

CBCS SCHEME - Make-Up Exam

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BEE601

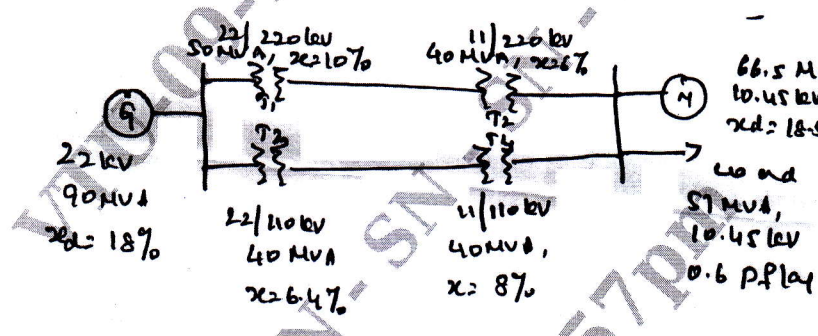
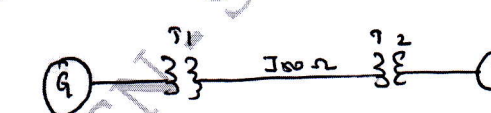
Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025 Power System Analysis – I

Time: 3 hrs.

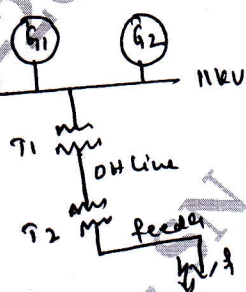
Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

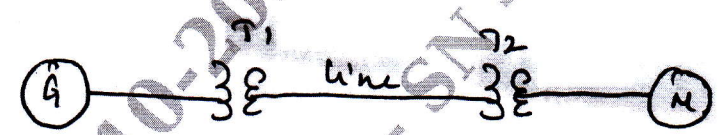
2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – I				M	L	C
Q.1	a.	What is per unit system? List the advantages of a per-unit system.		5	L1	CO1
	b.	Show that the per unit impedance of a two winding transformer on either of its side in equal.		5	L1	CO1
	c.	For the single line diagram of power system shown in Fig.Q.1(c). Draw the PU impedance diagram, select $KV_b = 22 \text{ kV}$ (generator side) $MVA_b = 100$.		10	L3	CO1
 Fig.Q.1(c)						
OR						
Q.2	a.	What is single line diagram? What is the need of single line diagram? Explain the procedure for finding the per-unit reactance diagram by stating all the assumptions involved.		10	L1	CO1
	b.	A single line diagram of a power system is shown in the Fig.Q.2(b). Draw its impedance diagram. Choose a base of 100 MVA, 220 KV, in 50Ω line. The rating of generator, motor and trf are given below: Generator : 40 MVA, 25KV, $x = 20\%$ Sy. Motor : 50 MVA, 11KV, $x = 30\%$ y-y-Trf : 40 MVA, 33/220 KV, $x = 15\%$ y-Δ Trf : 30 MVA, 11/220 KV (Δ/y), $x = 15\%$		10	L3	CO1
 Fig.Q.2(b)						

Module – 2

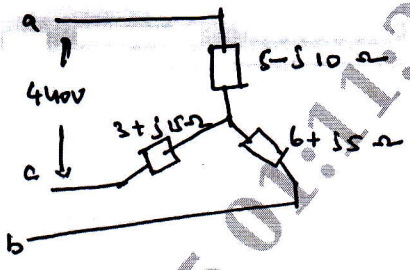
Q.3	a.	With the oscillogram of the short circuit current of a synchronous machine, define direct axis synchronous reactance, transient and sub-transient reactance.	10	L2	CO2
	b.	For the radial network shown, a 3 phase fault occurs at point f. Determine the fault current. Choose the generator ratings as base values: Generator G_1 : 10 MVA, 11KV, $x = 20\%$ Generator G_2 : 10 MVA, 11KV, $x = 12.5\%$ Transformer T_1 : 10 MVA, 11/33 KV, $x = 10\%$ Transformer T_2 : 25 MVA, 33/6.6 KV, $x = 8.7\%$ Overhead line Imp $Z = 6 + j10\Omega$ Feeder Impedance $Z = 0.5 + j0.15\Omega$  Fig.Q.3(b)	10	L3	CO2

