**IIPM SCHOOL OF ENGINEERIN AND TECHNOLOGY LESSON PLAN: 2020-21**

**Sub : Electrical Equipment in Mines Semester-**4th **Faculty name : Mausumibala panda**

**Duration : 60 hours**

**Objective:-**

* Various types of electrical cables used in Mines.
* Various types circuit breakers circuit diagram of gate-end box and drill panel.
* Different types of protective system.
* Different types of electric braking.
* Flame proof apparatus and intrinsically safe apparatus.
* Underground signaling arrangement.

**Learning Outcome :** Understanding of basics of the Electrical sources, Protective system and their uses.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl.No** | **Chapter** | **Proposed Week for Teaching** | **Lecture No.** | **Sub. Topic** | **Important Teaching Points** | **Content Source** |
| 1 | I | 1st | 1 | INTRODUCTION | 1.Electrical cables- Introduction | Electrical Power System |
|  |  |  |  | 2.Classification of Cables. | V K Mehta |
| 2 |  |  | 2 | 1.Constructional features of  high tension cables. |  |
|  |  |  |  | 2. low-tension Cables |  |
| 3 |  |  | 3 | 1.Size of cables |  |
|  |  | 2. Their uses. |  |
| 4 |  |  | 4 | 1.procedures of cable laying at surface, underground |  |
|  |  |  |  | roadway & in shafts. |  |
|  |  |  |  | 2.Cable joint box mining |  |
|  |  |  |  | type. |  |
| 5 | **II** |  | 1 | Assignment |  |
| 6 |  |  | 2 | Protective Systems | Protective Systems-  1.Introduction | Electrical  Power System |
|  |  |  |  | 2.Fuse-Definition | V K Mehta |
| 7 |  |  | 3 | 1. Fuse Materials 2. Rewireable Fuse |  |
|  |  | 2nd |  | -Advantages  -Disadvantages |  |
| 8 |  |  | 4 | 1 HRC Fuse  -Advantages |  |
|  |  |  |  | -Disadvantages |  |
|  |  |  |  | 2.Uses of fuse |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 9 |  | 3rd | 1 | Protective Systems | 1.Circuit Breakers-Definition  -Air Circuit Breaker. |  |
|  |  |  | 2. Minimum Oil Circuit |  |
|  |  |  | Breaker (MOCB) |  |
|  |  |  | -Advantages |  |
|  |  |  | -Disadvantages |  |
| 10 |  | 2 | 1.Bulk Oil Circuit Breaker  (BOCB). |  |
|  |  |  | 2.Air Blast Circuit Breaker |  |
|  |  |  | -Construction and Principle |  |
|  |  |  | -Advantages |  |
|  |  |  | -Disadvantages |  |
| 11 |  | 3 | 1..SF6 Circuit Breaker  -Advantages  -Disadvantages  2.Essential qualities of a good protective system. | Electrical Power System V K Mehta |
| 12 |  | 4 | 1.plunger, induction &  direction over current, over |  |
|  |  |  | loads. |  |
| 13 | 4th | 1 | 1.No volt and latching relay,  frequency relay and Earth |  |
|  |  |  | leakage relay. |  |
|  |  |  | 2. Construction,Principle |  |
| 14 |  | 2 | 1. Plunger type relay 2. Induction type relay |  |
|  |  |  | 3. Directional over current |  |
|  |  |  | relay |  |
|  |  |  | -Construction and Principle |  |
| 15 |  | 3 | 1. protection of transformer |  |
|  | by differential relay. |  |
| 16 |  | 4 | 1.Functions & operation of  drill panel. |  |
|  |  |  | 2.Earthing system in mines. |  |
|  |  |  | 3.Voltage limit | Electrical Equipment in Mines H.Cotton |
| 17 | **5th** | 1 | 1.General principle of working-basis remote control circuit & various protective  devices of Gate-End Box. |
| 18 |  | 2 | Assignment |  |
| 19 |  | 3 | Class test |  |
