



Name :

Roll No. :

Invigilator's Signature :

**CS/M.TECH (EE)/SEM-2/MTEE-201/2010
2010**

PROJECTION OF POWER SYSTEM AND DEVICES

Time Allotted : 3 Hours

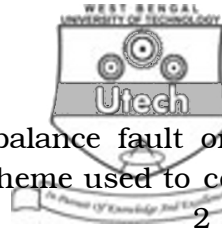
Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 which is compulsory and any four from the remaining. $5 \times 14 = 70$

1. Answer the following questions in few lines/word : 7×2
- a) Why is it necessary to suppress the field immediately after disconnection of faulty alternator from the system ?
 - b) Why are voltage differential protection of bus bars superior to circulating current protection ?
 - c) What is pole slipping phenomenon in case of an alternator ?
 - d) What is blinder and what is its function ?
 - e) What is the principle of out of step blocking relay ?
 - f) Why directional feature provided for impedance relay cannot be used for reactance relay ?
 - g) What is field suppression ?



2. a) What is the effect of prolonged unbalance fault on a generator ? Discuss the protection scheme used to cope with the effect. 2 + 5
- b) A three-phase 50 MVA, 11 kV star connected alternator has a synchronous reactance of 2.0 ohm per phase and resistance of 0.70 ohm per phase. It is being protected by Merz-Price balanced current system. Determine what portion of the winding remains unprotected if the neutral of the alternator is earthed through a resistance of 5 ohm. Assume that the relay operates when the out of balance current exceeds 25% of the load current. 7
3. a) The system shown in figure is fed by two generators G_1 and G_2 ; G_1 at the bus A and G_2 at 70% distance from A in section AB. The currents I_A and I_B supplied by them respectively are equal. The reactance of the transformer is 10%. The line voltages and impedances are shown in figure. Find the setting for the impedance relays for first, second and third zones adjusting the first zone to reach 80%, second zone to reach 50%. CTs and PTs have ratios 400/5 V and 166000/110 V respectively. 10

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- b) Draw impedance, reactance and MHO characteristics to protect the 100 per cent of the line having $(2.5 + j6)$ ohm impedance. A fault may occur at any point on the line through arc resistance of 2 ohm. Determine the maximum percentage of the line section which can be protected by each type of relay. 4
4. a) What will happen to a generator if there is —
- i) sudden loss of excitation ?
 - ii) sudden failure of prime-mover ?
 - iii) loss of load ?
- Discuss in brief the protection schemes that are needed to cope with the effect. 3 + 3 + 3
- b) What type of protection scheme is used for a generator rotor earth fault ? 5
5. a) Give the differences between 'protective' and 'measuring' current transformers. 3
- b) Give the basic principle of static distance relay and compare it with that of electromagnetic distance relay. 6
- c) Show with a simple diagram, how a static impedance relay can be realised by amplitude comparator. 5



6. a) Describe with block diagram the principle of operation of a microprocessor based harmonic restraint percentage differential relay scheme for protection of a power transformer. 11
- b) Why is harmonic restraint required ? 3
7. a) Explain briefly the process of current chopping in SF₆ breakers. 4
- b) Differentiate between type tests and routine tests. What different tests are carried out to prove the ability of circuit breaker ? 5
- c) Give the principle of operation of a DC circuit breaker. 5
8. a) Explain what is meant by short circuit capacity of a bus or fault level of a bus. 4
- b) Discuss the double bus bar arrangement of bus bar layout in a substation or a power station switchyard using single line diagram showing incoming, outgoing feeders and switchgears.
- What are its merits over single bus bar system ? 10
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