Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (OLD) EXAMINATION – SUMMER 2019

Subject Code: 170901   **Date: 18/05/2019**

Subject Name: Inter Connected Power System

Time: 02:30 PM TO 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)** For the system given in fig. 1(a), the linear directed graph is as given in fig. 1(b).   **07**
Determine the following:

a) Bus incidence matrix A, b) Primitive admittance matrix Y_b, c) Elements Y_{22} and Y_{33} of Y-Bus matrix of system of fig. 1(a)

Reactance values of various elements are given in fig. 1(a).
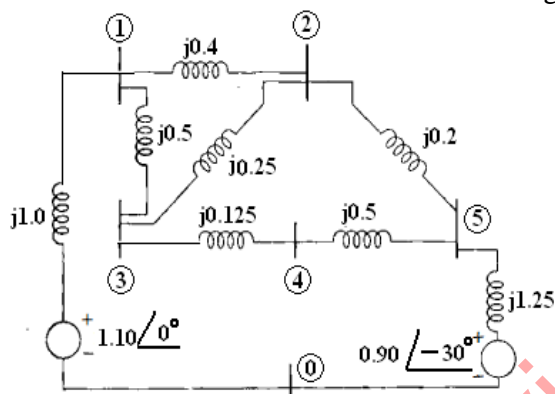

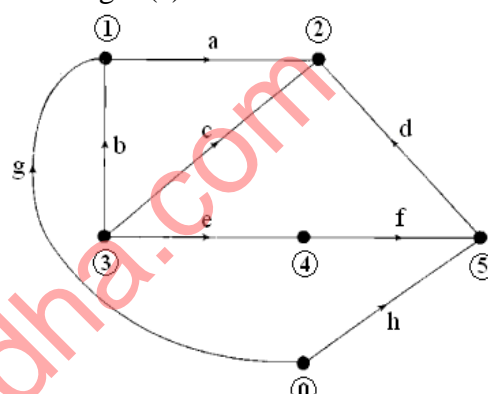Fig. 1(a)   Fig. 1(b)

(b) For the network shown in fig. 2(a), the bus impedance matrix is given in fig. 2(b).   **07**
Calculate final Z-bus matrix after the two modifications in the sequence given below.

a) A line with impedance of j0.4 is added between bus 2 and a new bus 3.

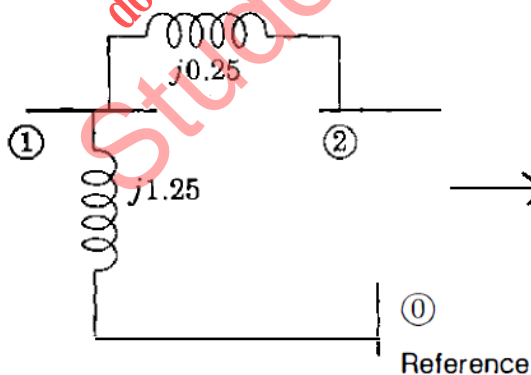b) Then, a line with impedance j1.25 is added between bus 3 and the reference bus.

                                                                                07

$$Z_{bus} = \begin{array}{c} \textcircled{1} \\ \textcircled{2} \end{array} \begin{bmatrix} j1.25 & j1.25 \\ j1.25 & j1.50 \end{bmatrix} \begin{array}{c} \textcircled{1} \quad \textcircled{2} \end{array}$$

Fig. 2(a)   Fig. 2(b)   **07**

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Q.2 **(a)** Draw diagram of turbine speed governing system. Derive a mathematical model this system and draw the block diagram for the same. **07**

(b) Compare NR method with GS method of load flow study. Give justification in brief for each point of comparison. **07**

OR

(b) With reference to economic power generation, derive coordination equations in terms of penalty factor and incremental transmission loss. **07**

Q.3 **(a)** Give all the approximations used in approximate load flow solution method. Derive the modified Static Load Flow Equations (SLFE) from the basic SLFE and hence explain how load flow solution is obtained with the approximate load flow solution method. **07**

(b) Enlist various techniques for improving transient stability of power system. Explain any three in detail. **07**

OR

Q.3 **(a)** A plant has two generators supplying the plant bus, and neither is to operate below 20 MW or above 125 MW. Incremental costs of the two units are: **07**

$$\frac{dC_1}{dP_{G1}} = 0.15P_{G1} + 18 \ Rs./MWh \qquad \frac{dC_2}{dP_{G2}} = 0.20P_{G2} + 15 \ Rs./MWh$$

Find the load shared by each plant and for economic dispatch, the plant cost of the received power in Rs./MWh when $P_{G1} + P_{G2}$ equals: a) 40 MW   b) 100 MW

(b) Explain cascade tripping and network islanding in an interconnected power system network. **07**

Q.4 **(a)** A 2 pole, 50 Hz, 11 kV turbo-generator has a rating of 75 MW with power factor 0.85 lagging. Its rotor has a moment of inertia of 10000 kg-m^2. Calculate its inertia constant in MJ/MVA and its momentum in MJ-sec/electrical degree. **07**

(b) Discuss the step by step method of solution of swing equation. **07**

OR

Q.4 **(a)** A 50 Hz ,4 pole turbo alternator rated 100 MVA ,11 KV has an inertia constant of 8 MJ/MVA, determine: **07**

a) The energy stored in the rotor at synchronous speed.

b) The rotor acceleration if the mechanical input is suddenly increased to 80 MW for an electric load of 50 MW (neglect electrical and mechanical losses).

(b) Explain Equal Area Stability Criterion in detail. **07**

Q.5 **(a)** Explain the power system load flow solution using Gauss-Siedel method, clearly explaining with necessary equations, how solution for bus voltages is obtained for PQ and PV buses. Explain, during a given iteration, when a PV bus is changed to PQ bus and why. Also explain why it is necessary to apply voltage magnitude correction in case of PV buses. **07**

(b) Explain various advantages of interconnection of power system. **07**

OR

Q.5 **(a)** Explain the Fast Decoupled load flow method with necessary assumptions. **07**

(b) Explain flat frequency control and selective frequency control methods of load frequency control in power system. **07**

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