Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIIth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 170901 **Date: 24/05/2012**

Subject Name: Inter Connected Power System

Time: 02:30 pm – 05:00 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 static load flow equations. Hence explain classification of buses. (7)

(b) Derive the criterion for economic distribution of load between different units of a plant when transmission losses are neglected. (7)

Q.2

(a) Discuss dynamics of synchronous machine and derive the swing equation (7)

(b) A 50Hz, 4-pole turbo alternator rated 20,000 kVA, 13.2 kV has an inertia constant of 9 kW-sec/kVA. Find the K.E. stored in the rotor at synchronous speed. Find the accelerating torque if the shaft input is 26,800 hp (metric) and the electric power developed is 16,000 kW. If the acceleration is maintained constant for a period of 15 cycles, determine the change in torque angle in that period and the rpm at the end of 15 cycles (7)

OR

(b) A synchronous generator feeds 1.0 pu power to an infinite bus through a transmission system (double circuit line). A fault occurs on one line which reduces the maximum power transfer to 0.5 pu, whereas before the fault this power was 2.0 pu and after the clearance of fault is 1.5 pu. By the use of equal area criteria determine the critical clearing angle. The losses in the system may be neglected. (7)

Q.3

(a) The following is the system data for a load flow solution (9)

Bus code	Admittance
1-2	2-j8
1-3	1-j4
2-3	0.666-j2.664
2-4	1-j4
3-4	2-j8

Bus	Pg	Qg	Pd	Qd	Bus voltage
1	?	?	0	0	1.06
2	0	0	0.5	0.2	?(PQ)
3	0	0	0.4	0.3	?(PQ)
4	0	0	0.3	0.1	?(PQ)

Find the bus voltages V_2 and V_3 at the end of first iteration using GS method. Use acceleration factor $\alpha = 1.6$

(b) Compare GS and NR method of load flow (5)

OR

Q.3

(a) With the help of a neat diagram explain turbine speed governing mechanism (7)

(b) Explain tie line load bias method of frequency control (7)

Q.4

(a) Derive the expression for B-coefficients in case of two generating plants connected to an arbitrary number of loads through a transmission network. (9)

(b) A system having two generating units connected through a line has the following loss co-efficients (5)

$B_{11} = 0.1\times10^{-2}$ MW^{-1}, $B_{12} = -0.01\times10^{-2}$ MW^{-1} and $B_{22} = 0.13\times10^{-2}$ MW^{-1}

Power is being dispatched economically with P_1=120 MW and P_2 = 200 MW. To raise the system load by 1 MW costs an additional Rs. 40 per hour. Find the penalty factor of plant 1 and the additional cost per hour to increase the output of plant 1 by 1 MW

OR

Q.4

(a) Explain point by point method of stability. State the assumptions made (9)

(b) Prove that synchronizing co-efficient of a machine should be positive for system stability (5)

Q.5

(a) Discuss Z_{BUS} building algorithm. Explain all types of modifications when transmission lines are added between the buses. (9)

(b) Obtain Z_{BUS} using Z_{BUS} building algorithm for the system whose data is given below (5)

Line no	Bus code	Impedance
1	R-1	0.6Ω
2	R-2	0.5Ω
3	1-3	0.25Ω
4	2-3	0.5Ω

Assume bus ‘R’ as the reference bus

OR

Q.5

(a) Explain formulation of Y_{BUS} using singular transformation. (7)

(b) Explain cascade tripping and network islanding in brief. (7)

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