MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

EE-703A

POWER SYSTEM-III

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. $10 \times 1 = 10$

(i) What is the unit of regulation in an AGC system?

(A) Hz / MW (B) MW / Hz (C) Unit less (D) MW / Sec

(ii) In an electrical power grid, the acceptable frequency variation is within

(A) ±10% (B) ±5% (C) ±2% (D) ±1%

(iii) A generating unit has an incremental production cost of Rs. 60.00 per MWh. If penalty factor for this unit is 1.2, what is the incremental cost of power?

(A) Rs. 120.00 (B) Rs. 72.00 (C) Rs. 50.00 (D) Rs. 12.00

(iv) Two neighboring Power System network having different frequencies may be interconnected through

(A) 800 KV HVDC link (B) 400 KV AC link
(C) 765 KV AC link (D) 1200 KV AC link

(v) The ownership and coordination of Transmission and Grid Management under Deregulation must be

(A) Government Monopoly
(B) Government and Private Operation
(C) Government, Private and Retail Operation
(D) Private Monopoly

(vi) What is the main function of series compensation in Transmission Lines?

(A) To prevent Ferro-Resonance (B) To improve Power Factor
(C) To enhance Stability Limit (D) To prevent Ferranti Effect

(vii) Which device is suitable to operate as a synchronous condenser?

(A) Synchronous generator
(B) Squirrel-cage induction motor
(C) Under-excited synchronous motor
(D) Over-excited synchronous motor

(viii) What is the suitable condition for Ferranti Effect to occur in a transmission line?

(A) Long and unloaded line
(B) Long and loaded line
(C) Short length and loaded line
(D) Medium length unloaded line

(ix) An overhead transmission line is provided with earth wire for protection against which type of disturbance?

(A) Switching surge (B) Travelling wave
(C) Lighting surge (D) Ferro-resonance

(x) The transient phenomenon lasts in power system for how much time?

(A) A few microseconds only (B) A few milliseconds to one second
(C) A few minutes (D) Instantaneous only

(xi) The characteristics impedance of a 250 km line is 400 ohms. What is the characteristic impedance of 200 km length of the same line?

(A) 320 ohms (B) 500 ohms (C) 200 ohms (D) 400 ohms

(xii) Series compensation in EHV line is used to

(A) improve voltage profile (B) reduce fault level
(C) improve efficiency (D) reduce power factor

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Explain Penalty Factor. A generating unit has an incremental production cost of Rs. 3,000 per MWh. If penalty factor for this unit is 1.15, calculate the incremental cost rate for this unit.

3. Describe the solution methodology of economic load dispatch with transmission loss.

4. What are the different environmental aspects on power generation?

5. Explain Ferranti effect in transmission line.

6. What is hydro-thermal scheduling? What do you mean by short term and long term hydro-thermal scheduling?

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. The input-output curves of the generators of a power plant are : 15

$C_1 = 1000 + 20P_1 + 0.02P_1^2$ Rs. / hr.
$C_2 = 400 + 15P_2 + 0.03P_2^2$ Rs. / hr.
$C_3 = 600 + 18P_3 + 0.025P_3^2$ Rs. / hr.

Find the generation schedule for a load of 1000 MW.
Given that $0 \le P_1 \le 300$ MW, $100 \le P_2 \le 500$ MW and $200 \le P_3 \le 600$ MW.

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8. (a) Explain the different components of a turbine speed governor with the help of a neat sketch. 7
(b) What is a Tie-line? Derive a model for the representation of Tie-line for frequency control analysis. 8

9. A two area system connected by a tie-line and operating in parallel at 60 Hz frequency at 1000 MVA base has the following parameters: 15

Parameter	Area-1	Area-2
Speed Regulation(R)	0.05	0.0625
Frequency sensitive load coefficient(D)	0.6	0.9
Turbine Time Constant(τ_T)	0.5	0.6
Generator Time Constant(τ_G)	0.2	0.3
Inertia Constant(H)	5.0	4.0

Find Tie-line power flow for a load change 187.5 MW occurred in Area-1. Assume nominal frequency of 50 Hz. Draw the frequency response to load change with or without AGC.

10. An overhead line is connected in series with a cable. The overhead line has an inductance of 2 mH/km and capacitance of 0.01 μF/km. The cable has an inductance of 0.25 mH/km and capacitance of 0.102 μF/km. If a surge having a maximum value of 100 kV travels along the overhead towards its junction with the cable, calculate – 15

(a) the surge impedance of the line and the cable,
(b) the velocities of wave propagation in the line and cable,
(c) the reflected and transmitted waves of voltage and current in junction.

If the 100 kV surge originates in the cable, calculate the reflected and transmitted waves of voltage and current at the junction.

11. (a) Write short note on Spinning Reserve. 5
(b) Write short notes on Distributed Generation and Dispersed Generation. 5
(c) Discuss and Formulate the Hydrothermal Scheduling problem. 5

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