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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; July - 2021

Power System Operation and Control

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer any **FIVE** full questions.*

1 a. Write briefly about SCADA with the help of digital computer configuration. 10

b. Two areas are interconnected as shown in Fig. 1(b). The generating capacity of area "A" is 36,000 MW and its regulating characteristics is 1.5% of capacity per 0.1 Hz. Area "D" has a generating capacity of 4000 MW and its regulating characteristic is 1% of capacity per 0.1 Hz. Find each area's share of +400 MW disturbance (load increase) occurring in area "D" and resulting tie-line flow. 10

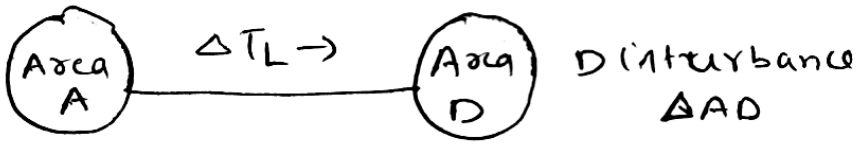

Fig. 1(b)

2 a. Obtain an expression for a tie-line power and frequency deviation in a two area control of load frequency. 10

b. Explain parallel operation of generators. 10

3 a. Explain the basic control loops of generator. 10

b. Explain how mathematical model of speed governor system in developed for Automatic Generator Control (ACG)? 10

4 a. Explain dynamic response of load frequency control of an isolated area for change in load using first order approximation. 10

b. A 100 MVA alternator is operating at rated load and UPF. The normal operating frequency is 50 Hz, the load suddenly increases by 50%. Find change in frequency, if it takes 0.4 sec before the steam volve starts opening to admit more steam. Take inertia constant $H = 5$ MJ/MVA. 10

5 a. Obtain relation between voltage, real power and reactive power. 6

b. Obtain the different sources and sinks of reactive power. 4

Contd… 2

c. Three supply point *A*, *B*, *C* are connected to common busbar *M*. Supply point *A* is maintained at nominal 275 kV and is connected to *M* through a 275/132 kV transformer of 0.1 PU reactance and a 132 kV line C_f 50 Ω reactance. Supply point *C* is nominally at 275 kV and in connected to *M* by a 275/132 kV transformer of 0.1 PU reactance and a 132 kV line of 50 Ω reactance. Supply point *B* is at 132 kV and connected to *M* through 132 kV line of 50 Ω reactance. If at a particular system load, the line voltage at *M* falls below its nominal value by 5 kV, calculate the magnitude of the reactive volt ampere injection required at *M* to recastablish the original voltage. The PU values are expand in 500 MVA base and resistance may be neglected throughout. 10

6 a. Explain voltage stability, voltage instability and voltage collapse. Explain the phenomenon of voltage collapse with relevant PV and QV diagram. 10

b. Discuss the injection of reactive power methods of voltage control in a power system. 10

7 a. Define unit commitment. Explain the problems and constraints found in unit commitment. 10

b. Construct the priority list table for the following data:

Unit 1: $F_1 = 600 + 7.1P_1 + 0.00141P_1^2$; Min = 160 MW; Max = 600 MW
Unit 2: $F_2 = 350 + 7.80P_2 + 0.00195P_2^2$; Min = 100 MW; Max = 450 MW
Unit 3: $F_3 = 80 + 8.0P_3 + 0.0049P_3^2$; Min = 50 MW; Max = 250 MW
Fuel Cost(1) = Rs.1.1/MBtu
Fuel Cost(2) = Rs.1.0/MBtu
Fuel Cost(3) = Rs.1.2/MBtu

10

8 a. Discuss the thermal constraints and role of spinning reserve in unit commitment problem. 10

b. Explain priority list method of unit commitment with an example. 10

9 a. What are factors affecting power system security? 6

b. What are major function that are carried out in an operation and control center to power system security? 6

c. Explain the different ways in which liner sensivity factors can be derived. 8

10 a. With flow chart, explain how contingency analysis is carried out? 10

b. What are the different states in the operation of a power system? Explain the transmission that can take place from one state to another state with a block diagram 10

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