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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, June 2017
(2013 Scheme)
13.605 : POWER SYSTEM ANALYSIS AND STABILITY (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **(2×10=20 Marks)**

1. Explain per unit (pu) system of computation.
2. Mention the advantages of symmetrical component method of analysis of fault.
3. What is meant by load flow study or calculation ?
4. Compare the merits and demerits of Gauss-Seidel and Newton-Raphson method of load flow studies.
5. What is Economic Dispatch ?
6. The incremental production costs of two plants are given by $\frac{dC_1}{dP_1} = 0.02P_1 + 50$ Rs./MWh ; $\frac{dC_2}{dP_2} = 0.01P_2 + 45$ Rs./MWh. If the total load supplied is 1000 MW, find the optimal load division between two plants.
7. What are the factors affecting stability of a power system ?
8. Explain power angle curve of single machine connected to infinite bus.
9. What is reactance diagram of a power system ?
10. Explain various impedances of synchronous machine during three phase short circuit.

P.T.O.

PART – B

Answer **any one** question from **each** Module. **(20×4=80 Marks)**

Module – I

11. a) Derive an expression for three phase power in terms of symmetrical component. **8**

b) A 30 MVA, 13.8 kV, 3 phase alternator has a sub-transient reactance of 15% and negative and zero sequence reactance of 15% and 5% respectively. The alternator supplies two motors over a transmission line having transformers at both ends as shown in Fig. 1. The motors have rated inputs of 20 MVA and 10 MVA both 12.5 kV with 20% sub-transient reactance, negative and zero sequence reactance of 20% and 5% respectively. The current limiting reactors of 2 ohm each are in the neutral of the alternator and the larger motor. The transformers are both rated 35 MVA, 13.2/115 kV with leakage reactance of 10%. Series reactance of the line is 80 ohms. The zero sequence reactance of the line is 200 ohms. Determine the fault current when L-G fault takes place at point P. **12**

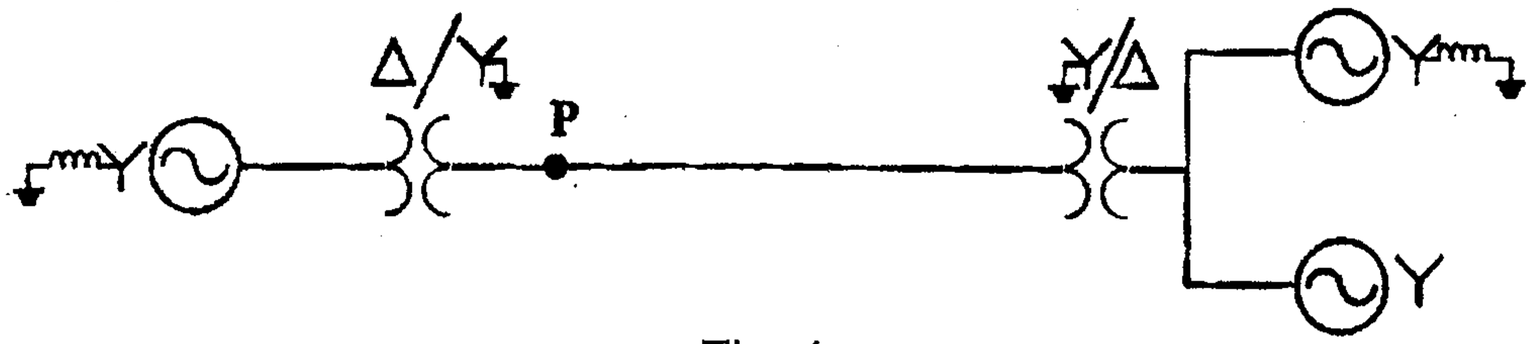

Fig. 1

OR

12. a) Explain short circuit MVA and current limiting reactors. **8**

b) A 100 MVA 33 kV 3 phase generator has a sub-transient reactance 15%. The generator is connected to the motor through a transmission line and transformer as shown in Fig. 2. The motor have rated inputs of 30 MVA, 20 MVA and 50 MVA at 30 kV with 20% sub-transient reactance. The 3 phase transformers are rated at 110 MVA, 32/110 kV with leakage reactance 8%. The line has a reactance of 50 ohms. Select the generator rating as the base quantities, determine the pu values in the other parts of the system and draw the reactance diagram. **12**

