

**INSTITUTE OF AERONAUTICAL ENGINEERING**

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022

Regulation: R18

POWER SYSTEM PROTECTION**Time: 3 Hours****(EEE)****Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)

All Questions Carry Equal Marks**All parts of the question must be answered in one place only****MODULE – I**

1. (a) Explain with a help of neat diagram the construction and working principle of vacuum circuit breaker. For what voltage range is it recommended? [7M]
- (b) A circuit breaker is rated as 1500 A, 1000 MVA, 33 kV, 3-phase oil circuit breaker. Find
 - i) Rated normal current
 - ii) Breaking capacity
 - iii) Rated symmetrical breaking current
 - iv) Rated making current
 - v) Short-time rating
 - vi) Rated service voltage. [7M]
2. (a) What is resistance switching? Derive an expression for 'R' critical. [7M]
- (b) A 50 cycles, three phase alternator with grounded neutral has inductance of 1.6mH per phase and is connected to bus bar through a circuit breaker. The capacitance to earth between the alternator and circuit breaker is $0.003\mu\text{F}$ per phase. The circuit breaker opens when r.m.s. value of current is 7500A. Determine the following:
 - i) Maximum rate of rise of restriking voltage.
 - ii) Time for maximum rate of rise of restriking voltage.
 - iii) Frequency of oscillations. [7M]

MODULE – II

3. (a) Explain the following with neat sketch
 - i) Attracted armature relay
 - ii) Induction cup relay. [7M]
- (b) What is a numerical relay? With the help of block diagram, discuss the operation of numerical relay and list their advantages. [7M]
4. (a) What is a data acquisition system? Discuss the functions of various components of the data acquisition system. [7M]
- (b) Describe with the help of neat diagram the construction of reactance relay and obtain its torque equation and draw the operating characteristic on R-X plane. [7M]

MODULE – III

5. (a) What is a gas insulated substation? Discuss its advantages and disadvantages as compared to conventional air insulated substation. [7M]
(b) Draw the single line diagram and show the location of substation equipments for single bus-bar system. [7M]
6. (a) Explain with the help of neat diagram the principle of operation of translay relay. [7M]
(b) Describe the need of busbar protection and difficulties in busbar protection. [7M]

MODULE – IV

7. (a) Discuss the various abnormal running conditions which may exists in a generator? What are its effects? How can it be minimized? [7M]
(b) A generator is protected by restricted earth fault protection. The generator ratings are 13.2kV, 10MVA. The percentage of winding protected against phase to ground fault is 85%. The relay setting is such that it trips for 20% out of balance. Calculate the resistance to be added in the neutral to ground. [7M].
8. (a) What is Buchholz relay? Which equipment is protected by it? For what types of faults is it employed? Discuss its working principle. [7M]
(b) A three-phase transformer rated for 33kV/6.6kV is connected in star/delta and the protecting current transformer on the low voltage side has a ratio of 400/5. Determine the ratio of current transformer on H.V. side. Assume 400A as the current flowing in the lines on the low voltage side. [7M]

MODULE – V

9. (a) What is a surge diverter? Explain the characteristics of an ideal surge diverter with neat sketch. [7M]
(b) Describe the principle of operation of Zinc oxide lightning arresters. What are the advantages Zinc oxide lightning arresters over conventional arresters? [7M]
10. (a) Explain the following with neat sketch
i) Rod gap
ii) Arcing horn. [7M]
(b) Describe the phenomenon of lightning. What protective measures are taken against lightning overvoltages? [7M]

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