SIDDHARTH INSTITUTE OF ENGINEERING AND TECHNOLOGY :: PUTTUR
(Autonomous)

QUESTION BANK (DESCRIPTIVE)

Subject with Code : PSOC(**20EE0224**) **Course & Branch**: B.Tech - EEE

Year & Sem: III-B.Tech & II-Sem **Regulation:** R20

UNIT –I

ECONOMIC OPERATION

1. a. Briefly explain about Input-output characteristics, Heat rate curve and Cost curve of thermal power station. [L2][CO1] [6M]

b. Define objective function and briefly explain about an incremental fuel cost of thermal power station. [L2][CO1] [6M]

2. a. What is the need of system variables and explain briefly? [L2][CO1][6M]

b. Explain about optimum generation allocation with line loss neglected. [L2][CO1][6M]

3. a. State and explain the equality and inequality constraints on the optimization of product cost of a power station. [L1][CO1][4M]

b. The fuel cost of two units are given by, $C_1=1.5+20P_{G1}+0.1P_{G1}^2$ Rs/hr, $C_2=1.9+30P_{G2}+0.1P_{G2}^2$ Rs/hr. If the total demand on the generation is 200MW, find the economic load scheduling of the two units [L3][CO1][8M]

4. a Define penalty factor. [L2][CO1][2M]

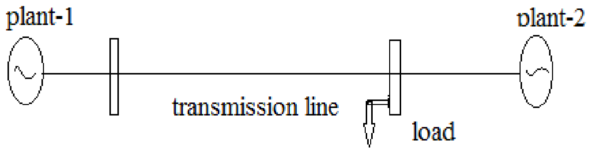
b Explain mathematical determination of optimum allocation of total load when transmission losses are taken into consideration [L2][CO1][10M]

5. The fuel inputs per hour of plants 1 and 2 are given as $F_1=0.2P_1^2+40P_1+120$ Rs/hr, $F_2=0.25P_2^2+ 30P_2+150$ Rs/hr. Determine the economic operating schedule and the corresponding cost of generation if the maximum and minimum loading on each unit is 100MW and 25MW, the demand is 180MW, and transmission losses are neglected. If the load is equally shared by both units, determine the saving obtained by loading the units as per equal incremental production cost. [L3][CO1][12M]

6. Derive the expression for general transmission loss formula in Optimal operation of Thermal Power Station. [L3][CO1][12M]

7. A system consists of two power plants connected by transmission line. The total load located at plant-2 is as shown in figure. Data of evaluating loss coefficients consist of information that a power transfer of 100 MW from station-1 to station-2 results in a total loss of 8 MW. Find the required generation at each station and power received by the load when λ of the system in Rs.100/Mwh. The IFCs of the two plants are given by [L3][CO1][12M]

$$\frac{dC_1}{dP_{G1}} = 0.12\, P_{G1} + 65 \text{ Rs/MWh.} \qquad \frac{dC_2}{dP_{G2}} = 0.25\, P_{G2} + 75 \text{ Rs/MWh}$$



8. The fuel cost curve of two generators are given as $C_1=0.06P_1^2+35P_1+625$ Rs/hr, $C_2=0.05P_2^2+30P_2+175$ Rs/hr. If the total load supplied is 550MW, find the optimal dispatch with and without considering the generator limits: $35MW< P_1<175MW$, $35MW< P_2<600MW$ and also comment about the incremental cost of both cases. [L3][CO1][12M]

9. The following incremental costs pertain to a 2 plant system. [L3][CO1] [12M]

$\frac{dF_1}{dP_1}=0.03P_1+14$ Rs/MWhr ; $\frac{dF_2}{dP_2}=0.04P_2+10$ Rs/MWhr. The loss coefficient are $B_{11}=0.001(MW)^{-1}$. $B_{12}=B_{22}=0$. If λ for the system is Rs.30/MWhr compute the required generation at the plants and the loss in the system

10 A system consists of two generators with the following characteristics [L3][CO1][12M]

$F_1=(7P_1+0.03P_1^2+70)10^6$; $F_2=(5P_2+0.05P_2^2+100)10^6$. Where F and P are fuel input in K-cal/hr and unit output in MW respectively. The daily load cycle is given as follows,

Time	Load
12 midnight to 6 am	50MW
6 am to 6 pm	150MW
6 pm to 12 midnight	50MW

Give the economic schedule for the three periods of the day.

