Revised CBCS Scheme

B.Sc. Fire and Industrial Safety

Course Structure and Credit Pattern

(I and II Semester)

SEMESTER	DSC	Course Name	Teaching /Learning/Evaluation Pattern in hours/week			Credits
			L (Lecture)	T (Tutorial)	P (Practical)	
I Semester	DSC C1	Fire Chemistry	4	0	0	4
	DSC C2	Practical Chemistry	0	0	4	2
	DSC C3	Safety Management – 1	4	0	0	4
	DSC C4	Lab on Workplace Safety	0	0	4	2
	DSC C5	Rules and Regulations - 1	4	0	0	4
	DSC C6	Lab Based on Rules and Regulations – I	0	0	4	2
II Semester	DSC C7	Fire Safety	4	0	0	4

	DSC C8	Harmful Gases Detection Lab	0	0	4	2
	DSC C9	Safety Management – 2	4	0	0	4
	DSC C10	Lab on Industrial Safety	0	0	4	2
	DSC C11	Rules and Regulations – II	4	0	0	4
	DSC C12	Lab Based on Rules and Regulations – II	0	0	4	2

DSC: Discipline Specific Core

TUMKUR UNIVERSITY

REVISED CHOICE BASED CREDIT SYSTEM (CBCS)

B. Sc. FIRE & INDUSTRIAL SAFETY
CREDIT AND CURRICULUM STRUCTURE

(I and II Semester)

From the academic year

2024-25

Board of Studies in Fire & Industrial Safety

Tumkur University, Tumkur

Karnataka, India

I SEMSTER

DSC-C1: FIRE CHEMISTRY:

(60 hours: 4 hrs./week: credits 4)

PAPER I

Unit-1 Introduction

History of fire; Chemistry of Fire; Controlled & Uncontrolled Fire; Nature of Fire; losses due to Fire; Causes for fire; Role of Fire brigade; Standards & Practices in fire protection; Factors contributing to Fire.

Unit-2 Fire

Definition; Fire Triangle, Fire Tetrahedron; Types of Fire-Fuels; Smouldering, Metal Fires, Combustion of Dusts; Ease of Ignition; Stages of Fire, Heat; Ignition Process; Spread of Fire; Structure of Flames, Flame Height/Length; Fire Plume, Plume Features; Flame Progression.

Unit-3 Chemistry behind Fire

Avogadro's Hypothesis; Energy in Chemical Reactions; Oxidation & Reduction; Chemical Chain Reaction in fire; Reducing Atmosphere; Flammability Limits & Flammable Range; Flash Point, Fire Point, Ignition Point, Ignition Energy.

Unit-4 Heat Transfer in Fire

Fundamental of Heat; Heat Transfer & Heat Flux; Modes of Heat Transfer; Temperature versus Heat in Fire; Severity & Growth of fire; Spontaneous Heating and Spontaneous Combustion; Heat Release rate.

Unit-5 Fire Science for Building

Introduction; Building Load; Materials of Construction; Fire Properties of Material Timber/Wood, Steel, Cement, Concrete, Brick, Glass, Plastics, Polystyrene, Gypsum; Fire Testing for Resistance; Segregation and Separation, Compartmentation; Products of fire, Fire spread in Building; Potential effects & toxic properties of Fire products.

DSC-C2: PRACTICAL CHEMISTRY

(30 hours: 4 hrs./week: credits 2)

(4hrs/week)

PRACTICAL-I

1. Estimation of Mohr's salt present in given solution using potassium permanganate solution.

Instrument: Mohr's salt, ferrous indicator, potassium di chromate, sodium carbonate.

2. Determination of total hardness of waste water.

Instrument: NH3-NH4Cl buffer, Eriochrome black T indicator.

3. Determination of acid value of biofuel.

Instrument: Benzene Alcohol, Phenolphthalein indicator KOH.

4. . Determination of pKa of weak acid using pH meter.

Instrument: Vinegar, NaOH, H_2SO_4, HCl.

