Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

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

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Write short / brief notes

S. No.		CO
Q 1	i. A system has 200 buses of which 20 buses are generator bus and the rest of them are load bus. The size of Jacobian matrix in Newton-Raphson method will be _______ ii. Specified quantities of slack bus are ________________ iii. In a 4*4 Y bus matrix the number of non-zero elements are 12. Find the sparsity of the system?	**CO 1**
Q 2	i. If the reactive power limits are violated in a _________bus than that bus is treated as a ____________bus ii. In Gauss-Seidel method of power flow problem, the number of iterations may be reduced if the correction in voltage at each bus is multiplied by (*a*) Gauss constant (*b*) Acceleration factor (*c*) Deceleration constant (*d*) Blocking factor iii. Active and reactive power are defined in ___________bus. iv. The per-unit impedance of transformer is same irrespective of primary and secondary side. True / False?	**CO 1**
Q 3	i. If a generator of 250 MVA rating has an inertia constant of 6 MJ/MVA, its inertia constant on 100 MVA base is ________. ii. A power station consists of two synchronous generators A and B of ratings 250 MVA and 500 MVA with inertia 1.6 p.u. and 1 p.u., respectively on their own base MVA ratings. The equivalent p.u. inertia constant for the system on 100 MVA common base is…………	**CO 2**
Q 4	A 200 MW capacity generator has a speed regulation of 4%. For a frequency drop of 0.05 Hz, find the power input supplied by the turbine for maintaining constant frequency?	**CO 3**
Q 5	i. What is the unit of penalty factor? [1M] ii. The incremental cost characteristic of two generators delivering 200 MW are as follows: [2M] $\frac{dF_1}{dP_1} = 0.1P_1 + 20 \quad \frac{dF_2}{dP_2} = 0.2P_2 + 16$ For economic operation, the generation P1 and P2 should be a. P1 = P2 = 100 MW b. P1 = 80 MW and P2 = 120 MW c. P1 = 200 MW and P2 = 0 MW d. P1 = 120 MW and P2 = 80 MW	**CO 5**

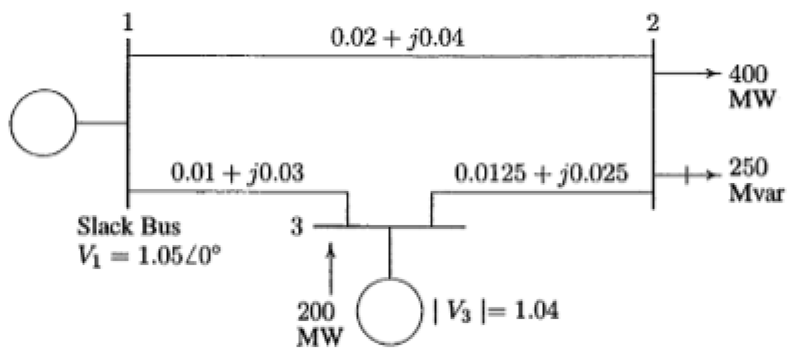
	iii. The loss formula coefficient matrix for a two-plant system is given by [2M] $B = \begin{bmatrix} 0.001 & -0.0001 \\ -0.0001 & 0.0013 \end{bmatrix} MW^{-1}$ The economic schedule for a certain load is given as P1 = 150 MW and P2 = 275 MW What is the penalty factor for plant 1 for this condition?	
Q 6	The generated power by two plants are P1 = 50 MW, P2 = 70 MW. The loss coefficients are given by B11 = 0.001, B22 = 0.0025 and B12 = -0.0004. The power loss in the system will be ____________	**CO 5**

SECTION B

1. Each question will carry 10 marks

2. Instruction: Write short / brief notes

Q 7	The one-line diagram of a simple three-bus power system with generators at buses 1 and 3 is shown below. The magnitude of voltage at bus 1 is adjusted to 1.05 p.u. Voltage magnitude at bus 3 is fixed at 1.04 p.u. with a real power generation of 200 MW. A load consisting of 400 MW and 250 MVAR is taken from bus 2. Line impedance are marked in p.u. on a 100 MVA base, and the line charging susceptance are neglected.	**CO 1**



