CBCS SCHEME

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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 γ 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)**

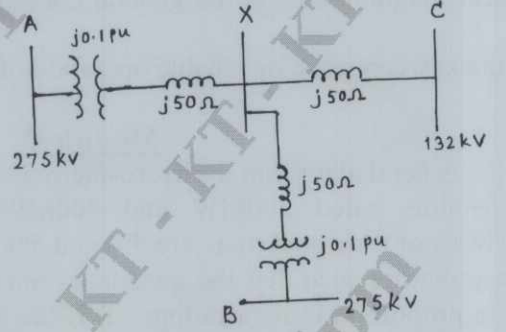

Fig.Q.7(b)

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)**

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15EE82

Eighth Semester B.E. Degree Examination, November 2020
Industrial Drives and Applications

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions irrespective of modules.

Module-1

1 a. With basic block diagram, explain the essential parts of electric drive. **(05 Marks)**

b. Explain the speed torque conventions and multiquadrant operations of a motor driving a hoist load. **(08 Marks)**

c. What are the advantages of an electrical drive system? **(03 Marks)**

2 a. Obtain an expression for the equivalent load torque and equivalent moment of inertia for loads rotational and translational motion. **(08 Marks)**

b. A 3 phase, 50KW, 6 pole, 960rpm, induction motor has a constant load torque of 300N-m and at wide intervals additional torque of 1500N-m for 10 seconds. Calculate :

i) The weight of fly wheel used for load equalization, if the motor torque were not to exceed twice the rated torque and the radius of gyration is 0.9mm

ii) The time taken after removal of additional load before the motor torque becomes 700N-m. Assume that the induction motor operates at that portion of the slip torque characteristics which is linear. **(08 Marks)**

Module-2

3 a. Explain the following classes of motor duty with necessary diagram showing variation of load, electrical losses and temperature with respect to time, also mention the cyclic duration factor for each case.

i) Intermittent periodic duty with starting and braking

ii) Continuous duty with starting and braking. **(08 Marks)**

b. With a neat circuit and graph, explain the regenerative, dynamic and plugging type of braking system for separately excited DC shunt motor. **(08 Marks)**

4 a. Explain with circuit diagram and relevant waveforms, a single phase fully controlled rectifier, control of a separately excited DC motor. **(08 Marks)**

b. Explain with a neat sketch, the dynamic braking of a separately excited DC motor. **(08 Marks)**

Module-3

5 a. Explain with relevant equations the operation of induction motor with unbalanced source voltage. **(08 Marks)**

b. Explain the DC dynamic braking of 3-phase induction motor. **(08 Marks)**

6 a. Explain the reverse voltage braking of an induction motor. **(04 Marks)**

b. A 2200V, 50Hz, 3 phase, 6 pole star connected squirrel cage induction motor has the following parameters : $R_S = 0.075\Omega$, $R_r^1 = 0.12\Omega$, $X_S = X_r^1 = 0.5\Omega$. The combined inertia of motor and load is 100kg-m^2.

i) Calculate time taken and energy dissipated in the motor during starting

ii) Time taken to stop the motor by plugging. **(04 Marks)**

c. A 400Volts, star connected 3phase, 6pole, 50Hz induction motor has following parameters referred to stator. $R_S = R_r^1 = 1$ohm, $X_S = X_r^1 = 2$ohm. For regenerative braking operation. Calculate the overhauling torque and range of speed operation. **(08 Marks)**

Module-4

7 a. With a neat circuit diagram and relevant waveforms, explain the operation of voltage source inverter drive system. **(08 Marks)**

b. Draw a neast circuit arrangement of static scherbius drives, explain its importance. **(08 Marks)**

8 a. With a neat drive circuit, explain the static scherbius drive. **(08 Marks)**

b. A 3 phase, 440V, 50Hz, 6pole Y-connected induction motor has the following parameters referred to the stator : $R_S = 0.5\Omega$, $R_r = 0.6\Omega$, $X_S = X_r^1 = 1\Omega$ stator to rotor Turing ratio is 2. If the motor is used for regenerative braking determine :

i) Maximum over hauling torque it can hold and the range of speed in which it can safely operate.

ii) The speed at which it will hold a load torque of 160N-m. **(08 Marks)**

Module-5

9 a. Explain the operation of self controlled synheonous motor drive employing load commentated thyristor inverter. **(08 Marks)**

b. Draw the block diagram of variable frequency control of multiple synchronous motor and explain. **(08 Marks)**

10 Write short notes on :

a. Steel rolling mill drive system

b. Cement mill drives

c. Paper mill drive. **(16 Marks)**

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