5. To determine Concentration of solution by titration against 0.1M solution of oxalic acid.

Instrument: Oxalic Acid, Kmno4.

6. Determination of Chemical oxygen demand of waste water.

Instrument: Morh's salt, buffer.

7. Determination of chloride content in water.

Instrument: NaCl, Silver nitrate, KCl, K2cr204.

8. To study characteristics of carbohydrates, fats proteins in pure form detection of their present in stuff.

Instrument: Glucose, fructose, Benedict reagent.

Text Books / References

1. Matthew Moncrieff Pattison Muir, —The Chemistry of Fire‖, General Books Publisher, 2012.

2. Laurence Gonzales, —The Chemistry of Fire‖, University of Arkansas Press Publisher, 2020.

3. Derek, James, —Fire Prevention Hand Book‖, Butter Worths and Company Publisher, London, 1986.

4. Gupta, R.S., —Hand Book of Fire Technology‖, Orient Longman, Bombay 1977.

5. R.K.Jain, Sunil S.Rao, —Industrial Safety, Health and Environment Management Systems‖, Khanna Publishers.

DSC-C3: SAFETY MANAGEMENT – 1

(60 hours: 4 hrs./week: credits 4)

PAPER II

Unit-1 Safety Management and its Responsibilities

Safety Management; Place of Industry in Society & Safety in Industry; Role of Safety management; General & Specific Functions; Planning, Organising, Directing for Safety; Leadership, Controlling for safety; Role of Supervisors, workers, Trade Unions, Competent person & Safety Specialists.

Unit-2 Safety Planning

Safety Policy; Strategic Planning and Process of Implementation; Management by Objectives and its Role in safety; Effective Planning for Safety; Safety Department: Functions and Responsibilities, Role, Authority; Power and Qualifications/Attributes of Safety Officer; Structure and Functions of Safety Committee.

Unit-3 Motivation for Safety

Assessment of Needs; Motivation of employees; Theories of motivation and their application to safety; Supervisors and safety department in motivation; Tool Box Talk; Safety Signboards-types and colour codes.

Unit-4 Safety Promotion

Safety Suggestion Schemes; Safety Competitions; Safety Incentive Schemes; Promotional Methods; Performance Appraisal; Modern Methods and Techniques of Safety Promotion; Purpose & Importance of Employee participation; Integrating SHE in Collective Bargaining.

Unit-5 Safety Organisations & Departments

Types & Objectives; Role of Industrial Organisations, Government's and Voluntary Organisations; Size and Function of Safety Department; Safety Officer- Need, Rules & Roles, Work Suggestions, Attitudes.

DSC-C4: LAB ON WORKPLACE SAFETY

(30 hours: 4 hrs./week: credits 2)

(4hrs/week)

PRACTICAL-II

1. Identification & Measurement of Exhaust gases from IC engines.

Instrument: Gas Analyzer

2. Measurement of exhaust gas levels to identify the gases causing the human health hazards.

Instrument: Gas Analyzer

3. Identification of breathing zone Particulates size.

Instrument: Personal Air Sampler & Particulate Counter.

4. Measurement of concentration of dust and fumes in breathing zone.

Instrument: Personal Air Sampler & Particulate Counter.

5. Measurement of Hot environmental condition at work place.

Instrument: CO2 meter, O2 Meter, Wet Bulb Temperature, CO meter, RH meter, LUX meter.

6. Measurement of cold environmental condition at work place.

Instrument: CO2 meter, O2 Meter, Wet Bulb Temperature, CO meter, RH meter, LUX meter.

7. Technique of collecting air from atmosphere for Air Sampling.

Instrument: Personal Air Sampler.

8. Identification & Measurement of explosive gases present in atmosphere.

Instrument: Explosive Meter.

