INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRCIAL AND ELECTRONICS ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**ECONOMIC OPERATION OF POWER SYSTEMS**				
Course Code	**BPSB02**				
Programme	M.Tech				
Semester	I	EPS			
Course Type	Elective				
Regulation	**IARE - R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	**Dr. V. Chandra Jagan Mohan, Associate Professor, EEE**				
Course Faculty	**Dr. V. Chandra Jagan Mohan, Associate Professor, EEE**				

COURSE OBJECTIVES:

The course should enable the students to:

I	To understand the electrical power plant operation and control with respect to its economic aspect.
II	To know the importance of compensation in power system and study the different compensating techniques.
III	Study about different transients and their protection those are introduced in power system.

COURSE LEARNING OUTCOMES:

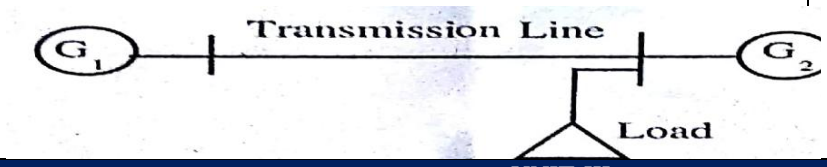
Students, who complete the course, will have demonstrated the ability to do the following:

BPSB02.01	Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems.
BPSB02.02	Design the mathematical models of the mechanical and electrical components involved in the operation of power systems and demonstrate the understanding of the open loop and closed loop control practices associated with the voltage and frequency control of single area or interconnected multi area power systems.

BPSB02.03	Specify the equivalent electrical parameters of transmission line to prepare and analyze models to predict the range and ratings of the equipments to be used, the protection required against line transients and determine the appropriate methods of compensation required for operational stability.
BPSB02.04	Solve the problems related to the economic dispatch of power, plant scheduling, unit commitment and formulate strategies to minimize transmission line losses and penalties imbibed..
BPSB02.05	Devise protection schemes required for the system to safeguard against transients after identifying and determining the severity of the transients occurring during the period of operation and design testing strategies to determine the performance characteristics of the compensating equipment to be used in the system.
BPSB02.06	Assess the different methods of control and compensation to choose the best option so that social and environmental problems are minimized and recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the flexibility and quality of operation

UNIT-I				
ECONOMIC LOAD SCHEDULING				
Part –A (SHORT ANSWER QUESTIONS)				
S. No	**Question**	**Blooms Taxonomy Level**	**CO**	**Course Outcome**
1	Define economic dispatch problem?	Remember	CO1	BPSB02.01
2	Define incremental cost?	Remember	CO1	BPSB02.01
3	Define base point?	Remember	CO1	BPSB02.01
4	Define participation factor?	Understand	CO1	BPSB02.03
5	What are the two basic types of steam turbines?	Remember	CO1	BPSB02.02
6	How can steam turbines be classified?	Remember	CO1	BPSB02.02
7	Besides lubrication, which are two functions of lubricating oil in some turbines?	Remember	CO1	BPSB02.03
8	Do the radial axial-bore cracks occur in the LP rotor/shaft alone?	Remember	CO1	BPSB02.03
9	How do the problems of vibration and fatigue arise with steam turbine blades?	Understand	CO1	BPSB02.03
10	What is the purpose of a turning gear?	Remember	CO1	BPSB02.02
11	What is the principle of a steam turbine?	Understand	CO1	BPSB02.02
12	What is the function of a gland drain?	Understand	CO1	BPSB02.02
13	What is the difference between partial and full arc admission?	Understand	CO1	BPSB02.03
14	What is the cause of circumferential cracking?	Remember	CO1	BPSB02.03
15	What is meant by the water rate of a turbine?	Remember	CO1	BPSB02.03
PART – B (LONG ANSWER QUESTIONS)				
1	Explain briefly the following : i) Capital cost ii) Operational cost	Understand	CO1	BPSB02.02
2	Enumerate and explain briefly various methods used to calculate the depreciation cost.	Understand	CO1	BPSB02.01
3	Discuss the selection of power plant equipments. What are the selection criterion for selection them	Understand	CO1	BPSB02.03
4	Describe the economics of steam plant, I.C. engine plants, gas plants, hydro plants, diesel plant and hydro steam plants	Understand	CO1	BPSB02.03
5	What do you mean by depreciation? How will you calculate depreciation in power plant?	Understand	CO1	BPSB02.03
6	Derive an expression for cost of electrical energy for power plants. Explain how the cost of unit energy generated by a generating unit is estimated.	Understand	CO1	BPSB02.03
7	Discuss about economics in plant selection and explain the economics of different types of generating plants.	Understand	CO1	BPSB02.03
8	Explain various techniques for power plants cost analysis with suitable example.	Understand	CO1	BPSB02.03
9	What is depreciation reserve? Discuss the methods to calculate depreciation charges.	Understand	CO1	BPSB02.03
10	Explain the components which constitute the fixed and operating cost of power plant.	Understand	CO1	BPSB02.02
11	Determine the generating cost per unit of energy from the following plant data, installed capacity = 120 MW, Capital cost of power plant = Rs40000/- per KW, interest and depreciation = 15%, Fuel consumption = 0.64 Kg/KWh, peak load = 100MW, load factor = 60%, salaries , wages, repairs and other operating costs per annum = Rs50000000/-	Understand	CO1	BPSB02.02
12	Explain the fixed percentage method to calculate the depreciation charge.	Understand	CO1	BPSB02.01
13	Discuss about the economics in plant section and explain the economics of different	Understand	CO1	BPSB02.02
14	What are the different factors affecting economic generations and distributions of generating plants.	Understand	CO1	BPSB02.01

