CBCS SCHEME

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

18EE81

Eighth Semester B.E. Degree Examination, June/July 2025
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. Outline the Preventive and Emergency control measures in Power System. **(06 Marks)**

b. Illustrate the basic and application functions of SCADA System. **(07 Marks)**

c. Explain the components of SCADA in Power System with diagram. **(07 Marks)**

OR

2 a. Discuss the key concepts of reliable operation. **(06 Marks)**

b. Classify SCADA systems based on number of RTUs and Master Stations. **(07 Marks)**

c. Explain the functional block diagram of Intelligent Electronic Devices with neat diagram. **(07 Marks)**

Module-2

3 a. Illustrate speed governing system of a steam turbine with schematic diagram. **(07 Marks)**

b. Obtain the Transfer function of a AGC with Proportional Plus Integral Controller from its relevant block diagram representation of ALFC. **(07 Marks)**

c. Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 5% respectively from no load to full load. Assuming that the generators are operating at 50HZ at no load, calculate the sharing of 600 MW load between them and system frequency at this load. Assume free governor operation. Repeat the problem if 60^{th} governors gave a droop of 4%. **(06 Marks)**

OR

4 a. Draw the schematic diagram of load frequency and excitation voltage regulators of turbo generators. **(07 Marks)**

b. Develop Mathematical Model of
i) Generator and load
ii) Turbine system **(08 Marks)**

c. A 1000MVA synchronous generator operates on full load at 50HZ frequency. The load is suddenly reduced to 800MW. Due to time lag in governor system, the steam value begins to close after 0.6s. Determine the change in frequency that occurs in this time. Given the inertia constant of Machine H = 5S. **(05 Marks)**

Module-3

5 a. Derive the expression of the line power and frequency deviation for two area system. **(08 Marks)**

b. Derive the Mathematical modelling of AVR function with block diagram. **(12 Marks)**

OR

6 a. Two control areas are connected via a tie line with the following characteristics.
Area 1 : $R_1 = 1\%$, $D_1 = 0.8$ base MVA = 500
Area 2 : $R_2 = 2\%$, $D_2 = 1$ base MVA = 500
A load increase of 100 MW occurs in area 1. Find the new steady state frequency and the change in the flow if the nominal frequency is 50 HZ. **(07 Marks)**

b. Explain the state space model for Two area Automatic Load Frequency Control System. **(07 Marks)**

c. Discuss speed governor dead band and its effect on A & C with neat block diagram. **(06 Marks)**

Module-4

7 a. Explain briefly the components of Power System that can generate and absorb reactive power. **(06 Marks)**

b. Show the expression for optimum economy by capacitor installation for power factor improvement and explain different methods of voltage control by reactive power injection in Power system. **(08 Marks)**

c. Consider a single phase 220 kv line of length 200km. The resistance/ km = 0.031Ω and reactance /km = 0.32Ω. Compute the sending end voltage with accurate formulae if the load is 500MW at a power factor of 0.85. **(06 Marks)**

OR

8 a. Obtain the relation between voltage power and reactive power at a node. **(08 Marks)**

b. Explain phenomenon of voltage collapse with relevant diagrams. **(06 Marks)**

c. In the radial transmission system in figure 8 (c), determine the real and reactive powers to be delivered by the generator and Neglect the voltage drops in the lines and transformers. All PU values are referred to the voltage bases shown and 100MVA. Determine also the power factor at which generator must operate.

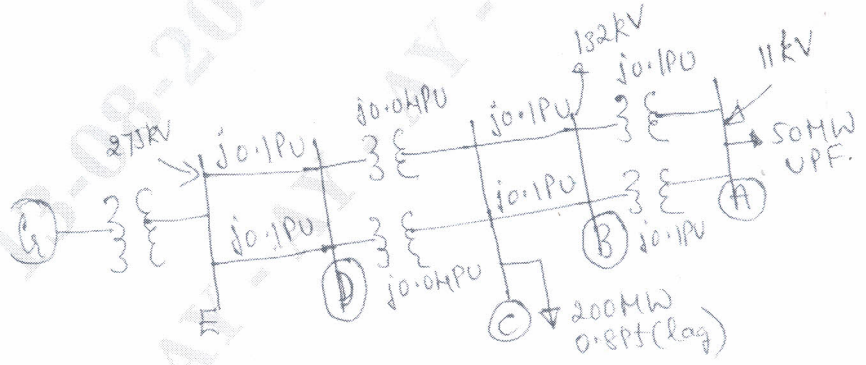

Fig. Q. 8 (c) **(06 Marks)**

Module-5

9 a. Explain the following terms:
i) Optimal dispatch
ii) Post contingency
iii) Secure dispatch
iv) Secure Post Contingency **(06 Marks)**

b. Explain contingency Analysis procedure with the help of flow chart. **(08 Marks)**

c. Explain the linear least square solution technique used in power system state estimation. **(06 Marks)**

OR

10 a. Explain the contingency analysis using linear sensitivity factors with relevant flow chart. **(08 Marks)**

b. Explain about three basic ways to obtain quicker power system security analysis study. **(06 Marks)**

c. Define power system security and discuss factors affecting power system security. **(06Marks)**

* * * * *