Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3150911 Date:31-05-2024

Subject Name: Power System- II

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARK
Q.1	**(a)**	Explain advantages of per unit system for power system calculations.	**03**
	(b)	Following three generators are connected in parallel. Generator G1 = 10 MVA, 10 kV, X" = 10%; Generator G2 = 12 MVA, 10.6 kV, X" = 15%; Generator G3 = 15 MVA, 12 kV, X" = 20%. Find the overall equivalent per unit reactance of these the system considering 20 MVA, 11 kV system base.	**04**
	(c)	Three loads are connected in parallel across a 1400 V rms, 60 Hz single phase supply as follows: Load 1: Inductive load, 125 kVA at 0.28 power factor Load 2: Capacitive load, 10 kW and 40 kvar Load 3: Resistive load of 15 kW. (i) Find the total kW, kvar,, kVA and the supply power factor (ii) Determine the kvar rating of a capacitor (of negligible resistance) and capacitance in μF to improve the power factor to 0.8 lagging. (iii) Find the reduction in current after PF improvement.	**07**
Q.2	**(a)**	Why synchronous compensators can supply leading as well as lagging vars?	**03**
	(b)	Discuss why equivalent π of a long line is preferred to the equivalent T circuit.	**04**
	(c)	What is a receiving end power circle diagram? How can it be drawn? What information does it provide?	**07**
		OR	
	(c)	What is nominal circuit? Find ABCD constants for nominal π and nominal T circuits of a transmission line?	**07**
Q.3	**(a)**	What is meant by doubling effect? Explain in brief.	**03**
	(b)	List various types of faults and write the relative frequency of occurrence of various types of faults.	**04**
	(c)	A 4 bus network given in Fig. 1 with following positive, negative and zero sequence reactances: G1 : X_0 = 0.06 pu; X_1=X_2 = 0.2 pu G2: X_0 = 0.05 pu; X_1=X_2 = 0.3 pu T1 & T2 : X_0 = X_1=X_2 = 0.2 pu Transmission line: X_0 = 0.08 pu; X_1=X_2 = 0.1 pu G1 and G2 neutral ground reactance = 0.3 pu A fault occurs at bus 4 phase R. Draw sequence impedance diagram and find the fault current in p. u.	**07**

[PTO]

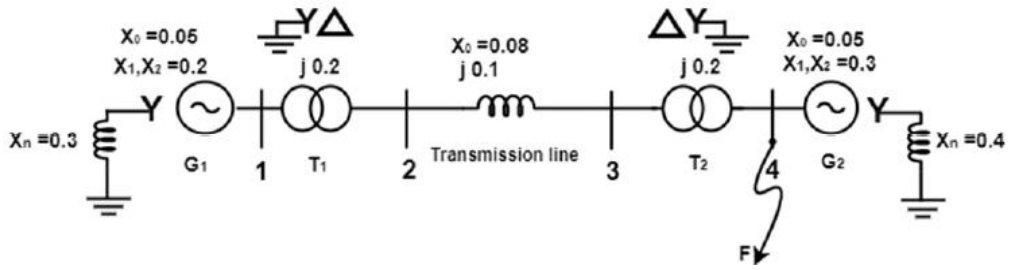

Fig. 1

OR

Q.3	**(a)**	Why are we interested in computation of sub-transient current rather than steady sustained short-circuit current?	**03**
	(b)	The Line currents in amperes in phases a, b, c respectively are 500 + j150, 100 – j600 and -300 + j600 referred to the same reference vector. Find the symmetrical components of currents?	**04**
	(c)	What is bus impedance matrix? Explain the method of fault calculation using bus impedance matrix.	**07**
Q.4	**(a)**	What is the reason for transients during short circuit?	**03**
	(b)	Prove that positive sequence and negative sequence impedance of fully transposed transmission line are always equal.	**04**
	(c)	Using appropriate interconnection of sequence networks, derive the equation for a line to line fault in a power system with faults impedance of Z_f.	**07**

OR

Q.4	**(a)**	What are symmetrical components and its need?	**03**
	(b)	Explain in brief phase shift of symmetrical components in Y-Δ transformer banks.	**04**
	(c)	Draw the waveforms for fault current for a 3-phase fault on alternator terminals. Explain the sub-transient, transient and steady state reactance. What is their significance in fault calculations?	**07**
Q.5	**(a)**	Explain methods to reduce corona loss in brief.	**03**
	(b)	Why the disruptive critical voltage is less than visual critical voltage.	**04**
	(c)	Discuss the phenomenon of wave reflection and refraction. Derive expression for reflection and refraction.	**07**

OR

Q.5	**(a)**	Explain the phenomena of corona.	**03**
	(b)	State factors affecting corona loss and discuss in brief.	**04**
	(c)	Find the critical disruptive voltage and critical voltages for local and general corona on a 3-phase overhead transmission line, consisting of three stranded copper conductors spaced 2.5 m apart at the corners of an equilateral triangle. Air temperature and pressure are 21^0 C and 73 cm Hg respectively. The conductor diameter, irregularity factor and surface factor are 10.4 mm, 0.85, 0.7 and 0.8 respectively.	**07**

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