Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X 60505

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Sixth Semester
Electrical and Electronics Engineering
EE 2351/EE 61/10133 EE 601 – POWER SYSTEM ANALYSIS
(Regulations 2008/2010)
(Common to PTEE 2351 Power System Analysis for B.E. (Part-Time)
Fourth Semester – Electrical and Electronics Engineering – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What are the functions of modern power system ?
2. Name the diagonal and off-diagonal elements of bus impedance matrix.
3. Write the static load flow equation.
4. State the role of acceleration factor in GS method.
5. Distinguish symmetrical and unsymmetrical faults.
6. What is meant by fault level ?
7. Name the faults in which all the three sequence component currents are equal and in which positive and negative sequence currents together is equal to zero sequence current.
8. Write the matrix notation of the operator 'a' which relates the phasors V_a, V_b and V_c with V_{a0}, V_{a1} and V_{a2}.
9. A four pole, 60-Hz synchronous generator has a rating of 200 MVA, 0.8 power factor lagging. The moment of inertia of the rotor is 45,100 kg-m^2. Determine M and H.
10. What is the significance of critical clearing time ?

PART – B **(5×16=80 Marks)**

11. a) i) For the system shown in Fig. 11 a) i) determine the generator voltage. Take a base of 100 MVA and 210 kV in the transmission line. **(10)**

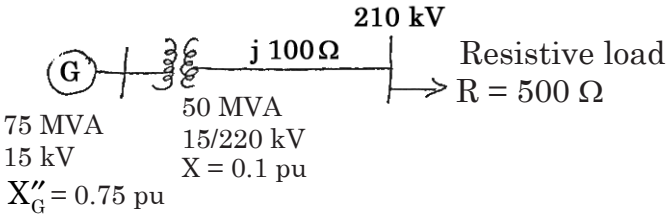

Fig. 11 a) i)

ii) Why is per unit system used in power system analysis and list its advantages. **(6)**

(OR)

b) Form the bus impedance matrix for the network shown in Fig. 11 b) by bus building algorithm. **(16)**

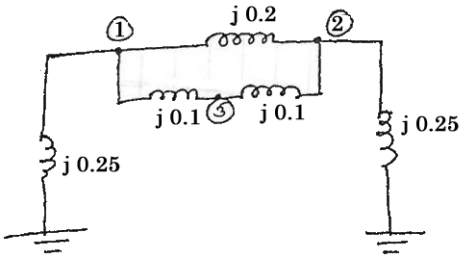

Fig. 11 b)

12. a) A three bus power system is shown in Fig. 12 a). The relevant per unit line admittance on 100 MVA base are indicated on the diagram and bus data are given in table 12 a). Form Y_{bus} and determine the voltages at bus 2 and bus 3 after first iteration using Gauss Seidal method. Take the acceleration factor $\alpha = 1.6$. **(16)**

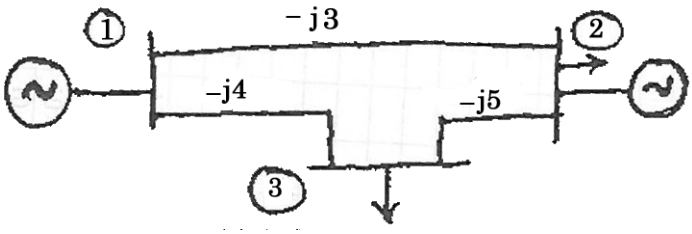

Fig. 12 a) A three – bus system

Table : 12 a)

Bus number	Type	Generation		Load		Bus Voltage	
		P_G	Q_G(MVAr)	P_L	Q_L	V(pu)	δ deg
1	Slack	?	?	0	0	1.02	0°
2	PQ	25	15	50	25	?	?
3	PQ	0	0	60	30	?	?

(OR)

b) i) Give the classification of various types of buses in a power system for load flow studies. **(6)**

ii) Give the advantages and limitations of Newton Raphson method. **(6)**

iii) What is meant by decoupled load flow methods ? **(4)**

13. a) Two generators are connected in parallel to the low voltage side of a 3 phase delta star transformer as shown in Fig. 4. Generator 1 is rated 60,000 kVA, 11 kV. Generator 2 is rated 30,000 kVA, 11 kV. Each generator has a sub-transient reactance of $X''_d = 25\%$. The transformer is rated 90,000 kVA at 11 kV-Δ/66 kV-Y with a reactance of 10%. Before a fault occurred, the voltage on the high tension side of the transformer is 63 kV. The transformer is unloaded and there is no circulating current between the generators. Find the sub-transient current in each generator when a three phase fault occurs on the ht side of the transformer.

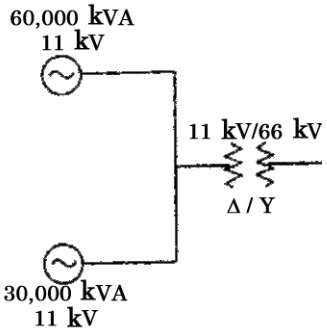

Fig. 4

(OR)

b) A generator transformer unit is connected to a line through a circuit breaker. The unit ratings are :

Generator : 10 MVA, 6.6 kV : $X''_d = 0.1$ pu, $X'_d = 0.2$ pu, and $X_d = 0.8$ pu

Transformer : 10 MVA, 6.9/33 kV, reactance 0.08 p.u.

The system is operating on no load at a line voltage of 30 kV, when a three phase fault occurs on the line just beyond the circuit breaker. Find

i) The initial symmetrical rms current in the breaker,

ii) The maximum possible dc offset current in the breaker,

iii) The momentary current rating of the breaker,

iv) The current to be interrupted by the breaker and the interrupting kVA, and

v) The sustained short circuit current in the breaker.

14. a) i) Derive the necessary equation to determine the fault current for a single line to ground fault. Draw a diagram showing the interconnection of sequence networks. **(8)**

ii) A 30 MVA, 11 kV generator has $Z_1 = Z_2 = j0.2$p.u. $Z_0 = j\ 0.05$ p.u. A line to ground fault occurs on the generator terminals. Find the fault current and line to line voltages during fault conditions. Assume that the generator neutral is solidly grounded and that the generator is operating at no-load and at rated voltage at the occurrence of fault. **(8)**

(OR)

b) A 50 MVA, 11 kV, 3-ph alternator was subjected to different types of faults. The fault currents are ; 3-ph fault 1870 A, line to line fault 2590 A, single line to ground fault 4130 A. The alternator neutral is solidly grounded. Find the p.u. values of the three sequence reactances of the alternator. **(16)**

15. a) Develop an algorithm and draw flow chart for the solutions of swing equations by modified Euler's method.

(OR)

b) A large cylindrical rotor generator is delivering 1.0 p.u. power to an infinite bus through a transmission network. The maximum power which can be transferred for pre fault, during fault and post fault conditions are 1.8 p.u, 0.4 p.u. and 1.3 p.u. Find the critical clearing angle.

———————