C 6129 (Pages 2) Name..............................

Reg. No..............................

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2010

EE 04 604—POWER SYSTEMS—II

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

1. (a) Define per unit Representation. Give the advantages of use of p.u. values.

   (b) Draw the one-line diagram for (i) Rotating M/C ; (ii) Two winding power transformer ; (iii) Air circuit-breaker ; (iv) 3 ϕ Y connection ; (v) Power circuit-breaker.

   (c) Define Economic Dispatch and unit commitment problem. Explain the difference between the two problems.

   (d) Two turbo alternators rated for 100 MW and 160 MW hare governor drop characteristic of 4% from no load to full load. They are connected in parallel to share a load of 250 MW. Determine the load shared by each machine, assuming free governor action.

   (e) List types of fault in power system and explain double line to ground fault in detail.

   (f) What is the need of short circuit studies ?

   (g) Define voltage instability. Explain the cause of voltage instability.

   (h) Derive the expression for the determination of critical clearing time.

(8 × 5 = 40 marks)

2. (a) Explain clearly with the aid of a flowchart the computational problem of load flow solution using Newton Raphson method when the system contain all types of buses.

(15 marks)

   (b) Carry out one iteration of load flow solution by Gauses Seidal method :

   Bus (1) slack bus, $E_{specified} = 1.05 \angle 0^\circ$

   Bus (2) PV bus, $|E|_{spec} = 1.2$ p.u. $P_G = 3$ p.u.

   Bus (3) PQ bus, $P_L = 4$ p.u. $Q_L = 2$ p.u.

   Take Q limits of generator 2 as $0 \le Q \le 4$. Y_{bus} for given system is :

$$Y_{bus} = \begin{bmatrix} 3 - j9 & -2 + j5 & -1 + j4 \\ -2 + j5 & 5 - j14 & -3 + j9 \\ -1 + j4 & -3 + j9 & 4 - j13 \end{bmatrix}$$

(15 marks)

Turn over

3. (a) Explain the different parts of speed governing system. Derive the transfer function model for speed governing system.

(15 marks)

(b) What is meant by Economic load dispatch ? Derive the conditions for optimal load dispatch including transmission lines.

(15 marks)

4. (a) A 25 MVA, 11 kV, generator has a $Xd'' = 0.2$ p.u. Its negative and zero sequence reactance are respectively 0.3 and 0.1 p.u. The neutral of the generator is solidly grounded. Determine the sub transient current in the generator and the line to line voltages for subtransient conditions when an line to ground fault occurs at the generators terminals. Assume that before the occurrence of the fault. The generator is operating at no load at rated voltage. Ignore resistance.

(15 marks)

(b) Determine the fault currents in each phase following a double line to ground short circuit at the terminals of a star-connected synchronous generator operating initially on an open circuit voltage of 1.0 p.u. The positive negative and zero sequence reactance of generator are $j0.35$, $j\,0.25$ and $j\,0.20$ respectively and its star point is isolated from ground.

(15 marks)

5. (a) 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 increase 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. Determine the critical clearing angle for the condition described.

(15 marks)

(b) Explain briefly what is meant by Swing equation. Derive an expression for Swing equation.

(15 marks)

[4 × 15 = 60 marks]