

West Bengal State Council of Technical &  
Vocational Education and Skill Development  
(Technical Education Division)



Draft  
Syllabus  
for

Diploma in Fire Technology  
and Safety [FTS]

3<sup>rd</sup> Semester

2024

***CURRICULUM STRUCTURE FOR PART-II (SEMESTER 3) OF THE FULL-TIME  
DIPLOMA COURSES IN FIRE TECHNOLOGY AND SAFETY***

| BRANCH: FIRE TECHNOLOGY AND SAFETY |              |         |  | Semester 3 |          |                      |           |            |
|------------------------------------|--------------|---------|--|------------|----------|----------------------|-----------|------------|
| SL No                              | Category     | Code No | Course Title   | L          | P        | Total Class per week | Credit    | Full marks |
| 1                                  | Program core | FTPC201 | Fundamental of Fire Science                            | 3          | -        | 3                    | 3         | 100        |
| 2                                  | Program core | FTPC203 | Basic Engineering Materials                            | 3          | -        | 3                    | 3         | 100        |
| 3                                  | Program core | FTPC205 | Fire Codes & Standards                                 | 3          | -        | 3                    | 3         | 100        |
| 4                                  | Program core | FTPC207 | Heat Transfer Technology                               | 3          | -        | 3                    | 3         | 100        |
| 5                                  | Program core | FTPC209 | Electrical Safety                                      | 3          | -        | 3                    | 3         | 100        |
| 6                                  | Program core | FTPC211 | Fire Fighting Appliances and Rescue Devices Laboratory | -          | 2        | 2                    | 1         | 100        |
| 7                                  | Program core | FTPC213 | Heat Transfer laboratory                               | -          | 2        | 2                    | 1         | 100        |
| 8                                  | Program core | FTPC215 | Electrical Safety Laboratory                           | -          | 2        | 2                    | 1         | 100        |
| 9                                  | Internship   | SI201   | Internship-I   | --         | -        | 0                    | 1         | 100        |
| <b>Total</b>                       |              |         |  | <b>15</b>  | <b>6</b> | <b>21</b>            | <b>19</b> | <b>900</b> |

**Pass Criterion:** Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately in each subject whether theoretical or practical.



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“Karigori Bhavan”, 4<sup>th</sup> Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

|  |   |
|--|---|
| <b>Name of the Course: Diploma in Fire Technology and Safety</b>   |   |
| <b>Category: Programme Core</b>  | <b>Semester: Third</b>  |
| <b>Code no.: FTPC201</b>   | <b>Theory: 100 marks</b>  |
| <b>Course/Subject Title: Fundamental of Fire Science</b>   | Examination Scheme:<br><b>1. External Assessment: 60 marks</b><br>(End Semester Examination)<br><b>2. Internal Assessment: 40 marks</b><br>[Class test: 20 marks<br>Quizzes, assignment, viva voce: 10 marks<br>Class attendance: 10 marks] |
| <b>Duration: 17 weeks</b> (Total hours per week = 3)   |   |
| <b>Total Theoretical class/week: 3</b>   |   |
| <b>Credit: 3</b>   |   |
| <b>Pass Criterion:</b> Students have to obtain at least 40% marks (pass marks) in both Internal Assessment and end semester assessment separately. |   |

**1. Course Outcomes (COs):**

After completion of this course the students will be able to

- i. Explain the fundamental of Combustion.
- ii. Classify different categories of Fire.
- iii. Understand Special combustion process and Gas Laws
- iv. Identify different Extinguishing media.
- v. Understand Fire & explosion hazard associated with Plastic, Flammable liquid, Gaseous substances & Dust.

**2. Theory Components:**

The following topics / subtopics should be taught and assessed in order to achieve the identified course outcomes.

| Unit/Chapter   | Topics & Sub-topics   | Teaching Hour |
|--|---|---------------|
| <b>UNIT 1:</b><br><br><b>Fundamental of Combustion</b> | 1.1 Basic concept of Combustion,<br>1.1.1 Processes of combustion<br>1.1.2 Combustion Characteristics of fuels<br>1.2 Fire triangle; Positive heat balance<br>1.3 Methods of fire extinction-smothering, cooling and starvation<br>1.4 Tetrahedron and chain breaking reaction.<br>1.5 Sources of ignition<br>1.6 Spread of fire<br>1.7 Calorific value of solid, liquid and gaseous combustible materials<br>1.8 Fire load- definition, expression of fire load and related simple numerical problems<br>1.9 Products of Combustion and their Effects.<br>1.10 Definition and safe guard from: Detonators, Propellants, Initiators<br><b>1.11</b> Concept of Deflagration. | <b>8 hrs.</b> |

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|---|---|----------------------|
| <p><b>UNIT 2:</b><br/><b>Basics of Ignition, Flammability and Radioactivity</b></p>       | <p>2.1 Ignition temperature<br/>2.2 Auto ignition temperature<br/>2.3 Diffusion flames and Premixed flames.<br/>2.4 Limits of flammability,<br/>2.5 Concept of Flash over, Flash back, Back draught<br/>2.6 Principle of Radioactivity: Alpha, Beta &amp; Gamma radiation, Decay &amp; half-life, Precaution to be adapted for safety</p>   | <p><b>6 hrs.</b></p> |
| <p><b>UNIT 3:</b><br/><b>Understanding of Special Combustion Process and Gas Laws</b></p> | <p>3.1 Concept of Smouldering, deep seated and surface fire.<br/>3.2 Spontaneous heating, ignition and combustion<br/>3.3 Pyrophoric Substance<br/>3.4 Laws related to fire: Ideal gas law, Boyles law, Charles's law, Graham's law and Pascal's law.<br/>3.5 Effect of Temperature and pressure on volume of Gas.<br/>3.6 Critical temperature and pressure.<br/>3.7 Fire with explosion types and effect: B.L.E.V.E, U.V.C.E<br/>3.8 Process and effect of Pyrolysis.</p> | <p><b>7 hrs.</b></p> |
| <p><b>UNIT 4:</b><br/><b>Basic knowledge on Fire</b></p>                                  | <p>4.1 Definition of Fire<br/>4.2 Classification of Hazard in terms of fire Load: Light, Ordinary and High Hazard<br/>4.2.1. Study of different degree of hazards as per IS 13039.<br/>4.3 Understanding of Stages of Fire with Time vs temperature curve.<br/>4.4 Probable causes of Fire &amp; control Technique</p>  | <p><b>6 hrs.</b></p> |
| <p><b>UNIT 5:</b><br/><b>Classification of Fire and Fire Extinguishing Agents</b></p>     | <p>5.1 Classification of Fire: Class A,B,C,D and K/F.<br/>5.2 Agents<br/>5.2.1 Water<br/>5.2.2 Foam<br/>5.2.3 Carbon Dioxide<br/>5.2.4 Dry Chemical Powder,<br/>5.2.5 Clean Agents alternative to Halon</p>   | <p><b>8 hrs.</b></p> |