Text Books / References

1. R K Mishra, —Safety management‖, AITBS publications, INDIA.
2. John V Grimaldi, Rollin H Simonds, —Safety management‖, AITBS publications, INDIA.
3. R.K.Jain, Sunil S.Rao, —Industrial Safety, Health and Environment Management Systems‖, Khanna Publishers.
4. Dr. K U Mistry, —Fundamentals of industrial safety and health‖, Siddharth Prakashan Publisher.
5. Deshmukh, —Industrial safety management, Hazard identification and risk control‖, McGraw Hill education.

DSC C5: RULES AND REGULATIONS - 1

(60 hours: 4 hrs./week: credits 4)

PAPER III

Unit-1 Factories Act 1948,

Provisions under the Act and Rules made there under with amendments Case Laws under the Factories Act.

Unit-2 Workman Welfare Acts

Workman Compensation Act and rules. ESI Act and rules. Contract Labour Act. Employees Liability Act, Public Liability Insurance Act-1991.

Unit-3 Explosion Acts

Indian explosive act. Gas cylinder rules. Static and Mobile Pressure Vessels Act. Indian petroleum act and rules.

Unit-4 Environmental Acts

Environmental pollution act 1986 and Rules,. The water (Control of Pollution) Act and Rules. The air (control of pollution) Act and Rules. Hazardous Waste Management Rule and Disaster Management Act-2005.

Unit-5 Chemical Acts

Calcium Carbide Rules, The insecticides Act and Rules, The Poison Act and Rules, The Dangerous Drug Act, The Drug and Cosmetic Act.

DSC-C6: LAB BASED ON RULES AND REGULATIONS – I

(30 hours: 4 hrs./week: credits 2)

PRACTICAL-III

(4hrs/week)

1. Case Study on Factories Act 1948
2. Case Study onWorkman Welfare Acts
3. Case Study on Explosion Acts
4. Case Study on Environmental Acts
5. Case Study on Chemical Acts

Text Books / References

1. Dr. K U Mistry, —Fundamentals of industrial safety and health‖, Siddharth Prakashan Publisher. 2. R.K.Jain, Sunil S.Rao, —Industrial Safety, Health and Environment Management Systems‖, Khanna Publishers.

3. Sathpal Puliani, —Guide to the factories act in Karnataka‖, 9th edition KLJ publications.

4. Sathpal Puliani, —The Karnataka environmental pollution and pollution control manual‖, volume 1 and 2, KLJ publications.

5. Employees state insurance act 1948‖, KLJ publications.

6. The explosives act 1894 along with allied act and rules‖, Universal.

II SEMESTER

DSC-C7: FIRE SAFETY

PAPER I **(60 hours: 4 hrs./week: credits 4)**

Unit-1 Introduction

Classification of Fire; Life safety & property Protection; Prevention System & Control Measures; Fire Escape Routes & Refuge; NEPA Code (NFC); Indian Standards.

Unit-2 Fire detectors & Alarms

Introduction to Detectors & Alarms; Types of detectors, Heat Detectors, Smoke Detectors, Optical Flame Detectors, Gas Sensing Detectors; Selection & Application of Detectors; Alarm System, Fire Alarm System and Control Panel (FDA System), Principal of Operation; Selection of detectors and alarm system.

Unit-3 Hydraulics, Pumps and Primers

Introduction; Laws of Fluid Flow; Flow Measurement in Closed and Open System; Flow & Friction Loss; Flow in Loops and Grids; Hydraulically Remotest Point; Head, Water Hammer; Friction Loss in flow through Hoses, Pumps; Net positive suction Head (NPSH); Pump Combination, Pump Selection, Primers.

Unit-4 Portable Extinguishers

Fundamentals of Extinguishers; Common Features of Extinguishers; Types of Extinguishers; Classification of Fire and Suitability of Extinguishers; Rating of Extinguishers; NEPA Codes; Hazard Categorization; Placement of Extinguishers.

Unit-5 Fixed Fire Protection System

Introduction; Water Based Fixed fire Protection System-Dry & Wet type; Automatic Sprinklers; Foam System; Water Spray System; Water Mist Systems; Carbon Dioxide Flooding System; Clean Agents, Draining out fire water.

