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Question Paper Code : 81287

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fifth Semester

Electrical and Electronics Engineering

EE 3501 — POWER SYSTEM ANALYSIS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Identify the purpose of a single line diagram.
2. Define per unit.
3. List out various types of buses in power system with its known and unknown quantities.
4. Mention the main objective of a power flow (load flow) study.
5. State the significance of using Thevenin's equivalent in short circuit studies.
6. What is the need for short circuit studies?
7. Write the significance of sequence networks in unsymmetrical fault analysis.
8. Define positive, negative and zero sequence components in a 3 phase system.
9. List the significance of steady-state stability in power systems.
10. Define a swing curve.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Construct the per-unit impedance diagram of a power system having a generator, transformer and transmission line. (4)
(ii) Explain about need of system planning and operation studies. (9)

Or

- (b) Formulate the bus admittance matrix (Y_{bus}) for a 3-bus system using the singular transformation method.

12. (a) Illustrate the handling of voltage-controlled (PV) buses during load flow studies.

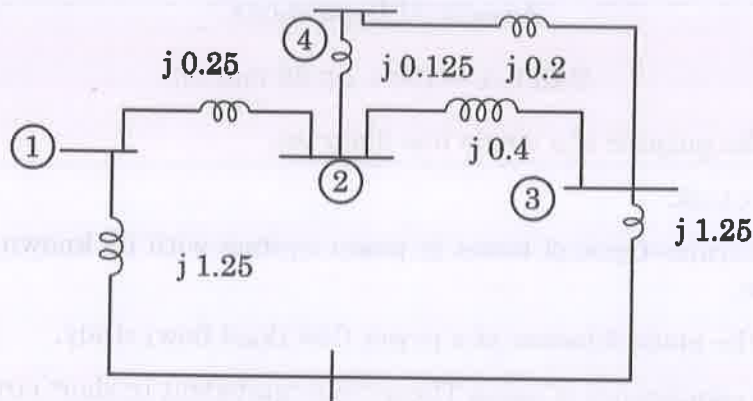
Or

- (b) Explain the Newton-Raphson method of power flow solution with its flow chart and algorithm.

13. (a) Describe the steps involved in symmetrical short circuit analysis using Thevenin's theorem.

Or

- (b) Examine the bus impedance matrix using bus building algorithm for the given network



14. (a) Derive an expression of fault current for LG and LL fault.

Or

- (b) Explain the general procedure of solving unsymmetrical fault problems using symmetrical components.

15. (a) Describe the concept of critical clearing angle and critical clearing time with examples.

Or

- (b) Explain the classification of power system stability and give examples of each type.

PART C — (1 × 15 = 15 marks)

16. (a) Two synchronous machines are connected through three-phase transformers to the transmission line as given in Fig. 16 (a). The ratings and reactances of the machines and transformers are :

Machines 1 and 2: 100 MVA ; 20 kV; $X_d'' = X_1 = X_2 = 20\%$; $X_0 = 4\%$; $X_n = 5\%$. Transformers T1 and T2: 100 MVA; 20 Y/345 Y kV; $X = 8\%$.

Both transformers are solidly grounded on two sides on a chosen base of 100 MVA, 345 kV in the transmission line circuit. The line reactances are $X_1 = X_2 = 15\%$ and $X_0 = 50\%$. The system is operating at nominal voltage without pre fault currents when a bolted ($Z_f = 0$) single line-to-ground fault occurs on phase 'a' at bus 3. Determine the sub-transient current to ground at the fault



Fig. 16 (a)

Or

- (b) In the power system shown in fig 16 (b) three phase fault occurs at P and the faulty line was opened a little later. Find the power output equations for the pre-fault during fault and post-fault condition if delivering 1.0 p.u. just before fault occurs, Also calculate critical clearing angle δ_{cc} .

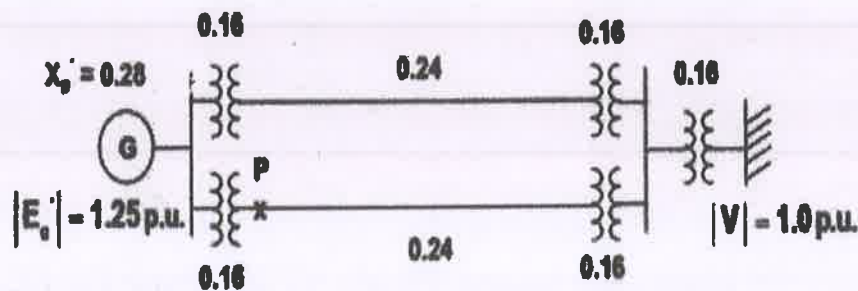


Fig. 16 (b)

