Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER– VI (NEW) EXAMINATION – WINTER 2021**

**Subject Code:3160920 Date:04/12/2021**

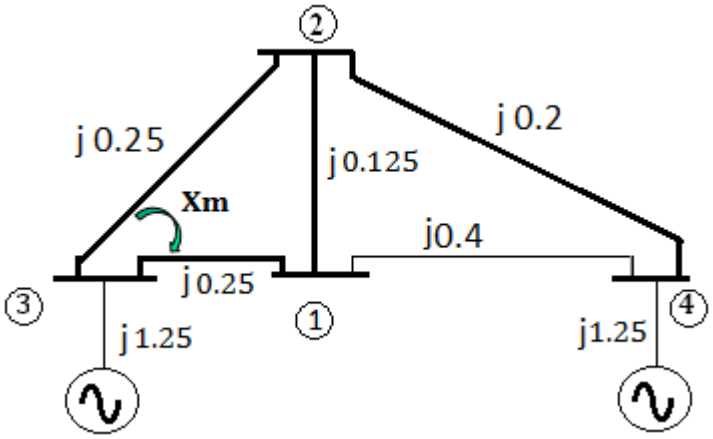
**Subject Name:Inter Connected Power System**

**Time:10:30 AM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | Marks |
|---|---|---|---|
| **Q.1** | **(a)** | What is power system islanding? Why it is needed? | **03** |
| | **(b)** | Derive the Static power flow equations and also discuss the types of buses. | **04** |
| | **(c)** | Formulate $Y_{BUS}$ using singular transformation Method for given network (line 1-3and 2-3 are mutually coupled and $\mathbf{X_m = j\ 0.2}$) | **07** |




| | | | |
|---|---|---|---|
| **Q.2** | **(a)** | What do you mean by Infinite bus with reference to power system? | **03** |
| | **(b)** | Write a short note on load dispatch Centre. | **04** |
| | **(c)** | Explain the Fast Decoupled load flow method with necessary assumptions | **07** |
| | | **OR** | |
| | **(c)** | Discuss the $Z_{bus}$ building algorithm. | **07** |
| **Q.3** | **(a)** | Discuss the steady state stability defining synchronizing power coefficient. | **03** |
| | **(b)** | Discuss the equal area criterion considering specific case in brief. | **04** |
| | **(c)** | | **07** |

| Bus to Bus | 1-2 | 1-3 | 2-3 | 2-4 | 3-4 |
|---|---|---|---|---|---|
| G(pu) | 2 | 1 | 1.5 | 1 | 2 |
| B(pu) | -j8 | -j4 | -j6.5 | -j4 | -j8 |

| Bus & Type | | $P_{gen}$ | $Q_{gen}$ | $P_{dem}$ | $Q_{dem}$ | Bus Voltage |
|---|---|---|---|---|---|---|
| 1 | Slack | ? | ? | 0 | 0 | 1.04 |
| 2 | PQ | 0 | 0 | 0.5 | 0.2 | ? |
| 3 | PQ | 0 | 0 | 0.4 | 0.3 | ? |
| 4 | PQ | 0 | 0 | 0.3 | 0.1 | ? |

For a given power system data obtain voltages at bus no 2, 3 and 4 using Gauss – Seidal method

**OR**

**Q.3** **(a)** What do you mean by primitive network? **03**

**(b)** Derive the equation describing the rotor dynamics. **04**

**(c)** A 200 MVA, 11kV, 50 Hz, 4 pole turbo generator has an inertia constant of 6 - MJ/MVA. 1) Find the stored energy in the rotor at synchronous speed 2) machine operating at load of 120 MW and the load suddenly increases to 160 MW. Find the rotor retardation Neglecting losses. 3) If the retardation is maintained for 5 cycles, find the change in power angle and rotor speed in rpm at the end of the period. **07**

**Q.4** **(a)** Define critical clearing angle and critical clearing time **03**

**(b)** Compare GS and NR method of load flow. **04**

**(c)** Discuss the procedure of solving swing equation using point by point method. **07**

**OR**

**Q.4** **(a)** What you mean by cascade tripping **03**

**(b)** Write short note on unit commitment. **04**

**(c)** With the help of a neat diagram explain turbine speed governing system. **07**

**Q.5** **(a)** Describe the methods of voltage control adopted for large size power system in brief. **03**

**(b)** Explain the terms 1) Incremental fuel cost 2) Penalty factor **04**

**(c)** Incremental fuel costs in dollars per megawatthour for a plant consisting of two units are given by **07**

$$\lambda_1 = \frac{dC_1}{dP_1} = 0.008 * P_1 + 8 \quad , \quad \lambda_2 = \frac{dC_2}{dP_2} = 0.0096 * P_2 + 6.4$$

Assume that both units are operating at all times, that total load varies from 250 MW to 1250 MW, and that maximum and minimum loads on each unit are to be 625 and 100 MW , respectively. Fins the Incremental fuel cost of the plant and the allocation of load between units for the minimum cost of various total loads.