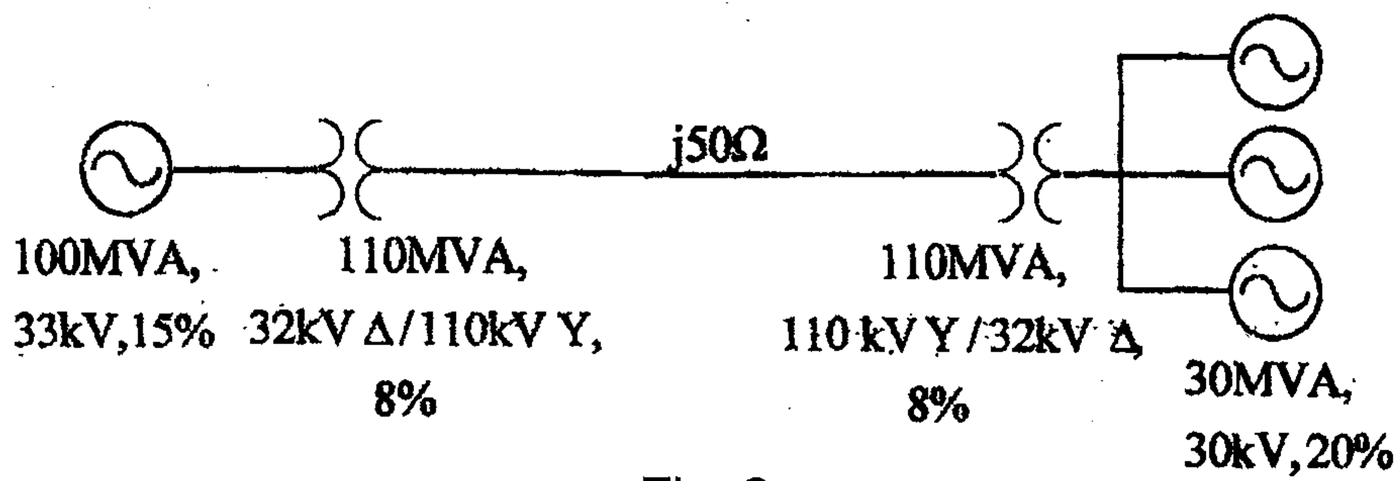

Fig. 2

Module – II

13. a) Explain the Gauss-Seidel method of obtaining load flow solution considering only PQ buses in addition to slack bus. **10**

b) Obtain the voltages at all buses for the three bus system shown in Fig. 3 at the end of first iteration by N R method. **10**

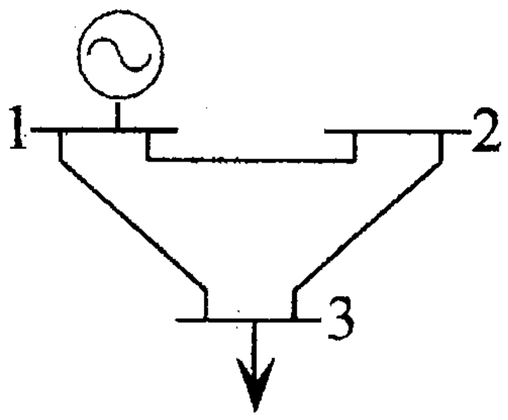

Fig. 3

Bus No.	P_G	Q_G	P_D	Q_D	V_{sp}
1	–	–	–	–	1.0
2	5.3217	–	–	–	1.1
3	–	–	3.6392	0.5339	–

$$Y_{bus} = \begin{bmatrix} -j15 & j10 & j5 \\ j10 & -j15 & j5 \\ j5 & j5 & -j10 \end{bmatrix}$$

OR

14. a) Form Y_{bus} for the system shown in Fig. 4. The line reactance in pu are given. **10**

