Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150911 Date:29/01/2021

Subject Name:Power System- II

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Explain Types of Transmission Line.	**03**
	(b)	Write a short note on (I) Ferranti effect (II) Tuned power lines	**04**
	(c)	Using Rigorous, Derive expressions for sending end voltage current for long transmission line.	**07**
Q.2	**(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)	A synchronous generator is rated 645 MVA, 24 KV, 0.9 pf lagging. It has a synchronous reactance 1.2 Ω. The generator is feeding full load at 0.9 pf lagging at rated voltage. Calculate: (a) Excitation emf (E_f) and power angle δ (b) Reactive power drawn by the load Carry out calculations in pu form and convert the result to actual values.	**07**
Q.3	**(a)**	Give classification of faults. What is difference between steady state reactance Xd, transient reactance Xd' and sub-transient reactance Xd''?	**03**
	(b)	What is receiving end power circle diagram? Write down steps to draw it.	**04**
	(c)	Explain factors deciding selection of circuit breaker.	**07**
Q.4	**(a)**	Explain the performance of loaded Synchronous Machine.	**03**
	(b)	Why does a generator produce only positive sequence voltage?	**04**
	(c)	A 50 Hz transmission line 300 km long has a total series impedance of 40 + j125 ohms and a total shunt admittance of 10^{-3} mho. The receiving end load is 50MW at 220 KV with 0.8 lagging pf. Find the sending end voltage, current, power and power factor using nominal – π method.	**07**
Q.5	**(a)**	What are symmetrical components and its need?	**03**
	(b)	Write and explain symmetrical component transformation	**04**
	(c)	Using appropriate interconnection of sequence networks, derive the equation for a line to line fault in a power system with fault impedance of Zf.	**07**
Q.6	**(a)**	Differentiate symmetrical and unsymmetrical faults. List various unsymmetrical faults.	**03**
	(b)	Write equation of phase voltage in terms of symmetrical components	**04**
	(c)	Explain sequence impedances and networks of synchronous machine.	**07**

Q.7	**(a)**	Explain the phenomena of corona	**03**
	(b)	Explain overvoltage due to arcing ground with necessary vector diagram.	**04**
	(c)	Derive the equation for attenuation of travelling waves	**07**
Q.8	**(a)**	Write a brief note on capacitance switching.	**03**
	(b)	Give reasons for following: The disruptive critical voltage is less than visual critical voltage.	**04**
	(c)	Explain travelling waves of a 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 – WINTER 2021

Subject Code:3150911 Date:23/12/2021

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)**	Write a short note on Ferranti effect.	**03**
	(b)	Two single phase loads having impedances $Z_1 = 100 + j80\ \Omega$ and $Z_2 = 150 - j60\ \Omega$ are connected in parallel and this parallel combination is supplied from a source of 200 V a.c. Calculate: (1) Complex power drawn by each load (2) Overall power factor of the combination as viewed from the source.	**04**
	(c)	Explain working of a synchronous generator connected to infinite bus. Draw equivalent circuit and phasor diagram.	**07**
Q.2	**(a)**	Explain classification of transmission lines. Define voltage regulation and efficiency of a transmission line.	**03**
	(b)	A balanced three phase load of 30 MW, 0.85 p.f. lagging is supplied at 132 kV, 50 Hz by overhead transmission line. The series impedance and shunt admittance of the line are $(20 + j52)$ ohm and $j3.15 \times 10^{-4}$ siemen. Using nominal-T method, determine, (i) ABCD constants of the line (ii) Sending end voltage	**04**
	(c)	Derive equations of power flow through a transmission line.	**07**
		OR	
	(c)	Explain rigorous solution of long transmission line	**07**
Q.3	**(a)**	Show that symmetrical component transformation is power invariant.	**03**
	(b)	Determine symmetrical components of phase-a voltages, $V_a = 200\angle 0^\circ$ V, $V_b = 200\angle 245^\circ$ V and $V_c = 200\angle 105^\circ$ V	**04**
	(c)	Discuss transients on a transmission line in case of a symmetrical fault.	**07**
		OR	
Q.3	**(a)**	Draw equivalent circuits of a synchronous machine during (a) sub-transient state (b) transient state and (c) steady state after occurrence of a three phase fault on its terminals.	**03**
	(b)	Write a short note on selection of circuit breaker.	**04**
	(c)	A delta connected balanced resistive load is connected across an unbalanced three phase supply as shown in fig. (1). The line currents in phase A and B are given as, $I_A = 10\angle 30^\circ$ A and $I_B = 15\angle -60^\circ$ A. Find the symmetrical components of line current I_A and delta current I_{AB}.	**07**