Q 8	A 50 Hz four-pole turbo-generator rated 30 MVA, 11 kV has an inertia constant of H = 8.0 kW-sec/kVA. Determine the K.E. stored in the rotor at synchronous speed. Determine the acceleration if the input less the rotational losses is 20000 HP and the electric power developed is 10000 kW. If the acceleration computed for the generator is constant for a period of 20 cycles, determine the change in torque angle in that period and the r.p.m. at the end of 20 cycles. Assume that the generator is synchronized with a large system and has no accelerating torque before the 20 cycle period begins.	**CO 2**
Q 9	Explain the role of excitation system in Q-V regulator with neat diagram. Also, discuss various types of excitation systems.	**CO 3**
Q 10	a. Discuss the importance reactive power compensation in a transmission line. b. Explain in detail about TCR with a neat diagram.	**CO 4**
Q 11	The fuel cost functions for three thermal plants in Rs/hr are given by $F_1 = 500 + 41P_{g1} + 0.15P_{g1}^2$ $F_2 = 400 + 44P_{g2} + 0.1P_{g2}^2$ $F_3 = 300 + 40P_{g3} + 0.18P_{g3}^2$ where Pg1, Pg2 and Pg3 are in MW. Neglecting the line losses and generator limits, find the optimal dispatch and the total fuel cost by iterative technique using gradient method. The total load is 850 MW.	**CO 5**

Section C

1. Each Question carries 20 Marks.

2. Instruction: Write long answer.

Q 12	Figure.1. shows a generator connected to a metropolitan system (infinite bus) through high voltage lines. The numbers on the figure indicate the reactances in p.u. Breakers adjacent to a fault on both	**CO 4**

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.

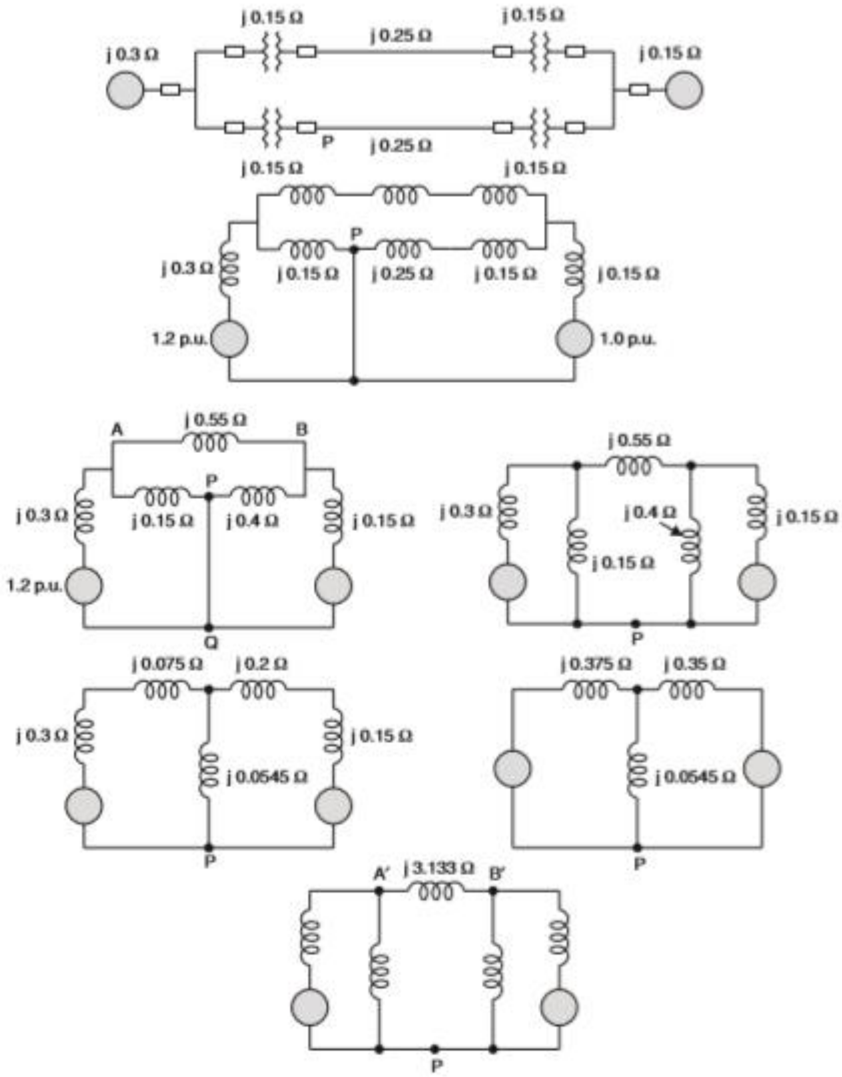


Figure 1

OR

i. A motor is receiving 25% of the power that it is capable of receiving from an infinite bus. If the load on the motor is doubled, calculate the maximum value of δ during the swinging of the rotor around its new equilibrium position.

ii. A 50 Hz generator is delivering 50% of the power that it is capable of delivering through a transmission line to an infinite bus. A fault occurs that increases the reactance between the generator and the infinite bus to 500% of the value before the fault. When the fault is isolated, the maximum power that can be delivered is 75% of the original maximum value. Determine the critical clearing angle for the condition described.