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Total Number of Pages : 02

B.Tech
PEE7J001

7th Semester Regular / Back Examination 2019-20
SWITCH GEAR & PROTECTIVE DEVICES
BRANCH : ELECTRICAL

Max Marks : 100

Time : 3 Hours

Q.CODE : HRB024

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)

- What is the basic difference between unit protection and non-unit protection?
- What is the physical significance of RRRV?
- What is the limitation of Merz-Price protection?
- How mal-operation due to power swings can be prevented?
- Write the universal relay equation?
- 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?
- What is the physical significance of sequence components?
- Which relay is most likely to operate undesirable on power swing?
- The zero sequence current of a generator from L-G fault is $j2.4\text{p.u.}$. What is the current flow through the neutral during the fault?
- What are the advantages of translay relay?

Part- II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- A single phase transformer is rated as 2.5KVA, 11/0.4KV. If the leakage reactance is 0.96 ohm when referred to low voltage side then determine its leakage reactance in p.u. system?
- Discuss the method of discrimination of fault?
- Discuss the current chopping phenomenon with neat diagram?
- Pilot wire protection with neat diagram?
- Differentiate time graded system and current graded system in over current protection?
- Discuss the impedance and offset Mho relay with R-X diagram?
- Derive the equation of current in double line to ground fault with fault impedance (Z_f)?
- Write a short note on ring main feeder with neat sketch?
- Differentiate time graded system and current graded system used in over current protection?
- Draw the schematic diagram of SF6 circuit breaker and its principle?
- Write the different characteristics of over current relay and characterized it with neat diagram?
- Draw the connection diagram for restricted earth fault protection of a generator?

Part-III

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

- Q3 An alternator and synchronous motor each rated for 50MVA, 13.2KV having sub transient reactance of 20% are connected through a transmission of reactance 10% on the base of machine rated the motor acts as a load of 30MW at 0.8 p.f. lead and terminal voltage 12.5KV when a three phase fault takes place at the motor terminals. Determine the sub transient current in the alternator, the motor and the fault. (16)
- Q4 A 132Kv, 50Hz system having inductance 10mH and capacitance 0.002F respectively. A resistance of 600 ohm is connected across the contact of Circuit breaker. Calculate natural frequency of oscillations, damped oscillations and critical value of resistance? (16)
- Q5 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. (8)
- b) Describe various zones of protection with neat circuit diagram? (8)
- Q6 A star connected 3 phase, 12 MVA, 11 kV alternator has a phase reactance of 10%. It is protected by Merz-Price circulating current scheme which is set to operate for fault current not less than 200 A. Calculate the value of earthing resistance to be provided in order to ensure that only 15% of the alternator winding remains unprotected. (16)

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B.Tech
PEL7J007

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)

- Give advantage of neutral groundings?
- How mal-operation of differential protection of transformer due to magnetizing inrush current is prevented?
- What is the limitation of Merz-Price protection?
- What is the under reach and over reach relay?
- Define short circuit capacity of bus?
- A fault occurring on an end supply transmission line is more severe from the point of view RRRV, what type of fault it is?
- If the fault current is 3000A for a relay with plug setting of 50% and CT ratio of 1000:1. What is the PSM?
- What is the difference between surge absorber and surge diverter?
- 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?
- 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)

- 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.
- Derive the expression to find out critical value of resistance to be connected across the CB contacts?
- The neutral point of a 3 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.
- Derive the general equation of magnitude comparator and also draw the phasor diagram?
- 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
- Describe a scheme for numerical differential protection?
- Derive the equation of current in double line to ground fault with neat sketch?
- 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 Pilot 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
 a) L-G fault
 b) L-L fault
 c) L-L-G fault
 Assuming $V_f = 120$ kV. (16)
- 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 80Ω and 200Ω 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 2Ω . 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