DSC-C8: HARMFUL GASES DETECTION LAB

(30 hours: 4 hrs./week: credits 2)

(4hrs/week)

PRACTICAL-I

1. Identification & Measurement of harm full gases Ammonia (NHa) in atmospheric air.

Instrument: Gas detector pump, Ammonia tubes.

2. Identification & Measurement of harm full gases Chlorine (Cl_2) in atmospheric air.

Instrument: Gas detector pump with tubes.

3. Identification & Measurement of harm full gases Carbon Monoxide (CO) in atmospheric air.

Instrument: Gas detector pump, Carbon Monoxide tubes.

4. Identification & Measurement of harm full gases Methanol (CH_3OH) in atmospheric air.

Instrument: Gas detector pump, Methanol tubes.

5. Identification & Measurement of harm full gases Ethanol (C_2H_5OH) in atmospheric air.

Instrument: Gas detector pump, Ethanol tubes.

6. Identification & Measurement of harm full gases Hydrocarbons (lower & higher class) in atmospheric air.

Instrument: Gas detector pump, Hydrocarbon tubes.

7. Identification & Measurement of harm full gases Nitrogen Dioxide (NO_2) in atmospheric air.

Instrument: Gas detector pump, Nitrogen tubes.

8. Identification & Measurement of harm full gases Benzene (C_6H_6) in atmospheric air.

Instrument: Gas detector pump, Methanol tubes.

Text Books / References

1. Akhil Kumar Das, —Principles of fire safety engineering, understanding fire and fire protection‖, PHI learning private limited.

2. Dennis Nolan, —Handbook of Fire and Explosion Protection Engineering Principles‖, 2nd Edition.

3. Gupta, R.S., —Hand Book of Fire Technology‖ Orient Longman, Bombay 1977. 2. R.K.Jain, Sunil S.Rao, —Industrial Safety, Health and Environment Management Systems‖, Khanna Publishers.

4. Dr. K U Mistry, —Fundamentals of industrial safety and health‖, Siddharth Prakashan Publisher.

DSC-C9: SAFETY MANAGEMENT – 2

(60 hours: 4 hrs./week: credits 4)

PAPER II

Unit-1 Concepts

Evolution of modern safety concept; Safety policy; Safety Organization; line and staff functions for safety; Safety Committee; budgeting for safety.

Unit-2 Techniques

Incident Recall Technique (IRT); disaster control; Job Safety Analysis (JSA); Safety Survey, Safety inspection, Safety sampling, Safety Audit.

Unit-3 Accident Reporting

Concept of an accident; reportable and non-reportable accidents; unsafe act and condition; principles of accident prevention; Cost of accident; Overall accident investigation process; Response to accidents; India reporting requirement; Planning document; Investigators Kit; Records of accidents.

Unit-4 Safety Performance Monitoring

Reactive and proactive monitoring techniques; Permanent total disabilities, Permanent partial disabilities, Temporary total disabilities; Accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety —tll score, safety activity rate.

Unit-5 Safety Education and Training

Importance of training; identification of training needs; training methods – Programme, seminars, conferences, competitions; method of promoting safe practice - motivation, communication, creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign, Domestic Safety and Training.

DSC-10: LAB ON INDUSTRIAL SAFETY

(30 hours: 4 hrs./week: credits 2)

(4hrs/week)

PRACTICAL-II

1. Measurement of noise level for various sources – Impact, continuous and intermittent.

Instrument: Noise level meter.

2. Frequency and spectrum analysis of noise.

Instrument: Noise level meter and Spectrum analyser.

3. Measurement of whole body vibration for various types of acceleration.

Instrument: Vibration meter and Vibration analyser.

4. Identification of source of vibration & its measurement.

Instrument: Vibration Simulator and Vibration analyser.

