CBCS SCHEME

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17EE81

Eighth Semester B.E. Degree Examination, July/August 2022
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. State and explain various key concepts for reliable operation of a power system. **(10 Marks)**

b. Define Unit Commitment Problem. Explain various constraints to be considered for the solution of Unit Commitment Problem. **(10 Marks)**

OR

2 a. State and explain the major components of a SCADA system. **(10 Marks)**

b. List out the purposes of RTUs used for SCADA in power systems. Also explain in detail the major components of RTUs and its functions. **(10 Marks)**

Module-2

3 a. Define a fundamental hydrothermal system. Also formulate the problem of fundamental hydrothermal scheduling, mathematically. **(10 Marks)**

b. A two plant system with a hydro plant and a thermal plant has the following characteristics.

Fuel cost characteristics of thermal plant is, $F_T = 20P_{GT} + 0.04P_{GT}^2$ Rs/hr.

Water discharge characteristics of hydro plant is, $Q_0 = 7.5P_{GH} + 0.004P_{GH}^2$ m^3/s.

Take $\gamma = 4.1 \times 10^{-4}$ Rs/m^3, $\lambda = 70$ sS/MWhr and $B_{HH} = 0.0025$ MW^{-1}.

Determine the generation of each plant, load on the system and the transmission power losses. **(10 Marks)**

OR

4 a. State the basic control loops equipped in a generator in power plant and explain them in detail with a neat functional block diagram. **(10 Marks)**

b. What are the functions of AGC? Explain various speed governing systems used in primary ALFC loop of a generator. **(10 Marks)**

Module-3

5 a. Derive a complete mathematical model of the primary ALFC loop of AGC and then also derive its transfer function. **(15 Marks)**

b. An isolated generating unit has the following parameters:

$T_{TR} = 0.3$ sec, $T_G = 0.2$ sec, $M = 10$ sec (2H), $D = 1.0$ pu, $R = 0.05$ pu

For a unit step decrease in load demand, determine the steady state frequency deviation and transfer function of primary ALFC loop of the generating unit. **(05 Marks)**

OR

6 a. Derive a mathematical model of a Tie-line interconnecting two control areas 1 and 2. Then draw the block diagram representation of a two-area interconnected system with primary control loop. **(10 Marks)**

b. Explain the frequency bias tie-line control of a two area system stating various tie line control actions. Also draw the block diagram of AGC for a two area system. **(10 Marks)**

Module-4

7 a. Derive a state space model of an isolated control area with AGC supplementary control in usual notations. **(10 Marks)**

b. Explain the dynamic response of tie line oscillations in a two-area system for a change in load demands in both areas. Also explain various dampings in tie-line oscillations. **(10 Marks)**

OR

8 a. Explain in detail, the production and absorption of reactive power by various components in a power system. **(06 Marks)**

b. Explain the control of voltage in a bus bar using synchronous condensers. **(04 Marks)**

c. Describe in detail, the following voltage control methods using transformers:
(i) Tap-changing transformers
(ii) Booster transformers **(10 Marks)**

Module-5

9 a. State and explain various security levels of the power system. **(06 Marks)**

b. List out the major functions of power system security and explain them in detail. **(08 Marks)**

c. Explain the factors affecting the power system security. **(06 Marks)**

OR

10 a. Define the following terms:
(i) Generation-shift sensitivity factor
(ii) Line-outage distribution factor **(04 Marks)**

b. Explain the contingency analysis procedure for the following outages in a power system with flow charts:
(i) Generator outages
(ii) Line outages **(16 Marks)**

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