(Pages : 4) **A – 2741**

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2016
(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 the concept of complex power.
2. Mention the function of current limiting reactors in the power system.
3. Write the assumptions made in Fast Decoupled Load Flow algorithm.
4. Explain the significance of Slack bus/Swing bus.
5. What do you mean by penalty factor and incremental transmission loss ?
6. What are B-coefficients ?
7. List few methods to improve voltage stability of power system.
8. Discuss about AVR of an alternator.
9. What is load flow solution ? Explain its significance in power system analysis.
10. What is reactance diagram of a power system ?

PART – B

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

Module – I

11. a) Analyse completely a line-to-ground fault on line 'a' of an unloaded generator whose neutral is solidly grounded. Draw the necessary sequence diagram. **8**

P.T.O.

b) A 30 MVA, 13.8 kV, 3 phase alternator has a $X'' = 15\%$. 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 $X'' = 20\%$. The transformers are both rated 35 MVA, 13.2/115 kV with leakage reactance of 10%. Series reactance of the line is 80 ohms. Draw the reactance diagram with all reactance marked in pu. Select generator rating as base in the generator circuit. **12**

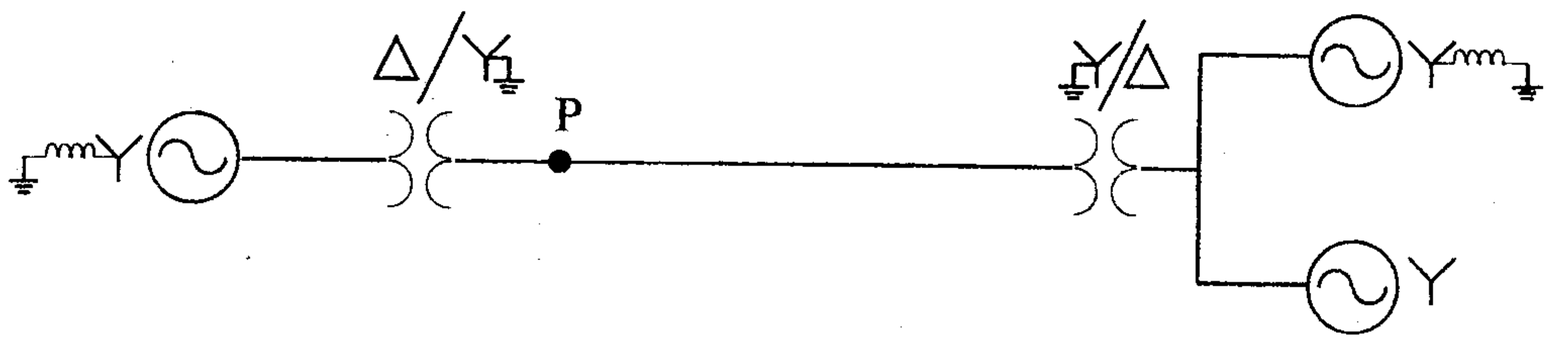

Fig. 1

OR

12. a) Derive the relevant expressions to show how sequence networks are to be connected to analyse the line-to-line fault. **8**

b) Two 20 MVA, 11 kV, 3 phase star connected generators are operated in parallel. The generators have sub-transient reactance of 18% and negative and zero sequence reactance are 15% and 10% respectively. The star point of one of the generator is isolated and the other is earthed through 2 ohm resistance. Determine the fault current, current in the ground resistor and voltage across ground resistor when line-to-ground fault occurs at one of its terminal. **12**

Module – II

13. a) Explain the Fast Decoupled Load Flow algorithm. **10**

b) Determine the set of load flow solution for the sample power system at the end of first iteration by GS method. **10**

$$Y_{bus} = \begin{bmatrix} 3-j12 & -2+j8 & -1+j4 & 0 \\ -2+j8 & 3.666-j14.664 & -0.666+j2.664 & -1+j4 \\ -1+j4 & -0.666+j2.664 & 3.666-j14.664 & -2+j8 \\ 0 & -1+j4 & -2+j8 & 3-j12 \end{bmatrix}$$

Bus No.	P	Q	V	Remarks
1	–	–	1.06	Slack bus
2	0.5	0.2	1+j0	PQ bus
3	0.4	0.3	1+j0	PQ bus
4	0.3	0.1	1+j0	PQ bus

OR

14. a) Compare the performance of Gauss-Seidel method and Newton-Raphson method of load flow solution using nodal admittance approach. **10**

b) Determine the matrix for the sample power system shown in Fig. 2. The line impedances in pu are given. **10**

