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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## June 2025 Semester End Main Examinations

**Programme: B.E.** | **Semester: VI**
**Branch: Electrical and Electronics Engineering** | **Duration: 3 hrs.**
**Course Code: 23EE6PCPS2** | **Max Marks: 100**
**Course: Power Systems-2**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | **UNIT - I** | *CO* | *PO* | **Marks** |
|---|---|---|---|---|---|
| 1 | a) | Define primitive network and get the performance equations in both admittance form and impedance form. | *CO1* | *PO1* | **06** |
| | b) | For the Given data shown in Table. 1 (b), obtain $Y_{bus}$ by inspection method. | *CO2* | *PO2* | **14** |

| Element No. | Buses (p-q) | R (ohms) | X (ohms) | $B_{sh}/2$ (ohms) | Off-nominal turns ratio (a) |
|---|---|---|---|---|---|
| 1 | 1-2 | 0.02 | 0.08 | 3 | - |
| 2 | 1-3 | 0.04 | 0.12 | 5 | - |
| 3 | 2-3 | 0.06 | 0.18 | - | 0.95 |

Table. 1 (b)

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 2 | a) | How an off-nominal turns ratio of a transformer is modeled while forming bus admittance matrix in power system. | *CO1* | *PO1* | **08** |
| | b) | For a given diagram shown in Fig. 2 (b), obtain A, B, C and K. | *CO1* | *PO2* | **12** |

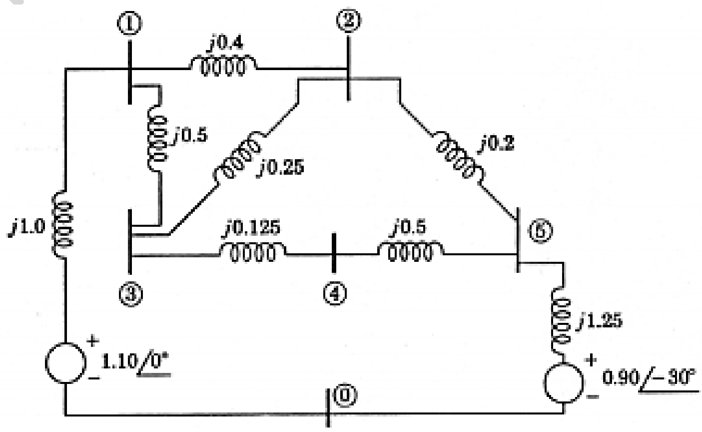


Fig. 2 (b)

## UNIT - II

**3 a)** Derive an expression bus admittance matrix using singular transformation method. — *CO2* | *PO1* | **06**

**b)** For a given data shown in Table. 3 (b), obtain $Z_{bus}$ by building algorithm approach. — *CO2* | *PO2* | **14**

| Element Number | Buses | Z (pu) |
|---|---|---|
| 1 | 0-1 | 1.2 i |
| 2 | 1-2 | 0.15 i |
| 3 | 0-2 | 1.0 i |
| 4 | 0-3 | 1.2 i |
| 5 | 2-3 | 0.02 i |

Table. 3 (b)

**OR**

**4 a)** Derive the generalized algorithm for finding the elements of bus impedance matrix when a link is added to the partial network. — *CO2* | *PO1* | **06**

**b)** For the given data shown in Table 4. (b) Obtain $Y_{bus}$ by singular transformation method. Take bus 1 as reference. — *CO2* | *PO2* | **14**

| Line No. | p-q | Z (pu) | Mutual Z (pu) |
|---|---|---|---|
| 1 | 1-2 | 0.6 i | -- |
| 2 | 1-3 | 0.5 i | 0.2 i (1) |
| 3 | 3-4 | 0.5 i | 0.1 i (1) |
| 4 | 1-2 | 0.4 i | -- |
| 5 | 2-4 | 0.2 i | -- |

Table 4. (b)

## UNIT - III

**5 a)** Develop the Gauss-Seidel load flow model for a power system with a slack bus and (n-1) number of PQ buses. — *CO3* | *PO2* | **06**

**b)** For a four-bus power system shown in Fig. 5 (b), generators are connected at all four buses while loads are at buses 2 and 3. Real and reactive powers are listed in the below Table 5. (b). Assuming flat voltage start, compute the voltages at all the buses at the end of first iteration using G.S. method. Take α as 1.4. — *CO3* | *PO3* | **14**

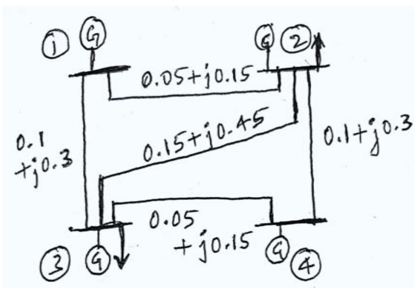


Fig. 5 (b)

| Bus No. | $P_i$(pu) | $Q_i$ (pu) | $V_i$(pu) |
|---|---|---|---|
| 1 | – | | 1.04∠0° |
| 2 | 0.5 | −0.2 | – |
| 3 | −1 | 0.5 | – |
| 4 | 0.3 | −0.1 | – |

Table 5. (b)

