Birla Institute of Technology and Science, Pilani
II-Semester 2022-23
Power System (EEE F312)- Comprehensive Exam- (PART-B)
Closed Book

Date: 13/5/2023 **M.M.: 90**

Name: ID No

Note: Assume suitable data, if necessary

Q.1 A 50 Hz, Two-pole turboalternator rated 20 MVA, 13.2 kV has an inertia constant of H = 9.0 kW-sec/kVA. (a) Determine the K.E. stored in the rotor at synchronous speed. (b) Determine the acceleration if the input is 18375 kW and the electric power developed is 15000 kW.

If the acceleration computed for the generator is constant for a period of 15 cycles, (c) Determine the change in torque angle in that period and (d) find frequency at the end of 15 cycles. **[20]**

Q.2 Two generators are feeding a town through a two-bus system as shown in figure below. If a load of 130 MW is fed only from generator 1 to the load, transmission loss of 16.9 MW is incurred. Determine the power generated from each generator and the load demand, if the cost of received power is Rs. 24/MWhr. Use coordination equations and the penalty factor method approach. The incremental production costs of the plants are:

$$\frac{dF_1}{dP_1} = 0.025\,P_1 + 15$$

$$\frac{dF_2}{dP_2} = 0.05\,P_2 + 20$$

[20]

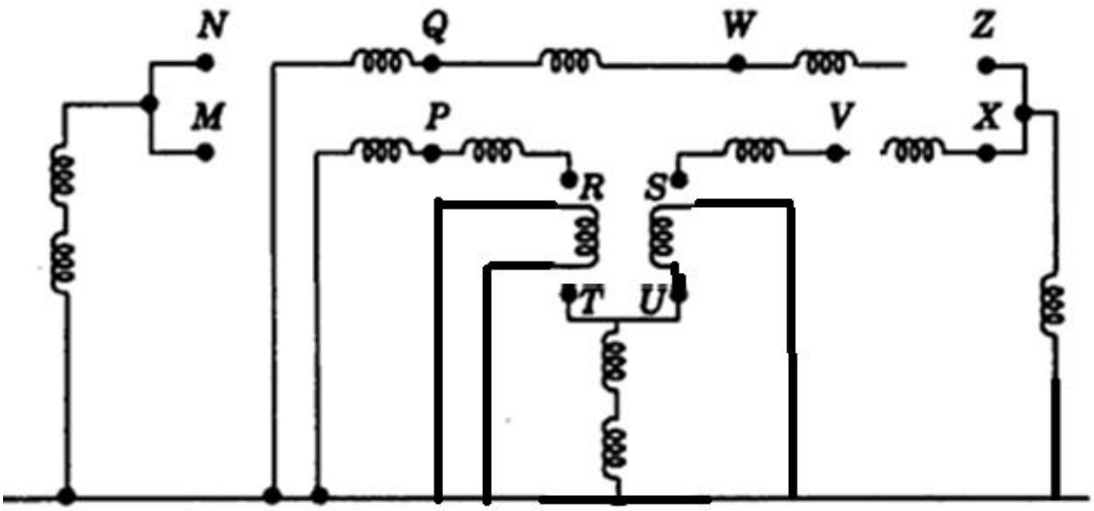
Q.3 A 33-kV, three-phase transmission line supplies a load of 1000 kW at a lagging power factor of 0.8. If the per-phase resistance and reactance of the line is 20 Ω and 50 Ω, respectively, what will be the required sending end voltage if 33 kV is to be maintained at the receiving end? Also compute (i) sending end real power, (ii) line loss, (iii) efficiency, and (iv) per cent regulation (v) determine the value of capacitor to be added to make load power factor unity (vi) total reduction in transmission losses in case of (v) **[15]**

Q.4 (a) A 3 phase unbalanced load is being met by a three-phase system. Symmetrical components transformation was done to develop three sequence models. Prove that symmetrical component transformation is power invariant. **[10]**

P.T.O

Q.4(b) Draw a neat single line diagram of the power system from the zero-sequence network shown below. Clearly showing the transformers types and connections, transmission lines, synchronous machines and other components.

Hint: (i) Transmission line: Between Q-W, P-R and S-V (ii) Grounded Synchronous machines: Between N/M-reference, T/U- reference and Z/X-reference. **[15]**



Q.5 It is observed that in lightly loaded long transmission line, sending end voltage is found to be less than receiving end voltage. Please give mathematical explanation using proper circuit diagram. **[10]**

****