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Reg. No.												

Question Paper Code	11548

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Fifth Semester

Electrical and Electronics Engineering

20EEPC501 - POWER SYSTEM ANALYSIS

(Regulations 2020)

Duration: 3 Hours — Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Define per unit value.	2,K1,CO1
2.	Recall the equation for converting the p.u impedance expressed in one base to another.	2,K1,CO1
3.	Infer the known and unknown quantities of swing and PV bus.	2,K2,CO2
4.	Compare the Gauss-Siedel and Newton-Raphson method of load flow analysis.	2,K3,CO2
5.	Illustrate the relative frequency of occurrence of various types of faults.	2,K2,CO3
6.	Define short circuit capacity. Mention its uses.	2,K1,CO3
7.	Infer the causes of unsymmetrical faults.	2,K2,CO4
8.	Outline the boundary condition and I_f equation for double line to ground fault.	2,K3,CO4
9.	Classify the types of power system stability.	2,K2,CO5
10.	Infer the power angle equation.	2,K2,CO5

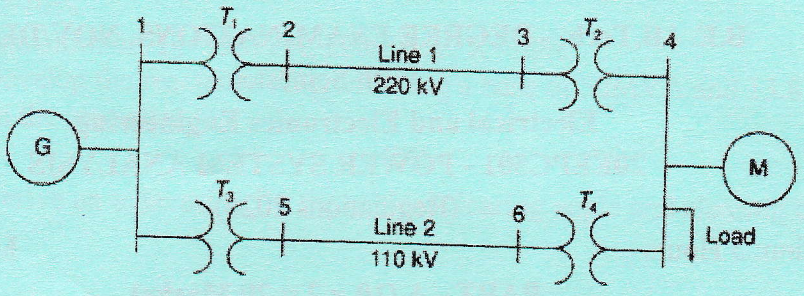
PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) The one-line diagram of a three-phase power system is given below. By selecting a common base of 100 MVA and 22 kV on the generator side, develop an impedance diagram showing all impedances including the load impedance in per-unit. The data are given as follows: *13,K3,CO1*

G: 90MVA, 22 kV,x=0.18
T1:50 MVA, 22 /220 kV, x=0.10
T2:40 MVA, 220/ 11 kV,x=0.06,
T3:40MVA, 22 / 110kV, x=0.064
T4:40 MVA, 110 /11 kV, x=0.08
M: 66.5MVA,10.45 kV, x=0.185

Lines 1 and 2 have series reactance's of 48.4 and 65.43Ω, respectively. At bus 4, the three-phase load absorbs 57MVA at 10.45kV and0.6 power factor lagging.



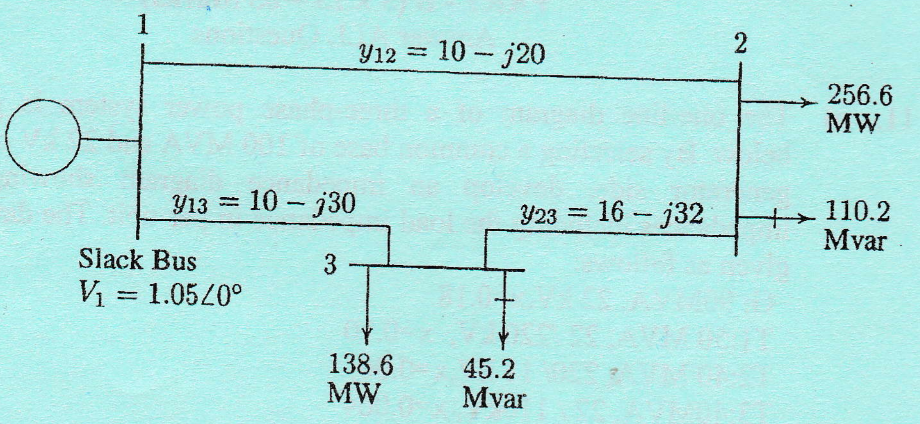
OR

b) The parameters of 4 bus system are as follows: 13,K3,CO1

Bus Code	Line impedance (p.u)	Line charging admittance (p.u)
1-2	0.2 + j 0.8	j 0.02
2-3	0.3 + j 0.9	j 0.03
2-4	0.25 + j 1.0	j 0.04
3-4	0.2 + j 0.8	j 0.02
1-3	0.1 + j 0.4	j 0.01

Draw the network and build bus admittance matrix.