UNIT –II

HYDRO-THERMAL SCHEDULING

1. a. What is the necessity of connecting two different plants on same load? [L1][CO2][4M]

b. Explain the hydro-thermal co-ordination and its importance. [L2][CO2][8M]

2. a. Define optimization problem of hydro-thermal system and Describe the types of hydro-thermal co-ordination. [L1][CO2][4M]

b. With neat figures explain the classification of hydro power plant [L2][CO2][8M]

3. a. What are the advantages of hydro-thermal plants combinations? [L1][CO2][4M]

b. Explain about conventional plants in detail [L2][CO2][4M]

c. What are the factors on which economic operation of a combined hydro-thermal system depends? [L1][CO2][4M]

4. a. Briefly explain about short term problem in hydrothermal scheduling. [L2][CO2][6M]

b. Briefly explain about long term problem in hydrothermal scheduling. [L2][CO2][6M]

5. Derive solution for short term hydro-thermal scheduling using kirchmayer's method. [L3][CO2][12M]

6. A two-plant system having a steam plant near the load center and a hydro-plant at a remote location is shown in Fig. The load is 500 MW for 16 hr a day and 350–MW, for 8 hr a day. The characteristics of the units are [L3][CO2][12M]

$C_1 = 120 + 45\, P_{GT} + 0.075\, P^2_{GT}$: $W_2 = 0.6\, P_{GH} + 0.00283\, P^2_{GH}\ m^3/s$

Loss coefficient, $B_{22} = 0.001\ MW^{-1}$

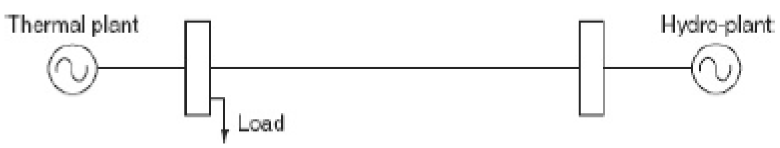


FIG. A typical two-plant hydro-thermal system

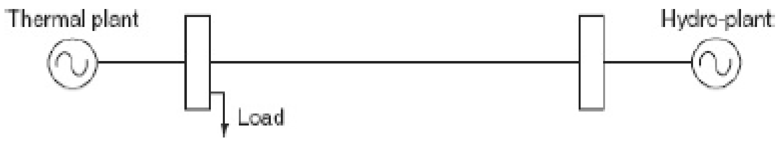
Find the generation schedule, daily water used by the hydro-plant, and daily operating cost of the thermal plant for $\gamma_j = 85.5$ Rs./m^3-hr.

7. Derive the condition for optimality of short-term hydro-thermal scheduling problem. [L3][CO2][12M]

8. In a two-plant operation system, the hydro-plant operates for 8 hr during each day and the steam plant operates throughout the day. The characteristics of the steam and hydro-plants are $C_T = 0.025\, P^2_{GT} + 14\, P_{GT} + 12$ Rs./hr [L3][CO2][12M]

$W_H = 0.002\, P^2_{GH} + 28\, P_{GH}\ m^3/s$. When both plants are running, the power flow from the steam plant to the load is 190 MW and the total quantity of water used for the hydro-plant operation during 8 hr is 220×10^6 m^3. Determine the generation of a hydro-plant and cost of water used. Neglect the transmission losses.

