CBCS SCHEME

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BEE601

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Power System Analysis – I

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define per unit. Show that the per unit impedance of a transformer is same irrespective of the side on which it is calculated.	8	L1	CO1
	b.	The one line diagram of a power system is as shown in Fig.Q1(b). The motors have rated output of 30MVA, 20MVA and 50MVA at 30KV with 20% subtransient reactance each. Selecting generator rating as base, develop the per unit reactance diagram.	12	L3	CO1

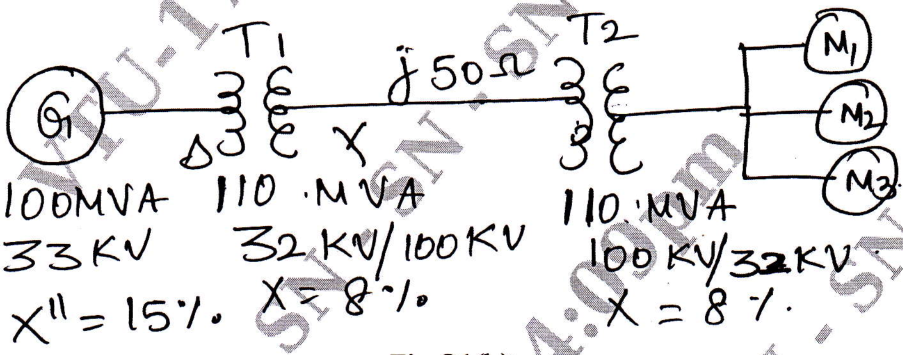
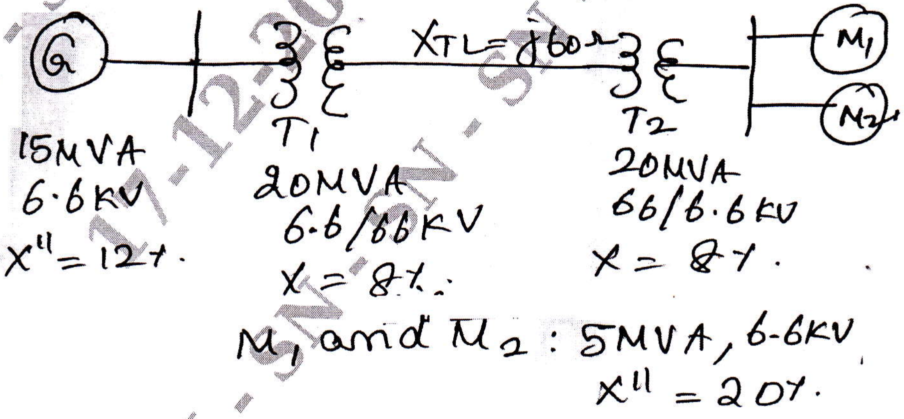


Fig.Q1(b)