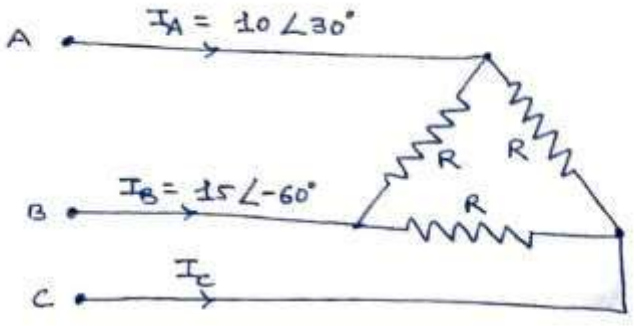

Fig. (1)

Q.4 **(a)** Draw zero sequence network of a three phase transformer with **03**
(1) Star-Star connection with both neutrals grounded
(2) Star delta connection with star side neutral grounded

(b) A 3-phase, 11 kV, 10 MVA synchronous generator has sequence reactances of $X_0 = 0.05$ p.u., $X_1 = X_2 = 0.15$ p.u., . Assuming that the generator is initially operating at no load, calculate the magnitude of fault current in case of an L-G fault at generator terminals. **04**

(c) Fig.(2) shows a power system network. The system data is given in the table below. **07**

Equipment	MVA Rating	Voltage Rating	X_1, p.u.	X_2, p.u.	X_0, p.u.
Gen-1	100	11 kV	0.25	0.25	0.05
Gen-2	100	11 kV	0.2	0.2	0.05
Transformer-T1	100	11/220 kV	0.06	0.06	0.06
Transformer-T1	100	11/220 kV	0.07	0.07	0.07
Line	100	220 kV	0.1	0.1	0.3

Neutral point of generator-2 is grounded through a reactance of 0.03 p.u. on generator base values.
A single line to ground fault occurs at bus-2 of the network. Find the fault current.

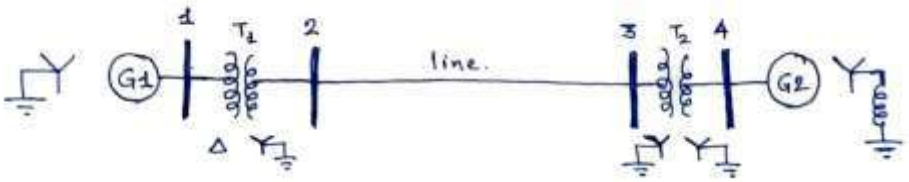

Fig. (2)

OR

Q.4 **(a)** A power system network is shown in the single line diagram of fig. (3). Draw zero sequence network for the system. **03**

Fig. (3)

(b) Explain analysis of a line to line fault. **04**

(c) A 3-phase synchronous generator rated 10 MVA, 11 kV delivers power to a static load through a line. Positive negative and zero sequence impedances of the generator and line are mentioned in the table below. **07**

Equipment	X_1, p.u.	X_2, p.u.	X_0, p.u.
Generator	0.2	0.2	0.05
Line	0.1	0.1	0.3

The load draws 5 MW power at 10 kV at 0.8 p.f. lagging before a line to ground fault takes place at load terminals. Determine the fault current. Assume the generator neutral to be solidly grounded.

