(10)

BE SEM VIII (choice base) R2019 Summer 2026 ELEC

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.

06/06/2026

Q1. Answer any Four from the following **[20]**

a. Explain the optimal allocation of generators in power system using Lagrangian multiplier neglecting transmission losses.
b. Explain steady state stability in power system with example.
c. What is decoupled method for load flow analysis? What are the assumptions made for deriving the equations?
d. A 250-MW, 60-Hz turbine generator set has a speed regulation of 5 percent based on its own rating. The generator frequency decreases from 60 Hz to a steady state value of 59.7Hz. Determine the increase in the turbine power output.
e. What is the effect of load variation on generator output voltage and frequency? Draw and explain with neat diagram.

Q 2. A. Explain the steps for Gauss-seidel method for power flow analysis with PQ buses. **[10]**

B. Two generating units rated for 250 MW and 400 MW have governor speed regulation of 6.0 and 6.4 percent, respectively, from no-load to full-load, respectively. They are operating in parallel and share a load of 500 MW. Assuming free governor action, determine the load shared by each unit and the steady-state frequency deviation. **[10]**

Q 3. A. Derive Swing equation for a synchronous machine that describes rotor dynamics. **[10]**

B. Two generating units of a power system are having the following cost curves: **[10]**

$C_1 = 0.4P_1^2 + 16P_1 + 100 \quad Rs/Hr$

$C_2 = 0.45P_2^2 + 12P_2 + 120 \quad Rs/Hr$

Where P_1 and P_2 are power output in MW. Determine the optimum load allocation between units for a total load of 200 MW, neglecting the transmission lines losses. What will be the daily loss if the units are loaded equally against optimum allocation?

Q 4 A. Explain power pool and the different types of energy transactions and interchanges in power system. **[10]**

B. Consider a power system where a single machine tied to an infinite bus through a transmission line. If a sudden short circuit occurs at sending end of line, explain the stability of the system using equal area criteria. **[10]**

Q 5 A. Draw complete block diagram of a generator for load frequency control and explain the impact of PI controller for controlling the system frequency. **[10]**

B. For the given power system, the generators are connected at all the four buses, while loads are at buses 2 and 3. Values of real and reactive powers are listed in Table. All buses other than the slack are PQ type. Assuming a flat voltage start, find the voltages and bus angles at the three buses at the end of the first GS iteration. **[10]**

Bus	P(pu)	Q(pu)	V(pu)	Remarks
1	-	-	$1.04\angle 0^\circ$	Slack
2	0.5	-0.2	-	PQ
3	-1.0	0.5	-	PQ
4	0.3	-0.1	-	PQ

Line (Bus to bus)	R(pu)	X(pu)
1-2	0.05	0.15
1-3	0.1	0.3
2-3	0.15	0.45
2-4	0.1	0.3
3-4	0.05	0.15

Q 6. A. Differentiate between Gauss Seidel, Newton Raphson, Decoupled and Fast decoupled iterative techniques for load flow analysis. **[10]**

B. Find the steady state power limit of a system consisting of a generator equivalent reactance 0.50 pu connected to an infinite bus through a series reactance of 1.0 pu. The terminal voltage of the generator is held at 1.20 pu. Assume infinite bus voltage as $1.0\angle 0^\circ$ pu. **[10]**