Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3160920 Date:14-07-2023

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)**	In a 99 bus power system a new line is being added (with series admittance Y and shunt half line charging susceptances Y_0) between the buses 44 and 87. Give the expressions for calculating new Y bus matrix from the original Y bus matrix.	**03**
	(b)	In a 100 bus power system, there are 10 generators and rest are load bus. While solving for NRLF (polar) method, following dimensions of jacobian submatrices derived: J1= (99 x 99) J2= (99 x 90) J1= (90 x 99) J2= (89 x 89) Will problem solution converge or diverge? Explain.	**04**
	(c)	For the power system network shown in **fig. 1**, determine admittance matrix by singular transformation method	**07**

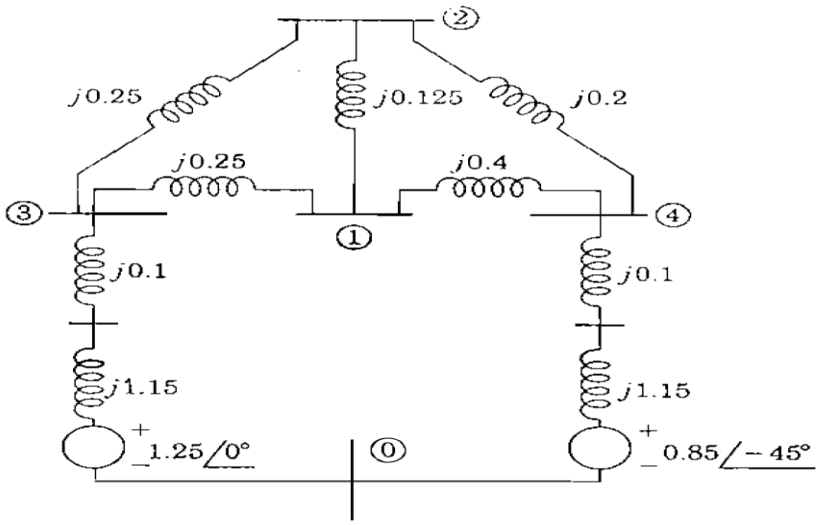

Fig. 1

Q.2	**(a)**	What is meant by interconnected power system? State its advantages.	**03**
	(b)	Breifely explain hierarchy of load dispatch centres of Indian national grid. Also discuss functions of load dispatch centres.	**04**
	(c)	For the power system shown in fig. 2, write down power flow equations in polar form.	**07**

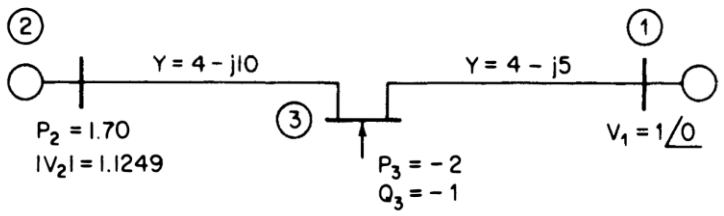

Fig.2

All values are given in p.u. [PTO]

OR

Q.2	**(c)**	Write down algorithm and draw flowchart for N-R method of load flow considering presence of PV bus in the system.	**07**
Q.3	**(a)**	Distinguish between steady state, transient and dynamic stability.	**03**
	(b)	A 100 MVA, 50 Hz alternator is operating at rated speed. The H constant of the machine is 5 kW · sec per kVA. The load suddenly increase by 50 MW. Due to delay in governor action there is a delay of 0.6 seconds in opening of steam valve. Find the frequency deviation.	**04**
	(c)	A synchronous machine is connected to an infinite bus through a transformer and transmission line. A 3-Φ fault occurs near the generator terminals which reduces the power transfer to zero. After some time the fault is cleared and original conditions are regained. Derive the expression for critical clearing angle and critical clearing time.	**07**

OR

Q.3	**(a)**	Discuss the effect of neutral grounding on the stability of power system.	**03**
	(b)	A 200 MVA 11 kV 50 Hz 4 pole generator has an intertia constant of 6 MJ/MVA. (a) Find the store energy in the rotor at synchronous speed. (b) The machine is operating at a load of 120 MW when the load is suddenly increases to 160 MV. Find the rotor retardation. Neglect losses. (c) Another generator 150 MVA, 3000 rpm, having H = 4 MJ/MVA is put in parallel with the above generator. Find the inertia constant for the equivalent generator on a base of 100 MVA.	**04**
	(c)	Discuss the dynamics of synchronous machine and hence derive the swing equation.	**07**
Q.4	**(a)**	Draw and describe significance of heat hate rate curve and incremental fuel rate curve.	**03**
	(b)	What do you understand by Unit Commitment?	**04**
	(c)	Derive the transmission loss formula explaining current distribution factors. Clearly state all assumptions made in above derivation.	**07**

OR

Q.4	**(a)**	Explain β-coefficient.	**03**
	(b)	Write basic criterion for economic division of load between units within a plant.	**04**
	(c)	What is incremental fuel cost? Give the steps for finding optimal loading of generators for system having N no. of generators in a plant.	**07**
Q.5	**(a)**	Discuss the factors affecting steady state stability.	**03**
	(b)	Discuss various methods of voltage contrel applied to the power system.	**04**
	(c)	List out the methods of Load Frequency Control and discuss (i) Selective Frequency Control and (ii) Tie Line Load Bias Control	**07**

OR

Q.5	**(a)**	Define critical clearing angle and critical clearing time	**03**
	(b)	How shunt compensation is differ from series compensation in voltage control?	**04**
	(c)	With the help of a neat diagram explain turbine speed governing system.	**07**