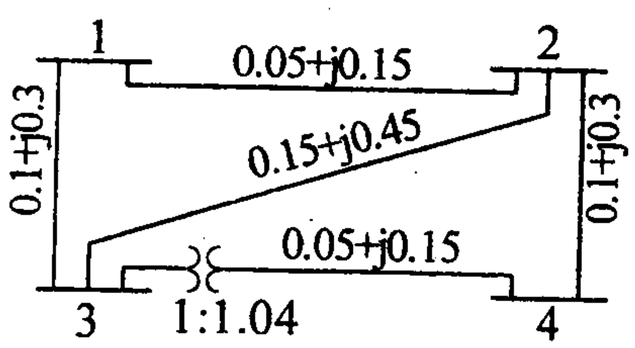

Fig. 2

Module – III

15. a) How can the effect of transmission loss be included in optimum scheduling in power plants ? **8**

b) The impedances of various branches and the currents flowing in the network shown in Fig.3 are given by

$Z_a = 0.03 + j0.09$ pu; $I_a = 1.5 - j0.4$ pu

$Z_b = 0.10 + j0.30$ pu; $I_b = 0.5 - j0.2$ pu

$Z_c = 0.03 + j0.09$ pu; $I_c = 1.0 - j0.1$ pu

$Z_d = 0.04 + j0.12$ pu; $I_d = 1.0 - j0.2$ pu

$Z_e = 0.04 + j0.12$ pu; $I_e = 1.5 - j0.3$ pu

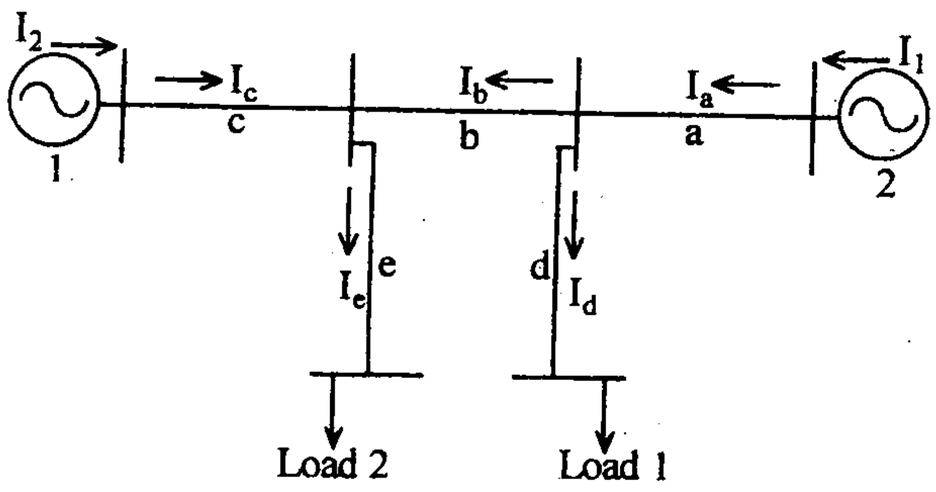

Fig. 3

The voltage at the bus which is at the junction of branches a, b and d is $1 \angle 0$ pu. Calculate the loss formula coefficients in pu and in MW^{-1} if base is 100 MVA. **12**

OR

16. a) Explain equal incremental cost criteria for optimum scheduling in power plants. **8**

b) The fuel cost of plant 1 and plant 2 are given by

$F_1 = 0.2P_1^2 + 40P_1 + 120$ Rs/h; $F_2 = 0.25P_2^2 + 30P_2 + 150$ Rs/h

Determine the economic operating schedule and the corresponding cost of generation if the maximum and minimum loading on each unit is 100 MW and 25 MW, and demand is 180 MW. Determine the saving obtained by loading the units as per economic loading and equal load sharing. **12**

Module – IV

17. a) Explain the equal area criterion of transient stability study. **10**

b) A 50 Hz, 4 pole turbo generator rated 20 MVA, 13.2 kV has an inertia constant H = 9 kW–sec/kVA. Determine the kinetic energy stored in the rotor at synchronous speed. Determine the acceleration if the input less the rotational loss is 2500 hp and electric power developed is 15000 kW. **10**

OR

18. a) From the fundamentals derive the swing equation of a synchronous machine. **8**

b) A 50 Hz synchronous generator having an internal voltage 1.2 pu, H = 5.2 MJ/MVA and a reactance of 0.4 pu is connected to an infinite bus through a double circuit line, each line of reactance 0.35 pu. The generator is delivering 0.8 pu power and the infinite bus voltage is 1.0 pu. Find the power angle relationship for the system when an L-G fault occurs in the middle of one line. **12**