CBCS SCHEME

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18EE81

Eighth Semester B.E. Degree Examination, June/July 2023
Power System Operation & Control

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. List out the operating states of a power system and explain them with a neat block diagram. **(08 Marks)**

b. Define preventive and emergency controls used in power system operation and list out them in detail. **(08 Marks)**

c. Define Energy Management centre and list out its functions. **(04 Marks)**

OR

2 a. List out the major components of SCADA and explain them in detail. **(08 Marks)**

b. Define an IED as per the industry standard. Explain the fundamental blocks of an IED in detail using the structural block diagram. **(08 Marks)**

c. Explain the following categories of SCADA systems with their configuration:
(i) Single master-single remote SCADA systems.
(ii) Single master-multiple RTU SCADA systems. **(04 Marks)**

Module-2

3 Derive the complete mathematical model of load frequency control of an isolated power system with the help of modeling the following components of it.
(i) Model of speed governing system
(ii) Turbine model.
(iii) Generator-load model. **(20 Marks)**

OR

4 a. Explain the operation of load frequency and excitation voltage regulators equipped in turbo-generators with a neat schematic diagram. **(08 Marks)**

b. State the need for proportional plus integral control in an isolated power system and derive the transfer function of it with PI controller through the block diagram of it. **(12 Marks)**

Module-3

5 Derive the state variable model of LFC of a two area power system in terms of state variables, control variables and disturbance variables by properly defining them. **(20 Marks)**

OR

6 a. Explain the operation of AVR equipped in a turbo-alternator with a neat schematic diagram and also derive its transfer function model with usual notations. **(10 Marks)**

b. Explain the need for Generation Rate Constraints (GRCs) in LFC and various ways of incorporating them in the mathematical model of LFC. **(05 Marks)**

c. Define speed governor dead-band and explain in detail about its effects on AGC with neat control block diagram. **(05 Marks)**

Module-4

7 a. Explain in detail about the generation and absorption of reactive power by various power system components. **(08 Marks)**

b. Consider a transmission system shown in Fig. Q7 (b) below. The pu reactance values are referred to the respective voltage bases and 100 MVA base. Determine the power supplied by the generator and its power factor.

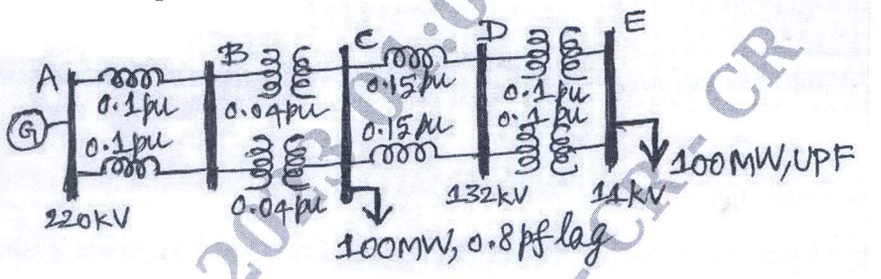

Fig. Q7 (b) **(12 Marks)**

OR

8 a. Explain various methods of voltage control by injection of reactive power at a node in a power system. **(12 Marks)**

b. Explain the following methods of voltage control at a node in a power system :

(i) Using booster transformers.

(ii) Using phase-shift transformers. **(08 Marks)**

Module-5

9 a. Define power system security and explain in detail about its three major functions that are carried out in an operation control center. **(10 Marks)**

b. Explain the simplest form of contingency analysis technique with the help of a neat flow chart. **(06 Marks)**

c. List out the factors affecting the power system security and explain them briefly. **(04 Marks)**

OR

10 a. List out and explain the linear sensitivity factors. Explain the contingency analysis procedure using sensitivity factors with a neat flow chart. **(12 Marks)**

b. Explain 1P1Q method for contingency selection procedure with a neat flow chart. **(08 Marks)**

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