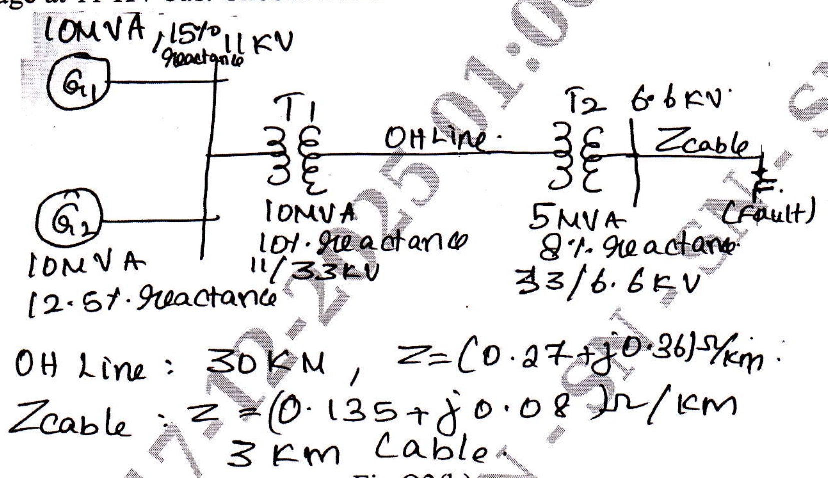
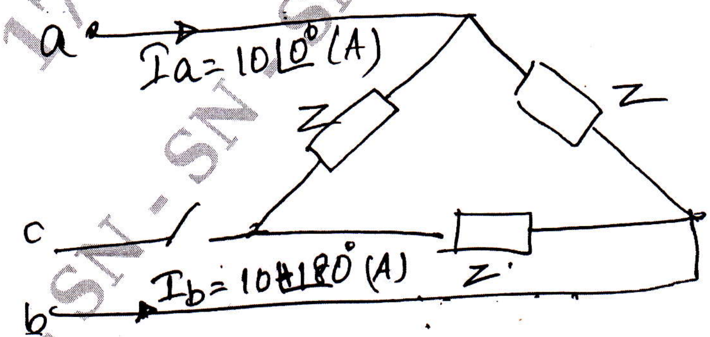
OR

			M	L	C
Q.2	a.	Define impedance and reactance diagram. Explain with the help of typical electrical power system.	8	L2	CO1
	b.	Develop the per unit reactance diagram of the system shown in Fig.Q2(b).	12	L3	CO1



Choose generator as a base.

Fig.Q2(b)

			Marks	Level	CO
		Module – 2			
Q.3	**a.**	With the oscillogram of the short circuit current of synchronous machine, define direct axis synchronous reactance, transient and subtransient reactance.	**8**	**L2**	**CO2**
	b.	For the radial network shown in Fig.Q3(b) when a 3ϕ fault occurs at point F, solve by Thevenin's method to determine fault current and the line voltage at 11 KV bus. Choose 100 MVA 33 KV as base.  Fig.Q3(b)	**12**	**L3**	**CO2**
		OR			
Q.4	**a.**	Explain doubling effect in transmission line substantiate with equations.	**8**	**L2**	**CO2**
	b.	A generator is connected to a synchronous motor through a transformer, on a common base the per unit sub transient reactance of generator and motor are 0.15 and 0.35 respectively. The leakage reactance of the transformer is 0.1 pu. A 3ϕ short circuit fault occurs at the terminals of the motor when terminal voltage of generator is 0.9 pu and output current of the generator is 1 pu at 0.8 pF leading. Develop the sub transient current in the fault, generator and motor.	**12**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Derive an expression for symmetrical components of voltage in terms of phase voltage.	**6**	**L2**	**CO3**
	b.	Derive an expression for complex power in terms of symmetrical components.	**4**	**L2**	**CO3**
	c.	A balanced delta connected load is connected to 3ϕ symmetrical supply. The line currents are each 10A in magnitude. If fuse in one of the lines blows out, determine the sequence components of line currents.  Fig.Q5(c)	**10**	**L4**	**CO3**

OR

Q.6	**a.**	Derive the relation between sequence components of phase and line voltages in star connected systems.	10	L2	CO3
	b.	A 250MVA, 11 KV, 3ϕ generator is connected to a large system through a transformer and a line as shown in Fig.Q6(b). All parameters on 250MVA base. Develop the sequence network diagrams for the system and indicate all per unit values.	10	L3	CO3