| 20 | III | 4 | Transformer | 1.Transformer-Construction  working Principle. |  |
|  |  |  |  | 2.E.M.F Equation of |  |
|  |  |  |  | Transformer. |  |
| 21 |  | **6th** | 1 | 1. Ideal Transformer 2. Practical Transformer | Electrical |
|  |  |  |  | Difference between them | Equipment in |
|  |  |  |  | 3.Transformation ratio | Mines |
| 22 |  |  | 2 | 1. Practical Transformer on  no load condition | H.Cotton |
|  |  |  |  | -Phasor Diagram |  |
| 23 |  |  | 3 | 1.Practical Transformer on  load Condition |  |
|  |  |  | 2.Phasor diagram |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 24 |  |  | 4 |  | 1.Shifting Impedance of Transformer |  |
| 25 | 7th | 1 | 1.No load test of  Transformer |
| 26 | 2 | 1. Short Circuit test of Transformer 2. Rating of Transformer |
| 27 | 3 | Assignment |
| 28 | 4 | Class Test |
| 29 | IV | 8th | 1 | Industrial drives | 1. Industrial drives- Introduction. 2. DC Motor-Introduction 3.Types of DC Motor | Electrical Equipment in Mines H.Cotton |
| 30 | 2 | 1. Characteristics of DC Motor  -Speed current Characteristics  - Speed Torque Characteristics |
| 31 | 3 | 1. Characteristics of AC Motor 2. selection of motors for mining use. |
| 32 | 4 | Assignment |
| 33 | V | 9th | 1 | Electric braking used in Mines | 1.Electric braking-  Introduction 2.Types of Braking | Electrical Equipment in Mines H.Cotton |
| 34 | 2 | 1-Regenerative braking  -Definition 1.Advantages and Disadvantages of  Regenerative braking |
| 35 | 3 | 1.Magnetic braking.  -Definition 1.Advantages and  Disadvantages of Magnetic braking |
| 36 | 4 | Assignment |
| 37 | 10th | 1 | Doubt Clear class |
| 38 | 2 | Class Test |
| 39 | VI | 3 | Flame proof & intrinsically safe apparatus | 1.Flame proof apparatus  -Definition  -Uses | Electrical Equipment in Mines H.Cotton |
| 40 | 4 | 1.Safety features of flame  proof Apparatus. |
| 41 | 11th | 1 | 1.Intrinsically safe apparatus  - Definition  -Uses |
| 42 | 2 | 1.Safety features of flame proof intrinsically safe  Apparatus |
| 43 | 3 | Assignment |
| 44 | 4 | Class Test |
| 45 | VII | 12th | 1 |  | 1.signals & shaft signal. |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | -Definition  -Uses |  |
| 46 |  |  | 2 | Underground signaling arrangement | 1.communication system in U/G mines.  -Uses | Electrical Equipment in Mines H.Cotton |
| 47 | 3 | 1. Point to point communication   -Application   1. Intercom   system/Telephone 3.Cordless system |
| 48 | 4 | Assignment |
| 49 | 13th | 1 | Class test |
| 50 | VIII | 2 | Sensors & their applications | 1. Sensors –Introduction 2. Types of sensors | Electrical Equipment in Mines H.Cotton |
| 51 | 3 | 1.Position sensors 2.Pressure sensors  3.Temperature sensors |
| 52 | 4 | 1Force sensors  2.Fluid property sensor |
| 53 | 14th | 1 | 1. Vibration sensor 2. Humidity sensor |
| 54 | 2 | Assignment |
| 55 | IX | 3 | Battery locomotive and Electric LHD | 1. Thyrister-Introduction 2. VI Characteristics of Thyrister | Electrical Equipment in Mines H.Cotton |
| 56 | 4 | 1.Battery locomotive-  Introduction |
| 57 | 15th | 1 | 1.Elecrical LHD-  Introduction 2.Uses |
| 58 | 2 | 1. Electric mine phone. Introduction 2. Uses |
| 59 | 3 | Assignment |
| 60 | 4 | Class test |
| 61 | 16th |  | Doubt clearing class |