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Roll No

EX - 603

B.E. VI Semester

Examination, December 2012

Switchgear & Protection

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks :35

Note: Attempt any five questions selecting two parts from each question. All questions carry equal marks. Assume missing data if any & write your assumption clearly.

1. (a) Name the method used for unsymmetrical faults analysis. Draw the zero sequence networks for different types of 3-phase transformer connections. How is fault analysis carried out in power system?
- (b) What is purpose of conducting short-circuit studies? List the different symmetrical and unsymmetrical faults in order of their severity. Show the connection of sequence networks for (i) L-G fault (ii) L-L fault and (iii) L-L-G fault on the terminals of an unloaded alternator.
- (c) A 25 MVA, 13.2 kV generator, with solidly grounded neutral has a sub-transient reactance of 0.25 p.u. The negative and zero-sequence reactances are 0.35 and 0.1 p.u. respectively. A single line to ground fault occurs at the terminals of the generator when it is operating at rated voltage and disconnected from the system. Find the fault current and line-to-line voltages. Neglect resistance.

2. (a) What are the required features of an ideal protective relay? Define terms; (i) Pick up value (ii) Operating time (iii) Seal-in-relay (iv) Burden
- (b) Explain how you provide directional features to (i) impedance (ii) reactance relay. Explain why directional feature provided for impedance relay cannot be used for reactance relay.
- (c) An IDMT relay operates in 5 sec. and 3 sec. for PSMs of 4 and 10 respectively. The relay is used to protect a feeder through a 1000/5A CT. Calculate the time of operation of the relay when the Feeder current is 1500A. The relay has a plug setting of 75% & time setting 0.4. The nominal current rating of the relay is 5 A.
3. (a) Explain construction, principle of operation and application of SF₆ circuit breaker with neat sketch. What are its advantage & disadvantage over other circuit breakers?
- (b) Explain the terms Recovery Voltage, Re-striking voltage and RRRV. Drive an expression for Re-striking voltage in terms of system capacitance and inductance.
- (c) Explain: (i) current limiting reactors (ii) HRC fuses (iii) principle of operation of vacuum circuit breaker (iv) testing of circuit breaker (v) arc quenching device.
4. (a) Explain with neat sketch Merz-Price protection scheme for an alternator.

- (b) Describe the principle of operation of differential system of protection applied to large power transformer with appropriate schematic diagram. What are the shortcomings of this scheme & how are they overcome, Explain.
 - (c) What is necessity of bus-bar protection? Discuss different type of bus-bar protection scheme in brief? How the bus bar protection scheme is stabilized.
5. (a) What is insulation co-ordination? Why is it required in large power system? Explain BIL?
- (b) What are the causes of over voltages in power systems? Discuss. Bring out the function of ground wire in transmission lines.
 - (c) Explain: (i) Rod gap & Horn gap (ii) surge diverter (iii) surge absorber (iv) phenomena of lightning (v) Earthing transformers (vi) arc suppression coil.
