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Question Paper Code : 10580

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025

Fifth Semester

Electrical and Electronics Engineering

EE 8501 – POWER SYSTEM ANALYSIS

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define per unit value of an electrical quantity and write the equation for base impedance for a three phase power system.
2. Define primitive network.
3. What is the need for load flow analysis?
4. Why is reference bus necessary for power flow analysis?
5. What is bolted fault or solid fault?
6. Define transient and synchronous reactance.
7. What is the sequence operator?
8. Draw the equivalent circuit of synchronous generator under L-G fault.
9. Define stability of a power system.
10. Mention the use of swing curve.

PART B — (5 × 13 = 65 marks)

11. (a) Develop a reactance diagram for the power system shown in Fig.1. Neglect resistance and use a base of 100MVA, 220KV in 50Ω line. The ratings of the generator, motor and transformer are given below.

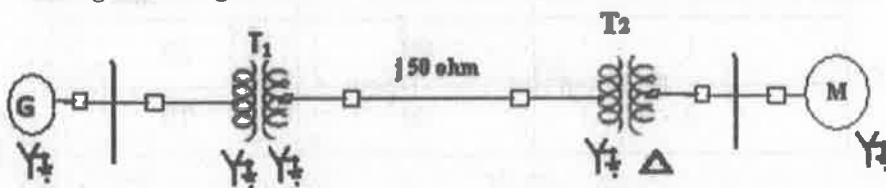


Fig 1

Generator: 40 MVA, 25 KV, $X''=20\%$

Synchronous motor: 50 MVA, 11 KV, $X''=30\%$

Y-Y Transformer: 40 MVA, 33/220KV, $X=15\%$

Y- Δ Transformer: 30 MVA, 11/220KV (Δ/Y), $X=15\%$

Or

- (b) Determine the Y bus matrix by inspection method for line specification as mentioned in Table 1.

Table 1

Line p-q	Impedance (p.u)	Half Line charging admittance p.u)
1-2	$0.04+j0.02$	$j0.05$
1-4	$0.05+j0.03$	$j0.07$
1-3	$0.025+j0.06$	$j0.08$
2-4	$0.08+j0.015$	$j0.05$
3-4	$0.035+j0.045$	$j0.02$

12. (a) Write the step-by-step algorithm for load flow solution by Gauss-Seidal method.

Or

- (b) Perform one iteration of Newton-Raphson load flow method and determine the power flow solution for a given power system. Refer Table 2 for data and Assume base MVA as 100.

Table 2

Line Data:

Line	Bus		R in p.u	X in p.u	Half line charging admittance
	From	To			
1	1	2	0.0839	0.5183	0.0636

Bus Data:

Bus	P_L	Q_L
1	90	20
2	30	10

13. (a) Draw the detailed flowchart, which explains how a symmetrical fault can be analyzed using ZBUS.

Or

- (b) Describe the bus impedance matrix method of fault current calculation.

14. (a) Derive the expression for the fault current and terminal voltage of three different phases of an alternator, when a double line to ground fault occurs at R phase. Assume that the alternator neutral is isolated.

Or

- (b) A 3 phase, 11 KV, 25 MVA generator with $X_0 = 0.05$ p.u, $X_1 = 0.2$ p.u is grounded through a reactance of 0.3. Calculate the fault current for a single line to ground fault. Also calculate the terminal voltage of the faulted phase with respect to the ground.

15. (a) A generator is operating at 50Hz, delivers 1.0 p.u. power to an infinite bus through a transmission circuit in which resistance is ignored. A fault takes place reducing the maximum power transfereable to 0.5 p.u. Before the fault, this was 2.0 p.u. and after the clearance of the fault it is 1.5 p.u. By the use of equal area criterion, determine the critical clearing angle.

Or

- (b) Explain the step wise procedure of determining the swing curve of power system using the modified Euler's method.

PART C — (1 × 15 = 15 marks)

16. (a) Create the admittance matrix Y_{bus} of the network shown in Fig.2. The data for design is given in Table.3. Select node 1 as the reference.

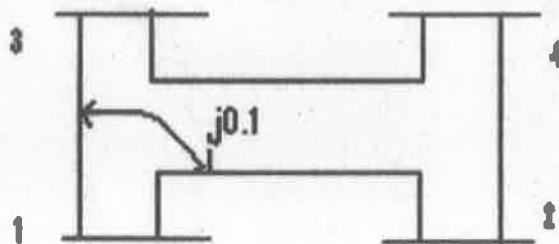


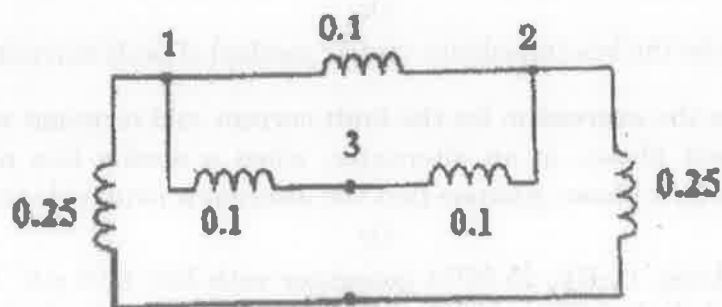
Fig 2

Table. 3

Element No	Self		Mutual	
	Bus code	Impedance	Bus code	Impedance
1	1-2	0.5	1.2	0.1
2	1-3	0.6		
3	3-4	0.4		
4	2-4	0.3		

Or

- (b) For the 3-bus network Fig. 3 shown below obtain Z bus by building algorithm.



Ref bus r

Fig. 3

