Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 25-05-2026 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B. Tech (EEE)	
Course Code: EEE3002	**Course Name:** Power System Analysis	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	**4**	**4**	**26**	**22**	**22**	**22**

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	In a given system, base values are selected. List any two base quantities used in per-unit system.	**2 Marks**	**L1**	**CO1**
2.	Two transmission lines have different voltage levels. Why is per-unit system useful in comparing them?	**2 Marks**	**L2**	**CO1**
3.	List any two properties of Ybus matrix.	**2 Marks**	**L1**	**CO2**
4.	A student is forming Ybus using inspection method. Why is this method faster for large systems?	**2 Marks**	**L2**	**CO2**
5.	Define is load flow analysis?	**2 Marks**	**L1**	**C03**
6.	Why is Newton-Raphson method preferred over Gauss-Seidel method for large systems?	**2 Marks**	**L2**	**CO3**
7.	If bus voltage is found to be lower than the limit, how does load flow analysis help?	**2 Marks**	**L2**	**CO3**
8.	A short circuit occurs in a transmission line. Why is fault analysis important in this situation?	**2 Marks**	**L2**	**CO4**
9.	Explain the effect of sudden generator loss on system stability.	**2 Marks**	**L2**	**CO5**
10.	List any two types of contingencies in power systems.	**2 Marks**	**L1**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11. A power system engineer is preparing input data for load flow analysis based on IEEE 3002 standard format. The following data is collected: **20 Marks** **L4** **CO3**

Table 1: Bus Data

Bus	Type	P (p.u.)	Q (p.u.)	Voltage
1	Slack	—	—	1∠0°
2	PQ	-0.8	—	—
3	PV	1	0.5	1.02
4	PQ	-0.5	-0.2	—

Table 2: Line Data

From	To	R	X	B
1	2	0.05	0.2	—
2	3	—	0.25	0.02
3	4	0.1	—	0.01

Answer the following questions:

a. Analyze the given data and identify any missing or incorrect parameters as per IEEE standard load flow data requirements (5M).

b. Suggest appropriate corrections or assumptions for the missing/incorrect data to make it suitable for load flow analysis (5M)

c. Analyze whether the bus types (Slack, PV, PQ) are correctly assigned, if not, justify the correct classification (5M).

d. Explain how incorrect or incomplete data can affect, Convergence of load flow and Accuracy of results (5M).

Or

12. A power system engineer is given the following transmission line and bus data of a 4-bus network. Due to increasing load demand, the engineer must first visualize the system, and then use the Gauss-Seidel (GS) method to analyze the system performance. **20 Marks** **L4** **CO4**

Table 1: Line Data (p.u.)

From Bus	**To Bus**	**R (p.u.)**	**X (p.u.)**
1	2	0.06	0.16
1	4	0.15	0.25
2	3	0.25	0.35
2	4	0.12	0.28
3	4	0.06	0.16

Table 2: Bus Data(p.u.)

Bus	**Type**	**P (p.u.)**	**Q (p.u.)**	**Voltage**
1	Slack	—	—	1∠0°
2	PQ	0.6	-0.3	—
3	PQ	-1.2	0.8	—
4	PQ	-0.6	-0.4	—

The system operator suspects that Bus 3 is heavily loaded, which may affect voltage stability. Before making decisions, the operator wants to visualize the network and use the Gauss-Seidel method to analyze the system behavior after the second iteration.

13.	A power generating station is operating with a 35 MVA, 13 kV generator supplying power to the grid. During operation, a line-to-line (LL) fault occurs between two phases at the generator terminals, causing an unbalanced condition in the system. The generator has the following sequence reactance's (in per unit): • Direct axis sub-transient reactance: $\boldsymbol{X_d''} = \mathbf{0.30}$p.u. • Negative sequence reactance: $\boldsymbol{X_2} = \mathbf{0.40}$p.u. • Zero sequence reactance: $\boldsymbol{X_0} = \mathbf{0.18}$p.u. Perform the following tasks: a. Draw the single line diagram (SLD) of the system showing-Generator and Fault location (3M). b. Draw the positive and negative sequence networks and show their interconnection for a line-to-line fault (5M) c. Determine the fault current during the line-to-line fault using the sequence network method (5M) d. Determine the phase voltages at the fault point during the fault (5M). **e.** Explain why the zero-sequence network is not involved in a line-to-line fault (2M)	**20 Marks**	**L3**	**CO4**
	Or			
14.	During heavy rainfall, a substation repeatedly experiences single line-to-ground faults. The protection engineer needs to quickly estimate the fault behavior to ensure proper relay operation. Using the concept of sequence networks: a. Draw the positive, negative, and zero sequence networks for the system and show their interconnection for a single line-to-ground fault (8M). b. Using the interconnected sequence network, determine the expression for the fault current at the fault location (6M). c. Based on your expression, identify which sequence reactance (positive, negative, or zero) has the most influence on the fault current, and justify your answer (6M)	**20 Marks**	**L3**	**CO4**

15.	**a.**	A generator experiences a sudden increase in mechanical input power while connected to the grid. Using the concept of the swing equation, determine how the rotor angle will change with time and explain the system response.	**12Marks**	**L3**	**CO5**
	b.	A synchronous generator is connected to an infinite bus with $P_{max} = 2.0 p.u.$ The generator initially delivers 1.0 p.u. power at an angle of 30°. Due to a disturbance, the rotor angle increases to 60°. Calculate the electrical power at 30° and 60°. a. Determine the accelerating power at both angles. b. Comment whether the system tends toward stability or instability.	**08 Marks**	**L3**	**CO5**
		Or			

16.	**a.**	A transmission line connects two areas, and the power transfer is increasing gradually. Using the power-angle equation, determine the maximum power that can be transferred and explain what happens if this limit is exceeded.	**12 Marks**	**L3**	**CO5**
	b.	A generator has a maximum power transfer of 2.5 p.u. and is currently supplying 1.5 p.u. power. a. Calculate the operating power angle. b. Determine the maximum allowable power before instability. c. Comment on how close the system is to instability.	**08 Marks**	**L3**	**CO5**

17.	**a.**	A power system experiences both steady-state violations and dynamic instability after a disturbance. Apply your knowledge to select appropriate contingency analysis methods and justify your choice.	**08 Marks**	**L2**	**CO6**
	b.	A power system is transferring power from Tumkuru to Davangere, and a line outage occurs during operation. Apply the contingency analysis procedure to identify how the system operator will detect, evaluate, and respond to this contingency. Present the steps using a flowchart.	**12 Marks**	**L3**	**CO6**
		Or			
18.	**a.**	Explain why contingency analysis is important for maintaining power system reliability.	**08 Marks**	**L2**	**CO6**
	b.	A transmission network is experiencing congestion due to overloading of certain lines during peak demand. Apply the concept of contingency analysis to explain how the system operator can identify and manage congestion in this situation.	**12 Marks**	**L3**	**CO6**