28-Dec-2023 10:30 am - 01:30 pm 1T00837 - B.E.(Electrical Engineering)(SEM-VII)(Choice Base Credit Grading System) (R- 19) ('C' Scheme) / 42272 - Electrical Power System III QP CODE: 10042863

Duration: 3hrs **[Max Marks: 80]**

N.B.: **(1) Question No 1 is Compulsory.**
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

Q1. Answer **any four** from the following: **20**

a) What is significance of equal area criteria in power system?
b) Why numerical methods are used for solution of load flow equations?
c) Draw state diagram and explain each operating state of power system.
d) Draw schematic diagram of a synchronous generator and explain why frequency control loop and voltage control loop are not cross-coupling?
e) State and explain the factors which can improve transient stability.

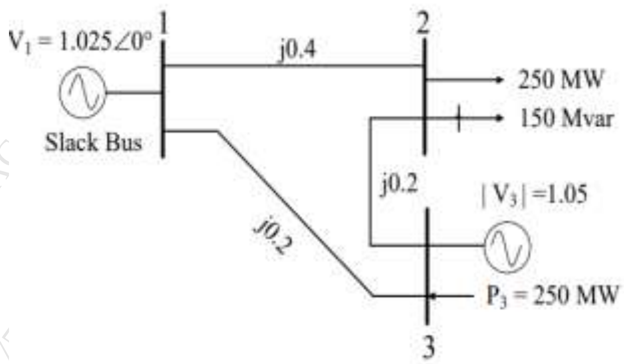
Q 2.

A A cylindrical rotor generator delivers 0.5 pu power in the steady-state to an infinite bus through a transmission line of reactance 0.5 pu. The generator no-load voltage is 1.5 pu and the infinite bus voltage is 1 pu. The inertia constant of the generator is 5 MW-s/ MVA and the generator reactance is 1 pu. Find the critical clearing angle in degrees for a three-phase dead short circuit fault at the generator terminal. **10**

B Derive the equation for optimum generation scheduling considering transmission losses (Exact coordinate equation). **10**

Q3.

A Figure below shows the single-line diagram of three-bus power system with generation at bus 1 and bus 3. The voltage at bus 1 is $V_1 = 1.025\angle 0^o$ per unit. The voltage magnitude at bus 3 is fixed at 1.05 per unit with a real power generation of 250 MW. The scheduled load on bus 2 is marked on the diagram. Line impedances are marked in per unit on a 100 MVA base. Line resistances and line charging susceptances are neglected. Obtain the bus voltages at the end of first iteration by Gauss-Seidel method. **10**



B Draw turbine speed governor system and explain the operation of major components of the system. **10**

Q4.

A A 50 Hz, 4-pole turbo generator rated 100 MVA, 11 kV has an inertia constant of 8 MJ/MVA. Find **10**

a. The stored kinetic energy in the rotor at synchronous speed.

b. The rotor acceleration, if the mechanical input is suddenly raised to 90 MW for an electrical load of 60 MW.

c. The speed at the end of 10 cycles. Neglect mechanical and electrical losses.

B Explain Decoupled load flow method for load flow solutions. **10**

Q 5

A A power station consists of two generators and supplies a total load of 310 MW. The incremental fuel cost in Rs/MWh are: **10**

$IC_1 = 0.125P_{G1} + 18.9$ Rs/MWh

$IC_2 = 0.131P_{G2} + 12$ Rs/MWh

Determine the most economical division of load between generators. Find saving in Rs/day obtained compared to equal load sharing between generators.

B What is power pool? Explain the different types of energy transactions and interchanges in power system. **10**

Q 6.

A Two generating units rated 300 MW and 400 MW have governor speed regulation of 6% and 4% respectively from no load to full load. Both the generating units are operating in parallel to share a load of 600 MW. Assuming that the generators are operating at 50 Hz at no load and free governor action, find the load shared by each unit and frequency of operation. **10**

B Derive Swing equation for a synchronous machine that describes rotor dynamics. **10**
