POWER SYSTEM-II
(ELEC 3201)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Current-limiting reactors in power system have
(a) large resistance and low reactance (b) large reactance and low resistance
(c) low reactance and low resistance (d) large resistance and large reactance

(ii) The most severe fault on the power system is
(a) three-phase short-circuit (b) line to line fault
(c) double line to ground fault (d) single line to ground fault

(iii) Which among these quantities are to be determined in slack bus?
(a) P and Q (b) Q and |V| (c) |V| and δ (d) Q and δ

(iv) The transient stability limit of the power system can be increased by introducing
(a) Series Inductance (b) Shunt Inductance
(c) Series Capacitance (d) Shunt Capacitance

(v) The rating of circuit breaker is usually determined on the basis of
(a) symmetrical fault (b) single line-to-ground fault
(c) double line-to-ground fault (d) line-to-line fault

(vi) Mho relay is
(a) voltage restrained overcurrent relay (b) voltage restrained directional relay
(c) directional restrained overcurrent relay (d) directional restrained overvoltage relay

(vii) Plug setting of a relay can be changed by changing
(a) Air gap (b) Backstop position
(c) Number of ampere turns (d) Damping

(viii) For symmetrical network, the neutral current is
(a) zero (b) infinity
(c) maximum (d) rated current

(ix) If the fault current is 2 kA, the relay setting is 50% and the C.T. ratio is 400/5, then the plug setting multiplier of a relay will be
(a) 5 (b) 7
(c) 8 (d) 10

(x) Equal area criterion gives the information regarding
(a) stability region (b) absolute stability
(c) relative stability (d) swing curves

Group – B

2. (a) Draw and explain equivalent circuits of synchronous machine under subtransient, transient and steady state conditions.

(b) Two generators each having short circuit capacities of 1300 MVA and 900 MVA respectively are operating at 11 kV and are linked by a interconnected cable having a reactance of 0.55 Ω/phase. Determine the short- circuit capacity of each station.

5 + 7 = 12

3. (a) What do you mean by positive, negative and zero phase sequence components of 3-phase unbalanced system?

(b) A synchronous generator is rated 25 MVA, 11 kV. It is star connected with the neutral point solidly grounded. The generator is operating at no load rated voltage. Its reactances are $X_1 = X_2 = 0.20$ pu and $X_0 = 0.08$ pu. Calculate the fault current for
(i) single line to ground fault
(ii) line to line fault
(iii) symmetrical three phase fault.

4 + 8 = 12

Group – C

4. (a) Define: (i) steady state stability, (ii) transient stability and (iii) stability limit.

(b) A 2 pole, 50 Hz, 11 kV, turbo generator has a rating of 60 MW, power factor 0.85 lagging. Its rotor has a moment of inertia of 8800 kg-m^2. Calculate the inertia constant in MJ per MVA and its momentum in MJ-s/electrical degree.

(2 + 2 + 2) + (3 + 3) =12

5. (a) Give the classification of different types of buses in power system for load flow analysis. Justify the classification.

(b) Write any two advantages of Newton-Raphson method over Gauss-Seidal method in load flow analysis.

(c) Determine $\mathbf{Y_{bus}}$ matrix for the 3-bus power system shown in Fig. 1. The line series impedances are given along with the transmission lines.

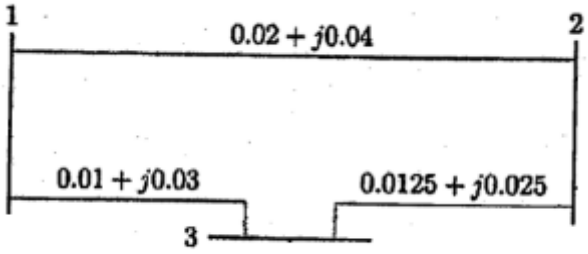

Fig. 1

4 + 2 + 6 = 12

Group – D

6. (a) Describe the basic principle of a directional overcurrent relay. How does it help in discrimination in protection of parallel feeder lines.

(b) Fig. 2 shows the percentage differential relay used for the protection of an alternator winding. The relay has a minimum pick up current of 0.2 Ampere and has a percentage slope of 20%. A high resistance ground fault occurs near the grounded neutral end of the generator winding with the current distribution as shown in figure-2. Assume CT ratio of 400/5 in both side. Determine whether the relay will operate or not.

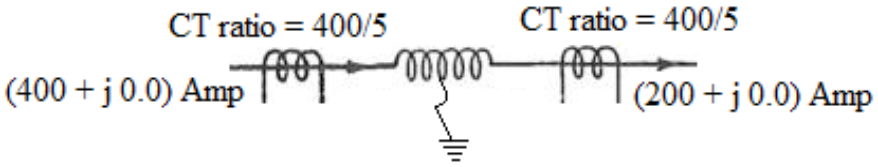

Fig. 2

(3 + 3) + 6 = 12

7. (a) What is Universal Torque Equation? Using this equation derive the operating characteristics of (i) Impedance relay , (ii) Reactance relay.

(b) A three phase 33 kV/11 kV power transformer is connected in star-delta (Y-Δ). The transformer is protected by Mertz-Price protection. CT ratio on low voltage side is 200/5. Find the CT ratio on high voltage side.

(1 + 2 + 2) + 7 = 12

Group – E

8. (a) Explain the following terms in a Circuit Breaker:
(i) Breaking current ,
(ii) Making current and
(iii) Short-time rating.

(b) A 50 Hz, 11 kV generator is connected to a power system. The system inductance and capacitance per phase are 10 mH and 0.02 μF respectively. Calculate

(i) the maximum voltage across the contacts of the circuit breaker at an instant when it passes through zero,
(ii) frequency of transient oscillation and
(iii) average rate of rise of restriking voltage up to the first peak of oscillation. Neglect resistance.

(2 + 2 + 2) + (2 + 2 + 2) = 12

9. (a) Briefly describe the following types of grounding in power system:
(i) Resonant grounding,
(ii) Zig-zag transformer grounding.

(b) A 132 KV, 3-phase, 50 Hz overhead line of 100 Km length has a capacitance to earth of each line of 0.01 μF/Km. Determine the inductance and KVA rating of the arc suppression coil suitable for this system.

(4 + 3) + 5 = 12

Department & Section	Submission Link
EE	https://classroom.google.com/c/MjI2MjE5NDQ2MDMy/a/MzY0MzE0NjU2Mzc2/details