Roll No: --------------------------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

UPES

End Semester Examination – December 2017

Program/course: B.Tech EL **Semester – VII**
Subject: Power System Operation and Control **Max. Marks : 100**
Code : ELEG 474 **Duration : 3 Hrs**
No. of page/s: 2

Section A

All questions are mandatory: (Each question: 4 marks)

Q.no.	COs	Question
1.	CO1	Elucidate the importance of capability curve of synchronous generator.
2.	CO2	Explain why high loop gain in AVR is undesirable and how to eliminate it.
3.	CO3	Explain in detail about static excitation system.
4.	CO4	Compare the performance of Series and Shunt compensation in a transmission line.
5.	CO4	Explain the importance of phase shifting transformer.

Section B

All questions are mandatory: (Each question: 10 marks)

Q.no.	COs	Question
6.	CO1	The heat rate of a 50 MW fuel fired generator unit is measured as follows: 25% of rating : 10 MKCal/MWhr 40% of rating : 8.6 MKCal/MWhr 100% of rating : 8 MKCal/MWhr Cost of fuel is Rs. 4 per MKCal. Calculate (a) $C(P_g)$ (b) Find the fuel cost when 100% loaded, 50% loaded and 25% loaded. (c) The incremental cost (d) The cost of fuel to deliver 51 MW.
7.	CO2	Derive the transfer function model of power system.
8.	CO3	Given the AVR loop has the time constants of Ts = 3s, Ta = 0.05s and Te = 0.4s. Find the value of open loop gain such that AVR loop is stable.
9.	CO4	a. Discuss the importance reactive power compensation in a transmission line. b. Explain in detail about TCR with a neat diagram.

Section C

All questions are mandatory: (Each question: 20 marks)

Q.no.	COs	Question
10.	CO1	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 P_{g1}, P_{g2} and P_{g3} are in MW. a. 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. b. Consider the generator limits and determine optimal dispatch by iterative technique using gradient method. $$125 \leq P_{g1} \leq 300\ MW$$ $$175 \leq P_{g2} \leq 350\ MW$$ $$100 \leq P_{g3} \leq 300\ MW$$
11.	CO3	a. Explain in detail about the method voltage control using tap changing transformer also derive the expression for tap changer settings. b. A 132 kV line is fed through 11 / 132 kV transformer from a constant 11 kV supply. At the load end of the line, the voltage is reduced by another transformer of nominal ratio 132 / 11 kV. The total impedance of the line and transformers at 132 kV is (20 + j 53) Ω. Both the transformers are equipped with tap changing facilities, which are so arranged that the product of the two off-nominal settings is unity. If the load on the system is 40 MW at 0.9 p.f. lagging, calculate the settings of the tap changers required to maintain the voltages at the both ends at 11 kV. . **OR** Derive the expression for real power and reactive power transfer if a. Shunt compensator is added at the middle of the transmission line b. Series compensator is added in the transmission line.

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Section A

All questions are mandatory: (Each question: 4 marks)

Q.no.	COs	Question
1.	CO1	Explain the significance of Heat rate curve, Cost curve in thermal power station.
2.	CO2	Draw the schematic diagram of load frequency control.
3.	CO3	Explain the function of excitation system.
4.	CO2	Explain the effect of generator loading in AVR loop.
5.	CO4	Discuss the effect of capacitor in series compensation circuit.

Section B

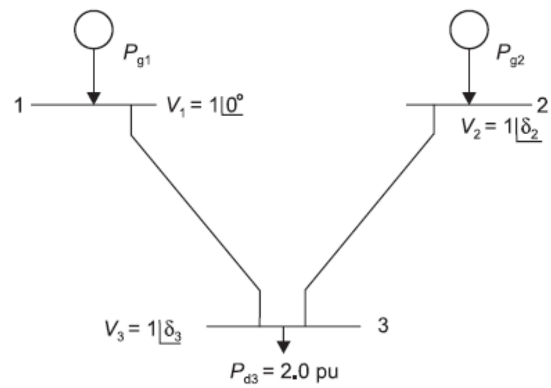
All questions are mandatory: (Each question: 10 marks)

Q.no.	COs	Question
6.	CO1	Derive the optimal loading condition of generators including line losses.
7.	CO2	Explain in detail about the static performance of AVR loop and derive the value of open loop gain for a specified accuracy of 1%.
8.	CO3	Discuss different types of excitation system and explain any two in detail with neat diagram.
9.	CO4	Explain in detail about Static Synchronous Compensators with neat diagram.

Section C

All questions are mandatory: (Each question: 20 marks)

Q.no.	COs	Question
10.	CO3	Draw the block diagram of the AVR loop without stability compensator. The values of the time constants are: $T_a = 0.04$ s; $T_e = 0.4$ s and $T_s = 2.5$ s. Construct the required root locus diagram and find the following a. Open loop gain of the system

		b. Steady state error of the system.
11.	CO1	Consider a power system network shown in figure. Given that $$IC_1 = 4.0 + 0.6P_{g1}$$ $$IC_2 = 4.0 + 0.6P_{g2}$$ $$Y_{Bus} = \begin{bmatrix} 1 - j10 & 0 & -1 + j10 \\ 0 & 0.5 - j5.0 & -0.5 + j5.0 \\ -1 + j10 & -0.5 + j5.0 & 1.5 - j15 \end{bmatrix}$$  Find the optimal generation schedule. **OR** Derive the expression of transmission loss coefficient for the network shown below. Assume the required parameters.