B.E. (Full Time) DEGREE ARREAR EXAMINATION, MARCH 2011
DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING, ANNA UNIVERSITY
V SEMESTER
EE9302- POWER SYSTEM ANALYSIS

Time: 3 hours   Maximum: 100 marks

Answer ALL questions

PART-A (10x2 = 20 Marks)

1. What are the advantages of pu representation?
2. A transmission line has an impedance of 0.03 + j 0.084 pu to a base of 1.5 MVA, 11 kV. What will be the corresponding values to a base of 2 MVA, 23 kV?
3. What is the need for short circuit analysis?
4. Draw the zero sequence network for a star connected generator earthed through a resistance R.
5. Draw the equivalent sequence network for a L-L bolted fault in power system.
6. Compare Gauss-Seidel and N-R method.
7. How the buses are classified in a power system?
8. State equal area criterion.
9. A system has two stability limits, 200 MW and 300 MW. Which is the steady state stability limit? Which is transient stability limit?
10. Define the term "transient stability".

PART-B (5x16 = 80 marks)

11. The data for the system whose single-line-diagram is shown in **Fig. 11** is as follows:

G1: 30 MVA, 10.5 kV, X" = 1.65 Ω;

G2: 15 MVA, 6.6 kV, X" = 1.23 Ω

G3: 25 MVA, 6.6 kV, X" = 0.54 Ω

T1: 15 MVA, 33/11 kV, X=15.5 Ω/phase on h.t side

T2: 15 MVA, 33/6.2 kV, X=17.0Ω/phase on h.t side

Transmission Line: X=21.5 Ω/phase

Loads: A: 40 MW, 11 kV, 0.9 p.f lagging;

B: 40 MW, 6.6 kV, 0.85 p.f lagging.

Choose the base power as 30 MVA and approximate base voltages for different parts. Draw the reactance diagram. Indicate pu reactances on the diagram. (16)

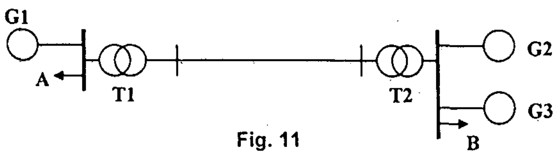

Fig. 11

12. (a) Explain the step-by-step procedure involved in z-bus building algorithm by considering all possible cases. (16)

[OR]

12. (b) (i). Starting from first principles show that a diagonal element of Y-bus equals the sum of admittances connected to that bus and an off diagonal element equals the negative of the sum of admittances directly connected between the buses.(8)

(ii). Prove that [Y-bus] = $[A]^T[y][A]$. (8)

13. (a) A sample system is described in **Fig. 13.a.** The Line data, bus data and load flow results are given Table 13.1 and 13.2. Assume base MVA is 100 and Compute the following:

i). Slack bus power (4)
ii). Reactive Power Generation from G2. (4)
iii). Line flows (4)
iv). Line losses (4)

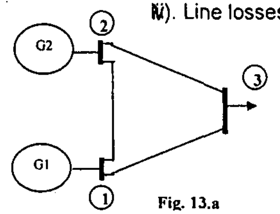

Fig. 13.a

Table 13.1 Line Data

Line	Admittance	Half line charging admittance
1-2	1.47 - j5.88	j0.15
1-3	2.94 - j11.77	j0.07
2-3	2.75 - j9.17	j0.04

Table 13.2 Bus data & Load Flow Results

Bus	Bus Voltage	Generation		Load	
		MW	MVAR	MW	MVAR
1	1.04∠0°	--	--	0	0
2	1.02∠-3.09°	100	-	50	20
3	0.93∠-7.01°	0	0	250	150

[OR]

13. (b)Derive the power flow problem. Explain the step-by-step computational procedure to solve the power flow problem using the Gauss-Seidel method. (16)

14.(a)An 11 kV, 100 MVA, alternator with solidly grounded neutral has positive sequence and negative sequence reactances of 0.2 pu each and zero sequence reactance of 0.05 pu. It is supplying an 11 kV, 50 MVA motor with positive and negative sequence reactances of 0.2 pu and zero sequence reactance of 0.05 pu through a short line. The neutral of the motor is also solidly grounded. The transmission line has positive and negative sequence reactances of 0.05 pu and zero sequence reactance of 0.15 pu on 100 MVA base. The motor is drawing 40 MW, at 0.8 pf leading with a terminal voltage of 10.95 kV when a single line to ground fault occurs at the generator terminals of phase a. Calculate the fault current and the current supplied by generator and motor under faulted condition. (16)

[OR]

14.(b) The **Fig. 14(b)** shows a generating station feeding a 132 KV system. Determine the total fault current, fault level and fault current supplied by each alternator for a 3 phase fault at the receiving end bus. The line is 200 km long.

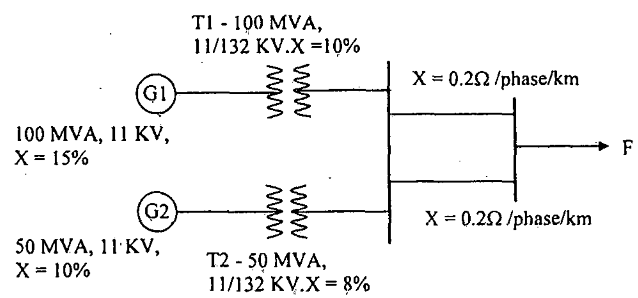

Fig. 14(b)

15.(a)Discuss the procedure for solving the swing equation using modified Euler method. (16)

[OR]

15 (b) The **Fig. 15(b)** shows transmission network. The pu reactances of the equipments are as shown. The voltage behind transient reactance of generator is 1.1 pu. The system is transmitting 1 pu real power when fault occurs at the middle of one of the line. Determine (i) transfer reactance for prefault, during fault and post fault conditions and (ii) critical clearing angle. (16)

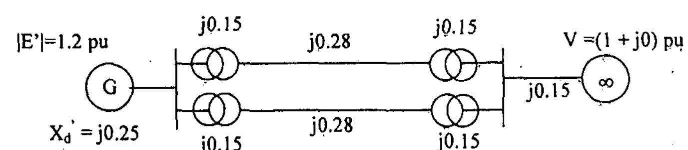

Fig 15(b)