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| <b>UNIT 6:<br/>Fire &amp; Explosion<br/>Hazard</b>                 | <b>6.1 Plastics</b><br>6.1.1 Types of Plastic.<br>6.1.2 Effects of heat.<br>6.1.3 Combustibility.<br>6.1.4 Behaviour during fire.   | <b>10 hrs.</b> |
|  | <b>6.2 Flammable Liquids</b><br>6.2.1 Classification of liquids,,<br>6.2.2 Boiling point,,<br>6.2.3 Flash point<br>6.2.4 Fire point<br>6.2.5 Extinguishing media<br>6.2.6 Fire extinction technique |                |
|  | <b>6.3 Gaseous Substance</b><br>6.3.1 Physical properties,<br>6.3.2 Classifications<br>6.3.3 Behaviour of gases<br>6.3.4 Gas explosion<br>6.3.5 Safe guards etc.                                    |                |
|  | <b>6.4 Dusts</b><br>6.4.1 Factors influencing<br>6.4.2 Dust explosion<br>6.4.3 Ignition sources<br>6.4.4 Explosion safe guards etc.   |                |
| <b>Total Lecture Classes (Sub Total):</b>                          |   | <b>45</b>      |
| <b>No. of classes required for conducting Internal Assessment:</b> |   | <b>06</b>      |
| <b>Grand Total:</b>  |   | <b>51</b>      |

### 3. Suggested Learning Resources:

| Sl. No. | Title of Book   | Author                                | Publication                          |
|---------|---|---------------------------------------|--------------------------------------|
| 1       | Hand Book of Fire Technology.   | R. S. Gupta                           | .Orient Longman                      |
| 2       | Industrial Fire Safety  | D. D. Purandare<br>Abhay D. Purandare | P & A Publications                   |
| 3       | Fire Fighting<br>The Essential Handbook                                 | Barendra Mohan Sen                    | Techno World                         |
| 4       | Manual of Firemanship. Book 1<br>Elements of Combustion &<br>Extinction | Her Majesty's<br>Stationery Office    | Hobbs the printers of<br>Southampton |



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|--|--|
| <b>Name of the Course: Diploma in Fire Technology and Safety</b>   |  |
| <b>Category: Programme Core</b>  | <b>Semester: Third</b>   |
| <b>Code no.: FTPC203</b>   | <b>Theory: 100 marks</b>   |
| <b>Course/Subject Title: Basic Engineering Materials</b>   | Examination Scheme:<br><b>1. External Assessment:60 marks</b>                                    |
| <b>Duration: 17 weeks</b> (Total hours per week = 3)   | (End Semester Examination)   |
| <b>Total Theoretical class/week: 3</b>   | <b>2. Internal Assessment:40 marks</b>   |
| <b>Credit: 3</b>   | [Class test: 20 marks<br>Quizzes, assignment, viva voce: 10 marks<br>Class attendance: 10 marks] |
| <b>Pass Criterion:</b> Students have to obtain at least 40% marks (pass marks) in both ii) Internal assessment and end semester assessment separately. |  |

**1. Course Outcomes (COs):**

**At the end of this course, the student will be able to**

- i. Explain crystal structures.
- ii. Distinguish between the ferrous metals and non-ferrous metals and their engineering applications.
- iii. Explain various heat treatment processes & their applications.
- iv. Identify the applications of non-metal and advance materials.
- v. Understand non-destructive testing methods and their applications.

**2. Theory Components:**

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

| <b>Unit/Chapter</b>                              | <b>Topics &amp; Sub-topics</b>   | <b>Teaching Hour</b> |
|--|--|----------------------|
| UNIT 1:<br><b>Basic of Engineering Materials</b> | 1.1. Introduction to engineering materials.<br>1.2. Classification of engineering materials.<br>1.3. Crystal structures- Unit cell and space lattice. Crystal system.<br>1.4. Crystal structure for metallic elements- BCC, FCC and HCP.<br>1.5. Mechanical properties of materials - elasticity, plasticity, ductility, malleability, toughness, hardness, hardenability, brittleness, fatigue, and creep.<br>1.6. Introduction to corrosion.<br>1.7. Corrosion prevention methods. | <b>07</b>            |

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|---|---|------------------|
| <p>UNIT 2:<br/><b>Ferrous Metals and Alloys</b></p>                       | <p>2.1. Cooling curve showing allotropic transformation of iron. Iron- Carbon equilibrium diagram and its explanation. Critical temperatures and its significance. Principal micro constituents of an iron carbon system up to 2.0% C content (austenite, ferrite, cementite, pearlite, eutectoid, hypo-eutectoid &amp; hyper-eutectoid steel)</p> <p>2.2. Broad classification of ferrous metals (steel, cast iron, wrought iron) according to percentage of carbon and their area of application.</p> <p>2.3. Steel and its classifications.</p> <p>2.4. Compositions, properties and applications of –(i) Plain carbon steel: low, (ii) medium and (iii) high carbon steel; Effect of silicon, sulphur, phosphorus and manganese in steel.</p> <p>2.5. Alloy steel: purpose of alloying, effects of various alloying elements like chromium, nickel, manganese, tungsten, vanadium, cobalt, and molybdenum.</p> <p>2.6. Compositions, properties and applications of Tool steel, high speed steel (HSS)</p> <p>2.7. Introduction to Stainless steel and Spring steel</p> | <p><b>10</b></p> |
| <p>UNIT 3:<br/><b>Heat Treatment of Steel</b></p>                         | <p>3.1. Introduction to heat treatment, TTT Diagram for eutectoid steel.</p> <p>3.2. Heat Treatment Processes: Purpose, process and applications of - Annealing, Normalising, Hardening &amp; Tempering.</p> <p>3.3. Surface hardening: Purpose, process and application of - Case hardening, Flame hardening, and Induction hardening.</p>   | <p><b>08</b></p> |
| <p>UNIT 4:<br/><b>Non-Ferrous Metals and Alloys</b></p>                   | <p>4.1. Properties and application of copper and its alloys such as brass, muntz metal, gun metal and bronze.</p> <p>4.2. Properties and application of aluminium alloys such as Y-alloy, hinalium, and duralumin.</p> <p>4.3 Properties and application of bearing metals such as white metal, babitt metal, and phosphor bronze.</p>  | <p><b>05</b></p> |
| <p>Unit-5:<br/><b>Non-Metallic and Advanced Materials</b></p>             | <p>5.1 Introduction to Polymeric materials.</p> <p>5.2 Properties and applications of thermoplastics and thermosetting plastics</p> <p>5.3 Properties and application of rubbers.</p> <p>5.4 Application of ABS, acrylics, nylons and vinyl, polyesters, epoxies, melamine and bakelite.</p> <p>5.5 Application of neoprene, butadiene, buna and silicon.</p> <p>5.6 Ceramics - properties and applications of glasses and refractories.</p> <p>5.7 Composite materials - properties and applications of laminated and fibre reinforced materials.</p> <p>5.8 Advanced engineering materials- Properties and applications of Nano materials and smart materials.</p>  | <p><b>09</b></p> |
| <p>Unit-6:<br/><b>Non-Destructive Testing</b></p>                         | <p>6.1. Introduction to destructive tastings.</p> <p>6.2. Non-destructive testing methods and their importance: Radiography (X-Ray &amp; Gamma Ray) test, Ultrasonic test, Dye penetration test, Magnetic particle test and eddy current test.</p> <p>6.3. Comparison between destructive and non- destructive testing.</p>   | <p><b>06</b></p> |
| <p><b>Total Lecture Classes (Sub Total):</b></p>                          |   | <p><b>45</b></p> |
| <p><b>No. of classes required for conducting Internal Assessment:</b></p> |   | <p><b>06</b></p> |
| <p><b>Grand Total:</b></p>  |   | <p><b>51</b></p> |

