CBCS SCHEME

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15EE81

Eighth Semester B.E. Degree Examination, June/July 2019
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. With mathematical model and constraint, explain r-λ iterative algorithm for short term hydrothermal scheduling. **(10 Marks)**

b. Two synchronous generators 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 characteristics of 4%. Their governors are adjusted so that the frequency is 100% on full load. Calculate the load supplied by each unit and frequency at this load. The system is 50 Hz system. **(06 Marks)**

OR

4 a. A two plant system with a hydral plant and a thermal plant has the following characteristics. The fuel cost characteristic of thermal plant is $F_T = 20P_{GT} + 0.04P_{GT}^2 Rs/hr$. The water discharge characteristics of hydral plant is $Q = 7.5P_{GH} + 0.004P_{GH}^2 m^3/sec$. The constant which converts incremental water discharge to incremental plant cost γ is 4.1×10^{-4} Rs/m^3 and $\lambda = 70$ Rs/MWhr, $B_{GH} = 0.0025$ MW^{-1}. Determine the generation of each plant, the load on the system and losses. **(08 Marks)**

b. Explain the following terms used in AGC:
i) Control area ii) Tie line
iii) Net interchange iv) Station control error **(08 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. Explain the different methods of voltage control by reactive power injection. **(08 Marks)**

b. Three generating stations are connected to a common bus bar and as shown in Fig.Q7(b). For a particular system load the line voltage at bus x falls by 5 KV. Calculate the reactive power injection required to bring back the voltage to the original value. All pu values are on a base of 500 MVA.

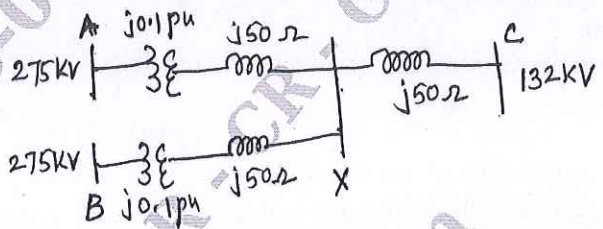

Fig.Q7(b) **(08 Marks)**

OR

8 a. Explain voltage control using; tap changing transformers, Booster transformers and phase shifting transformers. **(08 Marks)**

b. A 415 V, 50 Hz 3ϕ system delivers 500 KW at 0.8 p.f. lag. Shunt capacitors are installed to improve the p.f. to 0.92. Determine the value of capacitors needed if the capacitor bank is star connected. **(08 Marks)**

Module-5

9 a. With a neat flow chart, explain contingency analysis for generation outage using generation shift sensitivity factors. **(08 Marks)**

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

OR

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

b. Explain 1P1Q method for contingency Ranking. Also explain contingency processing using AC load flow analysis with a flow chart. **(08 Marks)**

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