15	A power plant has an initial cost of Rs2×10^8. Assuming a salvage value of 15% and useful life of 25 years. (i). Find rate of depreciation of by fixed percentage method. (ii). Also find the accumulated depreciation at the end of tenth year.	Understand	CO1	BPSB02.02
UNIT-II				
UNIT COMMITMENT				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define Unit commitment?	Remember	CO1	BPSB02.02
2	What is the thermal unit constraint?	Understand	CO1	BPSB02.02
3	Define minimum up time?	Remember	CO1	BPSB02.02
4	Define minimum down time?	Understand	CO1	BPSB02.02
5	Define crew constraints?	Remember	CO1	BPSB02.03
6	What are the two approaches to treat a thermal unit to operating temperature?	Remember	CO1	BPSB02.01
7	What are the techniques for the solution of the unit commitment problem?	Understand	CO1	BPSB02.02
8	What is load curve?	Remember	CO1	BPSB02.02
9	What is daily load curve?	Remember	CO1	BPSB02.02
10	What is monthly load curve?	Understand	CO1	BPSB02.02
11	What is yearly load curve?	Remember	CO1	BPSB02.02
12	What is connected load?	Understand	CO1	BPSB02.03
13	What is Maximum demand?	Understand	CO1	BPSB02.01
14	What is Demand factor?	Remember	CO1	BPSB02.01
15	What is Average demand?	Remember	CO1	BPSB02.01
PART – B (LONG ANSWER QUESTIONS)				
1	Explain the following of thermal power plants: (i).Input, output and heat rate characteristics, (ii). Penalty factors.	Understand	CO1	BPSB02.02
2	What are the sources of transmission losses in power plants and how can we overcome these losses?	Understand	CO1	BPSB02.02
3	Explain the optimal load allocation for a system having large of generating units.	Understand	CO1	BPSB02.02
4	Discuss the input, output, heat rate and incremental fuel rate characteristics of thermal power plants.	Understand	CO1	BPSB02.01
5	The fuel input characteristics for two thermal plants are given by F, : (8P, + 0.024 P t2 +80) 106 K- cal/hr. F2: (6P2+ 0.004 P22 +120) 106 K- cal,&r. Where P, and P, are in megawatts. i) Plot the input-output characteristics for each unit. ii) Plot the heat rate characteristics for each unit. (8) iii) Assuming the cost of fuel as Rs. 100/ton calculate the incremental production cost characteristics in Rs,MWhr for each plant plot the same against power produced in MW.	Understand	CO1	BPSB02.03
6	Explain the economic scheduling of thermal power plants considering effect of transmission losses.	Understand	CO1	BPSB02.02
7	How the sequence of adding units in thermal power plants is is decided?	Understand	CO1	BPSB02.02
8	Discuss input – output curve, heat rate and incremental cost.	Understand	CO1	BPSB02.03
9	Explain the economic scheduling considering transmission losses.	Understand	CO1	BPSB02.02
10	Two generating units of thermal stations have cost characteristics as under $C1 = 561+7.92P_1 + 0.001562 P_1^2$ RS/HR $C1 = 310 + 7.85 P_2 + 0.00194 P_2 2$ RS/HR Obtain the cost characteristics of the composite unit for a total demand P_T.	Understand	CO1	BPSB02.03
11	Explain the following of thermal power plants. (i). Effects of transmission losses. (ii). Sequence of adding units.	Understand	CO1	BPSB02.01