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**Suggested Learning Resources:**

| <b>Sl. No.</b> | <b>Title of Book</b>                            | <b>Author</b> | <b>Publication</b>               |
|----------------|---|---------------|----------------------------------|
| 1              | Engineering Materials                           | B.K.Agrawal   | McGraw Hill Education, New Delhi |
| 2              | Material Science                                | R.S. Khurmi   | S. Chand & Co. Ltd.              |
| 3              | Material Science & Engineering                  | Raghavan      | PHI                              |
| 4              | Materials Science for Polytechnic               | R.K.Rajput    | S. K. Kataria & Sons             |
| 5              | A Text Book of Materials Science and Metallurgy | O.P.Khanna    | Dhanpat Rai and Sons             |

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| <b>Name of the Course: Diploma in Fire Technology and Safety</b>   |   |
|--|---|
| <b>Category: Programme Core</b>  | <b>Semester: Third</b>  |
| <b>Code no.: FTPC205</b>   | <b>Theory: 100 marks</b>  |
| <b>Course/Subject Title: Fire Codes &amp; Standards</b>  | Examination Scheme:<br><b>1. External Assessment: 60 marks</b><br>(End Semester Examination)<br><b>2. Internal Assessment: 40 marks</b><br>[Class test: 20 marks<br>Quizzes, assignment, viva voce: 10 marks<br>Class attendance: 10 marks] |
| <b>Duration: 17 weeks</b> (Total hours per week = 3)   |   |
| <b>Total Theoretical class/week: 3</b>   |   |
| <b>Credit: 3</b>   |   |
| <b>Pass Criterion:</b> Students have to obtain at least 40% marks (pass marks) in both ii) Internal assessment and end semester assessment separately. |   |

**1. Course Outcomes (COs):**

After completion of this course the students will be able to

- i. Select portable Fire Extinguishers based on types of fire.
- ii. Describe safety parameter & prevention of Fire.
- iii. Understand the basic Fire Safety requirement based on establishment.
- iv. Explain Fire safety Act and Norms for different types of risks.
- v. Understand the functional requirement of Fire appliances.
- vi. Apply fundamental OISD rules.

**2. Theory Components:**

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

| <b>Unit/Chapter</b>  | <b>Topics &amp; Sub-topics</b>   | <b>Teaching Hour</b> |
|--|--|----------------------|
| <b>UNIT 1:<br/>Fire &amp; Life<br/>Safety Codes</b>                      | 1.1 National Building code-2016, Part-4 (with latest edition/amendment)<br>1.2 The West Bengal Fire Service Act. -1950 (with latest edition/amendment)<br>1.3 Kolkata Municipal Corporation Building Rule (with latest edition/amendment)<br>1.4 The West Bengal Municipal Building Rule (with latest edition/amendment) | <b>5 hrs.</b>        |
| <b>UNIT 2:<br/>Fire Safety<br/>Codes/Standards<br/>for various Risks</b> | 2.1 IS: 13716 : Fire Safety of Hotel.<br>2.2 IS:14435 : Fire Safety in Educational Institutions<br>2.3 IS:14850 : Fire Safety in Museums.<br>2.4 IS:11460 : Fire Safety of Libraries and archives Buildings.   |                      |

|  |  |                      |
|--|--|----------------------|
|  | <p>2.5 IS:12456 : Fire Protection of Electronic data Processing Installations</p> <p>2.6 IS:4878 : Byelaws for construction of cinema buildings</p> <p>2.7 IS:2726 : Code of practice for fire safety of industrial buildings :<br/>Cotton ginning and pressing (including cotton seed delinting)<br/>factories</p> <p>2.8 IS:3034 : Code of practice for fire safety of industrial buildings :<br/>Electrical generating and distributing stations</p> <p>2.9 IS:3058 : Code of practice for fire safety of industrial buildings :<br/>Viscose rayon yarn and/or staple fire plants</p> <p>2.10 IS:3079 : Code of practice for fire safety of industrial buildings :<br/>Cotton textile mills</p> <p>2.11 IS:3594 : Code of practice for fire safety of industrial buildings :<br/>General storage and warehousing including cold storage</p> <p>2.12 IS:3595 : Code of practice for fire safety of industrial buildings :<br/>Coal pulverizers and associated equipment</p> <p>2.13 IS:3836 : Code of practice for fire safety of industrial buildings :<br/>Jute mills (second revision)</p> <p>2.14 IS:4209 : Code of safety for chemical laboratories</p> <p>2.15 IS:4226 : Code of practice for fire safety of industrial buildings :<br/>Aluminium/ Magnesium powder factories</p> <p>2.16 IS:4886 : Code of practice for fire safety of industrial buildings :<br/>Tea factories</p> <p>2.17 IS:6329 : Code of practice for fire safety of industrial buildings :<br/>Saw mills and wood works</p> <p>2.18 IS:9109 : Code of practice for fire safety of industrial buildings :<br/>Paint and Varnish factories</p> <p>2.19 IS:11457 - 1: Code of practice for fire safety of chemical<br/>industries: Part 1 Rubber and plastic</p> <p>2.20 IS:8758: Code of practice for fire precautionary measures in<br/>construction of temporary structures and pandals</p> <p>2.21 IS: 3614 Part I &amp; 2 Specification of Fire check Door.<br/>Part-I : Plate , Metal covered &amp; Rolling type<br/>Part-2 : Metallic &amp; Non-Metallic Fire Check doors Resistance Test<br/>&amp; performance criteria.</p> | <p><b>8 hrs.</b></p> |
|--|--|----------------------|

