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B.TECH. DEGREE EXAMINATION, MAY 2014

Eighth Semester

Branch : Electrical and Electronics Engineering

POWER SYSTEM ANALYSIS (E)

(Old Scheme—Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. With help of a suitable example briefly explain the direct formation of Y bus.
2. Write a short note on sequence impedance and sequence network.
3. Explain the importance of load flow studies in power systems. How a load flow study is performed?
4. Briefly explain the effect of off nominal transformer in load flow analysis.
5. Briefly explain the various constraints to be considered in economical load dispatch.
6. With help of neat diagram briefly explain automatic load dispatch.
7. Draw the short circuit current envelope of a synchronous machine and discuss the different reactance offered by the machine during the fault.
8. Explain the concept of short circuit capacity of a bus.
9. A 50 Hz, 4 pole turbo generator of rating 30 MVA, 13.2 kV has an inertia constant of 10 kWsec/kVA. Find the kinetic energy stored in the rotor at synchronous speed.
10. Define critical clearing angle and critical clearing time.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Draw the reactance diagram for the power system given in fig.1. Neglect resistance and use a base of 100 MVA, 220 kV in 50 Ω line. The ratings of the transformer generator and motor are given below.

Generator : 40 MVA, 25 kV, X" = 20%.; Synchronous motor : 50 MVA, 11 kV, X" = 30%

Y–Y Transformer : 40 MVA, 33/220kV, X = 15%

Y–Δ Transformer : 30 MVA, 11/220 kV (Δ –Y), X = 15%.

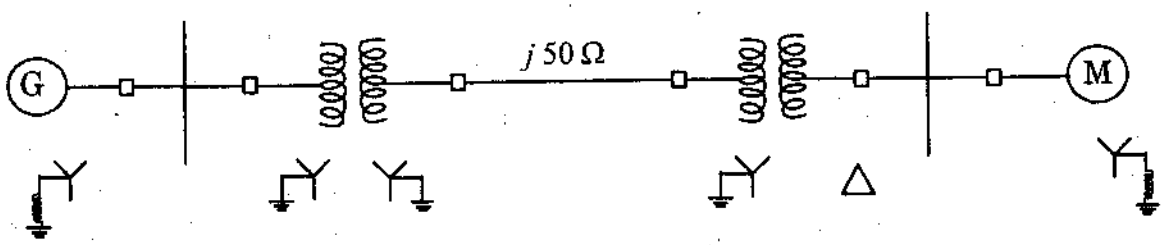


Fig. 1.

(8 marks)

(b) What is a symmetrical component ? Give its application in power system. (4 marks)

Or

12. Explain the formation of Y_{bus} using singular transformation technique. (12 marks)

13. The load flow data for a three bus system are shown in table 1 and table 2. The reactive power limit of bus 2 is $0.01 \leq Q_2 \leq 0.25$. Calculate the bus voltages at the end of first iteration by G – S method.

Bus code	*Impedance*
1-2	0.07 + *j* 0.2
1-3	0.01 + *j* 0.05
2-3	0.02 + *j* 0.15

Table 1

Bus code	P	Q	V	*Remark*
1	–	–	1.06 ∠0°	Slack
2	0.2	–	1.05	PV
3	0.6	0.25	–	PQ

Table 2

(12 marks)

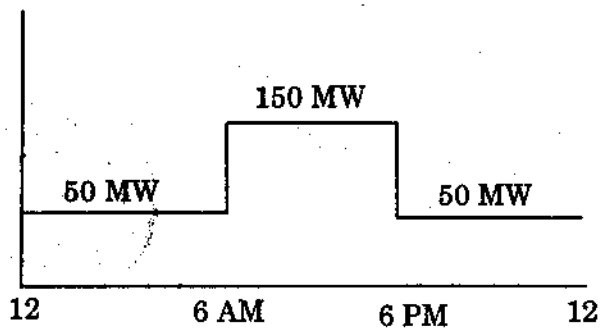
Or

14. With neat flow- chart explain clearly Newton - Raphson method for solving the load flow equations of a power system with PV buses. (12 marks)

15. Assume that the fuel input in Btu per hour for units 1 and 2 are given by

$$F_1 = (8P_1 + 0.024\,P_1^2 + 80)10^6\,; \qquad F_2 = (6P_2 + 0.04\,P_2^2 + 120)10^6.$$

The maximum and minimum loads on the units are 100MW and 10MW resp. Determine (i) Generation schedule ; (ii) The savings in the cost of generation with the generation schedule as in (iii) and equally divided when the following load is supplied. The cost of fuel is Rs.2 per million Btu.



Or

16. Derive the exact transmission loss formula from bus powers and the system parameters. (12 marks)

17. (a) Derive an expression for fault current due to a Line to- Line fault on an unloaded alternator. Also draw the sequence network. (8 marks)

(b) For a fault at a given location rank the various faults in the order of severity. (4 marks)

Or

18. A 25 MVA, 13.2 kV alternator with solidly grounded neutral has a subtransient reactance of 0.25 p.u. The negative and zero sequence reactance are 0.35 and 0.1 p.u respectively. A single line to ground fault occurs at the terminals of an unloaded alternator; determine the fault current and the line to line voltage. (12 marks)

19. Derive the swing equation from the fundamentals and hence explain the equal area criterion.

Or

20. (a) Find the steady-state power limit of a system consisting of a generator with reactance 0.6 p.u, connected to an infinite bus through a reactance of 0.8 p.u. The terminal of the generator is 1.15 p.u. and the voltage of the infinite bus is $1 \angle 0°$ p.u. (8 marks)

(b) Give the methods to improve the stability. (4 marks)

[5 × 12 = 60 marks]