Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER 2015

Subject Code: 170901 **Date:01/05/2015**

Subject Name: Interconnected Power System

Time: 02:30 to 05:00 **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)**	Briefly describe functions of a Load Dispatch Centre.	**07**
	(b)	A four bus system is shown fig. (a). Impedances of various branches is given in the following table. Derive (1) Bus Incidence Matrix A (2) Primitive Admittance Matrix Y. Are these two matrices unique? Explain. Also show how Bus Admittance Matrix Y_{BUS}, can be computed using above two matrices.	**07**

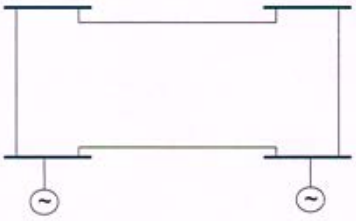

Fig. (a)

Sr. No.	Element	Impedance in p.u.
1	1-2	j0.025
2	1-4	j0.04
3	2-G	j0.02
4	2-3	j0.05
5	3-G	j0.01
6	3-4	j0.025

Q.2	**(a)**	Explain how G-S method can be applied for solution of Static Load Flow Equations when both PQ and PV buses are present in the system. Also explain how the algorithm is affected when Q limit is exceeded at a PV bus.	**07**

	(b)	A three bus system has Bus Admittance Matrix as given below.	07

16∟-75°	8 ∟104°	8 ∟104°
8 ∟104°	16∟-75°	8 ∟104°
8 ∟104°	8 ∟104°	16∟-75°

Bus powers and voltages are given below.

Bus	P_G	Q_G	P_D	Q_D	Bus Voltage
1	Unspecified	Unspecified	1.0	0.5	1.0 +j 0 (Slack Bus)
2	1.5	Unspecified	0	0	|V|=1.03
3	0	0	1.2	0.5	Unspecified

Form Jacobian Matrix and the set of equations for solution of Load Flow Problem for first iteration of Newton-Raphson method. (All values are in p.u. with appropriate base values)

		OR	
	(b)	Explain Fast Decoupled Load Flow method.	07
Q.3	(a)	Explain how active and reactive power flows over transmission lines can be calculated at the end of a load flow study.	07
	(b)	Explain optimal generation scheduling considering transmission losses.	07
		OR	
Q.3	(a)	Explain Kron's method for calculation of loss coefficients.	07
	(b)	In a system with two plants, the incremental fuel costs are given by,	07

$$(IC)_1 = 0.01P_{G1} + 20 \quad \text{Rs/MWh}$$
$$(IC)_2 = 0.015\,P_{G2} + 22.5 \text{ Rs/MWh}$$

The system is running under optimal scheduling with $P_{G1} = P_{G2} = 100$ MW. If $(\partial P_L/\partial P_{G2}) = 0.2$, find the penalty factors of both the plants and $(\partial P_L/\partial P_{G1})$

Q.4	(a)	Derive per unit swing equation of a synchronous machine. Show how machines swinging coherently can be reduced to a single machine.	07
	(b)	A 50Hz, 100 MVA, 4-pole synchronous generator has an inertia constant of of 3.5 MJ/MVA and is supplying 0.16 p.u. power on a system base of 500 MVA. The input to the generator is increased to 0.18 p.u.. Determine (1) the kinetic energy stored in the rotor and (2) the acceleration of the generator. If this acceleration is maintained for 7.5 cycles, calculate the change in rotor angle and speed in rpm at the end of this duration.	07
		OR	
Q.4	(a)	Discuss the concept of steady state stability. How steady state stability limit can be enhanced?	07
Q.4	(b)	A double circuit 3-phase feeder connects a single generator to a large network. The power corresponding to the steady state stability limit for each circuit is 100 MW. The line is transmitting 80 MW when one of the circuits is suddenly switched out. Determine using equal area criterion whether the generator is likely to remain stable or not. Neglect losses.	07

Q.5	**(a)**	Briefly discuss the concept of "Control Area" for Automatic Load Frequency Control and hence explain Two Area Load Frequency Control.	**07**
	(b)	Prove that voltage drop across a line is $$\Delta V = \frac{R \cdot P + X \cdot Q}{V}$$ Where R and X are Resistance and Series Reactance of line respectively whereas P and Q are active and reactive power delivered over the line.	**07**
		OR	
Q.5	**(a)**	Briefly discuss factors affecting and techniques to increase transient stability.	**07**
	(b)	Bus impedance matrix for a three bus system is given below. $$\begin{bmatrix} j0.14 & j0.11 & j0.12 \\ j0.11 & j0.14 & j0.12 \\ j0.12 & j0.12 & j0.18 \end{bmatrix}$$ Calculate the new bus impedance matrix if the branch between bus 2 and 3 having impedance j0.1 is removed.	**07**

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