B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2011

Sixth Semester

Electrical and Electronics Engineering

EE 2351 — POWER SYSTEM ANALYSIS

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions

PART A — (10 × 2 = 20 marks)

1. Draw a simple per-phase model for a cylindrical rotor synchronous machine.

2. What are the advantages of per unit system?

3. What is Jacobian matrix?

4. What is a slack bus?

5. Mention the objectives of short circuit analysis.

6. Write down the balanced and unbalanced faults occurring in a power system.

7. What is sequence network?

8. Write the symmetrical components of a three phase system?

9. Define critical clearing angle.

10. Write swing equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) With the help of single line diagram, explain the basic components of a power system. (8)

(ii) Write detailed notes about the per-phase model of a three phase transformer. (8)

Or

(b) Draw the impedance diagram for the electric power system shown in figure 11 (b) showing all impedance in per unit on a 100-MVA base.

Choose 20-kV as the voltage base for generator. The three-phase power and line-line ratings are given below. (16)

G1 : 90 MVA 20 kV X = 9%

T1 : 80 MVA 20/200 kV X = 16%

T2 : 80 MVA 200/20kV X = 20%

G2 : 90 MVA 18 kV X = 9%

Line : 200 kV X = 120

Load : 200 kV, S = 48 MW + j64Mvar

Fig. 11. (b)

12. (a) With neat flow chart explain the computational procedure for load flow solution using fast decoupled method when the system contains all types of buses. (16)

Or

(b) Explain the step by step computational procedure for the Gauss-Seidel method of load flow studies. (16)

13. (a) Explain symmetrical fault analysis using Z-bus matrix with neat flow chart. (16)

Or

(b) A 11 kV, 100 MVA alternator having a sub-transient reactance of 0.25 pu is supplying a 50 MVA motor having a sub-transient reactance of 0.2 pu through a transmission line. The line reactance is 0.05 pu on a base of 100 MVA. The motor is drawing 40 MW at 0.8 p.f. leading with a terminal voltage of 10.95 kV when a 3-phase fault occurs at the generator terminals. Calculate the total current in generator and motor under fault conditions. (16)

14. (a) What are the assumptions to be made in short circuit studies? Deduce and thaw the sequence network for a line to line fault at the terminals of

an unloaded generator. (16)

Or

(b) Two 11 kV, 20 MVA, three phase, star connected generators operate in parallel as shown in Figure 14. (b) ; the positive, negative and zero sequence reactance's of each being, respectively, j0.l8, j0.15, j0.10 pu. The star point of one of the generators is isolated and that of the other is earthed through a 2.0 ohms resistor. A single line to ground fault occurs at the terminals of one of the generators.

Estimate

(i) the fault current,

(ii) current in grounding resistor, and

(iii) the voltage across grounding resistor. (16)

Fig. 14. (b)

15. (a) Describe the Runge-Kutta method of solution of swing equation for multi-machine systems. (16)

Or

(b) Derive an expression for the critical clearing angle and clearing time. (16)