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|---|--|----------------------|
| <p><b>UNIT 3:<br/>Codes for Fire<br/>Detecting &amp;<br/>Extinguishing<br/>System</b></p> | <p>3.1 IS:3844 : Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises.</p> <p>3.2 IS:13039 : Code of practice for provision and maintenance of external hydrant system</p> <p>3.3 IS:6382 : Design &amp; Installation of fixed Carbon-di-Oxide Fire Extinguishing system.</p> <p>3.4 IS 15105 : Design and installation of automatic sprinkler Fire Extinguishing system</p> <p>3.5 IS:15325 : Design and installation of fixed automatic high and medium velocity water spray system.</p> <p>3.6 IS:15519 : Water mist fire protection systems - System design, installation and commissioning. Code of Practice</p> <p>3.7 IS:15497 : Gaseous fire extinguishing systems . IG 01 extinguishing systems</p> <p>3.8 IS:15506 : Gaseous fire extinguishing systems . IG 55 extinguishing systems</p> <p>3.9 IS:15501 : Gaseous fire extinguishing systems . IG 541 extinguishing systems</p> <p>3.10 IS:15525 : Gaseous fire extinguishing systems . IG 100 extinguishing systems</p> <p>3.11 IS:15505 : Gaseous fire extinguishing systems - HCFC Blend A</p> <p>3.12 IS:2189: Code of practice for selection, installation and maintenance of automatic fire detection and alarm system.</p> <p>3.13 IS:2190: Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers</p> <p>3.14 IS:15683: Selection Installation &amp; Maintenance of First-Aid Fire Extinguisher</p> | <p><b>7 hrs.</b></p> |
| <p><b>UNIT 4:<br/>Standards for<br/>Fire Brigade<br/>Appliances</b></p>                   | <p>4.1 IS: 944 : Functional requirement for 1800 l/min trailer pump for fire brigade use</p> <p>4.2 IS: 948 : Functional requirement for Water tender, Type A, for fire brigade use</p> <p>4.3 IS: 949 : Functional requirement for emergency (rescue) tender</p> <p>4.4 IS: 950 : Functional requirements for Water tender, Type B for fire brigade use</p> <p>4.5 IS: 955 : Functional requirements for Dry Powder tender, for fire brigade use</p> <p>4.6 IS: 10460 : Functional requirements for small foam tender for fire brigade use</p> <p>4.7 IS: 10993 : Functional requirements for 2000 kg dry powder tender for fire brigade use</p> <p>4.8 Rapid intervention vehicles for airport</p> <p>4.9 Air field crush tender</p>   | <p><b>6 hrs.</b></p> |

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| <b>UNIT 5:<br/>Ladders &amp;<br/>Breathing<br/>Apparatus Set</b> | <b>5.1</b> Introduction to Aerial Ladders and its application<br><b>5.2</b> Basic concept on hydraulically Turntable Ladders and its use<br><b>5.3</b> Overview on Hydraulic Platforms and its use<br><b>5.4</b> Self-content Breathing Apparatus Set and its application   | <b>3 hrs.</b>  |
| <b>UNIT 6<br/>Fire Safety<br/>Rules</b>                          | 6.1 Introduction to Gas Cylinder rule<br>6.2 Petroleum rule<br>6.3 Static & Mobile Pressure Vessels rule<br>6.4 MSDS of Hazardous Materials<br><b>6.5 IS:6044 (Part 1):</b> Liquefied petroleum gas storage installations - Code of Practice: Part 1 Residential commercial and industrial cylinder installations<br><b>6.6 IS: 6044 (Part 2):</b> Code of Practice for liquefied petroleum gas storage Installations: Part 2 Commercial, industrial and domestic bulk storage installations.   | <b>5 hrs.</b>  |
| <b>UNIT 7:<br/>OISD Rules</b>                                    | <b>7.1 : Design &amp; Layout</b><br><b>7.1.1</b> OISD-STD-118: Layouts for Oil and Gas Installations<br><b>7.1.2</b> OISD-STD-144: Liquefied Petroleum Gas (LPG) Installations<br><b>7.1.3</b> OISD-STD-150: Design and Safety Requirements for Liquefied Petroleum Gas Mounded Storage Facility<br><b>7.1.4</b> OISD-GDN-169: OISD Guidelines on Small LPG Bottling Plants (Design and Fire Protection facilities)<br><b>7.2 : Operating Practices</b><br><b>7.2.1</b> OISD-STD-105: Work Permit System<br><b>7.2.2</b> OISD-STD-114: Safe Handling of Hazardous Chemicals<br><b>7.2.3</b> OISD-GDN-192: Safety Practices During Construction<br><b>7.2.4</b> OISD-STD-194: Standard For Storage And Handling Of Liquefied Natural Gas (LNG)<br><b>7.3 : Maintenance and Inspection</b><br>OISD-STD-142 Inspection of fire fighting equipment and systems<br><b>7.4 : Environment Protection</b><br><b>7.4.1</b> OISD-GDN-166: Guidelines for Occupational Health Monitoring in Oil and Gas Industry<br><b>7.4.2</b> OISD-GDN-168: Emergency Preparedness Plan for Marketing | <b>11 hrs.</b> |

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|--|---|-----------|
|  | Locations of Oil Industry   |           |
|  | <p><b>7.5 : Safety &amp; Fire Protection</b></p> <p><b>7.5.1</b> OISD-GDN-115: Guidelines on Fire Fighting, Equipment and Appliances in Petroleum Industry</p> <p><b>7.5.2</b> OISD-STD-116: Fire Protection facilities for Petroleum Refineries and Oil/Gas Processing Plants</p> <p><b>7.5.3</b> OISD-STD-117: Fire Protection Facilities for Petroleum Depots and Terminals and Pipelines Installations</p> <p><b>7.5.4</b> OISD-STD-155: (Part I) Personal Protective Equipment</p> <p><b>7.5.5</b> OISD-STD-155: (Part II) Part I Non-respiratory equipment<br/>Part II Respiratory Equipment</p> <p><b>7.5.6</b> OISD-GDN-156: Fire Protection Facilities for Port Oil Terminals</p> <p><b>7.5.7</b> OISD-STD-164: Fire Proofing in Oil &amp; Gas Industry</p> <p><b>7.5.8</b> OISD-STD-173: Fire Protection System for Electrical Installations</p> <p><b>7.6: Training and Developments</b></p> <p><b>7.6.1</b> OISD-STD-154: Safety aspects in functional training</p> <p><b>7.6.2</b> OISD-STD-176: Safety, Health &amp; Environment Training for Exploration &amp; Production (Upstream Personnel)</p> <p><b>7.7 : Exploration And Production Activities</b></p> <p><b>7.7.1</b> OISD-GDN-204: Medical Requirements, Emergency Evacuation And Facilities (For Upstream)</p> <p><b>7.7.2</b> OISD-RP-205: Crane Operation, Maintenance and Testing (For upstream)</p> <p><b>7.7.3</b> OISD-GDN-206: Guidelines on Safety Management System in Petroleum Industry.</p> |           |
|  | <b>Total Lecture Classes (Sub Total):</b>   | <b>45</b> |
|  | <b>No. of classes required for conducting Internal Assessment:</b>  | <b>06</b> |
|  | <b>Grand Total:</b>   | <b>51</b> |

**Suggested Learning Resources:**

1. BIS Codes and Standards mentioned above Published by Bureau of Indian Standards
2. OISD Codes and Standards mentioned above Published by Oil Installation Standard directorate
3. National Building Code 2016 (Part: 4)
4. West Bengal Fire Service Act; 1950.
5. Kolkata Municipal Corporation Building Rule
6. West Bengal Municipal Building Rule



**WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT**

[A Statutory Body under West Bengal Act XXVI of 2013]