9. A load is feeded by two plants, one is thermal and the other is a hydro-plant. The load is located near the thermal power plant as shown in Fig. The characteristics of the two plants are as follows: $C_T = 0.04\ P^2_{GT} + 30\ P_{GT} + 20$ Rs./hr: $W_H = 0.0012\ P^2_{GH} + 7.5\ P_{GH}$ m^3/s and $\gamma = 2.5 \times 10^{-5}$ Rs./m^3 [L3][CO2][12M]



The transmission loss co-efficient is $B_{22} = 0.0015\ MW^{-1}$. Determine the power generation of both thermal and hydro-plants, the load connected when $\lambda = 45$ Rs./MWh.

10. A thermal station and a hydro-station supply an area jointly. The hydro-station is run 16 hr daily and the thermal station is run through 24 hr. The incremental fuel cost characteristics of the thermal plant are $C_T = 6+12P_{GT} +0.04\ P^2_{GT}$ Rs./hr. If the load on the thermal station, when both plants are in operation, is 350 MW, the incremental water rate of a hydro-power plant $\frac{d\omega}{dP_{GH}} = 28 + 0.03P_{GH} m^3/MW-s$. The total quantity of water utilized during a 16-hr operation of the hydro-plant is 450 million m^3. Find the generation of the hydro-plant and cost of water use. Assume that the total load on the hydro-plant is constant for the 16-hr period. [L3][CO2][12M]

UNIT –III

MODELING OF TURBINE AND GOVERNER

1		Explain turbine models for steam power plants with neat diagram.	[L2][CO3][12M]
2	a	Draw the block diagram of steam turbine and explain it in detail	[L1][CO3][6M]
	b	Discuss about transfer functions of reheat and non – reheat turbine.	[L2][CO3][6M]
3	a	Explain the functions of flyball speed governor and hydraulic amplifier in speed governing system.	[L2][CO3][6M]
	b	A 100 MVA synchronous generator operates on full load at a frequency of 50 Hz. The load is scheduled to 50 MW. Due to time lag in the governor	[L3][CO3][6M]

		system, the steam valve begins to close after 0.4 seconds. Determine the change in frequency that occurs in this time. M = 5 KW-S/KVA of generator capacity	
4		Two generating stations A and B have full load capacities of 200MW and 75MW respectively. The inter connector connecting the two stations has an induction motor /synchronous generator (plant (C) of full load capacity 25MW near station. A percentage changes of speed of A,B and C are 5 ,4 and 3 respectively. The loads on bus bars A and B are 75MW and 30MW respectively. Determine the load taken by the set C and indicate the direction of power flow	[L3][CO3][12M]
5		Two generator rated 200MW and 400MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50HZ at no load, how would a load of 600MW be shared between them? What will be the system frequency at this load? Assume free governor operation. Repeat the problem if the both governors have droop of 4%.	[L2][CO3][12M]
6	a	Explain about first order turbine model.	[L2][CO3][7M]
	b	Sketch the schematic diagram of speed governor system.	[L3][CO3][5M]
7		What are the parts of speed governor system? Explain each part with neat sketch.	[L1][CO3][12M]
8		Derive the mathematical modeling of speed governing system	[L3][CO3][12M]
9		Two turbo alternators rated for 110MW and 210MW, have governor drop characteristics of 5% from no load to full load. They are connected in parallel to share a load of 250MW. Determine the load shared by each machine assuming free governor action	[L3][CO3][12M]
10		Derive and explain the model of a generator and represent it by a block diagram.	[L3][CO3][12M]

