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Question Paper Code: 41353

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

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 value of diversity factor is

   (a) 0 (b) 1 (c) less than 1 (d) greater than 1

3. Which among the following buses constitute the maximum number in a power system?

   (a) Slack bus (b) P Q bus (c) P V bus (d) All of these

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. What is the value of negative sequence impedance?

(a) 1 (b) Z
(c) Same as positive sequence (d) ∞

7. On which among the following factors does the magnitude of the fault current depend?

(a) Total impedance upto the fault (b) Voltage at the fault point
(c) Both (a) and (b) (d) None of these

8. Which among these 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

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. Which among these is related to the critical clearing time of a fault in a power system?

(a) Transient stability limit (b) Steady state stability limit
(c) Frequency limit (d) None of these

PART - B (5 x 2 = 10 Marks)

11. What is per unit and give the advantages of per unit?

12. What is Jacobian Matrix?

13. Define Fault MVA.

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

15. Define dynamic stability with an example.

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)

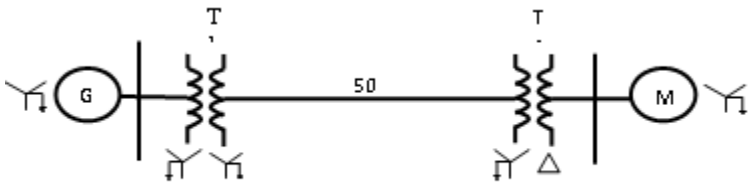

Figure 1

Or

(b) Explain the modelling of generator, load, transmission line and transformer for power flow, short circuit and stability studies. (16)

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) Clearly the algorithmic steps for solving load flow equations using Newton – Raphson method (polar form) when the system contains all types of buses. Assume that the generators at the P-V buses have adequate Q- limits. (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 for systematic fault analysis for three phase fault using bus impedance matrix. (16)

19. (a) Draw the sequence network connection for LL fault at any point in a power system . From that obtain an expression for the fault current. (16)

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)

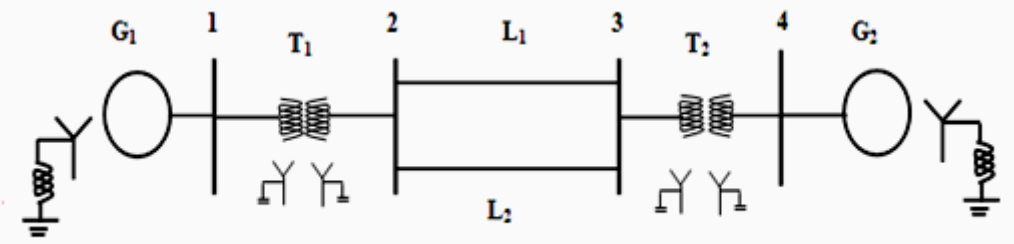

Figure 2

20. (a) Derive swing equation for a single machine connected to infinite bus system. State the usefulness of this equation. State the reasons for non linearity of this equation. (16)

Or

(b) State and explain equal area criterion in connection with transient stability analysis. What are the advantages and limitations of this method. (16)