equipments and accessories- Suction and delivery Hose, Hose reel, Hose fittings-coupling, adapters, branches, branch holders, radial branches, collecting heads, stand pipe, monitors, hydrants; Introduction to fire fighting vehicles and appliances-Pumps, primers, crash tenders, rescue tenders, hose laying tenders, control vans, hydraulic platforms; Ladders- extension ladders, hook ladder, turntable ladders, snorkel; Uses and maintenance of small gear and miscellaneous equipments used during fire fighting; Lamps and lighting sets; Fire cabinet; Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches; General rope work.	8	20%

VI	Fire stream-path, range; nozzles-types, calculation of discharge capacity, nozzle reaction, water hammer; Hydraulic and energy grade lines, pressure loss or gain because of elevation, back pressure; friction losses in pipes, fire hoses and fixtures, parallel and series connections; flow in pipes and fire hoses, branching lines; water relay techniques; Estimation of fire protection water requirements, pump capacity and other parameters relating to fire hydraulics. Fire ground operations - preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations.	8	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Duration: 3 Hours

Part – A: 5 MARK QUESTIONS

There will be two questions from module 2 and module 3 and one question each from remaining modules (5x8 = 40)

PART B: 10 MARK QUESTIONS

5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions

(3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS

4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions

(2 x15 = 30 marks)