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Question Paper Code: 41353

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fifth Semester

Electrical and Electronics Engineering

14UEE503 - POWER SYSTEM ANALYSIS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The bus matrix of power system is not a

   (a) symmetric (b) square
   (c) full matrix (d) having dominant diagonal element

2. The P.U impedance of the circuit element is 0.15. If the base *kV* and *MVA* values are reduced to half of its value then new value of circuit element in p.u will be

   (a) 0.05 (b) 0.15 (c) 0.3 (d) 0.60

3. Which of the following specified in slack bus

   (a) *V* and *P* (b) *V* and *Q* (c) *V* and Phase angle (d) *P and Q*

4. Gauss Seidal iterative method can be used to solve a set of

   (a) linear differential equation only
   (b) linear and non linear algebraic equations
   (c) linear and non linear differential equations
   (d) linear algebraic equation only

5. If the P.U value of synchronous impedance is 2, what is short circuit ratio?

(a) 0.05 (b) 0.5 (c) 2 (d) 0.02

6. Which is the most severe fault?

(a) single line to ground fault (b) double line to ground fault
(c) line to line fault (d) symmetrical fault

7. A zero sequence current a generator for line to ground fault is *j 2.4 p.u.* What is the current through neutral during the fault?

(a) *j 2.4 p.u.* (b) *j 7.2 p.u.* (c) *j 0.6 p.u.* (d) *j 4.8 p.u.*

8. Which one of the following is absent in line to line fault?

(a) positive sequence impedance (b) negative sequence impedance
(c) zero sequence impedance (d) all of the above

9. Kinetic energy of 800 *MJ* stored in the rotor at synchronous speed. What is the inertia constant for a 50 *Hz* four pole turbo generator rated at 100*MVA*, 11 *kV*

(a) 2 *MJ / MVA* (b) 8 *MJ / MVA* (c) 88 *MJ / MVA* (d) 6 *MJ / MVA*

10. Critical clearing time of fault in a power system is related to

(a) transient stability (b) reactive power (c) S.C. current (d) voltage limit

PART - B (5 x 2 = 10 Marks)

11. What are the advantages of per unit system?

12. What are the approximations to be made while drawing reactance diagram?

13. How the elements of Jacobian matrix are computed?

14. What is Short-Circuit Capacity (SCC)?

15. How to improve the transient stability of power system?

PART - C (5 x 16 = 80 Marks)

16. (a) Draw the reactance diagram for the power system shown in figure 1.
Take 100 *MVA*, 220 *kV* in 50 *Ohm* line as base value.

Generator : 40 *MVA*, 25 *kV*, *X''*= 20 *%*

Motor : 50 *MVA*, 11 *kV*, *X''*=30%

T (star /star) : 40 *MVA*, 33/220 *kV*, *X*= 15%

(delta / star) : 30 *MVA*, 11/220 *kV*, *X*= 15 %

(16)

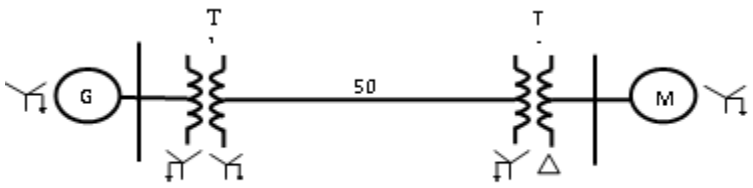

Figure 1

Or

(b) (i) Explain briefly about transmission line model. (8)

(ii) Explain the simple algorithm for the formation of Y-bus matrix. (8)

17. (a) Explain the algorithm of Gauss Seidal method for the load flow problem with a neat flow chart and relevant equations. (16)

Or

(b) Explain the algorithm of Newton Rapson method for the load flow problem with a neat flow chart. (16)

18. (a) A 11 *kV*, 100 *MVA* alternator having a sub-transient reactance of 0.25 *pu* is supplying to 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)

Or

(b) Explain the step by step procedure of symmetrical fault analysis using bus impedance matrix with neat algorithm. (16)

19. (a) (i) What are the assumptions to be made in short circuit studies? (4)

(ii) Deduce and draw the sequence network for a line to line fault at the terminals of an unloaded generator. (12)

Or

(b) The one-line diagram of a simple power system is shown in figure 2 below. Determine the fault current and fault MVA when

(i) A double line to ground fault occurs at bus 4

(ii) A single line to ground fault occurs at bus 4

G_1, G_2 : 100*MVA*, *20kV*, $x+ = x- = x_d'' = 20\%$; $x_0 = 4\%$; $x_n = 5\%$

T_1, T_2 : 100*MVA*, 20*kV*/345*kV* ; $x_{leak} = 8\%$

L_1, L_2 : $x+ = x- = 15\%$; $x_0 = 50\%$ on a base of 100*MVA* (16)

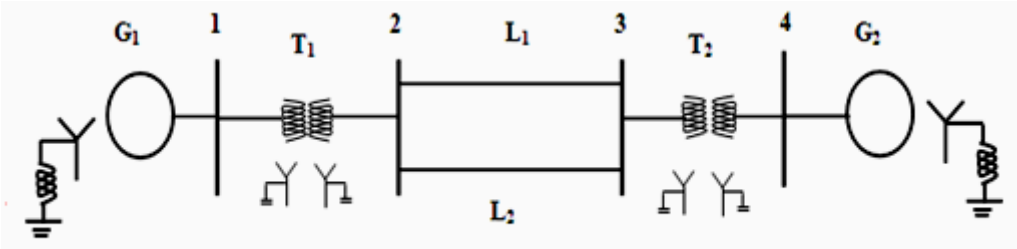

Figure 2

20. (a) (i) Derive swing equation of synchronous machine. (10)

(ii) Distinguish between steady state, transient and dynamic stability. (6)

Or

(b) A 50 *Hz* synchronous generator having inertia constant $H = 5$ *MJ/MVA* and a direct axis transient reactance $Xd' = 0.2$ *p.u.* is connected to an infinite bus through a purely reactive circuit as shown in figure 3. Reactances are marked on the diagram in *p.u* and on a common system base. The generator is delivering real power $Pe = 0.8$ *p.u.* and $Q = 0.6$ *p.u.* to the infinite bus at a voltage of $V = 1$ *p.u.* A temporary three-phase fault occurs at the sending end of the line at point *F*. When the fault is cleared, both lines are intact. Determine the critical clearing angle and the critical fault clearing time. (16)

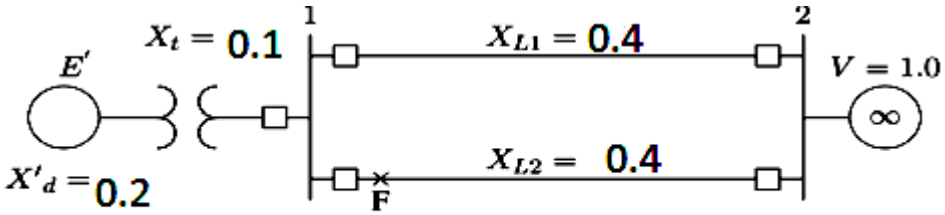

Figure 3