B.E. (EE) 7th Semester Final Examination 2012

Subject: Electric Power System - III

Paper / Code No: EE –701 **Branch:** Electrical Engineering

Time: 3 Hours **Full Marks:** 70

i) Answer any SIX questions taking THREE from each half
ii) TWO marks are reserved for neatness in each half

FIRST HALF

1. (a) Derive the voltage equation which is used in Gauss-Seidel Load flow analysis. (5)

(b) Explain the following terms:

i. acceleration factor
ii. voltage controlled bus
iii. on-line load flow study (6)

2. (a) Define inertia constant H. Derive the form of swing equation which contains H. (2 + 3)

(b) A 200 MVA, 11KV, 50 Hz, 4 pole turbo generator has an inertia constant of 6 MJ/MVA. (i) Find the stored energy in the rotor at synchronous speed. (ii) The machine is operating at a load of 120 MW when the load suddenly increases to 160 MW. Find the rotor retardation. Neglect losses. (iii) The retardation calculated above is maintained for 5 cycles. Find the change in power angle in electrical degree and rotor speed in r.p.m at the end of this period. (1 +2 +3)

3. A 50 Hz generator is delivering 50% of the power that it is capable of delivering through a transmission line to an infinite bus. A fault occurs that increases the reactance between the generator and the infinite bus to 500% of the value before the fault. When the fault is isolated, the maximum power that can be delivered is 75% of the original maximum value. Using Equal Area Criteria determine the critical clearing angle for the condition described. (11)

4. (a) What are the probable causes of saturation of a protective C.T.? What are the negative effects of saturation of a protective C.T.? (2)

(b) In connection with a protective C.T. define (i) Composite Error and (ii) Accuracy Limiting Factor. (4)

(c) How would you specify a protective C.T. (3)

(d) Would you recommend the use of a Capacitive Voltage Transformer (CVT) as a protective voltage transformer? Justify your answer. (2)

5. Justify the following statements:

(a) Fast Decoupled Load Flow technique is suitable for contingency analysis
(b) Protective C.T.s are different from metering C.T.s.
(c) In transient stability studies mechanical input power is treated as a constant quantity
(d) Use of Auto Reclosing C.B. may improve the transient stability of a power system. (11)

Second half

6. (a) Define cost function for economical operation of power system (3+8)

(b) The fuel inputs per hour of plants 1 and 2 are given as

$F_1 = 0.2P_1^2 + 40P_1 + 110$ Rs per hr

$F_2 = 0.25P_2^2 + 30P_2 + 120$ Rs per hr

Determine the economic operation schedule and the corresponding cost of generation if the maximum and minimum loading on each unit is 100MW and 25MW, the demand is 180MW and transmission losses are neglected. If the load is equally shared by both the units, determine the saving obtained by loading the units as per equal incremental production cost.

7. The fuel cost function for three thermal units in Rs/hr are given by: (11)

$C_1 = 400 + 5.2P_1 + 0.002P_1^2$

$C_2 = 500 + 5.3P_2 + 0.004P_2^2$

$C_3 = 300 + 5.6P_3 + 0.007P_3^2$

where P_1, P_2 and P_3 are in MW. For a total load of 1000MW, find the economic dispatch solution.

8. Give reasons: (6+5)

(1) For faults on transmission lines, a 3-phase fault is more severe than other faults.

(2) The neutral grounding impedance z_n appears as $3z_n$ in the zero sequence equivalent circuit.

9. Derive the necessary equation to determine the fault current for single line to ground fault without considering the fault impedance. Draw the sequence diagram showing the interconnection of sequence networks. Draw the Phasor diagram for the above fault. (11)

10) Write short notes on (any two) (5.5 X 2)

(a) Penalty Factor

(b) Loss Formula Coefficient or B-Coefficient

(c) Symmetrical component technique

(d) 3 Phase Power Expression in terms of Symmetrical Component