12. a) Figure shows the one-line diagram of a simple three-bus power system with generation at bus 1. The magnitude of voltage at bus 1 is adjusted to 1.05 p.u. The scheduled loads at buses 2 and 3 are as marked on the diagram. Line impedances are marked in per unit on a 100 MVA base and the line charging susceptance's are neglected. Using Gauss-Seidel method, solve the phasor values of the voltage at the load buses 2 and 3 at the end of first iteration. 13,K3,CO2



OR

b) Clearly explain the algorithmic steps for solving load flow equations using fast decoupled load flow method when the system contains all types of buses. 13,K2,CO2

13. a) A synchronous generator and motor are rated for 30,000 kVA, 13.2 kV and both have sub transient reactance of 20%. The line connecting them has a reactance of 10% on the base of machine ratings. The motor is drawing 20,000 kW at 0.8 pf leading. The terminal voltage of the motor is 12.8 kV. When a symmetrical three-phase fault occurs at motor terminals, solve for the sub transient current in generator, motor and at the fault point. *13,K3,CO3*

OR

b) A 3-phase transmission line operating at 33 kV and having resistance and reactance of 5 ohms and 15 ohms respectively is connected to the generating station bus bar through a 5000 kVA step up transformer which has a reactance of 0.05 p.u. Connected to the bus bars are two alternators, are 10,000 kVA having 0.08 p.u, reactance and another 5000 kVA having 0.06 p.u. reactance. Calculate the kVA at a short circuit fault between phases occurring at the high voltage terminals of the transformers. *13,K3,CO3*

14. a) Derive an expression for the positive sequence current I_a of an unloaded generator when it is subjected to a double line-to-ground fault. *13,K3,CO4*

OR

b) Derive the expression for fault current in Line-to-Line fault on an unloaded generator in terms of symmetrical components. *13,K3,CO4*

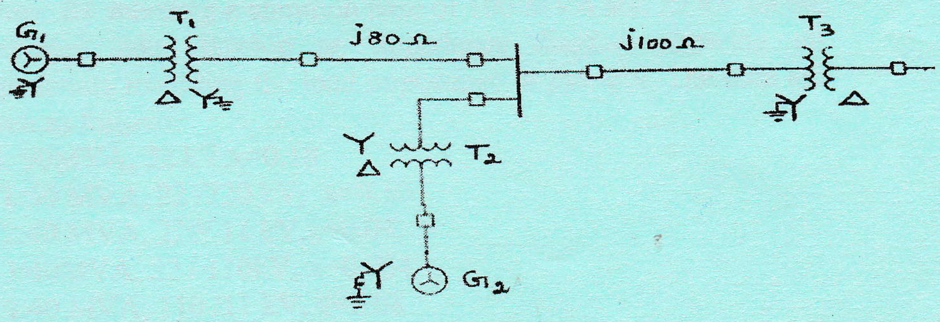
15. a) Derive the Swing equation used for stability studies in power system. *13,K3,CO5*

OR

b) Explain the equal area criterion method for power system stability analysis. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) The single line diagram of an unloaded power system is shown in figure below. The generator and transformers are rated as follows. *15,K3,CO1*



Generator, G_1=20 MVA,13.8 kV, X" =20%

Generator, G_2=30 MVA,18 kV, X″=20%
Generator,G_3=30MVA,20kV, X″=20%
Transformer,T_1=25MVA,220/13.8 kV, X=10%
Transformer, T_2=3 single phase units each rated at 10MVA, 127/18kV, X=10%.
Transformer, T_3=35MVA, 220/22kV, X=10%.
Develop the reactance diagram using a base of 50MVA and 13.8 kV on the generator G_1.

OR

b) Derive an expression for the critical clearing angle and clearing time. *15,K3,CO5*