INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	**:**	**Power System Operation and Control**
Course Code	**:**	**A70230**
Class	**:**	**IV B. Tech I Semester**
Branch	**:**	**Electrical and Electronics Engineering**
Year	**:**	**2018 - 2019**
Course Coordinator	**:**	**Mr. A Sathish Kumar, Assistant Professor, EEE**
Course Faculty	**:**	**Mr. A Sathish Kumar, Assistant Professor, EEE**

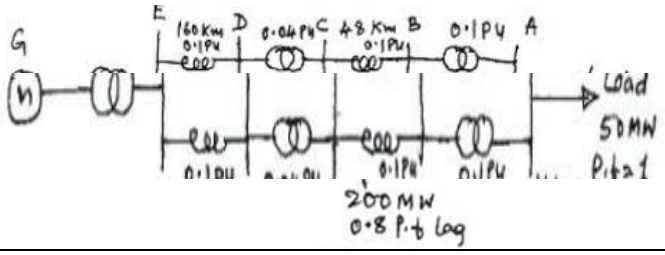
OBJECTIVE:

This course is deals with Economic operation of power system, hydrothermal scheduling and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control.

ASSIGNMENT I			
UNIT - I			
S. No	**QUESTION**	**Blooms Taxonomy Level**	**Course Outcomes**
1	Discuss in detail the terms production costs, total efficiency, incremental efficiency and incremental rates with respect to thermal power plant.	Understand	01
2	Describe the diagram of physical interpretation of coordination equation.	Remember	01
3	Give various uses of general loss formula and state the assumptions made for calculating B_{mn} coefficients.	Understand	01
4	Give step by step procedure for computing economic allocation of generation in a thermal station.	Remember	01
5	Write assumptions involved in deriving a loss formula coefficients.	Understand	02
6	The fuel cost for a two unit steam power plant are given by C1 = 0.1 $P1^2$ + 25 P1 + 1.6 Rupees/hour C2 = 0.1 P_2^2 + 32 P2 + 2.1 Rupees/hour Where p's are in megawatt. If there is an error of 1% in the representation of the input data, and the loss in operating economy for a load of 250 MW.	Understand	02
7	A power System consists of two, 125 MW units whose input cost data are represented by the equations : C1 = 0.04 P_1^2 + 22 P_1 + 800 Rupees/hour C2 = 0.045 P_2^2 + 15 P_2 + 1000 Rupees/hour If the total received power PR = 200 MW. Determine the load sharing between units for most economic operation.	Understand	02
8	100 MW, 150 MW and 280 MW are the ratings of three units located in a thermal power station. Their respective incremental costs are given by the following equations: dc1/dp1 = Rs(0.15p1 + 12);	Understand	02

