

*This question paper contains 3 printed pages.*

8490

Your Roll No. ....

**B. Tech. (E) / IV                      A**

**PAPER EEE-402— SWITCHGEAR AND  
PROTECTION**

**Time : 3 hours**

**Maximum Marks : 70**

*(Write your Roll No. on the top immediately  
on receipt of this question paper.)*

*Attempt any five questions.*

*All questions carry equal marks.*

*Assume missing data suitably, if any.*

1. A transformer rated at 30 MVA and having a short circuit reactance of 0.05 p.u. is connected to the bus bar of a generating station which is supplied through two 33 kV feeder cables each having an impedance of  $1+j2 \Omega$ . One of the feeders is connected to a generating station using generator capacity of 60 MVA connected to its bus bars having a short circuit reactance of 0.1 p.u. and other feeder to a generator with 80 MVA and having a reactance 0.15 p.u. Calculate the kVA supplied to the fault in the event of a short circuit occurring between the secondary terminals of the alternators. 14

2. A generator rated 100 MVA, 20 kV has  $X_1=X_2=20\%$  and  $X_0=5\%$ . Its neutral is grounded through a reactor

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- of 0.32 ohms. The generator is operating at rated voltage with load and is disconnected from the system when a single line-to-ground fault occurs at its terminals. Find the sub-transient current in the faulted phase and line-to-line voltage. 14
3. Describe the construction, principle of operation and applications of:
- (i) Rod gaps
  - (ii) Expulsion gap
  - (iii) Valve type lightning arrester. 14
4. A circuit breaker is rated as 2500 A, 1500 MVA, 33 kV, 3 seconds, 3-phase oil C.B. Determine the rated symmetrical breaking current, rated making current, short time rating and rated service voltage. 14
5. A 11 kV, 50 Hz alternator is connected to a system which has inductance and capacitance per phase of 10 mH and 0.01  $\mu$ F respectively. Determine:
- (i) The maximum voltage across the breaker contacts
  - (ii) Frequency of transient oscillations
  - (iii) The average RRRV
  - (iv) The maximum RRRV. 14
6. Compare the performance and characteristics of:

(i) Minimum oil CB and Air blast C.B.

(ii) Air blast C.B. and Bulk oil C.B. 14

7. What is Universal Torque Equation? Using this equation derive the following characteristics:

(i) Impedance Relay;

(ii) Reactance Relay;

(iii) Mho Relay.

Draw characteristics and indicate clearly the zones of operation and no-operation. 14

8. (a) Explain the terms:

(i) Restriking Voltage

(ii) Recovery Voltage

(iii) RRRV. 6

(b) Describe the construction, principle of operation and applications of SF<sub>6</sub> circuit breaker. 8