

**INSTITUTE OF AERONAUTICAL ENGINEERING**

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2023

Regulation: UG-20

POWER SYSTEM PROTECTION

**Time: 3 Hours** (ELECTRICAL AND ELECTRONICS ENGINEERING) **Max Marks: 70****Answer ALL questions in Module I and II****Answer ONE out of two questions in Modules III, IV and V****All Questions Carry Equal Marks****All parts of the question must be answered in one place only****MODULE – I**

1. (a) Explain the operating mechanism of minimum oil circuit breakers, highlighting the key components involved in their design. [BL: Understand| CO: 1|Marks: 7]
- (b) Discuss the working of SF6 circuit breakers and mention their advantages and disadvantages. [BL: Apply| CO: 1|Marks: 7]

**MODULE – II**

2. (a) Explain the fundamental differences between static relays and electromagnetic relays in terms of their operating principles. [BL: Understand| CO: 2|Marks: 7]
- (b) For a radial feeder, a directional overcurrent relay is used for protection. The nominal voltage is 13.8 kV, and the relay should operate for faults in the forward direction with a pickup current of 400A and a time delay of 0.2 seconds. Calculate the plug setting and time multiplier setting to achieve the desired relay characteristics. [BL: Apply| CO: 2|Marks: 7]

**MODULE – III**

3. (a) Explain the safety features incorporated into the design of indoor substations to protect personnel and equipment. [BL: Understand| CO: 3|Marks: 7]
- (b) Describe the fundamental principles behind Gas Insulated Substations (GIS) and how they differ from conventional air-insulated substations? [BL: Understand| CO: 3|Marks: 7]
4. (a) Discuss the principle of bus bar protection based on voltage systems. [BL: Understand| CO: 4|Marks: 7]
- (b) Outline the different operational modes of a main and transfer bus bar system, including normal operation, maintenance mode, and transfer mode. [BL: Understand| CO: 4|Marks: 7]

**MODULE – IV**

5. (a) Describe the operating principle and advantages of using differential relays in generator protection. [BL: Understand| CO: 5|Marks: 7]
- (b) Explain the fundamental principles of percentage differential protection in power systems. List the applications of percentage differential protection in different power system elements. [BL: Understand| CO: 5|Marks: 7]

6. (a) Discuss the specific role of Buchholz relays in detecting and responding to internal faults in oil-filled transformers. [BL: Understand| CO: 5|Marks: 7]
- (b) Explain the potential consequences of transformer failures and the need for effective protective measures. [BL: Understand| CO: 5|Marks: 7]

### MODULE – V

7. (a) Explain the term over voltage factor, protective ratio, protective angle, protective zone and coupling factor. [BL: Understand| CO: 6|Marks: 7]
- (b) Elucidate the principle of operation of valve-type surge arresters. Highlight any limitations or challenges associated with these surge protection devices. [BL: Understand| CO: 6|Marks: 7]
8. (a) Describe the operating principle of zinc oxide lightning arresters. Explain the specific applications of zinc oxide lightning arresters in power systems. [BL: Understand| CO: 6|Marks: 7]
- (b) Demonstrate the phenomenon of lightning stroke. How can wave set up by such a stroke be represented. [BL: Understand| CO: 6|Marks: 7]