	dc3/dp3 = Rs(0.21p3 + 13) dc2/dp2 = Rs(0.05p2 + 14) Where P1, P2 and P3 are the loads in MW. Determine the economical load allocation between the three units, when the total load on the station is 300 MW.		
9	150 MW, 220 MW and 220 MW are the ratings of three units located in a thermal power station. Their respective incremental costs are given by the following equations: dc1/dp1 = Rs(0.11p1 + 12); dc3/dp3 = Rs(0.1p3 + 13) dc2/dp2 = Rs(0.095p2 + 14) Where P1, P2 and P3 are the loads in MW. Determine the economical load allocation between the three units, when the total load on the station is (a) 350 MW (b) 500 MW.	Understand	02
10	What is mean by unit commitment problem? Discuss a method for solving the same.	Remember	01
	UNIT - II		
1	In a two plant operation system, the hydro plant is operation for 10 hrs, during each day and the steam plant is to operate all over the day. The characteristics of the steam and hydro plants are CT = 0.04 PGT^2 +30 PGT + 10 Rs/hr WH =0.12 PGH^2+30 PGH m3/ sec When both plants are running, the power own from steam plant to load is 150 MW and the total quantity of water is used for the hydro plant operation during 10 hrs is 150x106 m3. Determine the generation of hydro plant and cost of water used. Neglect the transmission losses.	Understand	04
2	In a two plant operation system, the Hydro plant is operating for 12 hrs. During each day and the hydro plant is operate all over the day. The characteristics of the steam and hydro plants are CT = 0.3 PGT^2+20 PGT + 5 Rs/hr WH =0.4PGH^2+20 PGH m3/ sec When both plants are running, the power own from steam plant to load is 300 MW and the total quantity of water is used for the hydro plant operation during 12 hrs is $180x10^6$ m3. Determine the generation of hydro plant and cost of water used.	Understand	04
3	Two generators rated 300 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 6% respectively from no load to full load. The speed changers of the governors are set so that a load of 400 MW is shared among the generators at 50 HZ in the ratio of their ratings. What are the no load frequencies of the generators.	Understand	05
4	A two plant hydro-thermal system with negligible losses has the following characteristics. Fuel cost as a function of active power generated at the thermal plant is F = ($2p_1$=$0.01p_2^2$) RS/hr. The optimal water conversion co-efficient is found to be 12.01RS/MCF. The load on the system is Duration (b) | 9 | 15 DD (MW) | 700 | 350 Compute the optimal active thermal and hydro power generations (in MW) in each of the subintervals and the allowable volume of water at the hydro plant.	Understand	05
5	A 3-phase single circuit, 220kV, line runs at no load. Voltage at the receiving end of the line is 205kV. Find the sending end voltage, if the line has resistance 21.7ohms, reactance of 85.2ohms and the total susceptance of $5.32X10^{-4}$ mho. The transmission line is to be represented by Pie-model.	Understand	05

6	Explain the problem of scheduling hydro thermal power plants. What are the constraints in the problem?	Understand	05
	UNIT - III		
17	What are the special features that are incorporated into the electrodynamometer wattmeter for making a low power factor type of wattmeter?	Understand	08
18	Explain how the power in a three phase circuit is measured by the use of single wattmeter?	Understand	09
19	In a dynamometer type wattmeter, the moving coil has 500 turns of mean diameter 3 cm. calculate the torque if the axis of the field and moving coils are at i) 30^0 ii) 60^0 and iii) 90^0 the flux density in the field coil is 15 m Wb/m^2, the current in the moving coil is 0.5 A and power being measured has a power factor of 0.866.	Understand	08
20	A wattmeter has a current coil of 0.1 ohms resistance and a pressure coil of 6500 ohms resistance. Calculate the percentage errors, due to resistance only with each of the two methods of connection of wattmeter when reading the input to an apparatus which takes i) 12 A at 250 V with unity power factor and ii) 12 A at 250 V and 0.4 power factor.	Understand	08
	ASSIGNMENT - II		
1	Determine the primary ALFC loop parameters for a control area with the following data: Total generation capacity = 2500 MW Normal operating load =1500 MW Inertia constant=5 kW-seconds per kVA; Load damping constant, B=1 %; frequency, f=50 Hz; and Speed regulation, R=2.5 Hz / p.u MW.	Understand	06
2	A 100 MVA Synchronous generator operates at 50 Hz, runs at 3000 rpm under no- load. A load of 25 MW is suddenly applied to the machine. Due to the time lag in the governor system the turbine commences to open after 0.6 sec. Assuming inertia constant H= 5 MW-sec per MVA of generator capacity, calculate the frequency of the system before steam own commences to increase to meet the new load.	Understand	07
3	Two generating stations 1 and 2 have full load capacities of 200 MW and 100 MW respectively at a generating frequency of 50 Hz. The two stations are interconnected by an induction motor and synchronous generator with a full load capacity of 25 MW. The speed regulation of station 1, station 2 and induction motor and synchronous generator sets are 4 %, 3.5% and 2.5% respectively. The load on respective bus bars is 75 MW and 50 MW respectively. Find the load taken by the motor generator set.	Understand	06
4	Two turbo alternators rated for 110 MW and 220 MW have governor drop characteristics of 5% 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.	Understand	06
	UNIT - IV		
1	Discuss the governor characteristics of a single generator.	Understand	09
2	Describe the nature of the steady state response of the uncontrolled LFC of a single area?	Remember	09
3	State briefly how the time response of the frequency error depends upon the gain setting of the integral control.	Remember	09
4	List out the basic requirements of a closed loop control system employed for obtaining the frequency constant?	Understand	09
5	Compute the nature of the generator load frequency characteristic?	Remember	09
6	With a neat block diagram explain the load frequency control for a single area system.	Understand	08
7	Draw and explain complete block diagram representation of single area	Remember	08