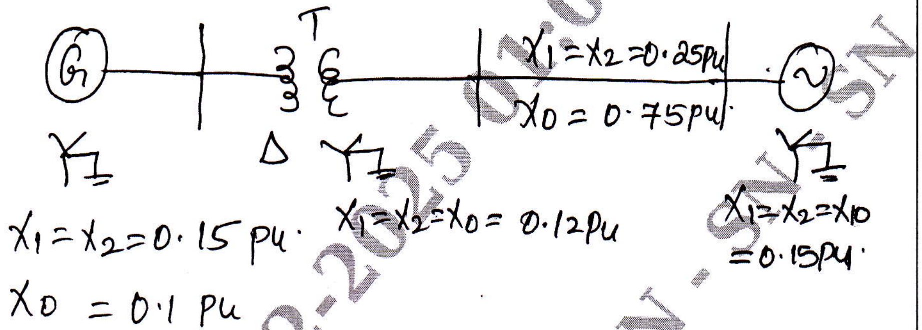


Fig.Q6(b)

Module – 4

Q.7	**a.**	For a double line to ground fault on an unloaded generator, derive the equation for fault current and draw the inter connected sequence network.	8	L2	CO4
	b.	A 3ϕ generator with an open circuit voltage of 400 V is subjected to an LG fault through a fault impedance of j2Ω. Determine the fault current if $Z_1 = j4\Omega$, $Z_2 = j2\Omega$, $Z_D = j1\Omega$. Repeat the problem for LL and LL G fault.	12	L3	CO4
		OR			
Q.8	**a.**	Explain the series types of faults in a power system.	8	L2	CO4
	b.	Determine the fault current when a L – G fault occurs at point F in the Fig.Q8(b).	12	L3	CO4

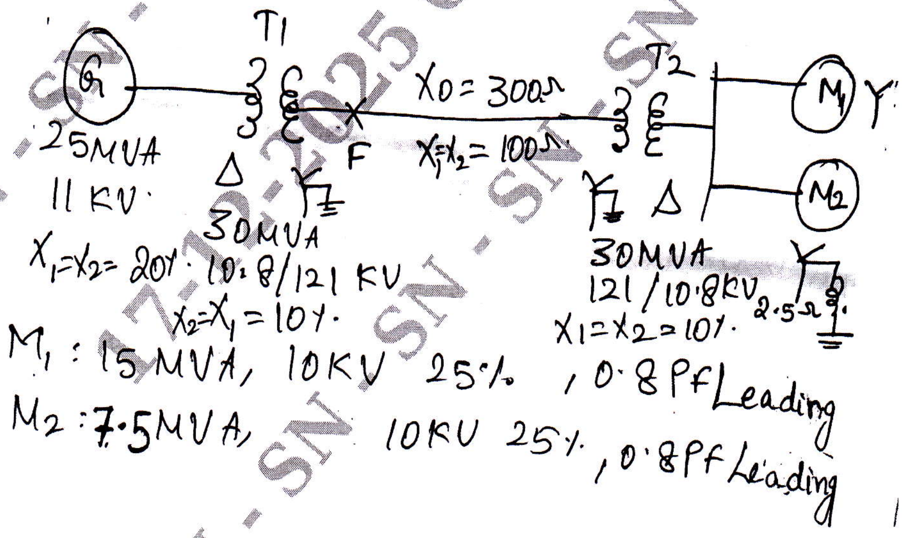


Fig.Q8(b)

		Module – 5			
Q.9	a.	Derive swing equation and also draw the swing curve.	10	L2	CO5
	b.	A 50 Hz, 4 pole turbo generator rated 100 MVA, 11 KV has an inertia constant of 8 MJ/MVA. i) Determine the stored energy ii) If mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find the rotor acceleration iii) If acceleration calculated in (ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in revolutions per minute at the end of the period.	6	L3	CO5
	c.	Two power stations A and B are located close together. Station A has four identical generators each rated 100 MVA, 9 MJ/MVA where as station B has three sets each rated 200 MVA, 4MJ/MVA. Calculate the inertia constant of the equivalent machines of both stations on 150 MVA base.	4	L3	CO5
		OR			
Q.10	a.	Derive power angle equation as applied to a salient pole synchronous machine.	10	L3	CO5
	b.	Explain equal area criterion when a power system is subjected to a sudden change in mechanical input.	10	L2	CO5

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