***U.S.N*** | | | | | | | | | | |

# 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; May / June - 2019**

**Power System Operation and Control**

*Time: 3 hrs* *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

## UNIT - I

1 a. Explain Digital computer configuration of a SCADA system in power system control centre. Also list out the scan points in a typical power system control centre. 10

b. Explain parallel operation of generators 10

2 a. Two synchronous generators are initially supplying a common load at 1 p.u frequency (60 Hz). The rating of unit 1 is 337 MW and has 0.03 p.u droop built in to its governor. Unit 2 is rated at 420 MW and has 0.05 p.u droop. Find each units share of 0.10 p.u increase in the load demand. Also find new line frequency. 5

b. Derive the expression for the line power flow and frequency deviation for a two area system. 7

c. Explain the following; 8

i) AGC and its minimum requirements ii) ACE iii) Functions of AGC

## UNIT - II

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

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

4 a. Two control areas are connected via a tie line with the 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 in Area 1, what is the new steady state frequency and the charge in flow? Assume nominal frequency as 50 Hz.

b. Explain AGC for a 2 area system using a Block diagram. 10

## UNIT - III

5 a. Obtain the relationship between voltage, real power and reactive power at a node. 6

b. Explain the dependence of voltage on reactive power and transmission angle on real power across a transmission line with $Z = R + jx$. 8

c. Explain voltage control by; i) Shunt capacitor ii) Series capacitor. 6

6 a. Explain; 10

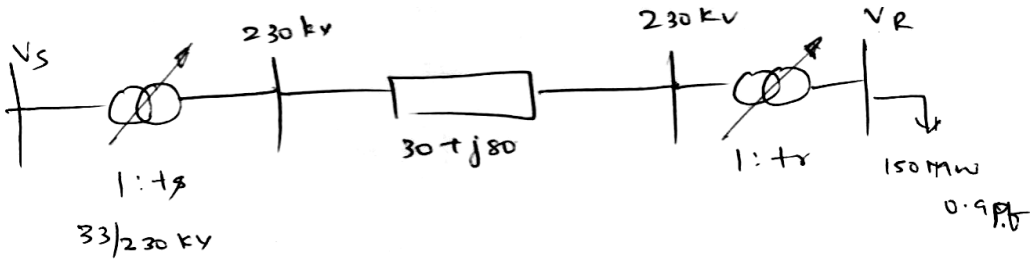
i) Voltage stability using PQ and PV curves

ii) Sub synchronous oscillation

iii) Voltage collepse

Contd… 2

b. A 200 kV line is fed through 33/230 kV transformer from a constant 33 kV supply. A single line diagram of 3φ system is shown in Fig. 6(b). The impedance of the line is (30 + j80) Ω. Both the transformers are equipped with tap changing facility which are so arranged that product of their tap setting is unity. If the load on the system is 150 MW at 0.9 p.f , determine the settings on top changes required to maintain the voltage of the load at the bus bar at 33 kV. 6




c. Explain voltage control by using Booster Transformer . 4

## UNIT - IV

7 a. Explain; i) Unit commitment ii) Constraints involved in unit commitment problem. 10

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

8 a. Explain;

i) Spinning reserve with an example

ii) Need of unit commitment 10

iii) Difference between unit commitment and economic dispatch

b. Enumerate the different steps of the system and prepare the priority list based on production cost,

| Unit | $P_1^{max}$ (MW) | $P_1^{min}$ (MW) | Full load average cost (Rs/MWh) | Start up cost |
|---|---|---|---|---|
| 1 | 100 | 25 | 240 | 3500 |
| 2 | 250 | 50 | 212 | 4000 |
| 3 | 300 | 50 | 198 | 8000 |
| 4 | 75 | 20 | 280 | 0 |

10

## UNIT - V

9 a. Explain contingency analysis using sensitivity factors. 10

b. Explian AC power flow security analysis. 10

10 a. Explain security constrained optimal power flow with an example. 10

b. Explain;

i) Factors affecting security

ii) Contingeny slection 10

iii) Functions of power system security

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