	having a turbo-generator supplying an isolated load for load frequency problem. Discuss the response of the system for a sudden change in load demand.		
8	Give a brief account on tie line bias bar control.	Remember	08
	UNIT - V		
1	Briefly explain the different methods of reactive power injection in the power system. 10 In a radial transmission system shown in figure, all p.u values are referred to the voltage bases shown and 100 MVA. Determine the power factor at which the generator must operate. 	Understand	10
2	Find the rating of synchronous compensator connected to the tertiary winding of a 132 kV star connected, 33 kV star connected, 11 kV delta connected three winding transformer to supply a load of 66 MW at 0.8 p.f. lagging at 33 kV across the secondary. The equivalent primary and secondary winding reactances are 32 ohms and 0.16 ohms respectively while the secondary winding reactance is negligible. Assume that the primary side voltage is essentially constant at 132 kV and maximum of nominal setting between transformer primary and secondary is1.1.	Understand	11
3	A 3-phase single circuit, 220kV, line runs at no load. Voltage at the receiving end of the line is 205kV. Find the sending end voltage, if the line has resistance of 21.7ohms, reactance of 85.2ohms and the total susceptance of $5.32X10^{-4}$ mho. The transmission line is to be represented by Pie-model.	Understand	10
4	Design a static VAR compensator for a low voltage distribution system with the following specifications: System voltage = 440 V System frequency = 50 Hz Coil inductance, L=5.37 mH The inductor saturates at 950 A and settles to a value of 1.8 mH at 1800 A. Compensation is required over a range of -80 kVAR to +30 kVAR per phase.	Understand	11
5	The load at receiving end of a three-phase, over head line is 25.5 MW, power factor 0.8 lagging, at a line voltage of 33 kV. A synchronous compensator is situated at receiving end and the voltage at both the ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has a resistance of 4.5 ohms per phase and inductive reactance (line to neutral) of 20 ohms per phase.	Understand	10
6	A 3-ph transmission line has resistance and inductive reactance of 25 and 90 respectively. With no load at the receiving end a synchronous compensator there takes a current lagging by 900, the voltage at the sending end is 145 kV and 132 kV at the receiving end. Calculate the value of the current taken by the compensator. When the load at the receiving end is 50 MW, it is found that the line can operate with unchanged voltages at sending and receiving ends, provided that the compensator takes the same current as before but now leading by 900. Calculate the reactive power of the load.	Understand	10
7	A 440V, 3-Ø distribution feeder has a load of 100 KW at lagging p.f. with the load current of 200A. If the pf. is to be improved, determine	Understand	10

	the following: i) Uncorrected pf. and reactive load ii) New corrected pf. after installing a shunt capacitor of 75 KVAR.		
8	A synchronous motor having a power consumption of 50 KW is connected in parallel with a load of 200KW having a lagging pf. of 0.8. If the combined load has a pf. of 0.9, what is the value of leading reactive KVA supplied by the motor and at what pf. is it working?	Understand	10

Prepared by: Mr. A Sathish Kumar, Assistant Professor, EEE

HOD, ELECTRICAL AND ELECTRONICS ENGINEERING