

Sixth Semester B.E. / B. Tech. Degree Examination, June/July 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 value. What are the advantages of per unit system?	5	L2	CO1
	b. Draw the reactance diagram using a base of 50 MVA and 13.8 kv on Generator G1 for the diagram shown in Fig.Q1 (b).	15	L3	CO1
Fig.Q1 (b)				
OR				
Q.2	a. Show that per unit reactance referred to a primary or secondary is same in the Transformer.	5	L2	CO1
	b. A 300 MVA, 20kv, 3φ generator has a reactance of 20%. The generator supplies 2 motors M ₁ and M ₂ over a transmission line of 64km as shown in one line diagram. The ratings of the components are as follows: T ₁ = 350MVA, 230KV-Y/20KV-Δ X=10% T _L = L = 64km, X _{TL} = 0.5j / km T ₂ = compound of 3 single phase transformers each rated 127/13.2 kv, 100MVA with leakage reactance of 10% M ₁ =200MVA, 13.2kv, X''=0.2jpu M ₂ =100 MVA, 13.2kv, X''=0.2jpu Select the generator ratings as base and draw the reactance diagrams with all reactance marked in pu for the system shown in Fig.Q.2(b) If the motors M ₁ and M ₂ have i/ps of 120 MW and 60MW, at 13.2 kv and operate at UPF. Find the V _g at the terminals of the generator.	15	L3	CO1

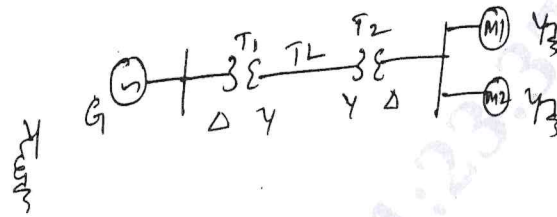


Fig.Q.2 (b)

Module – 2

Q.3	a.	With the help of waveform, when subjected to 3 phase symmetrical fault, define synchronous reactance (Steady state, Transient and Sub transient condition).	10	L2	CO2
	b.	For the radial network shown in Fig.Q3(b) a 3 ϕ fault occurs at F. Determine the fault current and the line V_g at 11kv bus under fault conditions. Take base MVA as 100MVA.	10	L3	CO2
Fig. Q3 (b)					
OR					
Q.4	a.	Write a note on selection of circuit breaker.	5	L2	CO2
	b.	Explain in detail, the transients on a transmission line.	5	L2	CO2
	c.	A synchronous generator and motor are rated 30000KVA (30MVA) and both have the transient reactance of 20%. The line connecting them has a reactance of 10% of the base of machine rating. The motor is drawing 20MW at 0.8 pf leading. The terminal V_g (V_t) of motor 12.8 kV. When a symmetrical 3 ϕ fault occurs at motor terminal, determine subtransient Current at generator, motor and fault point for the s/m shown in Fig.Q4(c).	10	L3	CO2

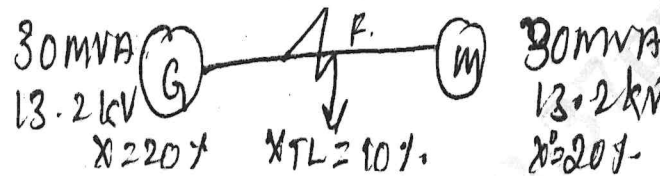


Fig. Q4 (c)

Module – 3

Q.5	a.	Express symmetrical components of voltages in terms of unbalanced phasors.	5	L2	CO3
	b.	Explain sequence impedance and sequence networks.	5	L2	CO3
	c.	Draw the +ve, -ve and zero sequence impedance networks for the power system of Fig. Q 5 (c). Choose a base of 50MVA, 220kv in the 50 Ω transmission lines and mark all reactances in Pu. The ratings of the generators and transformers are: G1: 25MVA, 11kv, $X'' = 20\%$ G2: 25MVA, 11kv, $X'' = 20\%$, 3-ϕ $\oplus$: 20MVA, 11Y/ 220 Y KV, $X = 15\%$. The -ve sequence reactance of each synchronous machine is equal to its sub transient reactance. The zero sequence reactance of lines are 250% of their +Ve sequence reactances. Take machine ratings as base in generator.	10	L3	CO3

