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Question Paper Code : 11294

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

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Fifth Semester

Electrical and Electronics Engineering

EE3501 — POWER SYSTEM ANALYSIS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define a “per unit” quantity and state its significance in power system studies.
2. List the basic components of a power system represented in a single-line diagram.
3. Identify the four variables associated with each bus in power flow analysis.
4. State the advantages of the Newton-Raphson method over the Gauss-Seidel method.
5. Mention the standard assumptions made in short circuit analysis.
6. Define the term “Fault Level” at a particular bus.
7. Write the matrix for transforming phase voltages (V_a , V_b , V_c) into symmetrical components (V_0 , V_1 , V_2).
8. Define Line-to-Line-to-Ground (LLG) fault.
9. Write the Swing Equation used in stability analysis.
10. Define “Critical Clearing Time”.

PART B — (5 × 13 = 65 marks)

11. (a) Discuss the procedure for the formation of YBus using singular transformation and deduce the relation $Y_{Bus} = A^T[y]A$.

Or

- (b) Draw the p.u impedance diagram for the system shown in Figure 11 (b) Choose base MVA as 100 MVA and base kV as 20 kV.

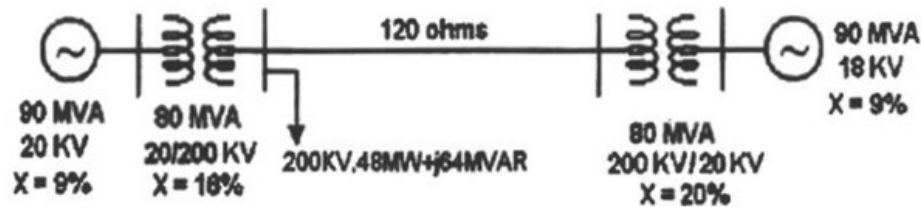


Figure 11 (b)

12. (a) Compare the Gauss-Seidel and Newton-Raphson methods for power flow solutions regarding convergence speed and computational complexity.

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Or

- (b) Explain with necessary equation and flowchart step by step procedure of Newton-Rapson Load flow method.
13. (a) Explain the procedure for Symmetrical fault analysis using the Bus Impedance Matrix (Z_{bus}).

Or

- (b) Develop the Z_{bus} using building algorithm for a power system whose element data is given in Table 13 (b) :

Table 13 (b) : Line data.

Line No.	Connected between bus No.	Self reactance (p.u)
1	1-2	0.3
2	1-3	0.15
3	2-3	0.2
4	1-2	0.15

14. (a) Derive the sequence network and the expression for fault current for a Line to-Line (LL) fault occurring at generator terminals.

Or

- (b) Derive the expressions related to sequence Networks for a synchronous generator under various fault conditions.
15. (a) Derive the power-Angle equation for a lossless transmission line connecting a generator to an infinite bus.

Or

- (b) Explain the Step-by-Step method used for solving the swing equation in stability analysis.

PART C — (1 × 15 = 15 marks)

16. (a) A three-bus power system is shown in Figure 16 (a).

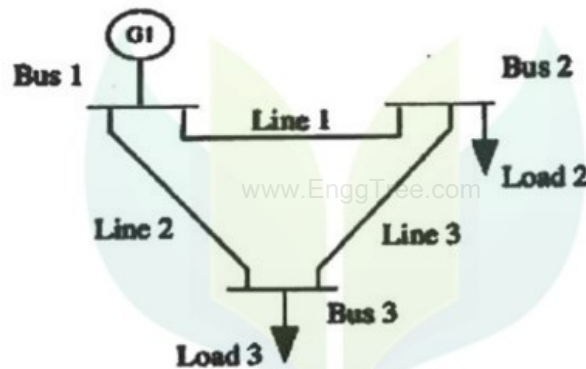


Figure 16 (a)

The following is the system data for a load flow solution:

Table 16 (a) (i) System data

Bus Number	Type	Generation		Load		Bus voltage	
		P_G (MW)	Q_G (MVAR)	P_G (MW)	Q_G (MVAR)	V(p.u)	δ (deg)
1	Slack	—	—	0	0	1.02	0
2	PQ	25	15	50	25	—	—
3	PQ	0	0	60	30	—	—

Table 16 (a) (ii) : Line admittances

Bus code	Admittance
1-2	$-j3.0$
1-3	$-j4.0$
2-3	$-j5.0$

Determine the bus voltages at the end of first iteration using Gauss-Seidal method. Take $\alpha = 1.6$.

Or

- (b) Apply the Equal Area Criterion to determine the Critical Clearing Angle for a Single Machine Infinite Bus (SMIB) system subjected to a sudden temporary three-phase fault on one of its parallel lines.

