Registration No :

Total Number of Pages : 03

Course: B.Tech
Sub_Code: REL6C001

6th Semester Regular / Back Examination: 2022-23
SUBJECT: Power System Operation and Control
BRANCH(S): EEE, ELECTRICAL
Time : 3 Hour
Max Marks : 100
Q.Code : M504
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   Answer the following questions: (2 x 10)

a)   What do you mean by p.u. value of any electrical parameter? How base values are selected for a power system.

b)   What are Synchronizing Power Coefficients?

c)   What do you mean by slack bus?

d)   Define Unit Commitment.

e)   What is the relationship between load and frequency?

f)   What is the significance of the Jacobian matrix in load-flow analysis?

g)   What are the methods used for Power factor correction?

h)   What is power angle?

i)   What is the load factor?

j)   What do you mean by Dynamic stability in a power system?

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of   (6 × 8)
        Twelve)

a)   Derive the approximation voltage equation in load flow studies.

b)   Obtain the expression of the governor model in a single area control showing the input-output relation.

c)   Write down the equations governing the N-R load flow method. Derive the necessary expression of the Jacobian elements in the matrix.

d)   Explain the different types of buses used in load flow studies.

e)   Derive the penalty factor in the economics dispatch problem.

f)   Two thermal generating units are operating in parallel at 60 Hz to supply a total load of 700 MW. Unit 1, with a rated output of 600 MW and 4% speed drop characteristics, supplies 400 MW, and Unit 2, which has a rated output of 500 MW and 5% speed drop, supplies the remaining 300 MW of load. If the total load increases to 800 MW, determine the new loading of each unit and the common frequency change before any supplementary control action occurs. Neglect losses.

g)   Two 200 MVA alternators operate in parallel. The frequency drops in the first machine from 50 Hz at no load to 48 Hz at full load, whereas in the case of the other machine, the frequency drops from 50 Hz to 47 Hz under the same conditions. a) How will the two machines share a total load of 300 MW? b) Determine the maximum load at unity power factor which can be delivered by the two machines without overloading any of there.

h)   What is the main function of load frequency control?

i) Derive the expressions of critical clearing angle and critical clearing time.

j) What do you mean by load frequency control describe ALFC with a block diagram.

k) The incremental fuel costs for two generation units 1 and 2 of a power plant are given by the following equation.

$$\frac{dF_1}{dP_1} = 0.065P_1 + 25$$

$$\frac{dF_2}{dP_2} = 0.08P_2 + 20$$

Where F is the fuel cost in rupees per hour and P is the power output in MW. Find i) The economical loading of the two units when the total load supplied by the power plants is 160 MW. ii) The loss in fuel cost per hour if the load of 160 MW is equally shared by both Units.

l) What is a single-area and two-area system?

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Derive the critical clearing angle for the fault that occurs at the busbar of the generator in a parallel transmission Line. **(16)**

Q4 A power system has a total load of 1260 MW at 60 Hz. The load varies by 1.5% for every 1% change in freq (D = 1.5). Find the steady-state frequency deviation when a 60 MW load is suddenly tripped if a) There is no speed control.
b) The system has 240MW of spinning reserve evenly spread among 500 MW of generation capacity with 5% regulation based on this capacity. All other generations are operating with values wide open. Assume that the effect of governing dead bands is such that only 80% of the governor responds to the reduction in system load. **(16)**

Q5 Using the Gauss-Seidel method, determine the phasor values of the voltage at the load buses 2 & 3 (PQ-buses) accurate to four decimal places. **(16)**
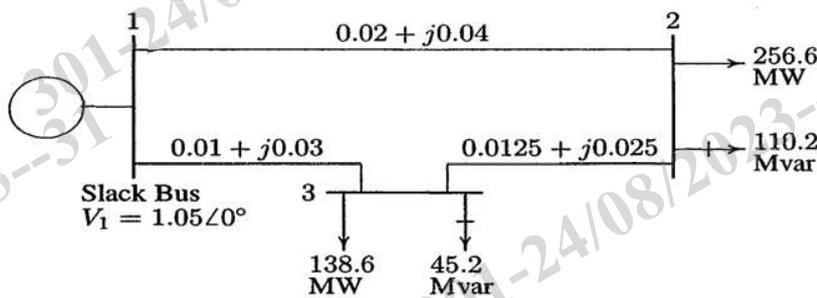
Q6 Derive the swing equation of the rotor. Derive the condition of stability after following a disturbance. **(16)**