(Formerly West Bengal State Council of Technical Education)

“Karigori Bhavan”, 4<sup>th</sup> Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

|  |  |
|--|--|
| <b>Name of the Course: Diploma in Fire Technology and Safety</b>   |  |
| <b>Category: Program Core</b>  | <b>Semester: Third</b>   |
| <b>Code no.: FTPC207</b>   | <b>Theory: 100 marks</b>   |
| <b>Course/Subject Title: Heat Transfer Technology</b>  | Examination Scheme:<br><b>1. External Assessment:60 marks</b><br>(End Semester Examination)      |
| <b>Duration: 17 weeks (Total hours per week = 3)</b>   | <b>2. Internal Assessment:40 marks</b>   |
| <b>Total Theoretical class/week: 3</b>   | [Class test: 20 marks<br>Quizzes, assignment, viva voce: 10 marks<br>Class attendance: 10 marks] |
| <b>Credit: 3</b>   |  |
| <b>Pass Criterion:</b> Students have to obtain at least 40% marks (pass marks) in both Internal assessment and end-semester assessment separately. |  |

**1. Course Outcomes (COs):**

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

- i. Explain the basic principles of heat transfer.
- ii. Distinguish amongst different modes of heat transfer.
- iii. Explain the mechanism of heat transfer in various process plants & equipment.
- iv. Solve different numerical problems on heat transfer.
- v. Acquire the basic knowledge essential for the operation of various types of heat exchangers.

**2. Theory Components:**

The following topics/subtopics should be taught and assessed to develop unit outcomes for achieving the identified course outcomes.

| Unit/Chapter                                     | Topics & Sub-topics   | Teaching Hour |
|--|---|---------------|
| <b>Unit 1:<br/>Introduction to Heat Transfer</b> | 1.1 Modes of Heat Transfer: Conduction, Convection, and Radiation.<br>1.2 Basic Laws of Heat Transfer: Conduction - Fourier's law, Convection - Newton's Law of Cooling, and Radiation - Stefan Boltzmann's Law.<br>1.2 Steady state and unsteady state heat transfer.<br>1.3 Significance of heat transfer.  | <b>02</b>     |
| <b>Unit 2:<br/>Conduction</b>                    | 2.1 Thermal Conductivity of solids, liquids, and gases. Factors influencing the Thermal Conductivity. Definition of Thermal Diffusivity.<br>2.2 One-dimensional Steady-State Conduction of heat through Single Plane Wall and Composite Plane Wall (in series and parallel), Cylinder, and Sphere. (Simple numerical problems on Single and Composite Plane Wall).<br>2.3 Combined modes of heat transfer, Concept of Thermal Resistance, and Overall Heat Transfer Coefficient.<br>2.4 Fins: Importance of Fins, Types of Fins - Rectangular, Triangular, Circumferential, and Pin Fins.<br>2.5 Thermal Contact Resistance, Critical Insulation Thickness, and Optimum Insulation Thickness. | <b>10</b>     |

|  |  |           |
|--|--|-----------|
| <b>Unit 3:<br/>Convection</b>                                      | 3.1 Physical Mechanism of Natural and Forced Convection.<br>3.2 Heat transfer between fluids separated by a plane wall, and by a cylindrical wall – overall heat transfer coefficient.<br>3.3 Thermal Boundary Layer, Dimensionless Groups in Heat Transfer (expression and physical significance).<br>3.4 Correlations for the Heat Transfer Coefficient in case of flow over flat plates, Flow across cylinders and spheres, Flow through circular pipes and non-circular ducts - Sieder-Tate equation, and Dittus-Boelter equation. (Simple problems for determining heat transfer coefficients for flow through circular and square ducts) | <b>10</b> |
| <b>Unit 4:<br/>Boiling and<br/>Condensation</b>                    | 4.1 The Boiling Phenomenon: Boiling Curve – Interface Evaporation, Nucleate or Pool Boiling, and Film Boiling.<br>4.2 The Condensation Phenomenon – Film Condensation and Drop-wise Condensation.  | <b>03</b> |
| <b>Unit 5:<br/>Heat<br/>Exchangers</b>                             | 5.1 Introduction to Heat Exchangers.<br>5.2 Heat Transfer with a Variable Driving Force - Co-current and Counter current Operations (LMTD approach).<br>5.3 Different types of Heat Exchangers: Double Pipe Heat Exchangers, Shell and Tube Heat Exchangers, and Plate Heat Exchangers – Construction, Operation, and Application.<br>5.4 Fouling Factor, LMTD Correction Factor, Design Overall Heat Transfer Coefficient. (Simple problems on LMTD and Overall Heat Transfer Coefficient)<br>5.5 Effectiveness, NTU method of Heat Exchanger Analysis.<br>5.6 Maintenance of Heat Exchangers.<br>5.7 Heat Transfer Efficient Fluids.         | <b>12</b> |
| <b>Unit 6: Thermal<br/>Radiation</b>                               | 6.1 Basic concepts of radiation from a surface (Absorptivity, Transmissivity, Reflectivity, Emissivity).<br>6.2 Black body Radiation, Planck’s Law, Wein’s Displacement Law, Stefan-Boltzmann Law, Kirchoff’s Law, Gray Body. (Simple problems on Stefan-Boltzmann Law).<br>6.3 View Factor, Rate of Radiation Exchange between Black Bodies, Radiation Shield.<br>6.4 Radiation Combined with Conduction and Convection.<br>6.5 Non-luminous gas radiation. Errors in temperature measurement due to radiation.   | <b>08</b> |
| <b>Total Lecture Classes (Sub Total):</b>                          |  | <b>45</b> |
| <b>No. of classes required for conducting Internal Assessment:</b> |  | <b>06</b> |
| <b>Grand Total:</b>  |  | <b>51</b> |

### 3. Suggested Learning Resources:

| <b>Sl. No.</b> | <b>Title of Book</b>                          | <b>Author</b>      | <b>Publication</b>                  |
|----------------|---|--------------------|-------------------------------------|
| 1.             | Heat Transfer principles and applications     | Binay K. Dutta     | PHI Learning Private Limited, Delhi |
| 2.             | Heat and Mass Transfer                        | Dr. D. S. Kumar    | S. K. Kataria & Sons                |
| 3.             | Process Heat Transfer                         | D.Q. Kern          | McGraw-Hill Book Co. Ltd., New York |
| 4              | Heat Transfer – A Practical Approach, 2nd Ed. | Yunus A. Cengel    | Mc Graw Hill,2002                   |
| 5              | Heat Transfer, 2nd Ed.                        | P.S. Ghoshdastidar | Oxford University Press,2012        |



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| Name of the Course: Diploma in Fire Technology and Safety  |   |
|--|---|
| Category: Programme Core   | Semester: Third   |
| Code no.: FTPC209  | Theory: 100 marks   |
| Course/Subject Title: Electrical Safety  | Examination Scheme:<br><b>1. External Assessment: 60 marks</b><br>(End Semester Examination)<br><b>2. Internal Assessment: 40 marks</b><br>[Class test: 20 marks<br>Quizzes, assignment, viva voce: 10 marks<br>Class attendance: 10 marks] |
| Duration: 17 weeks (Total hours per week = 3)  |   |
| Total Theoretical class/week: 3  |   |
| Credit: 3  |   |
| <b>Pass Criterion:</b> Students have to obtain at least 40% marks (pass marks) in both Internal assessment and end semester assessment separately. |   |

**1. Course Outcomes (COs):**

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

- i. Understand measurement of electrical parameters.
- ii. Know about electrical safety in residential building.
- iii. Describe about electrical safety in high-rise.
- iv. Understand safety measures of some electrical machines
- v. Explain electrical safety in hazardous area.
- vi. Understand CEA Regulation on electrical safety.

