Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3150911 **Date: 06/06/2026**

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.**

Q.1	**(a)**	What is pu system ? discuss its advantages	**03**
	(b)	Discuss power in single phase AC circuits	**04**
	(c)	Derive expression for sending end voltage and current for long transmission line using rigorous method	**07**
Q.2	**(a)**	Discuss Ferranti Effect	**03**
	(b)	Two single phase loads having $Z_1 = 50 + j\ 40$ and $Z_2 = 80 - j\ 30$ connected in paralle and this combination sypplied from source 200V , AC. Calculate current drawn and comlex power drawn by the load.	**04**
	(c)	Evaluate the generalized circuit constants for medium transmissions line — nominal T method	**07**
		OR	
Q.2	**(c)**	Explain Nominal T and Nominal $\prod$ method for analysis of medium transmission line	**07**
Q.3	**(a)**	What are the symmetrical components ? Explain in brief.	**03**
	(b)	Write a short note on selection of circuit breaker.	**04**
	(c)	Explain the zero sequence impedance diagram of transformer for various connection	**07**
		OR	
Q.3	**(a)**	Show how Z_{bus} gets modified when branch Z_b is added from new bus to old bus.	**03**
	(b)	Explain in detail sub transient , transient and steady sate reactance.	**04**
	(c)	Discuss the types of Fault ? derive single line to ground fault.	**07**
Q.4	**(a)**	Explain in brief surge absorber.	**03**
	(b)	What is insulation coordination ? define and explain in brief BIL.	**04**
	(c)	Using appropriate connection of sequence networks , derive the equation for line to line fault in power system.	**07**
		OR	
Q.4	**(a)**	What is a significance of zero sequence network ?	**03**
	(b)	Explain the phase shift in star delta transformer	**04**
	(c)	What is harmful effect of lightning on a power system ? discuss the different types of lightning strokes ?	**07**

Q.5 **(a)** Write short note on Arcing Ground Effect **03**

(b) Explain factors affecting the corona. **04**

(c) Explain Reflection and Refraction of Travelling waves at a T-junction on transmission lines. **07**

OR

Q.5 **(a)** Explain the following terms with reference to corona : **03**
(i) Critical disruptive voltage
(ii) Visual critical voltage
(iii) Power loss due to corona

(b) Discuss the causes of overvoltage. **04**

(c) What is lightning ? Describe the mechanism of lightning discharge. **07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3150911 Date:28-05-2025

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.**

			Marks
Q.1	**(a)**	What is the per-unit system? Give the advantages of the per-unit system.	**03**
	(b)	What is the balanced three-phase power? Prove that under balance conditions, the sum of phasors is zero.	**04**
	(c)	A 3-phase, 11kV, 15 km length, transmission line supplying a load of 850 kW at 0.8 power factor lagging, has resistance (R)= 0.45 Ω/km and reactance (X) = 0.60 Ω/km. Calculate, (i) the line current, (ii) receiving end voltage, (iii) voltage regulation, and (iv) the efficiency of power transmission.	**07**
Q.2	**(a)**	Explain in detail the sub-transient, transient, and steady-state reactance by drawing a proper transient wave.	**03**
	(b)	Obtain the equivalent circuit of the medium transmission line using nominal-π (PI) representation.	**04**
	(c)	Explain the working of a synchronous generator connected to an infinite bus. Draw equivalent circuit and phasor diagram.	**07**
		OR	
	(c)	A 275kV transmission line has the following line constants: $A = 0.85\angle 5°$, $B = 200\angle 75°$ Determine the power at unity power factor that can be received, if the voltage profile at each end will be maintained at 275 kV.	**07**
Q.3	**(a)**	What is fault? Classify various types of fault conditions of power system. Give the significance of the fault impedance.	**03**
	(b)	Explain salient pole synchronous generator with power angle curve in short.	**04**
	(c)	Give the analysis of double line to ground fault considering the effect of fault impedance.	**07**
		OR	
Q.3	**(a)**	Show that symmetrical component transformation is power invariant.	**03**
	(b)	Derive the necessary equations to obtain symmetrical components from the phase quantities.	**04**
	(c)	Explain the zero-sequence impedance of the transformer for various connections.	**07**
Q.4	**(a)**	What is insulation coordination? Define and explain BIL.	**03**
	(b)	Explain in brief the different methods of voltage control employed in power systems.	**04**
	(c)	Explain types of lightning strokes.	**07**