**OR**

**Q.5** **(a)** What is cascade tripping? **03**

**(b)** Explain tie line load bias method of frequency control in brief. **04**

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

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022**

**Subject Code:3160920 Date:10/06/2022**

**Subject Name:Inter Connected Power System**

**Time:10:30 AM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | **MARKS** |
|---|---|---|---|
| **Q.1** | **(a)** | What is Islanding? Elaborate the need of Islanding | **03** |
| | **(b)** | Discuss the main functions of Load Dispatch Centre and its grid arrangement. | **04** |
| | **(c)** | Form Y bus using data given in figure-1. Impedance of transmission line connected between two buses is shown in figure-1. | **07** |
| **Q.2** | **(a)** | Derive (i) Elements of Primitive Matrix and (ii) size of incidence matrix using figure-1. | **03** |
| | **(b)** | List out the methods used for formation of Ybus. Derive the equation of Ybus using singular transformation method. | **04** |
| | **(c)** | The governor speed regulation of Gen-1 and Gen-2 is of the order of 6.0 and 5.0 percent from no-load to full-load, respectively. The generation capacity of Gen-1 and Gen-2 is 250 MW and 350 MW, respectively. They are operating in parallel and share a load of 600 MW. Assuming free governor action and no-load operating frequency of generator is 50 Hz. determine the load shared by each unit. | **07** |
| | | **OR** | |
| | **(c)** | List out the methods of Load Frequency Control and discuss (i) Selective Frequency Control and (ii) Tie Line Load Bias Control | **07** |
| **Q.3** | **(a)** | Discuss the need of load flow study and discuss importance of slack bus in load flow study. | **03** |
| | **(b)** | Derive the static load equations for active and reactive power | **04** |
| | **(c)** | Elaborate flow chart for load flow study using Newton-Rapson method. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | List out the assumptions which are made to carry out approximate load flow study | **03** |
| | **(b)** | Discuss Bus classification for load flow study and mention specified quantities and quantities to be obtained on each of them. | **04** |
| | **(c)** | Discuss the comparison of Decoupled Load Flow method & Fast Decoupled Load Flow Method with Newton-Rapson Load Flow Method | **07** |
| **Q.4** | **(a)** | Discuss Incremental Rate curve | **03** |
| | **(b)** | Discuss Penalty factor | **04** |
| | **(c)** | A power system network consist of two plant is shown in Figure-2. The load is connected only at Bus-2. In this case, it is observed that 100 MW power flows from plant-1 to plant-2 which causes 10 MW power loss in transmission. The incremental costs of plants are given below<br>dC1/dP1=0.2P1+22<br>dC2/dP2=0.15P1+19<br>Calculate the economic loading of plant 1 and 2 when λ (Lamda)=49. Also | **07** |

calculate transmission line total load demand.

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Discuss Incremental Rate Curve | **03** |
| | **(b)** | Discuss Optimal operation by co-ordination equation. | **04** |
| | **(c)** | Derive equation for transmission loss formula | **07** |
| **Q.5** | **(a)** | List out methods used to improve transient stability and elaborate (i) Single pole Switching (ii) Breaking resistors. | **03** |
| | **(b)** | The value of inertia constant for 500 MVA and 900 MVA synchronous machine is of the order of (H1) 5.0 MJ/MVA and (H2) 3.0 MJ/MVA, respectively. Both of these units are operated in parallel with each other. Determine the equivalent inertia constant (H) for two considering 100 MVA base. | **04** |
| | **(c)** | Discuss the application of Equal Area Criteria in brief and elaborate critical clearing angle and critical clearing time | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Discuss the factors affecting steady state stability. | **03** |
| | **(b)** | Compare steady state stability with transient stability | **04** |
| | **(c)** | Discuss numerical solution of swing equation | **07** |

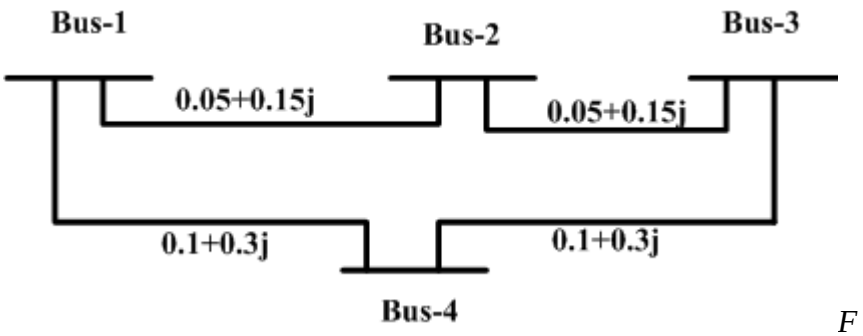


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**Figure-1**

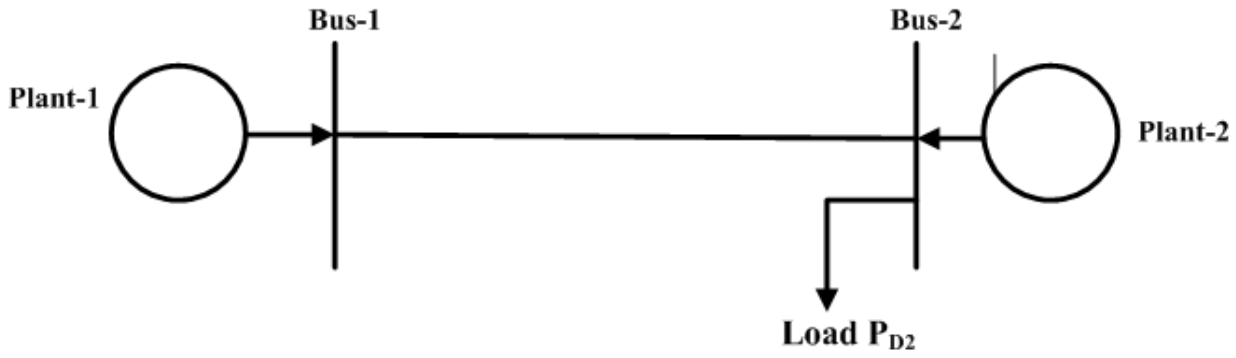


**Figure-2**