PVP 23

Code: 23EE3603

III B.Tech - II Semester - Regular Examinations – APRIL 2026

POWER SYSTEM ANALYSIS
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

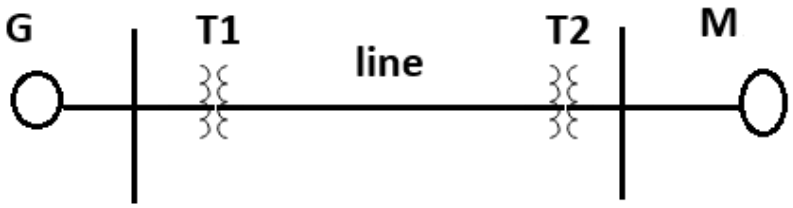
Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	What is a single-line diagram?	L1	CO1
1.b)	Define per unit quantity?	L1	CO1
1.c)	List the various types of faults.	L1	CO1
1.d)	List the various types of sequence component networks.	L1	CO1
1.e)	Define tree and co-tree with an example.	L1	CO3
1.f)	What is the role of the acceleration factor in the Gauss-Seidel load flow method?	L2	CO1
1.g)	What are the quantities determined through load flow studies?	L2	CO1
1.h)	Sketch the primitive network in admittance form.	L2	CO3
1.i)	A turbo generator rated 100 MVA, 13.8 kV has an inertia constant of 10 MJ/MVA. Find the kinetic energy stored.	L3	CO3
1.j)	What is the steady state stability limit?	L2	CO3

PART – B

			BL	CO	Max. Marks
UNIT-I					
2		A synchronous generator and a synchronous motor, each rated 25 MVA, 11 kV, having l5% sub-transient reactance, are connected through transformers and a line as shown below. The transformers are rated 25 MVA. 11/66 kV and 66/11 kV with leakage reactance of l0% each. The line has a reactance of 10% on a base of 25 MVA, 66 kV. The motor is drawing 15 MW at 0.8 power factor leading and a terminal voltage of 10.6 kV when a symmetrical three-phase fault occurs at the motor terminals. Find the sub-transient current in the generator, motor, and fault. 	L4	CO4	10 M
OR					
3	a)	Derive the expression for the maximum momentary short circuit current in terms of symmetrical short circuit current.	L3	CO2	5 M
	b)	Four identical alternators rated at 11 kV, 30 MVA are connected in parallel. Find the short circuit MVA at the terminal if the sub-transient reactance of each alternator is 20%.	L4	CO4	5 M

<table>
<tr><td colspan="6">UNIT-II</td></tr>
<tr><td>4</td><td colspan="2">Derive the necessary equations to determine the fault current for the LL fault, and also draw the interconnection diagram.</td><td>L3</td><td>CO4</td><td>10 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">5</td><td>a)</td><td>Illustrate the symmetrical components in a power system.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td>b)</td><td>The line currents in a 3-phase supply to an unbalanced load are I_a =-10+j20, I_b =12-j10, and I_c =-3-j5 amperes respectively. The phase sequence is abc, Determine the sequence components of currents for phase a.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td colspan="6">UNIT-III</td></tr>
<tr><td>6</td><td colspan="2">Explain the procedure for constructing the bus admittance matrix (Y-bus) using the singular transformation method.</td><td>L3</td><td>CO3</td><td>10 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>7</td><td colspan="2">The parameters of a 4-bus system are as follows.
<table>
<tr><th>Bus code</th><th>Line impedance (p.u.)</th></tr>
<tr><td>Ref - 1</td><td>j0.8</td></tr>
<tr><td>1 - 2</td><td>j0.9</td></tr>
<tr><td>2 - 3</td><td>j1.0</td></tr>
<tr><td>3 - 1</td><td>j0.8</td></tr>
</table>
Draw the network and form the bus impedance (Z-bus) matrix using the building algorithm.</td><td>L4</td><td>CO5</td><td>10 M</td></tr>
<tr><td colspan="6"></td></tr>
</table>

UNIT-IV					
8		Write the algorithm and sketch the flowchart for the Newton-Raphson method considering PV buses.	L3	CO3	10 M
OR					
9		For a two bus system with the data given below: $Y_{11} = Y_{22} = 1.6\angle -80^0$ p.u. and $Y_{21} = Y_{12} = 1.9\angle 100^0$ p.u. Determine the p.u. voltage at bus 2 by the GS-method after 2-iterations. Given $P_2 = 0.5$, $Q_2 = 0.3$ and $V_1 = 1.1\angle 0^0$.	L4	CO5	10 M
UNIT-V					
10	a)	Derive the expression for the swing equation in power system stability.	L3	CO5	5 M
	b)	A synchronous generator is connected to an infinite bus through a reactance of 0.5 p.u, Infinite bus voltage is 1.0 p.u, and the internal emf is 1.2 p.u. Calculate the i) synchronizing power coefficient of the generator. ii) Electrical power output of the generator. iii) Steady state stability limit of generator. When the rotor angle of the generator is 30^0.	L4	CO5	5 M
OR					
11	a)	Explain various transient stability improving methods.	L3	CO5	5 M
	b)	Determine the transient stability by the equal area criterion for a sudden change in mechanical power input.	L3	CO3	5 M