Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2023

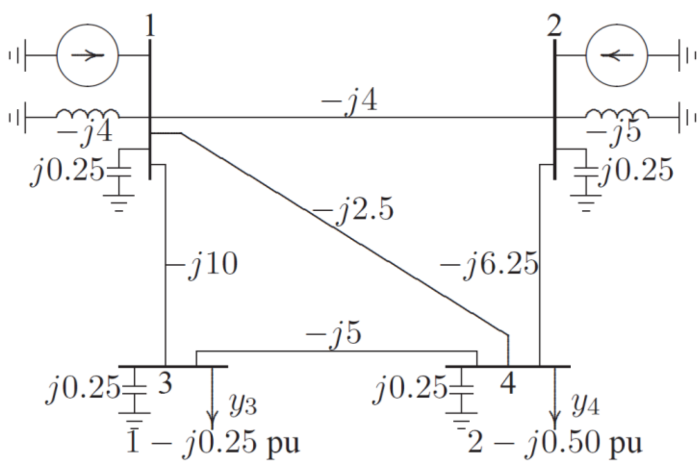
Course: Electrical Power System - II **Semester: V**

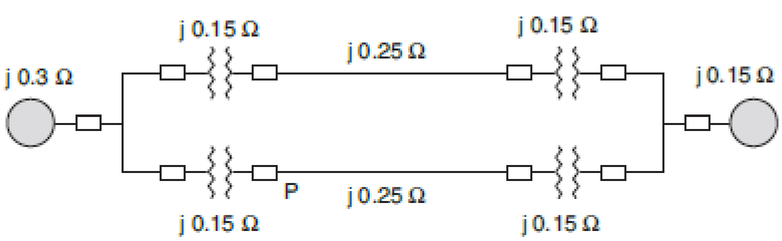
Program: B. Tech Renewable and Sustainable Energy Engineering **Time : 03 hrs.**

Course Code: EPEG 3028 **Max. Marks: 100**

Instructions: a. Attempt all the questions.
b. There is a choice in Q 9 and Q 11.

SECTION A
(5Qx4M=20Marks)

S. No.		**Marks**	**CO**
Q 1	For the network shown below in Figure 1, determine the bus admittance matrix.  Figure 1	**4**	**CO1**
Q 2	Two turbo alternators rated for 110 MW and 210 MW have governor drop characteristics of 5 percent from no load to full load. They are connected in parallel to share a load of 250 MW. Determine the load shared by each machine assuming free governor action.	**4**	**CO3**
Q 3	Two 60-Hz generating units operate in parallel within the same power plant and have the following ratings: Unit 1: 500 MVA, 0.85 power factor, 20 kV, 3600 r/min H_1 = 4.8 MJ/MVA Unit 2: 1 333 MVA, 0 .9 power factor, 22 kV, 1800 r/min H_2 = 3.27 MJ/MVA Calculate the equivalent H constant for the two units on a 100-MVA base.	**4**	**CO2**

Q 4	Explain with a suitable diagram the working of phase-shifting transformer and its function within the power system.	**4**	**CO4**
Q 5	A 100 MVA, 50 Hz turboalternator operates at no load at 3000 r.p.m. A load of 25 MW is suddenly applied to the machine and the steam valves to the turbine commence to open after 0.6 secs due to the time-lag in the governor system. Assuming inertia constant H of 4.5 kW-sec per kVA of generator capacity, calculate the frequency to which the generated voltage drops before the steam flow commences to increase to meet the new load.	**4**	**CO3**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Describe the importance of reactive power in the power system and also list down the reason to limit the frequency and reactive power.	**10**	**CO3**
Q 7	Prove that the system having two machines can be replaced by an equivalent system having one machine connected to an infinite bus.	**10**	**CO2**
Q 8	Explain load frequency and excitation control with the help of a suitable block diagram.	**10**	**CO2**
Q 9	Explain the term "system constraints". Write down the various constraints those are necessary to consider during load flow studies. OR Two turboalternators rated for 120 MW and 230 MW have governor drop characteristics of 4 percent from no load to full load. They are connected in parallel to share a load of 300 MW. Determine the load shared by each machine assuming free governor action.	**10**	**CO5**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	Figure 2 shows a generator connected to a metropolitan system (infinite bus) through high voltage lines. The numbers on the figure indicate the reactance's in p.u. Breakers adjacent to a fault on both sides are arranged to clear simultaneously. Determine the critical clearing angle for the generator for a 3-phase fault at the point P when the generator is delivering 1.0 p.u. power. Assume that the voltage behind transient reactance is 1.2 p.u. for the generator and that the voltage at the infinite bus is 1.0 p.u.  Figure 2	**20**	**CO4**
Q 11	The fuel-cost functions in $/h for two 800 MW thermal plants are given by		

	$C_1 = 400 + 6.0P_1 + 0.004P_1^2$ $C_2 = 500 + \beta P_2 + \alpha P_2^2$ where P_1 and P_2 are in MW. Determine: (a) The incremental cost of power λ is $8/MWh when the total power demand is 550 MW. Neglecting losses, determine the optimal generation of each plant. (b) The incremental cost of power λ is $10/MWh when the total power demand is 1300 MW. Neglecting losses, determine the optimal generation of each plant. (c) From the results of (a) and (b) find the fuel-cost coefficients β and α of the second plant. OR (a) A system consists of two plants connected by a tie line and a load is located at plant 2. When 100 MW are transmitted from plant 1, a loss of 10 MW takes place on the tie-line. Determine the generation schedule at both the plants and the power received by the load when λ for the system is Rs. 25 per megawatt hour and the incremental fuel costs are given by the equation: $\frac{dF_1}{dP_1} = 0.03\,P_1 + 17$ Rs./MWhr $\frac{dF_2}{dP_2} = 0.06\,P_2 + 19$ Rs./MWhr (b) Derive the expression for the Penalty factor during economic load dispatch using coordination equation.	**20**	**CO5**