BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

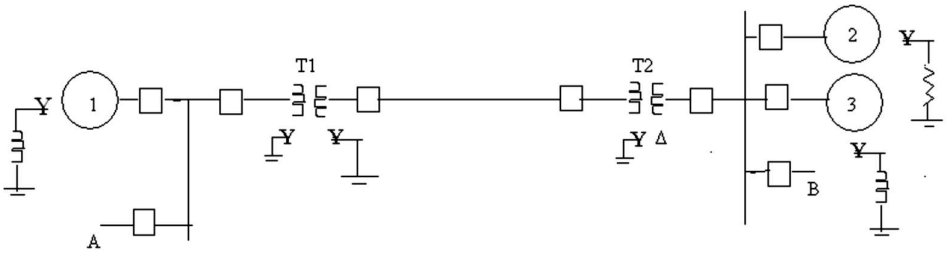
CLASS: BTECH **SEMESTER: VI**
BRANCH: EEE **SESSION: SP/2023**

SUBJECT: EE355 POWER SYSTEM ANALYSIS

TIME: 3 Hours **FULL MARKS: 50**

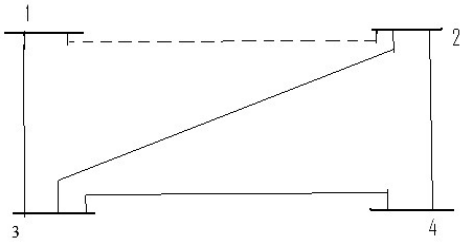
INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Obtain the per unit reactance diagram taking 30 MVA and 10.5kV as base values in generator 1 circuit of the power system of figure shown below.	[5]	1	3



Generator No. 1: 30 MVA, 10.5 KV, X" = 1.6 Ω;
Generator No. 2: 15 MVA, 6.6 KV, X" = 1.2 Ω
Generator No. 3: 25 MVA, 6.6 KV, X" = 0.56 Ω
Transformer T1 (3-phase) :15 MVA, 33/11 KV, X = 15.2 Ω/phase on HT side
Transformer T2 (3-phase) :15 MVA, 33/6.2 KV, X = 16 Ω/phase on HT side
Transmission Line: 20.5 Ω /phase
Load A: 15 MW, 11 KV, 0.9 lagging pf.; Load B: 40 MW, 6.6V, 0.85 lagging pf.

Q.1(b)	Write down the criterion for selecting the base quantities in per unit system? Enumerate the advantages of per unit calculation? In what way per unit method of calculation is better than % method of calculation? Enumerate the assumptions taken for drawing reactance diagram from impedance diagram.	[5]	1	1
Q.2(a)	Find Y_{BUS} if the line shown as dotted is not connected in the SLD of the network shown in figure below.	[5]	2	4



Line bus to bus	R,pu	X,pu
1-2	0.05	0.15
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15

Q.2(b)	What modification need to be carried out in Y_{BUS} if the line shown dotted is connected? Give the reasons. (i) direct solution of load flow problem is not possible. (ii) Most of the buses in power system are load buses. (iii) An acceleration factor is commonly used in load flow studies using in GS method. (iv) Bus admittance matrix is a sparse matrix. (v) One of the buses is taken as slack bus in load flow studies	[5]	2	5
Q.3(a)	Use circuit models of synchronous machine under faults to explain the different values of fault current in transient, sub-transient and steady-state period. Derive the expression of fault current of a loaded synchronous machine using Thevenin's theorem.	[5]	3	3, 4

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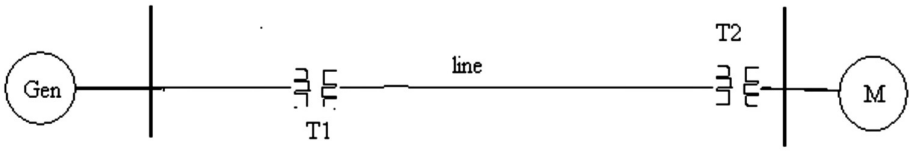
Q.3(b)	A synchronous generator and a synchronous motor each rated 25MVA,11kV having 15%subtransient reactance are connected through transformers and a line as shown in figure below. The transformers are rated 25MVA, 11/66kV and 66/11kV with leakage reactance of 10% each. The line has a reactance 10% on a base of 25 MVA, 66kV. The motor is drawing 15 MW at 0.8 leading factor and terminal voltage of 10.6kV when a symmetrical 3 phase fault occurs at the motor terminal. Find the sub transient current in the generator, motor and fault.	[5]	3	3



Q.4(a)	A 50 MVA, 11Kv, 3 phase alternator was subjected to different types of faults. The faults current were: 3 phase fault 1870 A, line to line fault 2590 A, single line to ground fault 4130 A, the alternator neutral is solidly grounded. Find the p.u. values of the three sequence-reactance of the alternator?	[5]	4	3
Q.4(b)	Draw a general circuit which can be used to determine the zero-sequence network of two winding transformer. Using this circuit, draw the zero sequence networks of (i) star-star transformer with star grounded (ii) delta-delta transformer?	[5]	4	4
Q.5(a)	A 50 Hz, 4 pole turbo generators rated 100MVA, 11 KV has an inertia constant of 8.0 MJ/MVA. (i) Find stored energy in rotor at synchronous speed. (ii) If mechanical input suddenly raised to 80 MW for an electric load of 50MW, find rotor acceleration, neglecting mechanical and electrical losses. (iii) If acceleration calculated in part (ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in revolution per minute at the end of this period.	[5]	5	3
Q.5(b)	Draw diagram to illustrate the application of equal area criterion to study transient stability for the following case: A sudden increase in input of generator.	[5]	5	2

:::::28/04/2023 M:::::