Code No: 137FX **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, January/February - 2023
POWER SYSTEM OPERATION AND CONTROL
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Give the necessity of maintaining frequency constant.	[2]
b)	Why PI is preferred over PD controller in LF control system?	[3]
c)	Distinguish between line and load compensation.	[2]
d)	How is line reactive power flows is related to bus voltages?	[3]
e)	What is Incremental Cost function? What is its physical significance?	[2]
f)	What is Penalty Factor? Give the expression for it.	[3]
g)	Briefly discuss about the computational burden in solving UC problem with increasing number of units.	[2]
h)	Distinguish between economic load scheduling and unit commitment problems.	[3]
i)	What is Energy Management System?	[2]
j)	Explain SCADA system.	[3]

PART – B

(50 Marks)

2. Explain, with a neat sketch, the principle of operation of a hydraulic governor and derive its linear block diagram representation from the basic governing equations. [10]

OR

3. Derive the transfer function of the closed loop controlled single area load frequency system and perform the steady state analysis and deduce the inferences there from. [10]

4.a) Why is voltage control required in power systems?
b) Why is excitation control necessary in an alternator? And briefly discuss about types of Excitation systems. [4+6]

OR

5.a) Derive the relation between voltage, power and reactive power at a node.
b) Briefly explain shunt capacitance method of voltage profile improvement and loss minimization in transmission lines. [5+5]

6.a) Briefly explain the input-output curve, heat rate curve, and incremental fuel and production cost curves of a Thermal Power generating station, with a neat sketch.

b) For the system of three units with the following data:

Unit1: Coal-fired steam unit: Max output=600MW & Min output=150MW

Input-output curve: $H_1\{\frac{MBtu}{h}\} = 510 + 7.2P_1 + 0.00142P_1^2$

Unit2: Oil-fired steam unit: Max Output=400MW & Min Output=100MW

Input-output curve: $H_2\{\frac{MBtu}{h}\} = 310 + 7.85P_2 + 0.00194P_2^2$

Unit3: Oil-fired Steam Unit: Max output=200MW & Min Output=50MW

Input-output curve: $H_3\{\frac{MBtu}{h}\} = 78 + 7.97P_3 + 0.00482P_3^2$

Take the fuel cost of Unit1: 0.9$/Mbtu, Unit2: 1.0 $/Mbtu, Unit3: 1.0 $/Mbtu.

Determine the economic operating point for these three units when delivering a total of 850 MW. [4+6]

OR

7. Derive the generalized Transmission loss formula. [10]

8. Explain the algorithm for solving unit commitment problem using forward dynamic program. [10]

OR

9.a) Explain the spinning reserve constraints, thermal unit constraints, hydro constraints, fuel constraints and other constraints in unit commitment problem

b) Explain Priority List method for solving Unit Commitment problem. [4+6]

10.a) Explain the Need of computer control of power systems.

b) Explain the objectives of a Load Dispatch centre and give the various routines performed for system operations. [4+6]

OR

11. Explain the importance of load forecast in real time operation of power system. Briefly discuss any one load forecasting method. [10]

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