CBCS SCHEME

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15EE81

Eighth Semester B.E. Degree Examination, July/August 2022
Power System Operation and Control

Time: 3 hrs. Max. Marks: 80

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 diagram showing the transition between the states. **(08 Marks)**

b. Explain the algorithm of priority list method of unit commitment. **(08 Marks)**

OR

2 a. With a neat diagram explain the general configuration and major components of SCADA system. **(08 Marks)**

b. Explain the various constraints to be considered in unit commitment. **(08 Marks)**

Module-2

3 a. Explain the general algorithm for hydro-thermal scheduling. **(08 Marks)**

b. Two generators rated 200MW and 400MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no-load to full-load. The speed set point are such that the generators operate at 50Hz when sharing the full load of 600MW in proportion to their ratings, i) If the load reduced to 400MW, how is it shared ? At what frequency will system operate? ii) If now the speed changers are reset so that the load of 400MW is shared at 50Hz in proportion to their rating, what are the no-load frequency now? **(08 Marks)**

OR

4 a. A steam plant and a hydro plant supply a load of 500MW for 12h and 300MW for 12h in a day. The thermal plant characteristics are given by

$F(P_{GT}) = 0.06\ P_{GT}^2 + 40P_{GT} + 100$ unit cos/h

The hydro plant characteristic is given by

$Q = 0.003P_{GH}^2 + 0.5P_{GH}\ m^3/s$

The loss is given by $P_{LOSS} = 0.001P_{GH}^2$

The value of γ is 80. Find the scheduling of power and the total discharge. Also determine the daily operating cost of thermal plant and the water used daily by the hydro plant. Obtain the schedule: i) Neglecting losses ii) Considering losses. **(10 Marks)**

b. Explain different modes of governor operation. **(06 Marks)**

Module-3

5 a. Derive the generator model, load model and combined generator load model of ALFC system. **(07 Marks)**

b. Two control areas are connected via a tie line with the following characteristics:
Area 1 : R1 = 1%, D_1 = 0.8, base MVA : 500
Area 2 : R1 = 2%, D = 1.0, base MVA : 500
A load change of 100 MW occurs in Area 1. Find the new steady state frequency, change in the line flow and change in generation of each area if the nominal frequency is 50 Hz. **(09 Marks)**

OR

6 a. A single area consists of two generators with following data:
G1: 200 MW $R_1 = 4\%$ (on machine base)
G2 : 400 MW $R_1 = 5\%$ (on machine base)
They are connected in parallel and share a load of 600 MW in proportion to their ratings, at 50 Hz. If 200 MW of load is tripped, what is the generation by each unit? What is the frequency at new load is D = 1.5 pu (on a base of 200 MW). Choose a base of 200 MW. Also find the increase in load due to frequency. **(08 Marks)**

b. Derive the state model of an isolated AGC system. **(08 Marks)**

Module-4

7 a. Two control areas of capacity 1500 MW and 10000 MW are interconnected through the tie-line. The parameters of each area on its own capacity are R = 1 Hz/PUMW and D = 0.02 PUMW/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. **(08 Marks)**

b. What are the tie-line oscillations? What determines the frequency of these oscillations? **(08 Marks)**

OR

8 a. Explain generation and absorption of reactive power in electrical power system. **(06 Marks)**

b. 3 – generating stations are connected to a common bus-bar X, as shown on Fig.Q8(b) for a particular system load, the line 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 PU values are on a 500 MVA base.

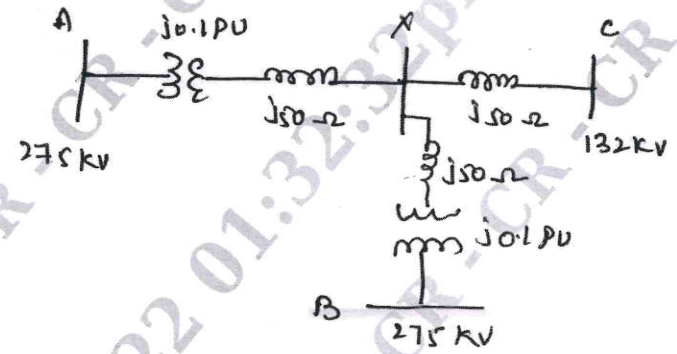

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Explain briefly various security levels of Energy Management System (EMS). **(08 Marks)**

b. Explain the formulation and state estimate using linear least square estimation. Also explain the condition for observability in least square estimation. **(08 Marks)**

10 a. Explain major functions involved in system security. **(08 Marks)**

b. With a neat flow chart, explain contingency analysis for the line outage, using line outage distribution factor. **(08 Marks)**

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