CBCS SCHEME

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21EE72

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
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. What are the operating states of a power system? Explain them in brief showing transition of states with a block diagram. **(10 Marks)**

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

c. Explain the major components of energy management center. **(05 Marks)**

OR

2 a. With a neat diagram, explain the general configuration and major components of SCADA system. **(10 Marks)**

b. List and briefly explain the classification of SCADA systems with relevant diagrams. **(10 Marks)**

Module-2

3 a. With a schematic diagram, explain the frequency and excitation voltage regulators of turbo generators. **(10 Marks)**

b. Explain function of proportional plus integral controller in Automatic Generation Control (AGC) with relevant block diagram. **(10 Marks)**

OR

4 a. Derive the generator model, load model and combined generator load model of automatic load frequency control system. **(10 Marks)**

b. Given a control area with 3 generating units with following ratings:

Unit	Rating (MVA)	%R (on machine base)
1	200	0.01
2	500	0.025
3	750	0.04

The units are loaded as follows: P_1 = 100 MW, P_2 = 400 MW and P_3 = 600 MW. If load increased by 200 MW, what are new generations if D = 0? Repeat for D = 1.0. **(10 Marks)**

Module-3

5 a. Explain optimal two area load frequency control by state variable. **(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 line flow if the nominal frequency is 50 Hz? Repeat if the load change occurs in Area 2. **(10 Marks)**

OR

6 a. With a neat schematic diagram, explain automatic voltage control of generator. **(08 Marks)**

b. Explain in detail speed governor dead band and its effect on AGC. **(06 Marks)**

c. Two control areas of capacity 1500 MW and 10,000 MW are interconnected through a tie-line. The parameters of each area on its own capacity are R = 1 Hz/pu MW and D = 0.02 pu MW/HZ. There is an increase of 200 MW in load of area 2. Determine the steady-state frequency deviation and change in tie-line power. **(06 Marks)**

Module-4

7 a. Explain the different methods of voltage control by transformers. **(10 Marks)**

b. Three generating stations are connected to a common bus X as shown in Fig.Q.7(b) below. For a particular load, the line voltage at the bus bar falls by 2 KV. Calculate the reactive power injection required to bring back the voltage to original value. All are in pu values on base of a 500 MVA. **(10 Marks)**

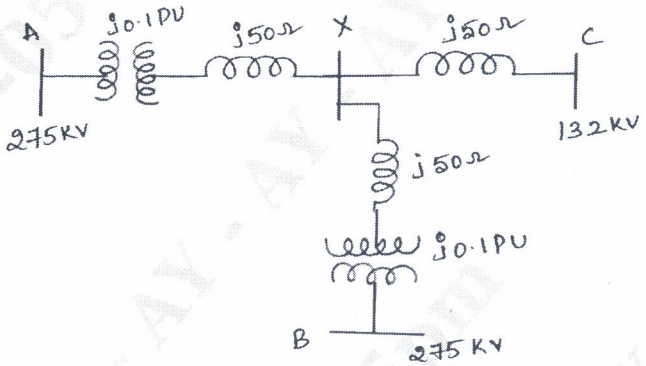

Fig.Q.7(b)

OR

8 a. Write a short note on absorption of reactive power and sensitivity of voltage. **(10 Marks)**

b. Explain the different methods of voltage control by reactive power injection. **(10 Marks)**

Module-5

9 a. Explain the power system security levels and major factors affecting security. **(10 Marks)**

b. Explain IPIQ method for contingency raking. Also explain the contingency processing using AC load flow analysis with a flow chart. **(10 Marks)**

OR

10 a. Explain the formulation and state estimate using linear square estimation. **(10 Marks)**

b. Explain with neat flowchart contingency analysis for line outage, using outage distribution factors. **(10 Marks)**

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