## **GUJARAT TECHNOLOGICAL UNIVERSITY** BE - SEMESTER-VII(OLD) • EXAMINATION – WINTER 2016

## Subject Code: 170901 Subject Name: Inter Connected Power System Time: 10:30 AM to 01:00 PM Instructions:

Date: 29/11/2016

**Total Marks: 70** 

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
  - Q.1 (a) Explain the classification of Bus and also importance of 07 slack bus.
    - (b) A 50 Hz 4 pole turbo generator rated 125 MVA, 11 kV has 07 an infinite constant of 9.0 MJ/MVA. Find (a) stored energy in the rotor at synchronous system.

(b) If the mechanical input is suddenly raised to 85 MW for an electrical load of 50 MW, find rotor acceleration, neglecting mechanical and electrical losses.

 $\bigcirc$  if the acceleration calculated in part (b) is maintained for 10 cycles, find the change in torque angle and rotor speed in revolutions per minute at the end of this period.

Q.2 (a) The four buses system is to be considered for evaluation of 07 voltages at the buses using GS Method. All buses other than the slack bus are PQ type. Assuming a flat voltage start, find the voltages at the three buses at the end of first GS iteration. Values of real and reactive power are listed in table 1 as follows.

Bus	P <sub>i</sub> pu	Q <sub>i</sub> pu	V <sub>i</sub> pu	Remarks
1	-	-	$1.04 < 0^0$	Slack
				bus
2	0.5	-0.2	-	PQ Bus
3	-1.0	0.5	-	PQ Bus
4	0.3	-0.1	-	PQ Bus

## (Table 1)

Consider the Y bus matrix for the four bus system is as under.

$$\begin{bmatrix} 3-j9 & -2+j6 & -1+j3 & 0\\ -2+j6 & 3.666-j11 & -0.666+j2 & -1+j3\\ -1+j3 & -0.666+j2 & 3.666-j11 & -2+j6\\ 0 & -1+j3 & -2+j6 & 3-j9 \end{bmatrix}$$

OR

- (b) Compare GS method with NR method. 07
- Q.3 (a) Incremental fuel costs in rupees per MWh for a plant 07 consisting of two units are

$$\frac{\partial F_1}{\partial P_{g_1}} = 0.20P_{g_1} + 40$$
 and  $\frac{\partial F_2}{\partial P_{g_2}} = 0.40P_{g_2} + 30$   
And the generators limits are

 $30 \text{ MW} \le \text{Pg1} \le 175 \text{ MW}$  and  $20 \text{ MW} \le \text{Pg2} \le 125 \text{ MW}$ Assume that both units are operating at all times. How will the load shared between the units as the system load varies over the full range of the load values? What are the corresponding values of the plant incremental costs?

(b) Derive the equations for  $\beta$  Coefficient.

Explain the Y-Bus formation using Singular Transformation 07 Q.3 (a) method. (b) Explain the numerical solution of swing equation. 07 Q.4 Explain the Z-Bus modification for type-1, 2 and 3. 07 **(a)** Explain transient state stability and method to improve it. **(b)** 07 OR Explain the speed governing system using diagram. 07 Q.4 (a) (b) List out the advantages of interconnected system and also 07 explain cascade tripping. 0.5 Discuss the different method of voltage control. 07 (a) Explain the difference between Jacobean Matrix of NR **(b)** 07 method and decoupled method. What is the reason of absent of slack bus in Jacobean matrix? OR (a) Explain the derivation of static load flow equation. Q.5 07 Explain sudden change in Mechanical input and effect of 07 **(b)** clearing time on stability with refers to equal area criteria.

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