OR

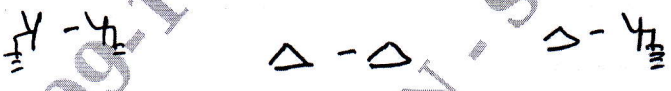
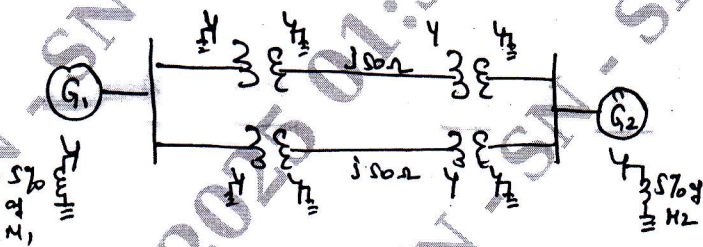
Q.4	a.	Derive the equation of a transient on a transmission line.	10	L2	CO2
	b.	A synchronous generator and a synchronous motor each rated 25 MVA, 11 KV having 15% sub – transient reactance are connected through transformers and a line as shown in the Fig.Q.4(b). The transformers are rated 25 MVA, 11/66 KV and 66 KV/11 KV with leakage reactance of 10% each. The line has a reactance of 10% on a base of 25 MVA, 66 KV. The motor is drawing 15 MW at 0.8 p.f. leading and a terminal voltage of 10.6 KV, when a symmetrical 3ϕ fault occurs at the motor terminals. Find the subtransient current in the generator, motor and faults.  Fig.Q.4(b)	10	L3	CO2

Module – 3

Q.5	a.	What are symmetrical components? How they are useful in the solution of power system?	5	L1	CO3
	b.	Derive an expression for the 3 ϕ complex power in terms of symmetrical components.	5	L2	CO3

	c. A 3 phase, star connected load as shown, is connected to a 3 phase supply having a line voltage of 440 volts. Calculate the current in line 'a'.  Fig.Q.5(c)	10	L3	CO3
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OR

Q.6	a. Draw the zero sequence impedance networks of a transformer for the following connection: 	6	L1	CO3
	b. Draw the positive, negative and zero sequence network for the power system shown, choose a base of 50 MVA, 220 KV in the 50Ω, T line and mark are reactance's in PU. The ratings of the generator and transformer are: G - 1 : 25 MVA, 11 KV $x'' = 20\%$ G - 2: 25 MVA, 11 KV, $x'' = 20\%$ 3φ transformer each : 20 MVA, 11/220 KV, $x = 15\%$. The negative sequence reactance of each machine is equal to the subtransient reactance. The zero sequence reactance of each machine is 8%. Assume that the zero sequence reactance of lines are 250% of their positive sequence reactance.  Fig.Q.6(b)	14	L3	CO3

Module - 4

Q.7	a. Derive an expression for fault current when single line to ground fault occurs through a fault impedance z_f in a power system. Draw the sequence network to represent the fault.	10	L2	CO4
	b. Derive an expression for fault current when – double line to ground fault through impedance occurs on power systems.	10	L2	CO4

OR

Q.8	A 50 Hz turbo generator is rated 10 MVA, 13.8 KV. It is star connected and solidly grounded and in operation at rated voltage at no-load. It is disconnected from the rest of the system. Its reactance are $x_1 = x_2 = 0.15$ Pu and $x_0 = 0.05$ Pu. Find : i) The ratio of the subtransient line current for a single line to ground fault to the sub-transient line current for a symmetrical 3ϕ fault. ii) The ratio of sub-transient line current for a line to line-fault to the sub-transients current for a symmetrical 3ϕ fault. iii) The Ohm's of inductive reactance to be inserted in the neutral connection of the generator to limit the subtransient line current for a single line to ground fault to that for a 3ϕ fault.	20	L3	CO4
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Module – 5

Q.9	a.	Explain equal area criteria concept when a power system is subjected to sudden loss of one of the parallel lines.	10	L2	CO5
	b.	Define: i) Steady state stability ii) Transient stability	5	L1	CO5
	c.	Discuss the methods of improving transient stability.	5	L2	CO5

OR

Q.10	a.	Derive the power angle equation for salient pole machine.	10	L2	CO5
	b.	Derive an expression for the swing equation.	10	L2	CO5
