[06 – 4120]

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

Elective – POWER SYSTEM ANALYSIS AND STABILITY

(Effective from the Admitted Batch of 2006-2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answers any FOUR from the remaining.

All questions carry equal marks.

1. (a) Write an expression for the per unit impedance of an element on a new base if per unit impedance to some other quantities are known.

(b) Define the following with respect to a power system :

(i) Single line diagram

(ii) Reactance diagram.

(c) Mention the role of the limiting reactors in power systems.

(d) List out all the advantages of symmetrical components in power system analysis.

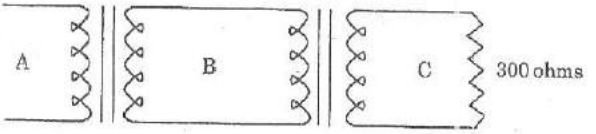
(e) Draw the interconnection of sequence network for a double line the ground fault.

(f) Why pre fault current is not considered for unsymmetrical fault analysis?

(g) "A system can be operated above transient stability limit but not above its steady state stability limit". Justify this statement.

2. (a) Show that for a transformer, the per unit value of impedance will be the same when referred to either side of the transformer.

(b) Three parts of a single-phase power system are designated as A, B and C and are connected to each other through transformers as shown in the figure below.



Figure

The transformers are rated as below. Transformer A-B : 10 MVA, 13.8 KV/138 KV, leakage reactance 10%.

Transformer B-C : 10 MVA, 69 KV/138 KV, leakage reactance 10%.

If the base in circuit B is chosen as 10 MVA and 138 KV, find :

(i) P.U. impedance of 300 ohms resistive load connected in circuit C referred to circuit A, B and C.

(ii) Draw the impedance diagram neglecting magnetizing current, transformer resistance and line impedance.

3. (a) Derive the expressions to solve Fast decoupled method of load flow studies.

(b) Obtain the bus admittance matrix for a 5 – bus system with the following data :

Bus code p-q	Impedance Z_{pq}	Line charging $Y_{pq/2}$
1-2	0.02 + j 0.04	j 0.02
2-3	0.04 + j 0.02	j 0.02
3-5	0.15 + j 0.4	j 0.025
4-5	0.02 + j 0.04	j 0.01
1-5	0.08 + j 0.2	j 0.02

4. (a) Explain the analysis of symmetrical faults in power system networks.

(b) Three synchronous generators of rating 20 MVA, 8%; 60 MVA, 10% and 20 MVA, 9% fed power to a 3-phase bus at 11.8 KV. Determine the fault MVA for a 3-phase symmetrical fault at the bus. Assume base KV = 11.8 and base MVA = 60 MVA.

5. (a) Obtain the expression for 3-phase power in terms of symmetrical components.

(b) A 3-phase generator is star connected and the neutral is grounded through a reactance of 4 ohms. The rated line to line voltage of the generator is 400 volts. If the generator is on open circuit and L-L fault takes place at the terminals of B and C, determine the fault current given that Z_1 = j 5 ohms, Z_2 = j 2 ohms and Z_0 = j 1 ohm. Phase sequence is ABC.

6. (a) Derive expressions for fault currents on an unloaded generator for single-line to ground fault. Also, draw the sequence diagram.

(b) The following currents were recorded in the R, Y and B lines of a 3-phase RYB phase sequence system under abnormal conditions.

$I_R = 300\angle 300°$; $I_Y = 500\angle 240°$ $IB = 1000\angle 60°$.

Calculate the values of positive, negative and zero sequence currents.

7. (a) Explain how equal area criterion method could be used to determine the critical clearing angle for the given input.

(b) Find the steady state stability limit of two machine system consists of a synchronous generator with equivalent reactance 0.49 p.u. connected to an infinite bus through a reactance of 0.9 p.u. The terminal voltage of the generator is held at 1.08 p.u. and the voltage of infinite bus at 1.0 p.u.

8. Write short notes on the following :

(a) Comparison of load flow methods

(b) Per unit impedance of 3-winding transformers.

(c) Phase shift in delta/star transformers.