5. Measurement of Static Electricity for different magnetic fields

Instrument: Static Electricity Meter

6. Analysis of hazardous chemical explosion & dispersion by Consequence modelling for puddle fire.

Software: Aloha Software

7. Analysis of hazardous chemical explosion & dispersion by Consequence modelling for pool fire.

Software: Aloha Software

8. Analysis of hazardous chemical explosion & dispersion by Consequence modelling for chemical blast.

Software: Aloha Software

Text Books / References

1. R K Mishra, —Safety management‖, AITBS publications, INDIA.

2. John V Grimaldi, Rollin H Simonds, —Safety management‖, AITBS publications, INDIA.

3. R.K.Jain, Sunil S.Rao, —Industrial Safety, Health and Environment Management Systems‖, Khanna Publishers.

4. Dr. K U Mistry, —Fundamentals of industrial safety and health‖, Siddharth Prakashan Publisher. 5. Deshmukh, —Industrial safety management, Hazard identification and risk control‖, McGraw Hill education.

DSC-C11: RULES AND REGULATIONS – II

PAPER III **(60 hours: 4 hrs./week: credits 4)**

Unit-1 Rules for Safety at Construction

Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996. Overview of OHSAS 18000 and ISO 14000.

Unit-2 Rules for MSIHC & Hazardous Material Transportation

Manufacture, Storage and Import of Hazardous Chemical (MSIHC) rules 1989, Hazardous Material Transportation Rules

Unit-3 Rules for Indian Boiler & Electricity

Indian Boilers Act, 1923 and Regulations-1961, Indian Electricity Act-2003 and Rules.

Unit-4 Other Important Legislations

Radiation Protection Act and Regulations, The Dock workers (Safety, Health & welfare) Act 1996 Rules & Regulations, Marine pollution statutes, Motor Vehicles Act.

Unit-5 Standards

Relevance and Importance of Standards in Safety, various standards organization, Bureau of Indian Standards, Oil Industry Safety Directorate etc. (OISD), Codes of Practices, GRI, Reporting of Safety Matters in Company Annual Report.

DSC-12: REGULATIONS & RULES-II

(30 hours: 4 hrs./week: credits 2)

(4hrs/week)

PRACTICAL-III

1. Case Study on Rules for Safety at Construction
2. Case Study on Rules for MSIHC & Hazardous Material Transportation
3. Case Study on Rules for Indian Boiler & Electricity
4. Case Study on Other Important Legislations
5. Case Study on Standards

Text Books / References

1. Dr. K U Mistry, —Fundamentals of industrial safety and health‖, Siddharth Prakashan Publisher. 2. R.K.Jain, Sunil S.Rao, —Industrial Safety, Health and Environment Management Systems‖, Khanna Publishers.

3. Sathpal Puliani, —Guide to the factories act in Karnataka‖, 9th edition KLJ publications.

4. Sathpal Puliani, —The Karnataka environmental pollution and pollution control manual‖, volume 1 and 2, KLJ publications.

5.The motor vehicle act, 1988‖, Professional book publishers.

6. Electricity act 2003‖, KLJ publications.

7. The Karnataka electricity manual‖, volume 1,2 and 3, KLJ publications.

B.Sc Fire and Industrial Safety QUESTION PAPER PATTERN – PRACTICAL

MAXIMUM MARKS: 40 **TIME: 3 HOURS**

1. **Major Experiment:** 12 Marks
2. **Minor Experiment:** 08 Marks
3. **Spotters/Demonstrations:** 12 Marks
4. **Record Submission:** 04 Marks
5. **Viva-Voce:** 04 Marks

Note: Scheme of valuation specific to each semester has to be prepared by the BOE for each examination separately

Internal Assessment:

Internal tests:	5 Marks
Assignments/Project work/Seminar	5 Marks
TOTAL:	10 Marks

Note: Students should be given a choice of picking a topic of their interest for project work and the teachers should guide them in making an informed choice.

CHAIRMAN
BOS IN Fire and Safety
TUMKUR UNIVERSITY
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