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Question Paper Code: BPSB02



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

M.Tech I Semester End Examinations, January - 2020

Regulations: R18

**ECONOMIC OPERATION OF POWER SYSTEMS
(ELECTRICAL POWER SYSTEMS)**

Time: 3 hours

Max. Marks: 70

Answer ONE Question from each
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. a) Describe the economics of steam plant, I.C. engine plants, gas plants, hydro plants, diesel plant and hydro steam plants. [7M]
- b) 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. [7M]
2. a) Discuss about economics in plant selection and explain the economics of different types of generating plants. [7M]
- b) What are the different factors affecting economic generations and distributions of generating plants. [7M]

UNIT – II

3. a) Explain the following for hydro thermal plants. [7M]
 (a) Scheduling methods and applications. (b) Reservoirs of hydro and thermal plants.
- b) Explain the following of thermal power plants. [7M]
 (i). Effects of transmission losses. (ii). Sequence of adding units.
4. a) What do you mean by penalty factors? Derive an expression of penalty factors. Explain the utility of power plants. [7M]
- b) Explain the economic scheduling of thermal power plants considering effect of transmission losses. [7M]

UNIT – III

5. a) Explain the following for hydro thermal plants. [7M]
 (a) Scheduling methods and applications. (b) Reservoirs of hydro and thermal plants.
- b) What are the advantages of hydro thermal coordination? Explain the coordination of runoff river and steam plant. [7M]
6. a) Describe the advantages of pump storage plant as peak load plant in an Inter connected system? [7M]
- b) What do you mean by hydro thermal co ordination? Explain with suitable example. II. Explain the reservoirs of hydro and thermal plants. [7M]

UNIT – IV

7. a) Explain the following with neat sketches: [7M]
(a) Synchronizing power and torque of alternators. (b) Operating limits of alternators.
- b) Discuss the effect of change in excitation of one of the machines when two alternators are running in parallel. [7M]
8. a) 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 [7M]
- b) Explain synchronizing current and power for two alternators in parallel. Discuss the operating limits of alternator. [7M]

UNIT – V

9. a) Write short notes on the following : [7M]
(a) Break even and minimum cost analysis. (b) Linear and non linear break even.
- b) Give a brief introduction on optimal power flow and discuss how we can combine economic dispatch to optimal power flow. [7M]
10. a) Explain financial efficiencies of electrical goods and services. Describe break even cost analysis. [7M]
- b) Briefly discuss on optimal power flow (OPF) using DC power flow and explain about algorithms for solution of the ACOPF, [7M]



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COURSE OBJECTIVES:

The course should enable the students to:

I	Formulate and derive the necessary conditions for economical load scheduling problem.
II	Understand various constraints, problem formulation and methods to solve the UNIT commitment problem.
III	Explain the constraints related to hydro power plants, problem formulation and solution techniques for hydro-thermal scheduling problem.
IV	Describe the necessity, factors governing the frequency control and analyze the uncontrolled and controlled LFC system.
V	Explain the basic difference between ELS and OPF problem, formulation of the OPF problem and solution techniques.

COURSE OUTCOMES (COs):

CO 1	Understand the electrical power plant operation and control with respect to its economic aspect.
CO 2	Know the importance of compensation in power system and study the different compensating techniques.
CO 3	Study about different transients and their protection those are introduced in power system.
CO 4	Able to understand about the implementation of automatic generation control (AGC).
CO 5	Analyze the problem of optimal power flow (OPF).

COURSE LEARNING OUTCOMES (CLOs):

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.
BPSB02.03	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.
BPSB02.04	Assess the different methods of control and compensation to choose the best option so that social and environmental problems are minimized
BPSB02.05	Recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the quality of operation.
BPSB02.06	Know about constraints in UNIT commitment and dynamic programming solutions.
BPSB02.07	Understand the characteristics of hydro and thermal units.
BPSB02.08	Analyze short term and long term hydro-thermal scheduling.
BPSB02.09	Remember different hydroelectric plant models, hydrothermal scheduling with storage limitations and dynamic programming solution to hydrothermal scheduling.
BPSB02.10	Understand control of generation and models of power system elements.
BPSB02.11	Know how to control generation with the help of PID controllers.
BPSB02.12	Analyze the implementation of Automatic Generation control (AGC) and AGC features.
BPSB02.13	Know the problem of Optimal power flow , OPF calculations combining economic dispatch and power flow
BPSB02.14	Analyze optimal power flow (OPF) using direct current (DC) power flow.
BPSB02.15	Able to understand algorithms for solution of the ACOPF, optimal reactive power dispatch.

MAPPING OF SEMESTER END EXAMINATION TO COURSE OUTCOMES

SEE Question No	Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level	
1	a	BPSB02.01	Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems.	CO 1	Remember
	b	BPSB02.02	Design the mathematical models of the mechanical and electrical components involved in the operation of power systems.	CO 1	Understand
2	a	BPSB02.03	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.	CO 1	Remember
	b	BPSB02.02	Design the mathematical models of the mechanical and electrical components involved in the operation of power systems.	CO 1	Understand
3	a	BPSB02.04	Assess the different methods of control and compensation to choose the best option so that social and environmental problems are minimized	CO 2	Understand
	b	BPSB02.05	Recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the quality of operation.	CO 2	Understand
4	a	BPSB02.05	Recognize the need to continuously follow the advancements in technology and incorporate them in the present system to improve efficiency and increase the quality of operation.	CO 2	Understand
	b	BPSB02.06	Know about constraints in UNIT commitment and dynamic programming solutions.	CO 2	Understand
5	a	BPSB02.07	Understand the characteristics of hydro and thermal units.	CO 3	Understand
	b	BPSB02.08	Analyze short term and long term hydro-thermal scheduling.	CO 3	Understand
6	a	BPSB02.08	Analyze short term and long term hydro-thermal scheduling.	CO 3	Understand
	b	BPSB02.09	Remember different hydroelectric plant models, hydrothermal scheduling with storage limitations and dynamic programming solution to hydrothermal scheduling.	CO 3	Understand
7	a	BPSB02.10	Understand control of generation and models of power system elements.	CO 4	Understand
	b	BPSB02.11	Know how to control generation with the help of PID controllers.	CO 4	Understand
8	a	BPSB02.12	Analyze the implementation of Automatic Generation control (AGC) and AGC features.	CO 4	Understand
	b	BPSB02.12	Analyze the implementation of Automatic Generation control (AGC) and AGC features.	CO 4	Understand
9	a	BPSB02.13	Know the problem of Optimal power flow , OPF calculations combining economic dispatch and power flow	CO 5	Understand
	b	BPSB02.14	Analyze optimal power flow (OPF) using direct current (DC) power flow.	CO 5	Remember
10	a	BPSB02.15	Able to understand algorithms for solution of the ACOPF	CO 5	Understand
	b	BPSB02.15	Able to understand algorithms for solution of the ACOPF	CO 5	Understand

Signature of Course Coordinator

HOD, EEE