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III B.Tech. II Semester Supplementary Examinations, April/May – 2013 SWITCH GEAR AND PROTECTION

(Electrical and Electronics Engineering)

Time: 3 Hours

Max Marks: 80

Answer any FIVE Questions All Questions carry equal marks

- a) Explain the various components of fault clearing time of a circuit breaker. [8M]
 b) List out the different classification criteria done with respect to circuit breakers. [8M]
- Explain the different types of Air Blast circuit brakers with neat schematic diagram along with the principle of operation. Further list the advantages of air blast circuit braker over oil circuit breakers. [16M]
- 3. a) Explain the operating principle of Reverse power or directional relay along with the constructional features and area of Applications. [10M]
 b) Why IDMT relays are widely used for over current protection. [6M]
- 4. What type of a protective device is used for the protection of an alternator against overheating of its (a) stator, (b) rotor? Discuss them in brief. [16M]
- a) What is Bucholz relay? Which equipment is protected by it? For what types of faults is it employed? Discuss its working principle. [10M]
 b) What protective devices other than the differential protection are used for the protection of a large transformer? Briefly explain them. [6M]
- 6. Explain briefly the factors deciding the necessary time interval between successive relays employed for Radial feeder protection. [16M]
- 7. a) What are the principal purposes of Grounding? Differentiate between neutral grounding and equipment grounding? [8M]
 b) List the advantages of neutral grounding and what are the varoius types of neutral grounding? [8M]
- 8. What is a Tower footing Resistance? Why is it required to have this resistance as low as economically possible? What are the methods to reduce this resistance? [16M]

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1.	 a) What do you mean by arc interruption and explain different methods of arc interruption. b) For a 132 KV system, the reactance and capacitance up to the location of the circuit braker is 3 ohms and 0.015 μF, respectively. Calculate the following: (i) The frequency of transient oscillation (ii) The maximum value of restriking voltage across the contacts of the circuit breaker. (iii) The maximum value of RRRV. 		
2.	Explain the different types of SF_6 circuit breaker and further list out the advantages and disadvantages of SF_6 Circuit breakers. [16M]		
3.	 a) What are the merits of Induction cup construction relay over the Induction disc construction Relay? b) Discuss why the ratio of reset to pick up should be high. 		
4.	What type of a protective scheme is employed for the protection of the field winding of the alternator against ground faults. [16N		
5.	A 3-phase ,11 KV/33KV, star-delta connected power transformer is protected by differential protection .The CT_s on the LV side have a current ratio of 400/5.What must be the ratio of CT_s on the HV side. How the CT_s on both the sides of the transformer are connected.		
6.	a) What do you understand by directional sensitivity of a directional relay?[16]b) Draw the detailed ac circuit diagram of directional over current and earth-fault protection of a feeder.[8]		
7.	Define the following terms with respect to grounding system :a) Step voltageb) Touch Voltagec) Coefficient of groundingd) Arcing grounde) effectively grounded system[16M]		
8.	Describe the phenomenon of lighting and explain the terms pilot streamer, stepped leader,		

return steamer, dart leader, cold lightning stroke and hot lightning stroke. [16M]

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- 1. What do you mean by Restriking voltage and recovery voltage and further derive the expression for Restriking voltage and Rate of Restriking Voltage (RRRV). [16M]
- 2. a) Explain Miniature circuit Breaker(MCB) and Moulded case circuit Breaker(MCCB) .What are their advantages over conventional breakers and fuse switch units. [10M]
 b) Discuss the arc extinction phenomenon in SF₆ Circuit Breaker [6M]
- a) What are the various components of a protection system? Briefly describe their functions with the help of an schematic diagram [8M]
 b) Derive an expression for torque produced by an induction relay. [8M]
- 4. a) Explain percentage differential protection of generator [8M]
 b) An 11 KV,100 MVA alternator is provided with differential protection. The percentage of winding to be protected against phase to ground fault is 85%. The relay is set to operate when there is 20% out of balance current. Determine the value of resistance to be placed in the neutral to ground connection. [8M]
- 5. Explain the phenomenon of magnetising inrush. Which Harmonie is the most dominant in magnetising inrush current? What are the factors on which the magnitude of the magnetising inrush current depends? [16M]
- 6. a) Explain over-reach and under-reach in connection with Distance Relays. [8M]
 b) Explain the basis of setting three-step distance relay for the first, second and third zones of distance measurement. [8M]
- 7. Show that when a single line-to-ground fault occurs in an ungrounded system, the neutral shift is equal to the zero-sequence voltage, and voltage of the healthy lines with respect to the ground is equal to the line voltage. [16M]
- 8. a) Differentiate between surge diverter and surge absorber. What are the characteristics of an ideal surge diverter? [8M]
 b) Explain briefly about Basic impulse insulation level (BIL) [8M]

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1. Explain resistance switching and deduce the necessary equation for resistance to be connected to reduce the Restriking voltage, RRRV and severity of the transient oscillations.

[16M]

- 2. a) Explain the phenomenon of current chopping in a circuit breaker. What measures are taken to reduce it? [8M]
 b) What are the factors to be considered while selecting the circuit breaker, given an application? [8M]
- 3. Explain the operating principle of an induction disc relay with a neat sketch. [16M]
- a) Discuss the faults and various abnormal operating conditions of induction motors and protection provided against each. [8M]
 b) Explain the differential protection scheme for large motors? [8M]
- 5. What type of protective scheme is employed for the protection of a large power transformer against short circuits? With neat sketches discuss its working principle. [16M]
- 6. a) What is the demerit of a blocking carrier scheme for protection of a transmission line?
 b) With a neat circuit diagram explain how a phase comparison carrier –current protection scheme operates. [8M+8M]
- 7. Three 6.6KV, 3-phase, 10 MVA generators are connected to a grid. The positive sequence reactance of each generator is 0.15 pu while the negative and zero sequence reactances are 75 % and 30 % of positive sequence reactances respectively. A single line -to- ground fault occurs on the grid bus. Determine the fault current if (i) All the generators neutrals are solidly grounded. (ii) one generators neutral is solidly grounded and other two neutrals are isolated. (iii) one generator neutral is grounded through 0.3 ohm resistance and the other two neutrals are isolated. [16M]

8.	Write short notes on the following.		
	a) Klydonograph and magnetic link	b) Rod gap	
	c) Arcing horns	d) Ferranti surge absorber.	[16M]

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