12	Explain the different methods of loading turbo generators in power plants.	Understand	CO1	BPSB02.02
13	What do you mean by penalty factors? Derive an expression of penalty factors. Explain the utility of power plants.	Understand	CO1	BPSB02.02
14	A system consists of two plants connected by a transmission line as shown in figure. The load is at plant 2. The transmission line loss calculations reveal that a transfer of 100 MW from plant 1 to plant 2 means a loss of 15 MW. Find the required generation at each plant for λ = 60. Assume that the incremental costs of the two plant are given by $dC_1/dP_1 = 0.2P_1 + 22$ RS/MWh $dC_2/dP_2 = 0.15P_2 + 30$ RS/MWh 	Understand	CO1	BPSB02.02
	UNIT-III			
	HYDRO THERMAL SCHEDULING			
	PART – A (SHORT ANSWER QUESTIONS)			
1	Define hydrothermal scheduling problem?	Understand	CO2	BPSB02.02
2	Define spinning reserve?	Remember	CO2	BPSB02.02
3	What is meant by scheduled reserve?	Remember	CO2	BPSB02.03
4	What are the assumptions made in dynamic programming problem?	Remember	CO2	BPSB02.03
5	Define long range hydro scheduling problem?	Remember	CO2	BPSB02.03
6	What is the optimization technique for long range hydro scheduling problem?	Remember	CO2	BPSB02.03
7	Define short range hydro scheduling problem?	Remember	CO2	BPSB02.03
8	Define system blackout problem?	Remember	CO2	BPSB02.02
9	What is meant by cascading outages?	Understand	CO2	BPSB02.03
10	What is range of temperature at Hydro thermal reservoirs?	Remember	CO2	BPSB02.03
11	When do hydrothermal resources arise?	Remember	CO2	BPSB02.03
12	How does the hot water or steam escape through earth surface?	Remember	CO2	BPSB02.02
13	What is the range of depth of most Hydro thermal wells?	Remember	CO2	BPSB02.03
14	How the steam after passing turbine is cooled down in the geo thermal energy plant?	Remember	CO2	BPSB02.04
15	How much percent of Non-condensable gases are contained in steam?	Remember	CO2	BPSB02.04
	PART – B (LONG ANSWER QUESTIONS)			
1	Explain the various base load peak load operation requirements for hydro thermal plants.	Understand	CO2	BPSB02.02
2	What do you mean by short term hydro thermal coordination? Explain with example.	Understand	CO2	BPSB02.02
3	Explain the following for hydro thermal plants. (a) Scheduling methods and applications. (b) Reservoirs of hydro and thermal plants.	Understand	CO2	BPSB02.03
4	What are the advantages of Hydra thermal coordination? Explain the coordination of runoff river and steam plant.	Understand	CO2	BPSB02.03
5	Explain the long-term energy scheduling in hydro thermal system	Understand	CO2	BPSB02.03
6	Describe the short term hydro thermal scheduling.	Understand	CO2	BPSB02.03
7	For a hydro-thermal plant the total load is a constant of 90 MW for a month of 30 days. Find the running time of the thermal plant if the maximum hydroenergy is 50, 000 MWhr. The cost function of thermal power plant is given by (F" : 54 + 11 Pth + 0.02 P,r, '?) Unit of cost 41-.	Understand	CO2	BPSB02.03