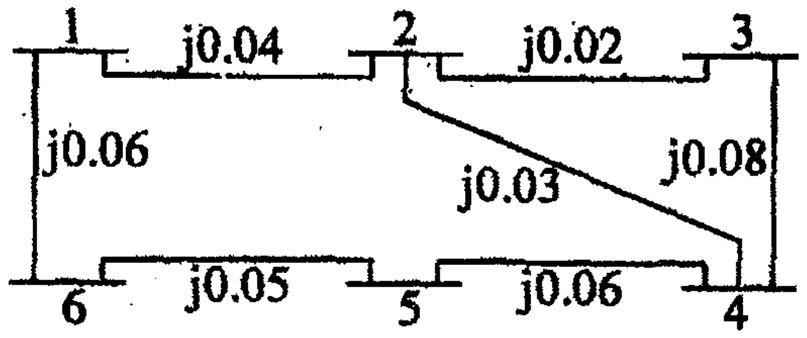

Fig. 4

b) Write the necessary relationship for Newton-Raphson power flow, starting from the power injection equations. **10**

Module – III

15. a) Describe all the steps involved in iterative procedure of Economic Load Dispatch of the thermal power plants including transmission loss. **10**

b) A two bus system is shown in Fig. 5. If a load of 125 MW is transmitted from plant 1 to load, a loss of 15.625 MW is incurred. Determine the generation schedule and the load demand if the cost of received power is R. 24/MWh.

The incremental cost of the plant are $\frac{dC_1}{dP_1} = 0.025P_1 + 15$; $\frac{dC_2}{dP_2} = 0.05P_2 + 20$. **10**

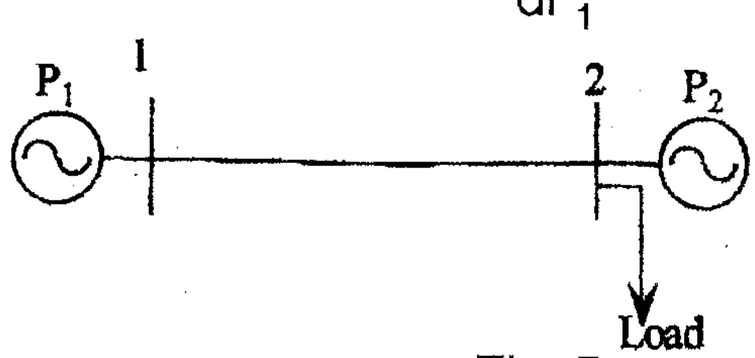

Fig. 5

OR

16. a) Define unit commitment problem. Explain thermal and hydro constraints. **8**

b) The fuel cost functions in Rs./h for three thermal plants are given by

$F_1 = 0.004P_1^2 + 7.2P_1 + 350$; $F_2 = 0.0025P_2^2 + 7.3P_2 + 500$; $F_3 = 0.003P_3^2 + 6.74P_3 + 600$. P_1, P_2, P_3 are in MW. Find the optimal schedule and compare the cost with the case when the generators share load equally if $P_D = 450$ MW. **12**

Module – IV

17. a) Derive the swing equation of a synchronous generator swinging with respect to an infinite bus. Mention the units of all the terms used in the derivation. **10**

b) Determine the steady state stability limit of the sample system shown in Fig. 6. V_t – 1.0 pu. **10**

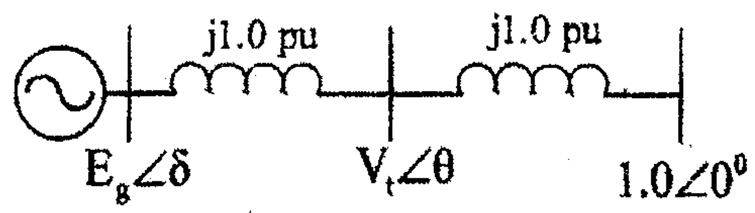

Fig. 6

OR

18. a) Explain the schematic diagram of load frequency and excitation voltage regulator of a turbo generator. **10**

b) A 30 MVA, 15 kV, 4 pole, 50 Hz turbo alternator has an inertia constant of 10 kW-sec/kVA. Compute the kinetic energy stored by the rotor at synchronous speed and acceleration in rpm/sec if the input power is 25 MW and output power is 20 MW. **10**