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Question Paper Code: 45303

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

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. What will be the per unit impedance of a synchronous motor having a rating of 100 kVA, 13.2 kV and having a reactance of 75 Ω / ph?

    (a) 0.043 pu   (b) 0.057 pu   (c) 0.036 pu   (d) 0.298 pu

2. To control which among the following is the regulating transformer used in a power system?

    (a) Power flows   (b) Frequency   (c) Voltage   (d) Power factor

3. What is the value of acceleration factor used in the GS method?

    (a) 2.3 – 2.7   (b) 1.6 – 2.0   (c) 1.2 – 1.5   (d) 2.4 – 2.9

4. Initially what will be the voltage at all the PQ buses for solving the load flow problem using NR method.

    (a) $V_i = 1 \angle 90°$ (b) $V_i = 1 \angle 0°$ (c) $V_i = 1 \angle 180°$ (d) $V_i = 1 \angle 45°$

5. 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

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

<div align="center">PART - B (5 x 2 = 10 Marks)</div>

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. How to improve the transient stability of power system?

<div align="center">PART - C (5 x 16 = 80 Marks)</div>

16. (a) Draw the reactance diagram for the power system shown in figure 1.   (16)

    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%

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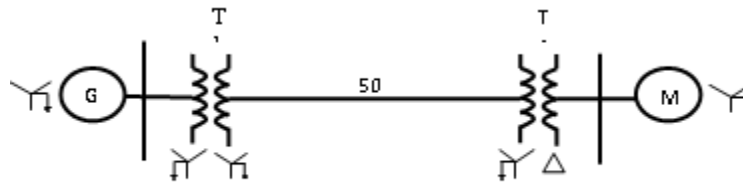

Figure 1

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 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)
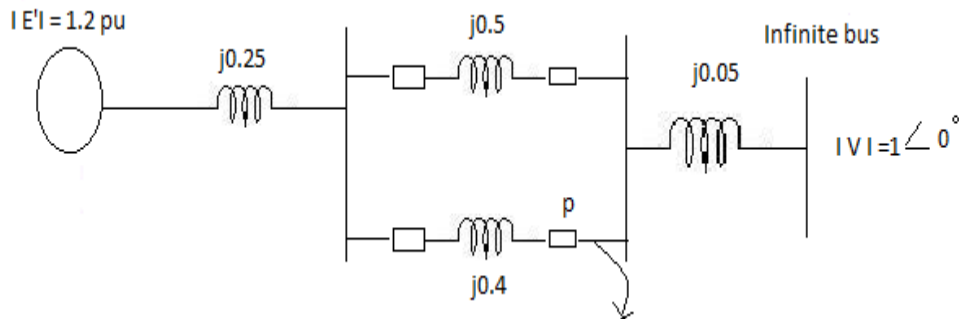
Or

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(b) Derive the relationship to determine the fault current for a single line to ground fault on an unloaded generator. Draw an equivalent network showing the interconnection of sequence of networks to simulate single line to ground fault. (16)

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

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

Or

(b) For the given system a three phase fault occurs at the point P. Find the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2.The reactance values of various components are indicated on the diagram. The generator is delivering 1.0 pu power at the instant preceding the fault.

(16)

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