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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Aug. / Sep. - 2020

Power System Operation and Control

4/9/2020

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **TWO** full questions, selecting **ONE** full question from **UNIT - I** and **UNIT - II**.*
*ii) Answer any **THREE** full questions, choosing from **UNIT - III, UNIT - IV** and **UNIT - V**.*

UNIT - I

1 a. With a neat block diagram, explain digital computer configuration for power system control. 10

b. Derive the expression for tie-line power flow and frequency deviation for two area system. 10

OR

2 a. Explain parallel operation of generators with necessary derivation. 10

b. Explain area control error. 4

c. Two synchronous generators are initially supplying a common load at 1 pu frequency (60 Hz). The rating of Unit 1 is 337 MW and has 0.03 pu droop built into its governor. Unit 2 is rated at 420 MW and has 0.05 pu droop. Find each units share of a 0.1 pu (75.7 MW (or) 10% of total generation) increase in the load demand. Also find new line frequency. 6

UNIT - II

3 a. Derive the mathematical model of the speed governing system for AGC. 10

b. Two control areas are connected via a tie-line with following characteristics:

Area 1: $R_1 = 1\%$, $D_1 = 0.8$, MVA Base = 500
Area 2: $R_2 = 2\%$, $D_2 = 1.0$, MVA Base = 500 10

A load increase of 100 MW occurs at Area 1, what is the new steady state frequency and change in flow? Assume nominal frequency.

OR

4 a. Explain the concept of control area and obtain transfer function model of ALFC of a single area. 8

b. Explain in detail the block diagram representation of two area system. 12

UNIT - III

5 a. Obtain the relationship between voltage, real and reactive power at a node. 10

b. A 200 kV line is fed through 33/230 kV transformer from a constant 33 kV supply. A single line diagram of a 3-phase system is shown in Fig. Q5(b). The impedance of the line is (30+j80) Ω. Both the transformer is equipped with top changing facility which are so arranged that the product of half nominal setting as unity. If the load on the system is 150 MW at 0.9 P.f. Determine the setting of tap changer required to maintain the voltage of load bus bar at 33 kV. 10

Contd....2

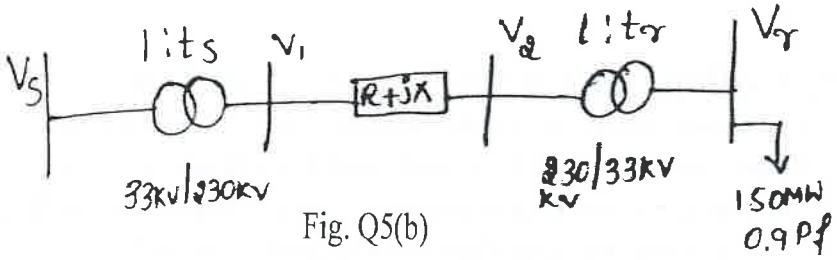

Fig. Q5(b)

6 a. Discuss briefly on voltage control using;

i) Reactive power injection

ii) Top changing transformer 10

b. Explain voltage stability and voltage collapse with neat graphs. 10

UNIT - IV

7 a. Discuss the problems of unit commitment in optimal power system operation. Mention its constraints. 10

b. What are the different methods of solving unit commitment problem? Explain any one method briefly. 10

8 a. Construct a priority list for the units;

Unit 1: Min =150 MW Max = 600 MW

$H_1 = 510 + 7.2P_1 + 0.00142P_1^2$ MBtu/h

Unit 2: Min = 100 MW Max = 400 MW

$H_2 = 310 + 7.85P_2 + 0.00194P_2^2$ MBtu/h 10

Unit 3: Min = 50 MW Max = 200 MW

$H_3 = 78 + 7.97P_3 + 0.00482P_3^2$ MBtu/h

b. Explain spinning reserve and thermal constraints. 10

UNIT - V

9 a. Explain AC power flow security analysis. 10

b. Explain contigency analysis using sensitivity factors. 10

10 a. Explain the power system security function with an example. 10

b. Explain any two types of network sensitivity factors. 10

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4/9/2020

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