Hall Ticket No | | | | | | | | | | |

Question Paper Code: AEEC35

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2023
Regulation: UG-20
POWER SYSTEM OPERATION AND CONTROL

Time: 3 Hours **(ELECTRICAL AND ELECTRONICS ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Explain the optimal generation schedule among various generation systems when transmission losses are neglected in a thermal system. [BL: Understand| CO: 1|Marks: 7]

   (b) Obtain the transmission line loss formula for a system consisting of n generating plants supplying several loads inter connected through transmission networks. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) What are the components of speed governor system of an alternator? Draw the schematic diagram and explain. [BL: Understand| CO: 2|Marks: 7]

   (b) The AVR system of a generation has the following data given in Table 1. Find the steady state response. [BL: Apply| CO: 2|Marks: 7]

Table 1

Gain	Time	constant
Amplifier	10	0.1
Exciter	1	0.9
Generator	1	1

MODULE – III

3. (a) Draw the block diagram of two-area load frequency control system and explain the uncontrolled static analysis. [BL: Understand| CO: 3|Marks: 7]

   (b) A two area system connected by a tie-line has the following parameters given in Table 2 with base MVA for each area [BL: Apply| CO: 3|Marks: 7]

Table 2

Area	1	2
Turbine output power	2000 MVA	1000 MVA
Nominal frequency	50 Hz	50 Hz
Inertia constant	3%	4%
Power system gain	50 Hz / p.u MW	40
Governor time constant	0.3	0.2
Turbine time constant	0.6	0.4

The synchronizing power coefficient is computed from the initial operating condition T12 = 2.0 p.u. A load change of 400 MW occurs in area 1. Determine the steady state frequency and the change in the tie-line flow. Comment on the results.

4. (a) Discuss in detail the dynamic response of a single area system, without integral control following a step load disturbance. [BL: Understand| CO: 4|Marks: 7]

   (b) For the isolated area the following data are available, Rated capacity of the area = 1500 MW, Nominal operating load = 750 MW, inertia constant of the area = 5.0 sec, speed regulation of all regulating generators = 3 %, Nominal frequency = 50Hz. Assume linear load frequency characteristic which means the connected system load increases by one percent if the system frequency increases by one percent. [BL: Understand| CO: 4|Marks: 7]

MODULE – IV

5. (a) Differentiate between voltage and current in AC circuits? Explain the concept of power factor. [BL: Understand| CO: 5|Marks: 7]

   (b) A single phase motor connected to 400V, 50Hz supply takes 31.7A at power factor of 0.7 lagging. Calculate the capacitance required in parallel with the motor to raise the power factor 0.9 lagging. [BL: Apply| CO: 5|Marks: 7]

6. (a) How the voltage control is achieved by injection of power at nodes? Outline the operation of on load tap changing transformer. [BL: Understand| CO: 5|Marks: 7]

   (b) An alternator is supplying a load of 300 kw at 0.6 p.f lagging. If the power factor to be improved to unity, how many more kilo watts can alternator supply for the same KVA loading. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Name the various categories of loads. Write the charcteristics of typical load system. [BL: Understand| CO: 6|Marks: 7]

   (b) A generating station has a maximum demand of 25 MW. Load factor is 60%, plant capacity factor is 50% and plant use factor is 72%. Find the reserve capacity and daily energy produced. [BL: Apply| CO: 6|Marks: 7]

8. (a) Draw the load curve and load duration curve. Summarize the importance of these curves in connection with economic operation of power system. [BL: Understand| CO: 6|Marks: 7]

(b) A power supply is having the following loads given in Table 3. [BL: Apply| CO: 6|Marks: 7]

Table 3

Type of load	Maximum demand (kw)	Diversity factor of group	Demand factor
Domestic	10,000	1.2	0.8
Commercial	30,000	1.3	0.9
Industrial	50,000	1.35	0.95

If the overall system diversity factor is 1.5 determine

i) The maximum demand

ii) Connected load of each type.