8	What are the advantages of pump storage plant as peak load plant in an Inter connected system?	Understand	CO2	BPSB02.03
9	Explain plant requirement for base load and peak load operation.	Understand	CO2	BPSB02.03
10	Explain the advantages of operating hydro thermal plant in coordination.	Understand	CO2	BPSB02.03
11	A two plant system is having a steam plant near load centre a hydro plant at a remote location. The load is 700 MW for 14 hrs a day 500 mw for 10 hrs a day the characteristics of units are loss coefficient B_{22} = .0005, $C_1 = (24+0.02P_1)\ P_1$ RS/hr, $W_2 = (6 + 0.0025P_2)\ P_2\ m^3$/sec. Find the generation schedule, daily water used by hydro plant and daily operating cost thermal plant for γ_2 = 2.5 Rs/hr/m3/sec.	Understand	CO2	BPSB02.03
12	What do you mean by hydro thermal co ordination? Explain with suitable example.	Understand	CO2	BPSB02.04
13	Discuss the advantages of combined operation (hydro-thermal co-ordination).	Remember	CO2	BPSB02.03
14	Explain the combined working of run- off river and steam plant.	Remember	CO2	BPSB02.03
15	Explain the reservoirs of hydro and thermal plants.	Remember	CO2	BPSB02.03
	UNIT – IV			
	LOAD FREQUENCY CONTROL			
	PART – A (SHORT ANSWER QUESTIONS)			
1	What is meant by load frequency?	Remember	CO2	BPSB02.04
2	What does load frequency control mean?	Remember	CO2	BPSB02.04
3	What is automatic load frequency control?	Remember	CO2	BPSB02.04
4	Why is load frequency control necessary?	Remember	CO2	BPSB02.03
5	What is Area Control Error?	Remember	CO2	BPSB02.04
6	How is frequency controlled in power system?	Understand	CO2	BPSB02.03
7	What is AGC power system?	Remember	CO2	BPSB02.04
8	How does a governor work?	Remember	CO2	BPSB02.04
9	What is control area concept?	Remember	CO2	BPSB02.04
10	What is tie line bias control?	Understand	CO2	BPSB02.05
11	What is a tie line number?	Remember	CO2	BPSB02.05
12	What is a tie line in power systems?	Understand	CO2	BPSB02.04
13	What is single area system?	Understand	CO2	BPSB02.05
	PART – B (LONG ANSWER QUESTIONS)			
1	Explain the synchronizing current and power of generators.	Understand	CO2	BPSB02.03
2	Discuss about the effect of change in excitation and load sharing effects of alternators.	Understand	CO2	BPSB02.03
3	Explain the following with neat sketches: (a) Synchronizing power and torque of alternators. (b) Operating limits of alternators.	Understand	CO2	BPSB02.04
4	Explain synchronizing current and power for two alienators in parallel	Understand	CO2	BPSB02.05
5	A 3 MVA, 6 pole alternator runs at 1000 r.p.m. in parallel with other machines on 3.3 kV bus bars. The synchronous, reactance is 20% Calculate the synchronizing power per one mechanical degree of displacement and the corresponding torque.	Understand	CO2	BPSB02.04
6	Explain the effect of change in excitation on alternator in parallel.	Understand	CO2	BPSB02.04
7	Two alternators working in parallel supply a load of 3000 kw and a motor load aggregating to 5000 kW at a p.f. 0.72-,one machine is loaded up to 5000 kw at 0.8 p.f. lagging. what is the load and power factor of the other machine?	Understand	CO2	BPSB02.04
8	What is synchronizing power? How does it help in keeping the machines in step ?	Understand	CO2	BPSB02.05
9	Discuss the effect of change in excitation of one of the machines when two alternators are running in parallel.	Understand	CO2	BPSB02.05
10	Discuss briefly control of active and reactive power.	Understand	CO2	BPSB02.05
11	Discuss the conditions necessary for parallel operation of alternators.	Remember	CO2	BPSB02.05
12	Explain load sharing and sharing of currents when two alternators are running in parallel. Write short note on infinite bus bar. Discuss the	Remember	CO2	BPSB02.05

	conditions necessary for parallel operation of alternator.			
13	Explain synchronizing current and power for two alternators in parallel. Discuss the operating limits of alternator.	Remember	CO2	BPSB02.05
UNIT – V				
OPTIMAL POWER FLOW				
PART – A (SHORT ANSWER QUESTIONS)				
1	What is optimal power flow?	Understand	CO3	BPSB02.05
2	What is optimal power flow analysis?	Understand	CO3	BPSB02.06
3	What is DC power flow?	Understand	CO3	BPSB02.05
4	Why DC power flow is required?	Understand	CO3	BPSB02.05
5	What is DC current used for?	Understand	CO3	BPSB02.06
6	Why DC supply is not used in home?	Understand	CO3	BPSB02.05
7	What is reactive power used for?	Understand	CO3	BPSB02.05
8	Can batteries provide reactive power?	Understand	CO3	BPSB02.06
9	What is an algorithm and an example?	Understand	CO3	BPSB02.07
10	What are different types of algorithms?	Understand	CO3	BPSB02.05
PART – B (LONG ANSWER QUESTIONS)				
1	Write short notes on the following : (A) Break even and minimum cost analysis. (B) Linear and non linear break even.	Understand	CO3	BPSB02.05
2	Write short notes on the following: (a) Economics for electrical goods and services. (b) Supply and demand economics.	Understand	CO3	BPSB02.06
3	Explain financial efficiencies of electrical goods and services. Describe break even cost analysis.	Understand	CO3	BPSB02.06
4	Explain supply and Demand. Write short note on linear and nonlinear minimum cost analysis.	Understand	CO3	BPSB02.05
5	Write short notes on linear and non linear break even. Also write on break even and minimum cost analysis.	Understand	CO3	BPSB02.06
6	Explain supply and demand relationship.	Understand	CO3	BPSB02.06
7	Explain the concept of break even analysis in brief.	Understand	CO3	BPSB02.05
8	Describe supply and demand economics. Also explain the equilibrium of economy.	Understand	CO3	BPSB02.06
9	Describe financial efficiencies of electrical goods and services in brief.	Understand	CO3	BPSB02.06
10	How the change in demand does occur? Explain with required curves.	Understand	CO3	BPSB02.05

Prepared by:

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