UNIT –IV

LOAD FREQUENCY CONTROL

1	a	Why frequency of the power system should be kept constant?	[L4][CO4][6M]
	b	Discuss in detail the importance of load frequency control.	[L2][CO4][6M]
2	a	Define control area	[L1][CO4][2M]
	b	Explain about load frequency control and economic dispatch control.	[L2][CO4][10M]
3		Draw the block diagram representation of a single area system and deduce the expression for the steady state response of the system.	[L1][CO4][12M]
4	a	Derive the expression for dynamic response of isolated power system under uncontrolled case.	[L3][CO4][6M]
	b	A 500MW generator has a speed regulation of 4%. If the frequency drops by 0.12Hz with an unchanged reference, determine the increase in turbine power. And also find by how much the reference power setting should be changed if the turbine power remain unchanged.	[L3][CO4][6M]
5	a	Explain the multi control area systems.	[L1][CO4][5M]
	b	Two generating units having the capacities 600 and 900MW operating at a 50Hz supply. The system load increases by 150MW when both the generating units are operating at about half of their capacity which results in the frequency falling by 0.5Hz. If the generating units are to share the increased load in proportion to their ratings. What should be the individual speed regulations? What should the regulation to be expressed in PU Hz/ PU MW.	[L1][CO4][7M]
6		The following data is available for an isolated area, capacity 4000MW, frequency 50Hz, operating load 2500MW, speed regulation constant 2Hz/puMW. Intertia constant=5sec. 2% of change in load takes place for 1% change in frequency. Find a) Large change in step load if steady state frequency is not exceed by more than 0.2Hz. b) Change in frequency as a function of time after a step change in load.	[L3][CO4][12M]
7		Give typical block diagram for a two-area system inter connected by tie line and explain each block.	[L2][CO4][12M]
8		Two interconnected area 1 and area 2 have the capacity of 2000 and 500MW respectively. The incremental regulation and damping torque coefficient for	[L3][CO4][12M]

		each area on its own base are 0.2pu and 0.8pu respectively. Find the steady state change in system frequency from a nominal frequency of 50Hz and the change in steady state tie line power following a 750MW change in the load of area 1	
9		Explain the proportional plus integral control for load frequency control of single area system	[L2][CO4][12M]
10		Explain about of tie-line bias control with neat sketch	[L2][CO4][12M]

UNIT –V

REACTIVE POWER CONTROL AND POWER SYSTEM RESTRUCTURING

1	a	Describe about the series compensation in transmission line	[L2][CO5][6M]
	b	A short transmission line has an impedance of (2+j3) ohms interconnects two power stations, A and B both operating at 11 KV, equal in magnitude and phase. To transfer 25 MW at 0.8 p.f. lagging from A to B determine the voltage boost required at plant A.	[L3][CO5][6M]
2		Explain clearly what do mean by compensation of a transmission line and discuss briefly different methods of compensation	[L2][CO5][12M]
3		What are the different types of compensating equipment used for transmission systems. Explain all in detail	[L1][CO5][12M]
4		A load of (15+j10)MVA is supplied with power from a generating station from a line at 110KV 3 phase 50HZ. The line is 100Km length. The line is represented by π model with the parameters- R=26.4ohms, X=33.9ohms, B=219*10^{-6} voltage at the generated in 116KV. Determine the power supplied by the generating station	[L3][CO5][12M]
5		List the types of reactive power compensation. Briefly describe about load power compensation with necessary equations	[L1][CO5][12M]
6	a	What are the advantages and disadvantages of different types of compensating equipment for transmission systems?	[L1][CO6][7M]
	b	Explain about static var compensators.	[L2][CO5][5M]
7		Two substation A and B are interconnected by a line having an impedance of (0.03+j0.12)pu the substation voltages are 33<2^0 KV and 33<0^0 KV respectively. In phase and quadrature boosters are installed at A. Determine their output-voltage ratings and MVA ratings in order to supply 5MVA at	[L3[CO5][12M]

		0.8pf lagging at substation B.	
8	a	Distinguish shunt and series compensations.	[L2][CO5][6M]
	b	List the specifications of load compensation.	[L1][CO5][6M]
9	a	Explain the limitations of series compensation.	[L2][CO5][6M]
	b	What is surge impedance loading and also derive the necessary equations	[L1][CO5][6M]
10		Explain the motivation for restructuring power system.	[L2][CO6][12M]