OR

Q.4	**(a)**	Justify, that for a fault at alternator terminals, a single line-to-ground fault is generally more severe than a three-phase fault.	**03**
	(b)	Explain various factors affecting Corona effect of the transmission line.	**04**
	(c)	Find the critical disruptive voltage and corona loss for a 3-phase line that is operating at 220 kV, 50 Hz frequency. The line has a conductor of 1.5 cm diameter arranged in a 3-meter delta connection. Assume air density of 1.05 and dielectric strength of air to be 21.1 kV/cm.	**07**
Q.5	**(a)**	Define surge impedance and explain the surge impedance loading of the transmission line.	**03**
	(b)	Explain any two causes which are producing transients on a transmission line.	**04**
	(c)	Write a note on the following: (1) Lightning Arresters (2) Surge absorber	**07**

OR

Q.5	**(a)**	Write a brief note on capacitance switching.	**03**
	(b)	Define the following terms (i) transient (ii) restriking (iii) recovery voltage.	**04**
	(c)	Explain in brief the traveling waves of the transmission line when the receiving end is short-circuited.	**07**

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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]

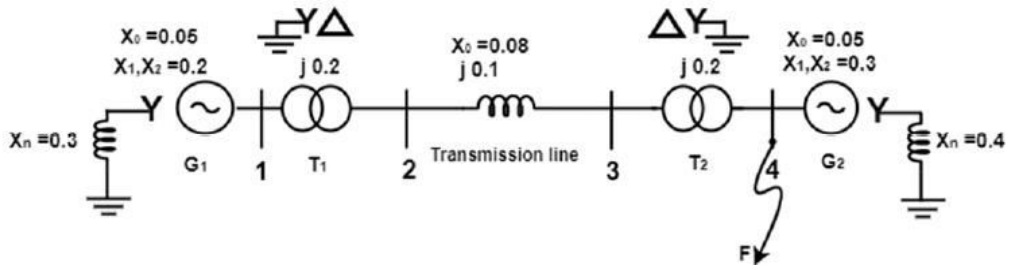


Fig. 1

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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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3150911 Date: 03/07/2023

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.**

			MARKS
Q.1	**(a)**	How capacitance present between the line and ground is taken into account while modelling medium length transmission line?	**03**
	(b)	An overhead 3-φ short transmission line delivers 5000 kW at 22 kV at 0.8 pf lagging. The resistance and reactance of each conductor is 4Ω and 6Ω respectively. Determine (i) the sending end voltage (ii) percentage regulation	**04**
	(c)	Prove that per-unit impedance of a transformer is same whether it is computed from primary or secondary side	**07**
Q.2	**(a)**	Distinguish between symmetrical and unsymmetrical faults giving appropriate examples	**03**
	(b)	In a 3-φ, 4-wire system, the currents in phase A,B and C under abnormal loading conditions are given by Ia = $100\underline{/30^0}$ A, Ib = $50\underline{/300^0}$ A, Ic = $30\underline{/180^0}$ A. Calculate the positive and zero sequence currents Ia1, Ia0 and return current in the neutral wire.	**04**
	(c)	Using rigorous solution method, derive the expression for ABCD constants of a long transmission line in terms of hyperbolic sine and cosine terms	**07**
		OR	
	(c)	Prove that travelling wave on a transmission line travels at the speed of light. What would be the velocity of a surge, travelling in cable having relative permittivity of 5?	**07**
Q.3	**(a)**	Show that symmetrical component transformation is power invariant	**03**
	(b)	Discuss the criteria for selection of circuit breakers	**04**
	(c)	A 100 MVA, 33 kV, 3-φ generator has a reactance of 15%. The generator is connected to the motors through a transformer and transmission line as shown in figure 1. Motors have rated inputs of 40 MVA, 30 MVA and 20 MVA with 20% reactance each. Draw the per-unit reactance diagram. Assume a base of 100 MVA and 33 kV in generator circuit.	**07**