**2. Theory Components:**

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

| Unit/Chapter   | Topics & Sub-topics   | Teaching Hour |
|--|---|---------------|
| <b>Unit 1:<br/>Basics of<br/>Electrical<br/>Measurement</b>              | 1.1 Basic knowledge of electrical circuit elements and parameters.<br>1.2. Measurement methods used for electrical parameters i.e. current, voltage, power in DC networks; active power, reactive power, energy, frequency, power factor in single and three phase AC networks.<br>1.3. Measurement of insulation resistance by megger.<br>1.4. Measurement of earth resistance by earth megger/ earth tester.<br>1.5. Effect of electricity on Human body and tolerable range at different body parts. | <b>5 Hrs</b>  |
| <b>Unit 2:<br/>Electrical<br/>safety in<br/>Residential<br/>Building</b> | 2.1. Do's and don'ts regarding safety in domestic electrical appliances.<br>2.2. Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration (CPR).<br>2.3 Illumination level required for various applications like reading room, kitchen, lobby etc as per ECBC (Energy efficient building code.)   | <b>10 Hrs</b> |



|   |  |               |
|---|--|---------------|
|   | <p>2.4 Principles of circuit design in lighting and power circuits.</p> <p>2.5 Understand single line diagram of wiring for residential building.</p> <p>2.6. Selection of type of wiring and rating of wires &amp; cables.</p> <p>2.7. Selection of rating of main switch, distributions board, fuse, RCCB, MCB.</p> <p>2.8. Brief concept of: Types of earthing used in residential area.</p>  |               |
| <b>UNIT 3:<br/>Electrical safety in high-rise building</b>        | <p>3.1 Electrification of high rise and high risk building. (overview as per National building code 2016 part 8)</p> <p>3.2 Understand single line diagram of wiring for high rise building.</p> <p>3.3 Deciding the size of cables, bus-bar, bus-bar chambers, fuse, MCCB/ACB (simple numerical).</p> <p>3.4 Occupancy sensors (for energy saving): Types and application area.</p> <p>3.5 Emergency power supply with D-G backup and its associated safety features.</p> <p>3.6 Elementary idea of Fire detection and protection system.</p>   | <b>10 Hrs</b> |
| <b>Unit:4:<br/>Transformer and electrical machines</b>            | <p>4.1 Transformer: Rating, identification of HV and LV side; cooling system and its requirements; Protection of transformer: Buchholz relay, Pressure release valve, HVWS (high velocity water spray) system (exceed 10MVA and oil capacity 2000lts and above), nitrogen injection system.</p> <p>4.2 Induction Motor: Types of three phase and single phase induction motor and their application area; requirement of starter; types of starter and their application; elementary idea of motor over load protection, single phase preventer.</p> <p>4.3 System earthing and equipment earthing.</p> <p>4.4 Testing of electrical device and machines.</p> <p>4.4.1 Objectives of testing, Types of tests and concepts: Routine test, type test, supplementary test, special tests.</p> <p>4.5 Classifications of insulating materials as per IS:1271-1985 Reaffirmed 2001. Factors affecting life of insulating materials. Ageing Factors and Thermal Classes.</p> | <b>10 Hrs</b> |
| <b>Unit 5:<br/>Electrical Safety in some Hazardous Industries</b> | <p>5.1 Electrical Substation</p> <p>5.1.1. Concept of touch potential and foot potential.</p> <p>5.1.2. Earth screen.</p> <p>5.1.3. Elementary idea of lightning arrester: Different types and applications (As per: OISD-GDN-180: Lightning Protection)</p> <p><b>5.2 Mines and petroleum industries</b></p> <p>5.2.1 Electrical Safety in Hazardous Areas: Hazardous zones—class 0,1 and 2</p>   | <b>6 hrs</b>  |

|  |  |              |
|--|--|--------------|
|  | <p>5.2.2 Spark, flashovers, problems associated with static charge (as OISD-STD-110; Recommended Practices on Static Electricity.)</p> <p>5.2.3 Introduction and application of intrinsically safe apparatus and flame proof enclosure.</p> <p>5.2.4. Special Cables used for mines and petroleum industries like mineral insulated and fire survival cables.</p> <p>5.2.5: OISD-STD-113:Classification of Area for electrical installation at Hydrocarbon processing and handling facilities</p>  |              |
| <b>Unit 6:<br/>Regulations<br/>and<br/>Standards</b>               | <p>Brief idea on following regulations as mentioned in Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023.</p> <p>Regulation 13: Plan for area of supply to be made and kept open for inspection.</p> <p>Regulation 14: General safety requirements pertaining to construction, installation, protection, operation and maintenance of electric supply lines and apparatus.</p> <p>Regulation 17: Identification of earthed and earthed neutral conductors and position of switches and switchgear therein.</p> <p>Regulation 18: Earthed terminal on consumer's premises.</p> <p>Regulation 30: Display of instructions for resuscitation of persons suffering from electric shock.</p> <p>Regulation 31: Precautions to be adopted by consumers, owners, occupiers, electrical contractors, electrical workmen and suppliers.</p> <p>Regulation 38: Provisions for supply and use of electricity in multi-storied building more than fifteen meter in height.</p> <p>Regulation 42: Test of insulation resistance.</p> <p>Regulation 43: Connection with earth.</p> <p>Regulation 44: Residual Current Device.</p> <p>Regulation 60: Clearance in air of the lowest conductor of overhead lines.</p> <p>Regulation 74:Earthing.</p> <p>Regulation 76: Safety and protective devices.</p> <p>Regulation 77: Protection against lightning.</p> <p>Overview of National Electricity Code 2023.</p> | <b>4 hrs</b> |
| <b>Total Lecture Classes (Sub Total):</b>                          |  | <b>45</b>    |
| <b>No. of classes required for conducting Internal Assessment:</b> |  | <b>06</b>    |
| <b>Grand Total:</b>  |  | <b>51</b>    |

