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| **Name:**<br>**Enrolment No:** | |

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, May 2022**

**Course: Power System - II** **Semester: VI**
**Program: B. Tech Electrical Engineering** **Time : 03 hrs.**
**Course Code: EPEG 3011** **Max. Marks: 100**

**Instructions:**

**SECTION A**
**(5Qx4M=20Marks)**

| S. No. | | Marks | CO |
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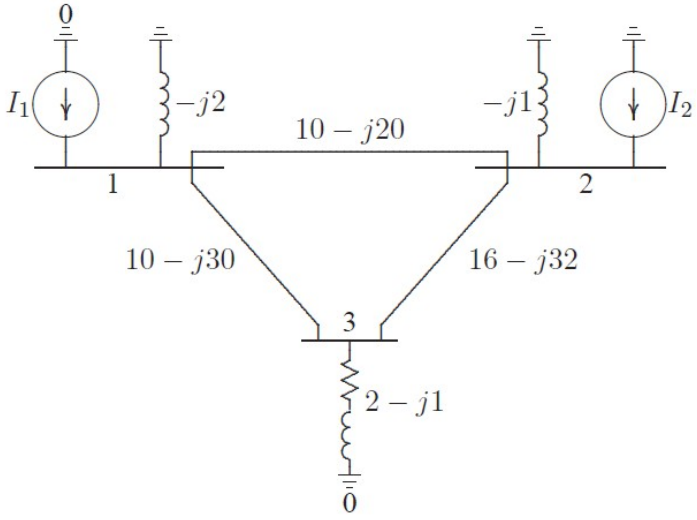
| Q 1 | For the network shown below in Figure 1, determine the bus admittance matrix.<br>  <br><br>Figure 1 | **4** | **CO1** |
| Q 2 | Define STATCOM and its role in power system. | **4** | **CO4** |
| Q 3 | Two generating units 300 MW and 400 MW have governor speed regulation of 6% and 4% respectively from no load to full load. Both the generating units are operating in parallel to share a load of 600 MW. Assuming free governor action, the load shared by the larger unit is ____ MW? | **4** | **CO3** |
| Q 4 | A four-pole, 60-Hz synchronous generator has a rating of 200 MVA, 0.8<br>power factor lagging. The moment of inertia of the rotor is 45,100 $kg.m^2$. Determine M and H. | **4** | **CO2** |
| Q 5 | Explain with a suitable diagram the working and advantages of Thyristor controlled series compensation. | **4** | **CO4** |

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| **SECTION B (4Qx10M= 40 Marks)** | | | |
| Q 6 | Explain load frequency and excitation control with the help of a suitable block diagram. | **10** | **CO3** |
| Q 7 | (a) Explain the role of power angle curve in synchronous machine.<br>(b) What is the role of AVR in improving the stability? | **5+5** | **CO2** |
| Q 8 | What is 'critical clearing angle'? Derive the expression of critical clearing angle. | **10** | **CO2** |
| Q 9 | What is excitation system? Explain in detail how it can be used to regulate the terminal voltage of the generator? | **10** | **CO4** |
| **SECTION-C (2Qx20M=40 Marks)** | | | |
| Q 10 | For the system of Figure 2, find the voltage at the receiving bus at the end of the first iteration. Load is 2 + j0.8 pu. Voltage at the sending end (slack) is 1 + j0 pu. Line admittance is 1.0 - j4.0 pu. Transformer Reactance is j0.4 pu. Off-nominal turns ratio is 1/1.04. Use the GS Technique. Assume $V_R = 1 \angle 0^0$.<br>  <br>Figure 2 | **20** | **CO4** |
| Q 11 | The input-output curve of a coal-fired generating unit (with a maximum output of 450MW) is given by the following expression:<br>$H(P) = 120 + 6.8P + 0.0035P^2$ [MJ/h]<br>If the cost of coal is 1.37 $/MJ, calculate the output of the unit when the system marginal cost is:<br>a) 14 [$/MWh] and<br>b) 20 [$/MWh]<br>OR<br>The fuel-cost functions in $/h for two 600 MW thermal plants are given by<br>$C_1 = 300 + 5.0P_1 + 0.006P_1^2$<br>$C_2 = 400 + \beta P_2 + \alpha P_2^2$<br>where $P_1$ and $P_2$ are in MW.<br>Determine:<br>(a) The incremental cost of power λ is $10/MWh when the total power demand is 450 MW. Neglecting losses, determine the optimal generation of each plant.<br>(b) The incremental cost of power λ is $12/MWh when the total power demand is 1100 MW. Neglecting losses, determine the optimal generation of each plant.<br>(c) From the results of (a) and (b) find the fuel-cost coefficients $\beta$ and $\alpha$ of the second plant. | **20** | **CO5**<br>**CO5** |