Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. VIIth Semester–Examination – Nov- 2011

Subject code: 170901

Subject Name: Inter Connected Power System

Date:19/11/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 70

Instructions:

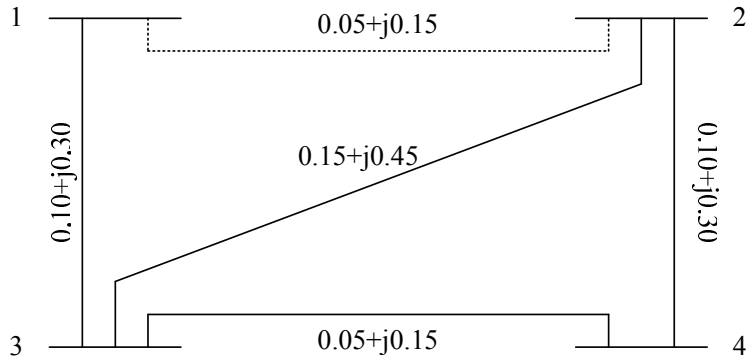
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive the expression for B-coefficients in case of two generating plants connected to an arbitrary number of loads through a transmission network. **07**

(b) Discuss the procedure for solving the swing equation using point by point method. **07**

Q.2 **(a)** Compare the GS and NR methods of load flow study. **07**

(b) The following figure shows a simple 4-bus system. **07**



Line	G, pu	B, pu
1-2	2.0	–6.0
1-3	1.0	–3.0
2-3	0.666	–2.0
2-4	1.0	–3.0
3-4	2.0	–6.0

The shunt admittances at all the buses are assumed negligible.

1) Find Y_{BUS} assuming that the line shown dotted is not connected.
2) What modifications need to be carried out in Y_{BUS} if the line shown dotted is connected?

OR

(b) A system consists of four identical 400 MVA generating units feeding a total load of 1016 MW. The inertia constant of each unit is 5 on 400 MVA base. The load changes by 1.5% for a 1% change in frequency. When there is sudden drop in load by 16 MW, obtain the power system time constant (T_p) with constants H and D expressed on 1600 MVA base. **07**

Q.3 **(a)** A power system has two generating plants and power is being dispatched economically with $P_1 = 150$ MW and $P_2 = 275$ MW. **08**

The loss coefficients are:

$$B_{11} = 0.10 \times 10^{-2} \ \text{MW}^{-1}$$

$$B_{12} = -0.10 \times 10^{-2} \ \text{MW}^{-1}$$

$$B_{22} = 0.13 \times 10^{-2} \ \text{MW}^{-1}$$

To raise the total load on the system by 1 MW, an additional cost of 200 Rs./hour will be incurred. Find;

a) The penalty factor of plant:1
b) The additional cost per hour to increase the output of plant:1 by 1 MW.

(b) Give reasons: **06**

1) One of the buses is taken as slack bus in load flow studies.
2) Bus admittance matrix is a spare matrix.
3) An acceleration factor is commonly used in load flow studies using GS method.

OR

Q.3 **(a)** Give the algorithm with flow chart for a fast decoupled load flow solution. **07**

(b) Write a short note on Load Dispatch Centre. **07**

Q.4 **(a)** What is power system islanding? Why it is needed? What is ideal procedure to restore the grid? Discuss the effects of islanding. **07**

(b) Derive a mathematical model of turbine speed governing system. **07**

OR

Q.4 **(a)** A 100 MVA, 50 Hz synchronous generator having inertia constant of the machine as 5 kW-sec per kVA. The load suddenly increases by 50 MW. Due to delay in governor action there is a delay of 0.6 seconds in opening of steam valve. Find the frequency deviation. **07**

(b) Distinguish between steady state, dynamic and transient stability. Derive power angle equation $P_e = P_m \sin\delta$. State the assumptions made. **07**

Q.5 **(a)** A single area consists of two generating units, rated at 400 and 800 MVA, with speed regulation of 4% and 5% on their respective ratings. The units are operating in parallel, sharing 700 MW. Unit 1 supplies 200 MW and unit 2 supplies 500 MW at 1.0 per unit (50 Hz) frequency. The load is increased by 130 MW. Assume there is no frequency-dependent load. Find the steady-state frequency deviation and the new generation on each unit. **07**

(b) Explain the following: **07**

1) Bus incidence matrix
2) Primitive network

OR

Q.5 **(a)** A 50 Hz generator of reactance of 1.2 pu is connected to an infinite bus bar through a line reactance of 0.6 pu. |E| = 1.2 pu and |V| = 1.0 pu. The inertia constant is 4 MW-sec per MVA. The generator is loaded to 50% of its maximum power limit. Find the frequency of natural oscillations. **07**

(b) Write a short note on Automatic Voltage Control. **07**

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