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**Suggested Learning Resources:**

| <b>Sl. No.</b> | <b>Title of Book</b>  | <b>Author</b>                          | <b>Publication</b>                    |
|----------------|---|--|---------------------------------------|
| 1              | Electrical and Electronics Measurements and Instrumentation.        | Sawhney A.K.                           | Dhanpat Rai and Sons, New Delhi.      |
| 2              | A Text Book of Electrical Technology Vol-I(Basic Electrical Engg.)  | Theraja B. L., Theraja A. K.           | S.Chand and Co. New Delhi.            |
| 3              | Electrical Machines   | Bhattacharya, S.K.                     | McGraw Hill Education, New Delhi.     |
| 4              | Electric Machines   | Ashfaq Husain, Harroon Ashfaq          | Dhanpat Rai & Co. (P) Limited;        |
| 5              | Electrical Design Estimating and Costing                            | Raina, K.B. and S.K. Bhattachary       | New Age International Ltd., New Delhi |
| 6              | Electrical Estimating and Costing,                                  | Allagappan, N. S.Ekambarram            | TMH New Delhi                         |
| 7              | Code of practice for electrical wiring installation                 | Bureau of Indian Standard IS: 732-1989 |                                       |
| 8              | A Course in Electrical Installation Estimating and Costing          | Gupta, J B                             | S K Kataria and Sons                  |
| 9              | National Lighting Codes 2010  | Bureau of Indian Standard, SP 72       |                                       |
| 10             | Installation, Commissioning and Maintenance of Electrical Equipment | Tarlok Singh                           | S. K. Kataria and Sons                |
| 11             | Mine Machinery Volume 2   | Universal Mining School (UMS)          | Universal Mining School               |

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| <b>Name of the Course: Diploma in Fire Technology and Safety</b>  |  |
|---|--|
| <b>Category: Programme Core</b>   | <b>Semester: Third</b>   |
| <b>Code no.: FTPC211</b>  | <b>Theory: 100 marks</b>   |
| <b>Course/Subject Title: : Fire Fighting Appliances and Rescue Devices Laboratory</b>   | <b>Examination Scheme:</b>   |
| <b>Duration: 17 weeks (Total hours per week = 2)</b>  | <b>1. External Assessment: 40 marks</b><br>(End Semester Examination)  |
| <b>Total Practical class/week: 2</b>  | [Assignment on the day of viva voce :20 marks<br>Viva voce (before Board of Examiners): 20 marks]  |
| <b>Credit: 1</b>  | <b>2. Internal Assessment: 60 marks</b><br>[Continuous assessment of class performance and in time submission of Assignments: 30 Marks<br>Viva Voce:20 Marks<br>Class Attendance:10 Marks] |
| Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and external assessment separately. |  |

**COMPETENCY**

After doing this practical course the students will be competent to operate and maintain equipment related to fire fighting appliances and rescue devices industry.

**COURSE OUTCOMES (COs)**

The experimental works associated with this course will help the students to demonstrate the following industry oriented COs related with the above mentioned competency.

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

- i. Operate and maintain different types of portable fire extinguishers.
- ii. Use Breathing Apparatus Set.
- iii. Make different types of knots & hitches of lines and ropes.
- iv. Describe components (Rope, Pulley and Pawl) of Ladder used for fire-fighting and rescue operations.
- v. Use insulated axe & insulated gloves in fire-fighting operations.
- vi. Explain the working principle of pressure gauge and pressure switch

**TEACHING AND EXAMINATION SCHEME**

| Teaching Scheme  | Credit | Examination Scheme |          |       |
|--|--------|--------------------|----------|-------|
|  |        | Practical          |          |       |
| At least 8 (Eight) Practical/Experiments to be completed | 1      | External           | Internal | Total |
|  |        |                    |          | 40    |

**PRACTICAL**

**NAME OF THE PRACTICAL**

|   |  |
|---|--|
| 1 | Study of Water type and DCP types of Portable Fire extinguishers.            |
| 2 | Study of CO <sub>2</sub> Type and Foam Types of Portable Fire extinguishers. |

|    |   |
|----|---|
| 3  | Study of Breathing Apparatus Set and calculate the capacity of cylinder based on its pressure                 |
| 4  | Study different types of lines and ropes used in rescue operations.   |
| 5  | Making Different types of knots & hitches of lines and ropes  |
| 6  | Study of different components (Rope, Pulley and Pawl) of Ladder used for fire-fighting and rescue operations. |
| 7  | Study of Insulated Axe & Insulated Gloves used in fire-fighting operations                                    |
| 8  | Study with actual model of Pressure Gauge – Construction, working principle and Application.                  |
| 9  | Study with actual model of Pressure Switch – Construction, working principle and Application                  |
| 10 | Study with actual model of Water Flow Switch – Construction, working principle and Application                |



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|   |   |
|---|---|
| <b>Name of the Course: Diploma in Fire Technology and Safety</b>  |   |
| <b>Category: Programme Core</b>   | <b>Semester: Third</b>  |
| <b>Code no.: FTPC213</b>  | <b>Theory: 100 marks</b>  |
| <b>Course/Subject Title: : Heat Transfer<br/>Laboratory</b>   | <b>Examination Scheme:</b><br><b>1. External Assessment: 40 marks</b><br>(End Semester Examination)<br>[Assignment on the day of viva voce :20 marks<br>Viva voce (before Board of Examiners): 20 marks]<br><b>2. Internal Assessment: 60 marks</b><br>[Continuous assessment of class performance and<br>in time submission of Assignments: 30 Marks<br>Viva Voce:20 Marks<br>Class Attendance:10 Marks] |
| <b>Duration: 17 weeks (Total hours per week = 2)</b>  |   |
| <b>Total Practical class/week: 2</b>  |   |
| <b>Credit: 1</b>  |   |
| Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and external assessment separately. |   |

|   |
|---|
| <p><b>COMPETENCY</b><br/>         After doing this practical course the students will be competent to operate and maintain equipment related to heat transfer industry.</p>   |
| <p><b>COURSE OUTCOMES (COs)</b><br/>         The experimental works associated with this course will help the students to demonstrate the following industry oriented COs related with the above mentioned competency.<br/>         At the end of this course, the student will be able to</p> <ol style="list-style-type: none"> <li>Evaluate thermal conductance of a composite wall.</li> <li>Determine thermal conductivity of a solid metallic rod.</li> <li>Find out the temperature Distribution along the length of a Pin Fin.</li> <li>Calculate the overall heat transfer coefficient for heat exchanger.</li> <li>Compare Shell &amp; Tube type Heat Exchanger and Plate Type Heat Exchangers</li> </ol> |

| <b>TEACHING AND EXAMINATION SCHEME</b>                   |        |                    |          |
|--|--------|--------------------|----------|
| Teaching Scheme  | Credit | Examination Scheme |          |
|  |        | Practical          |          |
| At least 8 (Eight) Practical/Experiments to be completed | 1      | External           | Internal |
|  |        | 40                 | 60       |
|  |        | Total              | 100      |

| <b>PRACTICAL</b> | <b>NAME OF THE PRACICAL</b>   |
|------------------|---|
| 1                | To find out the overall thermal conductance and plot the temperature distribution in case of a composite wall |

|    |  |
|----|--|
| 2  | Determination of thermal conductivity of a solid metallic rod.   |
| 3  | To determine the thermal conductivity of a liquid.   |
| 4  | To find out the temperature Distribution along the length of a Pin Fin under free convection.              |
| 5  | To find out the temperature Distribution along the length of a Pin Fin under forced convection             |
| 6  | To find out the Stefan-Boltzmann constant.   |
| 7  | To calculate the overall heat transfer coefficient for parallel flow heat exchanger.                       |
| 8  | To calculate the overall heat transfer coefficient for counter current flow heat exchanger.                |
| 9  | Study the working principle of a condenser and identify different component of it.                         |
| 10 | Study and compare Shell & Tube type Heat Exchanger and Plate Type Heat Exchangers using cut section model. |