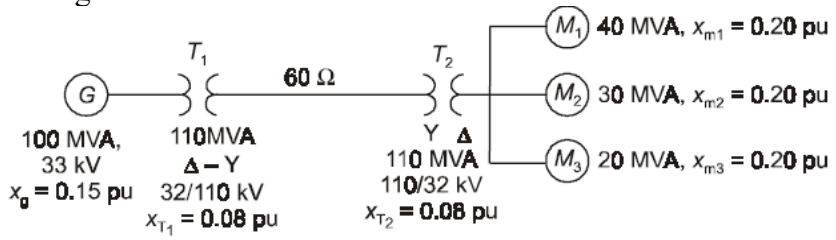


Figure-1

OR

Q.3	**(a)**	Explain Ferranti effect	**03**
	(b)	Draw and discuss the operating chart of a synchronous generator	**04**
	(c)	Show how Zbus matrix gets modified when branch Zb is added from new bus to old bus (type-2 modification), and when Zb connects old bus to reference bus (type-3 modification)	**07**
Q.4	**(a)**	Draw the zero sequence reactance diagram of transformers having the following connections (i) delta-delta (ii) star-delta with star side grounded	**03**
	(b)	A 3-φ short transmission line has a resistance of 5Ω per phase and inductive reactance of 15Ω per phase. If the sending end and receiving end voltage are 140 kV and 132 kV respectively, find the horizontal and vertical co-ordinate of the receiving end power circle diagram (i.e. centre of the circle) in MW and MVAR	**04**
	(c)	Derive the expression for fault current for a double line to ground fault at the generator terminals. Also discuss how sequence networks are connected for L-L-G fault.	**07**
		OR	
Q.4	**(a)**	Explain corona phenomena in transmission lines	**03**
	(b)	Determine the disruptive critical voltage and corona loss for a 3-phase line operating at 110 kV which has conductor of 1.25 cm diameter arranged in a 3.05 meter delta. Assume air density factor of 1.07 and dielectric strength of the air to be 21 kV/cm	**04**
	(c)	A 25 MVA, 11 kV generator has X''d = 0.2 pu. Its negative and zero sequence reactances are 0.3 and 0.1 pu respectively. The neutral of the generator is solidly grounded. Determine the subtransient current in the generator and the line to line voltages for subtransient conditions when an L-G fault occurs at the generator terminals. Assume that generator is operating on no-load before the fault occurs	**07**
Q.5	**(a)**	A wave travels over a line and enters the cable. The surge impedance of overhead line and cable are 400Ω and 40Ω. Find the value of refracted voltage wave as percentage of incident voltage wave	**03**
	(b)	Explain in brief the different methods of voltage control employed in power systems	**04**
	(c)	Explain the phenomena of arcing grounds in an isolated neutral systems. Discuss why it can cause severe overvoltages in a power system.	**07**
		OR	
Q.5	**(a)**	A 500 kV, 2μS rectangular surge on a line having a surge impedance of 350Ω approaches a station at which the concentrated earth capacitance is 3000 pF. Determine the maximum value transmitted wave	**03**
	(b)	Derive the expression for refracted voltage wave due to a surge travelling at T-junction	**04**
	(c)	Discuss the different types of lightning strokes and their harmful effects on power system	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150911 Date:09/06/2022

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.**

Q.1	**(a)**	What is p.u. system? Give the advantages of p.u. system	**03**
	(b)	Explain power in single phase AC circuits briefly	**04**
	(c)	Explain rigorous solution of long transmission line	**07**
Q.2	**(a)**	Write a short note on Ferranti effect.	**03**
	(b)	Show that symmetrical component transformation is power invariant.	**04**
	(c)	Explain working of a synchronous generator connected to infinite bus. Draw equivalent circuit and phasor diagram.	**07**
		OR	
	(c)	Derive equations of power flow through a transmission line.	**07**
Q.3	**(a)**	Explain classification of transmission lines. Define voltage regulation and efficiency of a transmission line.	**03**
	(b)	What is receiving end power circle diagram? Write down steps to draw it.	**04**
	(c)	Explain phase shift in star-delta transformer with phasor diagram.	**07**
		OR	
Q.3	**(a)**	Explain ABCD constant for medium transmission line.	**03**
	(b)	Explain salient pole synchronous generator with power angle curve in short.	**04**
	(c)	Discuss transients on a transmission line in case of a symmetrical fault.	**07**
Q.4	**(a)**	Differentiate symmetrical and unsymmetrical faults. List various unsymmetrical faults.	**03**
	(b)	Explain analysis of a line to line fault.	**04**
	(c)	Explain types of lightning strokes.	**07**
		OR	
Q.4	**(a)**	What is corona? Write formula of Disruptive critical voltage and briefly describe each variable in the formula.	**03**
	(b)	Write a short note on selection of circuit breaker.	**04**
	(c)	Derive all components of V and I for double line to ground fault on an unloaded generator with sequence network. (consider 3-phase star connected generator with ground neutral)	**07**
Q.5	**(a)**	Write a short note on radio interference.	**03**
	(b)	Explain overvoltage due to arcing ground with necessary vector diagram.	**04**
	(c)	Write a note on following: (1) Lightning Arresters (2) Surge absorber	**07**
		OR	
Q.5	**(a)**	Write a brief note on capacitance switching.	**03**

(b) Explain reflection and refraction at a T-junction for travelling wave with necessary equation. **04**

(c) Derive the equation for attenuation of travelling waves **07**

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