GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

POWER SYSTEM-III

EE703A

TIME ALLOTTED: 3Hours **FULL MARKS:70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No
1.	i)	If penalty factor of a plant is unity. Its incremental transmission loss is a) -1 b) 0.0 c) 1 d) 2.0	1	CO2
	ii)	A power system has a maximum load of 15 MW. Annual load factor is 50%. The reserve capacity of plant is _____ if the plant capacity factor is 40%. a) 3.75 MW b) 7.75 MW c) 46.75 MW d) 8.75 MW	1	CO1
	iii)	Frequency in Indian Power Grid is maintained at a) 45 – 55 Hz b) 49 – 51 Hz c) 49.9 – 50.05 Hz d) 49.5 - 50.2	1	CO1
	iv)	Economic operation of power system is carried out on the basis of a) Equal incremental fuel cost b) Equal area criterion c) Equal fuel cost criterion d) All units sharing equal power.	1	CO2
	v)	Unit of regulation of speed governor is a) Hz/MW b) MW/Hz c) Unit less d) km/sec	1	CO3
	vi)	The propagation constant is given by a) $\gamma = \sqrt{(Z/Y)}$ b) $\gamma=\sqrt{(ZY)}$ c) $\gamma=\sqrt{(Z+Y)}$ d) $\gamma=\sqrt{(Z-Y)}$	1	CO4

vii) What is the suitable condition for Ferranti Effect to occur in a transmission line? 1 CO4
   a) Short and Unloaded line
   b) Short and Loaded line
   c) Long and Loaded line
   d) Long and Unloaded line

viii) TCSC is a 1 CO1
   a) shunt controller.
   b) series controller.
   c) combination of a) and b)
   d) none of these

ix) Pump storage hydro units serve as, 1 CO3
   a) Spinning reserve
   b) Scheduled reserve
   c) Offline reserve
   d) Must run unit.

x) Permissible change in power frequency is 1 CO1
   a) ±0.5 Hz
   b) ± 1 Hz
   c) ± 5 Hz
   d) ±10 Hz

xi) The unit of transmission loss coefficient is 1 CO2
   a) MW
   b) $(MW)^{-1}$
   c) $(MW)^{-2}$
   d) Unit less

GROUP – B
(Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No
2.	Describe the solution methodology of Economic Load Dispatch with transmission loss. What are penalty factor and incremental transmission loss?	5	CO3
3.	Two generators rated 250 MW and 400 MW are operating in parallel. The droop characteristics of the governors are 4% and 6% respectively. if a load of 450 MW be share between them. What will be the system frequency?	5	CO2
4.	Derive the expression for reflection and refraction co-efficient for voltage and current travelling waves.	5	CO4

5. There are two turbo-generators feeding a load bus with the following incremental characteristics: (5, CO3)

$$\frac{dF_1(P_1)}{dP_1} = 3 + 0.015P_1 \text{ and}$$

$$\frac{dF_2(P_2)}{dP_2} = 2 + 0.018P_2 .$$

Find the economic schedule if total load is 160 MW. Assume no generator limits.

6. A generating station has a maximum demand of 25 MW, at load factor of 60%,a plant capacity factor of 50% and a plant use factor of 72%.Find (i) the daily energy produced, (ii) the reserve capacity of the plant and (ii) the maximum energy that could be produced daily if the plant, while running as per schedule, were fully loaded. (5, CO2)

GROUP – C
(Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

		Marks	CO No
7. a.	What is hydro-thermal scheduling? What do you mean by long term and short term hydro-thermal scheduling? How do you justify for the cost of water?	6	CO2
b.	A power system has two generating plants and the power is being dispatched economically with P_1 = 125MW and P_2 = 250 MW. The loss coefficients are $B_{11} = 0.10 \times 10^{-2}$ MW^{-1}, $B_{12} = -0.01 \times 10^{-2}$ MW^{-1}, $B_{22} = 0.13 \times 10^{-2}$ MW^{-1}. To raise the total load on the system by 1 MW will cost an additional Rs 200 per hour. What will be the penalty factor for plant 1 and plant 2?	9	CO3
8 a.	The reactive power supplied by a synchronous generator to an infinite bus can be varied by varying the excitation. Explain.	5	CO4
b.	What is FACTS? Classify FACTS controllers.	5	CO1
c.	What is passive compensation? Compare series and shunt compensation.	5	CO4
9 a.	What is an exciter? What is its role in AVR loop?	6	CO1
b.	A 100 MVA 50 Hz turbo alternator operates at no load at 3000 r.p.m. A load of 25 MW suddenly applied to the machine and the steam valves to the turbine commence to open after 0.6 sec due to the time lag in governor system. Assuming inertia constant H of 4.5 kW-sec per kVA of generator capacity, calculate the frequency to which the generated voltage drops before the steam flow commence to increase to meet the new the new load.	9	CO2
10. a.	Explain the mechanism by which lightening strokes develop and induce over voltages on overhead power lines.	10	CO4
b.	Explain lightening phenomenon.	5	CO4
11.	Write Short note: (Any three)	3x5=15	
a.	Necessity of restructuring in electricity market	5	CO1
b.	Static Synchronous Compensator (STATCOM)	5	CO2
c.	Pump Storage Plan for Hydro thermal scheduling	5	CO3
d.	Unit commitment.	5	CO3
e.	Bewley Lattice Diagram	5	CO4