CBCS SCHEME

USN | | | | | | | | | | |

15EE81

# Eighth Semester B.E. Degree Examination, November 2020
## Power System Operation and Control

Time: 3 hrs. Max. Marks: 80

***Note: Answer any FIVE full questions irrespective of modules.***



### Module-1

1 a. What are the objectives of power system control? Explain. **(06 Marks)**

b. With a neat flow-chart, explain forward dynamic programming method of solving unit commitment problem. **(10 Marks)**

2 a. With a neat diagram explain the general configuration and major components of SCADA system. **(08 Marks)**

b. Explain the key concepts for reliable operation of power system. **(08 Marks)**

### Module-2

3 a. Explain the general algorithm for hydro-thermal scheduling. **(08 Marks)**

b. Two generators rated 200MW and 400MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no-load to full-load. The speed set point are such that the generators operate at 50Hz when sharing the full load of 600MW in proportion to their ratings, i) If the load reduced to 400MW, how is it shared ? At what frequency will system operate? ii) If now the speed changers are reset so that the load of 400MW is shared at 50Hz in proportion to their rating, what are the no-load frequency now? **(08 Marks)**

4 a. A steam plant and a hydro plant supply a load of 500MW for 12h and 300MW for 12h in a day. The thermal plant characteristics are given by

$F(P_{GT}) = 0.06\ P_{GT}^2 + 40P_{GT} + 100$ unit cos/h

The hydro plant characteristic is given by

$Q = 0.003P_{GH}^2 + 0.5P_{GH}\ m^3/s$

The loss is given by $P_{LOSS} = 0.001P_{GH}^2$

The value of $\gamma$ is 80. Find the scheduling of power and the total discharge. Also determine the daily operating cost of thermal plant and the water used daily by the hydro plant. Obtain the schedule: i) Neglecting losses ii) Considering losses. **(10 Marks)**

b. Explain different modes of governor operation. **(06 Marks)**

### Module-3

5 a. Derive the state space model of an isolated AGC system. **(08 Marks)**

b. A 1000MVA generator operates on full load at the rated frequency of 50Hz. The load is reduced to 800MW. The steam valve has an operating time lag of 0.65. If H = 5sec, determine the change in the frequency. **(08 Marks)**

6 a. Derive an expression for tie-line power and frequency deviation for two area system. **(10 Marks)**

b. A system consists of four identical 100MVA generators feeding a total load of 250MW. The inertia constant H = 5 for each machine on its own base. The load varies by 1.2% for a 1% change in frequency. If there is a drop of 10MW of load, determine the speed deviation and plot it. **(06 Marks)**

## Module-4

7 a. Explain state space model for two area system. **(08 Marks)**

b. Three generating stations are connected to a common bus bar X, as show in Fig.Q.7(b). For a particular system load, the line voltage at the bus bar falls by 2kV. Calculate the reactive power injection required 2kV. All pu values are on 500MVA base to bring back the voltage to the original value. **(08 Marks)**

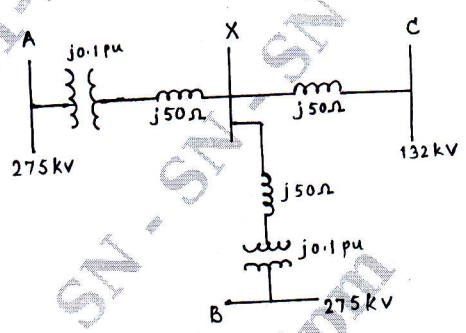


Fig.Q.7(b)

8 a. Explain briefly the various elements of power system that can generate or absorb reactive power. **(08 Marks)**

b. Two areas 1 and 2 are interconnected. The capacity of area 1 is 1500MW and area 2 is 500MW. The incremental regulation and damping torque coefficient for each area on its own base are 0.2pu and 0.9pu respectively. Find the steady state frequency and change in steady-state tie-line power, for an increase of 60MW in area 1. The nominal frequency is 50Hz. **(08 Marks)**

## Module-5

9 a. Explain briefly various security levels of Energy Management System (EMS). **(08 Marks)**

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

10 a. Explain major functions involved in system security. **(08 Marks)**

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

* * * * *