**OR**

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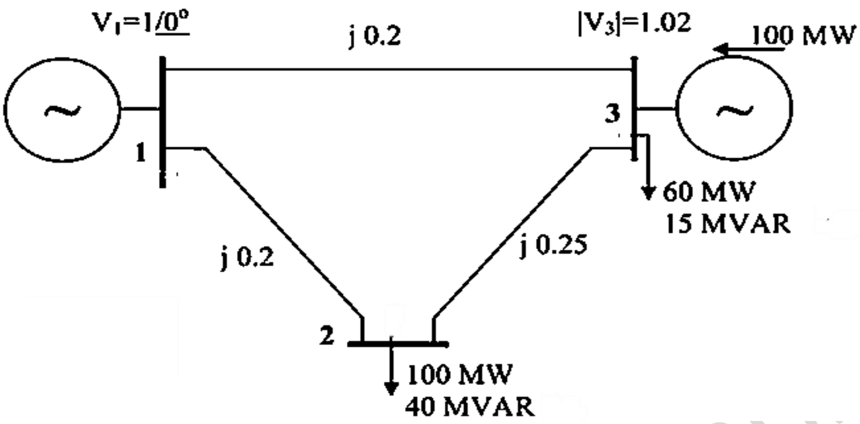
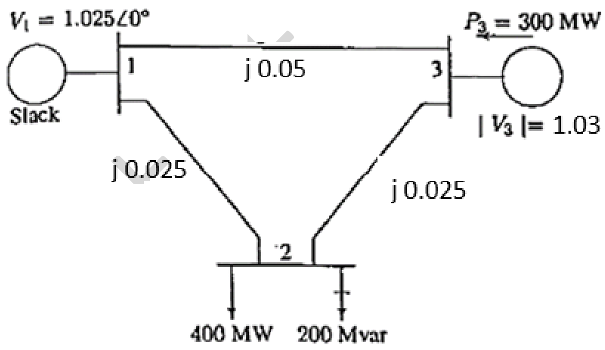
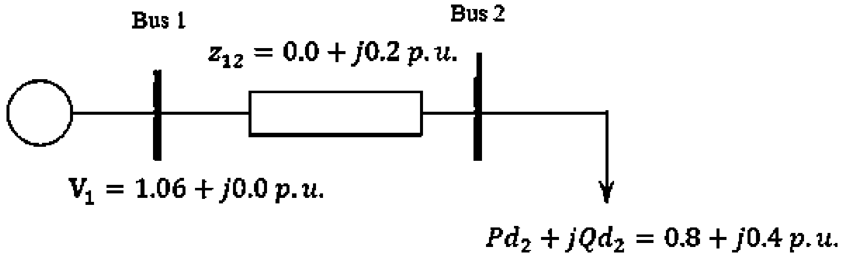
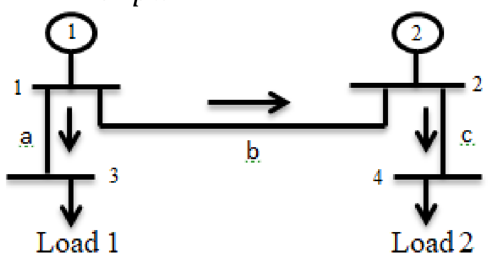
<table>
<tr><td></td><td>6</td><td>a)</td><td>How buses are classified in power system? Explain the significance of Slack bus.</td><td>CO3</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>b)</td><td>For the power system shown in Fig 6. (b), obtain voltages at all the buses after first iteration using G.S method.  Line reactances are in p.u and Base MVA is 100. Given $0 \leq Q_{g_3} \leq 0.45$ pu.<br><br><br>Fig 6. (b)</td><td>CO3</td><td>PO3</td><td>14</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Explain the algorithm for fast decoupled load flow analysis, clearly stating all the assumptions made.</td><td>CO4</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>b)</td><td>For the power system shown in Fig 7. (b), obtain diagonal elements of J1 and J4 in Jacobian matrix using N.R method.  Line reactances are in p.u and Base MVA is 100.<br><br><br>Fig 7. (b)</td><td>CO4</td><td>PO4</td><td>14</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>Derive expressions for diagonal and off-diagonal elements of J1 matrices using NR method. Starting from power mismatch matrices.</td><td>CO4</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>b)</td><td>For the power system shown in Fig 8. (b), obtain voltages at all the buses after first iteration using FDLF method. Consider a line is having half line charging admittance of j 1 pu.</td><td>CO4</td><td>PO4</td><td>14</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | <br><br>Fig 8. (b) | | | |
| | | | **UNIT - V** | | | |
| | 9 | a) | Derive an expression for economic dispatch neglect losses. | *CO5* | *PO2* | **08** |
| | | b) | Compute the loss co-efficient for the network shown in Fig.9 (b)<br>$I_a = 1.6 - j0.4\ pu \quad Z_a = 0.15\angle 85^0\ pu$<br>$I_b = 2 - j0.5\ pu \quad Z_b = 0.15\angle 78^0\ pu$<br>$I_c = 1.8 - j0.45\ pu \quad Z_c = 0.25\angle 85^0\ pu$<br>$consider\ v_1 = 1.2\angle 0^0\ pu$<br><br><br>Fig.9 (b) | *CO5* | *PO3* | **12** |
| | | | **OR** | | | |
| | 10 | a) | Derive an expression for loss-co-efficient for a two-generating plant in economic operation of power systems. | *CO5* | *PO2* | **08** |
| | | b) | Incremental Fuel Costs of Generators G1 and G2 are 10,000 Rs/MWh and 12,500 Rs/MWh respectively. Loss in the line is given by $P_{loss\ (pu)} = 0.5PG^2_{1(pu)}$. Where the loss co-efficient is specified in p.u. on a 100 MVA base. Find economic scheduling for 40 MW load. | *CO5* | *PO3* | **12** |

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