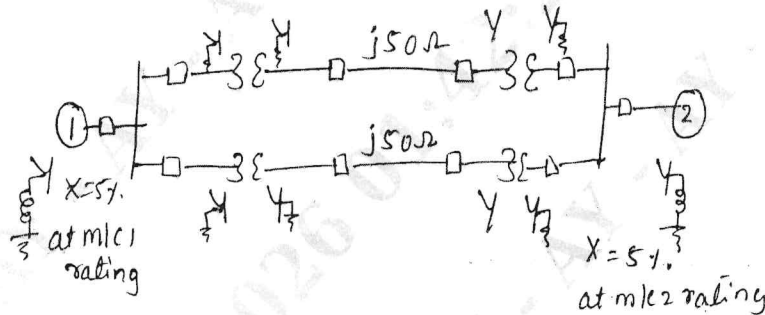


Fig. Q 5 (c)

OR

Q.6	a.	Explain phase shift of symmetrical components in Y- Δ transformer bank.	10	L2	CO3
	b.	Draw the zero sequence network for the following $\oplus$ connections for the below combinations. (i) $Y-\Delta$ (ii) $Y-Y_{\frac{1}{2}}$ (iii) $\Delta-Y$ (iv) $\Delta-Y_{\frac{1}{2}}$ (v) $\Delta-\Delta$	10	L3	CO3

Module – 4

Q.7	a.	Explain LLG fault which occurs through the fault impedance Z in a power system and show the inter connection of sequence network.	12	L3	CO4
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	b.	A 3- ϕ generator with an open circuit voltage of 400v is subjected to an LG fault through a fault impedance of $2j\Omega$. Determine the fault current is $Z_1 = 4j\Omega$, $Z_2 = 2j\Omega$ and $Z_0 = 1j\Omega$. Repeat the numerical for LLG and LL faults.	8	L3	CO4
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OR

Q.8	a.	Explain the series types of faults in a power system.	5	L2	CO4
	b.	A 25MVA, 11KV, 3 ϕ generator has a subtransient reactance of 20%. The generator supplies 2 motors over a transmission line with $\oplus$ at both ends as shown in Fig.8 (b). The motors have rated input of 15 & 7.5 MVA, both 10kv with 25% sub transient reactances. The 3 ϕ $\oplus_s$ are both rated 30MVA, 10.8 / 121KV, connected Δ -Y with leakage reactances of 10% each. The series reactance of line is 100Ω calculate the fault current when a single line to ground fault occurs at F. The motors are loaded to draw 15 and 7.5MW at 0.8 pf Leading. Assume that -ve sequence reactance is equal to +ve sequence. The zero sequence reactance are shown in Fig. 8 (b).	15	L3	CO4

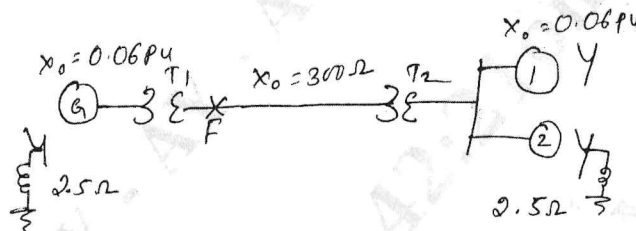


Fig. 8 (b)

Module – 5

Q.9	a.	Explain the dynamics of synchronous machine.	8	L2	CO5
	b.	Derive swing equation with notations.	8	L2	CO5
	c.	Define stability of the system and Transient State Stability.	4	L1	CO5

OR

Q.10	a.	Explain Equal Area Criterion in a power system.	10	L2	CO5
	b.	A loss free alternator supplies 50MW to an infinite bus, the steady state stability limit being 100MW. Determine if the alternator will remain stable if the input to the prime mover of the alternator is abruptly increased by 40MW.	10	L3	CO5
