7th Semester Regular/Back Examination 2018-19
SWITCH GEAR & PROTECTIVE DEVICES
BRANCH : EEE
Max Marks : 100
Time : 3 Hours
Q.CODE : HRB122
Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1		Only Short Answer Type Questions (Answer All-10)	(2 x 10)
	a)	Give advantage of neutral groundings?	
	b)	How mal-operation of differential protection of transformer due to magnetizing inrush current is prevented ?	
	c)	What is the limitation of Merz-Price protection?	
	d)	What is the under reach and over reach relay?	
	e)	Define short circuit capacity of bus?	
	f)	A fault occurring on an end supply transmission line is more severe from the point of view RRRV, what type of fault it is ?	
	g)	If the fault current is 3000A for a relay with plug setting of 50% and CT ratio of 1000:1. What is the PSM?	
	h)	What is the difference between surge absorber and surge diverter?	
	i)	A 3-phase 11/66 kV, Delta-star transformer is protected by Merz-price scheme has CT ratio of 400/5 on LT side. What is the ratio of CT on HT side?	
	j)	Write the drawback of current graded system?	

Part- II

Q2		Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)	(6 x 8)
	a)	With neat sketch, explain the principle of operation of "Induction disc type" Over Current (O.C) relay. How the time delay mechanism is adjusted in the O.C. IDMT relay characteristics? Explain in brief.	
	b)	Derive the expression to find out critical value of resistance to be connected across the CB contacts?	
	c)	The neutral point of a3 phase 20 MVA, 11KV Star connected alternator is earthed through a resistance of 5 Ohms. The relay operates when the out of balance current is 1.5 Amp. The C.T. has a ratio of 1000/5. What is the percentage of winding that is protected? Moreover, calculate the resistance required to protect 90% of the winding.	
	d)	Derive the general equation of magnitude comparator and also draw the phasor diagram?	
	e)	In a short circuit test on 3-pole 110 KV , the power factor of the fault , which involves earth was found out to be 0.4 and the recovery voltage was 0.95 times the full line value. The nature of breaker current was symmetrical and the frequency of oscillation of restriking voltage was 15 Khz. Determine the following. (4) a) The value of RRRVAvg b) The value of RRRVMax	
	f)	Describe a scheme for numerical differential protection?	
	g)	Derive the equation of current in double line to ground fault with neat sketch?	
	h)	Determine the time of operation of relay of rating 5A, 2.25IDMT and having a relay setting 1.25% and TMS = 0.6. It is connected to supplying through a CT ratio 400/5 and the fault current is 4000A?	

i) Discuss the Piolt wire protection scheme for feeder protection?
j) Draw the schematic diagram of Air blast circuit breaker and its principle?
k) Describe the various bus-bar protection schemes?
l) Draw the connection diagram for unrestricted earth fault protection of a generator?

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 A three phase power transformer having a line voltage ratio of 400 V to 33 kV is connected in star-delta. The C.T.s on 400 V side have current ratio as 1000/5. What must be the C.T. ratio on 33 kV side. Assume current on 400 V side of transformer to be 1000 A. **(16)**

Q4 A 3-phase alternator has a sub-transient reactance of 50% and positive and zero sequence reactance of 15% and 5% respectively. The alternator supply 2V over a transmission line having its at both the ends. The motor has rated as 20MVA and 10MVA both are 12.5 kV with 20% sub-transient reactance and negative and zero sequence reactance are 20% and 5% respectively. The current limiting reactance of 2Ω and the neutral of alternator is small and large for motor. If 3-phase transformer both rated as 35MVA, 13.2/115 kV. Star-delta transformer with leakage reactance 10% and series reactance 200Ω. The series reactance of the line is 80Ω. Determine the fault current for **(16)**
 a) L-G fault
 b) L-L fault
 c) L-L-G fault
Assuming V_f = 120 kV.

Q5 A 30 MVA, 13.8 KV 3-phase alternator is supplying load to two motors at the receiving end. There are two numbers of transformers connected at the sending and receiving ends rated at 35 MVA, 13.2KV(grounded Star)/115KV(Delta) with 10% leakage reactance. The series and zero sequence reactances of the transmission line are 80 Ω and 200 Ω respectively. The motors are having 10 MVA and 20 MVA capacities at 12.5 KV. The sub-transient , negative sequence and zero sequence reactances of the alternator are 15%, 15% and 5% and those of motors are 20%, 20% and 5% respectively, at their respective own bases. The neutral point of Star connected alternator and one of the motors (Star connected) is grounded through reactors of 2 Ω. Draw the sequence network and determine the fault current for a LG fault near the secondary side of the sending end transformer, and determine the fault MVA also. **(16)**

Q6 a) What is the principle with which a Carrier Current Protection system operates for protection of a long transmission line? With neat schematic diagram showing all important components, discuss about its operation. **(8)**

b) An IDMT relay is used to protect an alternator of 33KV (Star) rating, through 500/1 Amp C.T. The relay has plug setting of 125% and TMS of 0.75. A three phase short circuit fault occurs near the alternator such that the impedance from alternator to the fault point is j6 Ohms. Find the fault current and the time of operation of the relay. The IDMT characteristic is given below, which is assumed to be linear between two consecutive points. **(8)**
PSM   2 4 6 8 10 12
Time(s) 7 6 4.2 3.5 3.1 2.9