CBCS SCHEME

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17EE81

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
Power System Operation and Control

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the operating states of power system with a neat block diagram and discuss the various parameters states in each block. **(08 Marks)**

b. Illustrate various controls adopted during preventive and emergency operation of power system. **(07 Marks)**

c. List and briefly explain any five key concepts of reliable operation of power systems. **(05 Marks)**

OR

2 a. With a neat diagram, explain various components of SCADA system. **(10 Marks)**

b. Explain with flowchart dynamic programming methods for unit commitment. **(10 Marks)**

Module-2

3 a. Explain Discrete Time Interval Method for Hydrothermal Scheduling. **(12 Marks)**

b. Obtain short-term hydrothermal scheduling using penalty factors. **(08 Marks)**

OR

4 a. Mention two major control loops the generators are equipped with and explain basic generator control loops with a neat block diagram. **(08 Marks)**

b. Two machines operate in parallel to supply a load of 400 MW. The capacities of the machines are 200 MW and 500 MW. Each has a droop characteristic of 4%. Their governors are adjusted so that the frequency is 100% on full load. Calculate the load supplied by each unit and the frequency at this load if the frequency is 50 Hz. **(06 Marks)**

c. Briefly explain the commonly used terms in AGC:
(i) Tie line (ii) Time Deviation (iii) Station Control Error **(06 Marks)**

Module-3

5 a. Derive mathematically the generator model, load model and combined generator-load model of ALFC system. **(12 Marks)**

b. Explain function of Proportional Integral Controller in AGC with the reduced models. **(08 Marks)**

OR

6 a. Derive the state space model of an isolated AGC system. **(10 Marks)**

b. Two control areas are connected via a tie line with the following characteristics:
Area 1 : $R_1 = 1\%$, $D_1 = 0.8$, Base MVA = 500
Area 2 : $R_2 = 2\%$, $D_2 = 1.0$, Base MVA = 500
If a load increase of 100 MW occurs in Area 1, what is the new steady state frequency and the change in tie flow if the nominal frequency is 50 Hz? Repeat if the load change occurs in Area 2. **(10 Marks)**

Module-4

7 a. With necessary assumptions derive expression for Tie line oscillations and conditions for critical, under and over damping. **(10 Marks)**

b. Two areas 1 and 2 are interconnected. The capacity of area 1 is 1500 MW and area 2 is 500 MW. The incremental regulation and damping torque coefficient for each area on its own base are 0.2 p.u and 0.9 p.u respectively. Find the steady state frequency and change in steady state tie line power, for an increase of 60 MW in area 1. The nominal frequency is 50 Hz. What would be the effect of not having governor control? **(10 Marks)**

OR

8 a. Explain different methods of voltage control by reactive power injection. **(09 Marks)**

b. Derive an expression for cost saving in installation of reactive power equipment for a simple two part Tariff. **(05 Marks)**

c. Three generating stations are connected to a common bus bar X, as shown in Fig.Q8(c). For a particular system load, the live voltage at the bus bar falls by 2 KV. Calculate the reactive power injection required to bring back the voltage to the original value. All p.u. values are on a 500 MVA base.

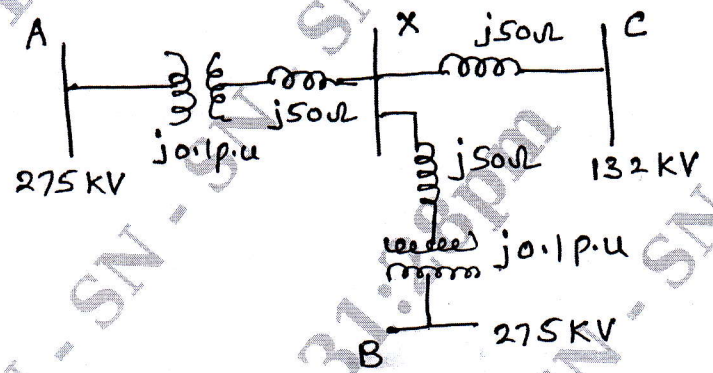

Fig.Q8(c) **(06 Marks)**

Module-5

9 a. Explain Adequacy Indices at various hierarchical levels. **(08 Marks)**

b. Draw and explain the flow chart for contingency analysis procedure. **(06 Marks)**

c. Explain 1P1Q method for Contingency Ranking. **(06 Marks)**

OR

10 a. Explain the formation and state estimate using linear least square estimation. Also explain the condition for observability in least square estimates. **(10 Marks)**

b. Explain other issues in State Estimation. **(10 Marks)**

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