PVP 20

Code: 20EE3603

III B.Tech - II Semester – Regular Examinations – JUNE 2023

POWER SYSTEMS ANALYSIS
(ELECTRICAL & ELECTRONICS ENGINEERING)

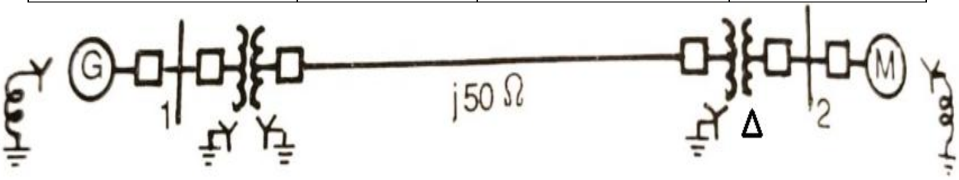
Duration: 3 hours   Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level   CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Outline the advantages of per unit system also explain the need of the per unit system.	L4	CO5	7 M
	b)	Develop the PU impedance diagram for the power system shown in given figure. Neglect resistance and use a base of 100 MVA, 220 kV in 50 ohms line. The rating of the generator, motor and transformer are:	L3	CO2	7 M

Generator	40 MVA	25 kV	$X'' = 20\%$
Motor	50 MVA	11 kV	$X'' = 30\%$
Y-Y transformer	40 MVA	33Y-220Y kV	$X = 15\%$
Y-Δ transformer	30 MVA	11Δ- 220Y kV	$X = 15\%$



<table>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>a)</td><td>Deduce the following relation
$Z_{pu(new)} = Z_{pu(old)} \text{ X } \frac{MVA_{BASE(NEW)}}{MVA_{BASE(OLD)}} \text{ X } \frac{(KV)^2_{BASE(OLD)}}{(KV)^2_{BASE(NEW)}}$</td><td>L4</td><td>CO5</td><td>7 M</td></tr>
<tr><td></td><td>b)</td><td>Construct the PU impedance diagram for the power system shown in given figure. Neglect resistance and use a base of 100 MVA, 110 kV in 80 ohms line. The rating of the generator, motor and transformer are:
<table>
<tr><td>Generator1</td><td>50 MVA</td><td>13.8 kV</td><td>$X'' = 15\%$</td></tr>
<tr><td>Generator2</td><td>40 MVA</td><td>33 kV</td><td>$X'' = 20\%$</td></tr>
<tr><td>Y-Y transformer</td><td>60 MVA</td><td>16Y-110Y kV</td><td>$X = 10\%$</td></tr>
<tr><td>Y-Δ transformer</td><td>40 MVA</td><td>33Δ- 110Y kV</td><td>$X = 15\%$</td></tr>
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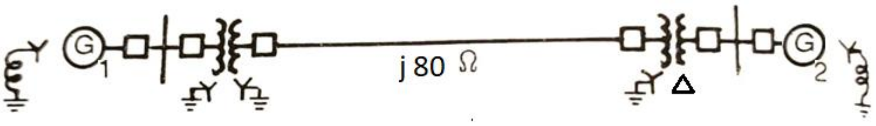

</td><td>L3</td><td>CO2</td><td>7 M</td></tr>
<tr><td colspan="6">UNIT-II</td></tr>
<tr><td>3</td><td>a)</td><td>Classify the types of buses in power system. Explain the necessity of power flow studies.</td><td>L4</td><td>CO4</td><td>7 M</td></tr>
<tr><td></td><td>b)</td><td>Develop the algorithm for Gauss Seidel Method for load flow solutions with PQ bus.</td><td>L3</td><td>CO3</td><td>7 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>4</td><td colspan="2">The load flow data for a three bus system are shown in Table 1 and Table 2. Solve for the bus voltages at the end of first iteration by Gauss Seidel Method.
Table 1
<table>
<tr><th>Bus Code</th><th>Impedance</th></tr>
<tr><td>1-2</td><td>0.07 + j0.20</td></tr>
<tr><td>1-3</td><td>0.01 + j0.05</td></tr>
<tr><td>2-3</td><td>0.02 + j0.15</td></tr>
</table>
</td><td>L3</td><td>CO3</td><td>14 M</td></tr>
</table>

	Table 2				

Bus Code	P	Q	V	Remarks
1	-	-	$1.06\angle 0^0$	Slack
2	0.2	0.3	-	PQ
3	0.6	0.25	-	PQ

UNIT-III

5	a)	Deduce the expressions for elements of Jacobian matrix in Newton Raphson Method of solving load flow equations in polar coordinates form.	L4	CO4	7 M
	b)	Deduce the load flow equation of Newton Raphson Method.	L4	CO4	7 M

OR

6	Construct the flow chart for Newton Raphson Method for load flow solutions in polar coordinate form.	L3	CO3	14 M

UNIT-IV

7	a)	Outline the advantages of symmetrical components.	L4	CO5	7 M
	b)	Deduce an expression for fault current when line to line fault occurs on the terminals of an unloaded alternator? Draw the sequence network diagram.	L4	CO5	7 M

OR

8	a)	Deduce an expression for fault current when single line to ground fault occurs on the terminals of an unloaded alternator through a fault impedance Z_f. Draw the sequence network diagram.	L4	CO5	7 M

	b)	A 50 MVA, 12.6 kV, 3-phase, 50Hz generator has its neutral earthed through a 7% reactor. It is in parallel with another identical generator having its neutral earthed through a 7% reactor. Each generator has positive, negative and zero sequence reactance’s which are 10%, 7% and 5% respectively. When line to ground short circuit occurs in the common bus bar, determine the fault current.	L3	CO2	7 M
		UNIT-V			
9	a)	Analyze the stability of the power system when there is a sudden change in the mechanical input by the application of equal area criterion.	L4	CO4	7 M
	b)	Outline the methods to improve transient stability.	L4	CO4	7 M
		OR			
10	a)	Deduce the swing equation.	L4	CO4	7 M
	b)	Find the steady state power limit of a system consisting of a generator with reactance 0.6 p.u. connected to an infinite bus through a reactance of 0.8 p.u. The terminal voltage of the generator is 1.15 p.u. and the voltage of infinite bus is 1.0 p.u.	L4	CO4	7 M