**Suggested Learning Resources:**

| Sl. No. | Title of Book                             | Author             | Publication                         |
|---------|---|--------------------|-------------------------------------|
| 1.      | Heat Transfer principles and applications | Binay K. Dutta     | PHI Learning Private Limited, Delhi |
| 2.      | Heat and Mass Transfer                    | Dr. D. S. Kumar    | S. K. Kataria & Sons                |
| 3.      | Process Heat Transfer                     | D.Q. Kern          | McGraw-Hill Book Co. Ltd., New York |
| 4       | Heat Transfer – A Practical Approach      | Yunus A. Cengel    | Mc Graw Hill,2002                   |
| 5       | Heat Transfer                             | P.S. Ghoshdastidar | Oxford University Press,2012        |

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| <b>Name of the Course: Diploma in Fire Technology and Safety</b>  |   |
|---|---|
| <b>Category: Programme Core</b>   | <b>Semester: Third</b>  |
| <b>Code no.: FTPC215</b>  | <b>Theory: 100 marks</b>  |
| <b>Course/Subject Title: Electrical Safety<br/>Laboratory</b>   | <b>Examination Scheme:</b>  |
| <b>Duration: 17 weeks (Total hours per week = 2)</b>  | <b>1. External Assessment: 40 marks</b><br>(End Semester Examination)   |
| <b>Total Practical class/week: 2</b>  | [Assignment on the day of viva voce :20 marks<br>Viva voce (before Board of Examiners): 20 marks]   |
| <b>Credit: 1</b>  | <b>2. Internal Assessment: 60 marks</b><br>[Continuous assessment of class performance and<br>in time submission of Assignments: 30 Marks<br>Viva Voce:20 Marks<br>Class Attendance:10 Marks] |
| Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and external assessment separately. |   |

**COMPETENCY**

After doing this practical course the students will be competent to operate and maintain equipment related to electrical safety industry.

**COURSE OUTCOMES (COs)**

The experimental works associated with this course will help the students to demonstrate the following industry oriented COs related with the above mentioned competency.

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

- i. Understand insulation, Earth resistance.
- ii. Explain single line diagram.
- iii. Describe about performance of MCB, ELCB, RCBO.
- iv. Explain the working principle of different types of lightning arrestors.
- v. Describe mining cable.

**TEACHING AND EXAMINATION SCHEME**

| Teaching Scheme  | Credit | Examination Scheme |          |       |
|--|--------|--------------------|----------|-------|
|  |        | Practical          |          |       |
|  |        | External           | Internal | Total |
| At least 8 (Eight) Practical/Experiments to be completed | 1      | 40                 | 60       | 100   |

**PRACTICAL**

**NAME OF THE PRACTICAL**

|   |   |
|---|---|
| 1 | To measure insulation resistance with megger. |
| 2 | To measure earth resistance by earth megger.  |



|    |   |
|----|---|
| 3  | Study of pipe and plate earthing.                             |
| 4  | Study of equipment earthing.                                  |
| 5  | Study of single line diagram of a residential building.       |
| 6  | Study of single line diagram of a high rise building.         |
| 7  | To test the performance of MCB.                               |
| 8  | To test the performance of ELCB.                              |
| 9  | To test the performance of RCBO.                              |
| 10 | To study the safety features of D-G set.                      |
| 11 | Study of occupancy sensors.                                   |
| 12 | Study of different types of lightning arrestor.               |
| 13 | To measure current in AC circuit using analog/ digital meter. |
| 14 | Study of mining cables and sketching of their construction    |

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**WEST BENGAL STATE COUNCIL OF TECHNICAL  
& VOCATIONAL EDUCATION AND SKILL DEVELOPMENT**

[A Statutory Body under West Bengal Act XXVI of 2013]

(Formerly West Bengal State Council of Technical Education)

"Karigori Bhavan", 4<sup>th</sup> Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

|   |  |
|---|--|
| <b>Name of the Course: Diploma in Fire Technology and Safety</b>        |  |
| <b>Category: Programme Core</b>   | <b>Semester: Third</b>   |
| <b>Code no.: SI201</b>  | <b>Theory: 100 marks</b>   |
| <b>Course/Subject Title: Internship-I</b>                               | <b>Examination Scheme:</b><br><b>(i) Internal Assessment: 100 Marks</b><br><b>Internship Report - 60</b><br><b>Internship Seminar - 40 marks</b> |
| <b>Total Practical class/week: After 2<sup>nd</sup> Semester</b>        |  |
| <b>Credit: 1</b>  |  |
| Pass Criterion: Students have to obtain at least 40% marks (pass marks) |  |

**Suggested Internship Project Work in 3rd Semester**

After the **2nd Semester**, for **Internship-I**, students are required to be involved in Inter/ Intra Institutional activities viz; Learning at Departmental Lab/Institutional workshop; Training and simulation program with different Institutes like Workshop of ITI, Other Polytechnics and other Technical Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at innovation/entrepreneurship cell of the institute; participation in workshops/competitions etc.

After completion of Internship I, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The student may contact Industrial Supervisor/Faculty Mentor/TPO for assigning topics and problems and should prepare the final report on the assigned topics. The training report should be signed by the Industrial Supervisor / Internship Faculty Mentor, TPO and HOD.

The Internship report will be evaluated on the basis of following criteria (as applicable):

| <b>Sl. No.</b> | <b>Criteria for evaluation of Internship Report [60]</b>                                   |
|----------------|--|
| 1              | Originality  |
| 2              | Adequacy and purposeful write-up   |
| 3              | Organization, format, drawings, sketches, style, language                                  |
| 4              | Practical applications and relationships with basic theory                                 |
| 5              | Concepts taught in the course outcome  |
| 6              | Practical applications, relationships with basic theory and concepts taught in the course. |
| 7              | Attendance record, daily diary, quality of the Internship Report                           |

Seminars must be arranged for the students based on his/her training report, before an internal committee constituted by the concerned department of the institute. The evaluation will be based on the following criteria:

| <b>Sl. No.</b> | <b>Criteria for evaluation of Internship Seminar [40 marks]</b>  |
|----------------|--|
| 1              | Quality of content presented                                     |
| 2              | Proper planning for presentation                                 |
| 3              | Effectiveness of presentation                                    |
| 4              | Depth of knowledge and skills                                    |
| 5              | Viva voce  |
|                | <b>Total Marks (Internship Report + Internship Seminar): 100</b> |
|                | Pass criterion for Internship-I = 40 Marks [Minimum]             |