Q.5 **(a)** What is corona? Write formula of Disruptive critical voltage and briefly describe each variable in the formula. **03**

(b) What is insulation coordination? Define and explain BIL. **04**

(c) What do you understand by "**Travelling Waves**" on transmission lines? Derive equations showing relationship between voltage and current in a forward wave and a backward wave on a lossless transmission line. **07**

OR

Q.5 **(a)** A 3-phase, 220 kV, 50 Hz transmission line is 250 km long. Calculate the corona loss occurring on the line if the radius of each conductor is 11 mm and Equivalent spacing between conductors is 6 m. It is given that the relative density of air is 0.9456 and disruptive critical voltage is 118 kV per phase. **03**

(b) Discuss recovery transients due to removal of a short circuit. **04**

(c) Explain types of lightning strokes. **07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2021

Subject Code:3150911 Date:05/10/2021

Subject Name:Power System- II

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 per unit system? How are the base quantities selected?	**03**
	(b)	Explain advantages of per unit system for power system calculations.	**04**
	(c)	The power system shown in Fig. 1 has the following specifications: Generator G1 : 20 MVA, 6.6 kV, X_{g1} = 0.1 pu Generator G2 : 25 MVA, 11 kV, X_{g2} = 0.2 pu Transformer T1: 25 MVA, 6.6/132 kV, X_1 = 0.08 pu Transformer T2: 30 MVA, 11/132 kV, X_2 = 0.1 pu Transmission line Z= (30+j120) ohms at 132 kV L-L voltage. Assume base MVA 50 MVA. Draw reactance diagram and obtain pu values of all equipment. Neglect load impedances.	**07**

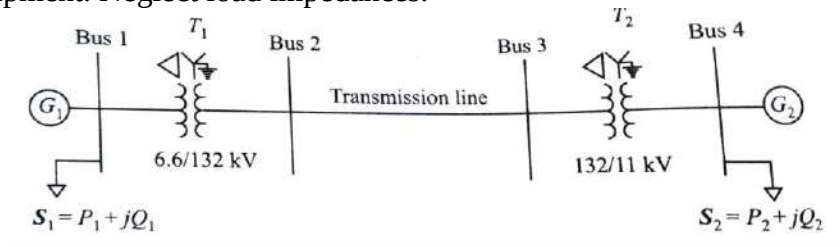

Fig. 1

Q.2	**(a)**	Discuss why equivalent π of a long line is preferred to the equivalent T circuit.	**03**
	(b)	Why synchronous compensators can supply leading as well as lagging vars?	**04**
	(c)	What is nominal circuit? Find ABCD constants for nominal π and nominal T circuits of a transmission line,	**07**
		OR	
	(c)	What is a receiving end power circle diagram? How can it be drawn? What information does it provide?	**07**
Q.3	**(a)**	List various types of faults and write the relative frequency of occurrence of various types of faults.	**03**
	(b)	What is meant by doubling effect? Explain in brief.	**04**
	(c)	What is bus impedance matrix? Explain the method of fault calculation using bus impedance matrix.	**07**
		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? [PTO]	**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.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)	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 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)	A single line to ground fault occurs on phase a of a 30 MVA, 11 kV, star connected three phase generator. The generator is operating on no-load at rated terminal voltage. It has a sub-transient reactance of 0.5 pu and negative and zero sequence reactances of 0.30 pu and 0.08 pu respectively. Assume that the generator neutral is grounded through a reactance of 5 ohms. Calculate the sub-transient fault current and the phase voltages.	**07**
Q.5	**(a)**	Explain methods to reduce corona loss in brief.	**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**
		OR	
Q.5	**(a)**	Explain the phenomena of corona.	**03**
	(b)	Why the disruptive critical voltage is less than visual critical voltage.	**04**
	(c)	Derive the equation for attenuation of travelling waves.	**07**

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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