Question Paper Code : 71776

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fifth Semester

Electrical and Electronics Engineering

EE 6501 — POWER SYSTEM ANALYSIS

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages of per unit computation.

2. A Y corrected generator rated at 300 MVA, 33kV has a reactance of 1.24 p.u. Find the ohmic value of the reactance.

3. Compare Newton Raphson and Gauss Seidal methods of load flow solutions.

4. Write the quantities that are associated with each bus in a system.

5. What is the significance of subtransient reactance and transient reactance in short circuit studies?

6. For a fault at a given location, rank the various faults in the order of severity.

7. Express the unbalanced voltages in terms of symmetrical components.

8. Draw the zero-sequence network of Y/Δ transformer with neutral ungrounded.

9. Define swing curve. What is the use of Swing curve?

10. State Equal Area Criterion.

PART B — (5 × 16 = 80 marks)

11. (a) 300 MVA, 20 kV, 3Φ generator has sub transient reactance of 20%. The generator supplies 2 synchronous motors through a 64 km transmission line having transformers at both ends as shown in Fig.11.a. In this, T1 is a 3Φ transformer 350 MVA, 20/230 kV, 10% reactance & T2 is made of 3 single phase transformer of rating 100 MVA, 127/13.2 kV, 10% reactance.

Series reactance of the transmission line is 0.5 Ω/km. The ratings of 2 motors are: M1=200 MVA, 13.2 kV, 20% & M2 = 100 MVA, 13.2 kV, 20%. Draw the reactance diagram with all the reactance's marked in p.u. Select the generator rating as base values. **(16)**

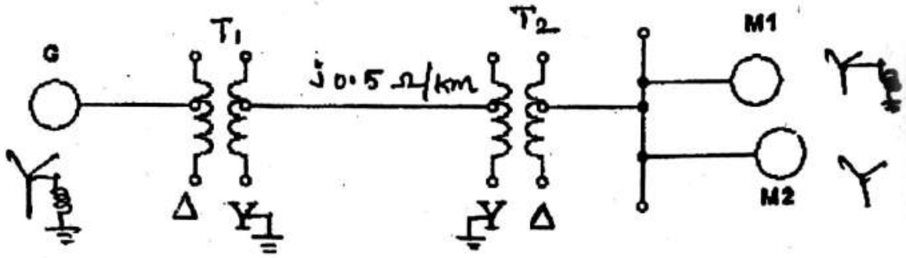
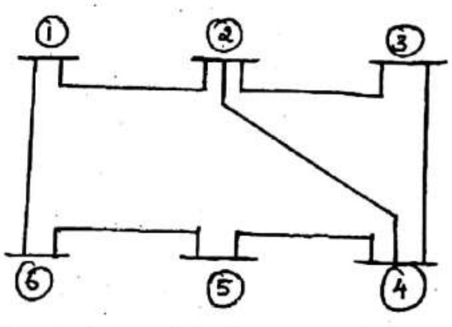


Fig.11.a.

Or

(b) Form bus admittance matrix for the data given below using Singular transformation method. Take node '6' as reference node. **(16)**

Elements	Bus code	X (p.u.)
1	1-2	0.04
2	1-6	0.06
3	2-4	0.03
4	2-3	0.02
5	3-4	0.08
6	4-5	0.06
7	5-6	0.05



12. (a) With a neat flow chart, explain the computational procedure for load flow solution using Newton Raphson iterative method when the system contains all types of buses. **(16)**

Or

(b) Single line diagram of a simple power system, with generators at busses 1 and 3 is shown in Fig. 12.b. The magnitude of voltage at bus 1 is 1.05 p.u. Voltage magnitude at bus 3 is fixed at 1.04 p.u. with active power generation of 200 MW. A load consisting of 400 MW and 250 MVAR is taken from bus 2. Line impedances are marked in p.u. on a 100 MVA base and the line charging susceptances are neglected.

Determine the voltage at buses 2 and 3 using Gauss-Seidal method at the end of first iteration. Also calculate Slack bus power.

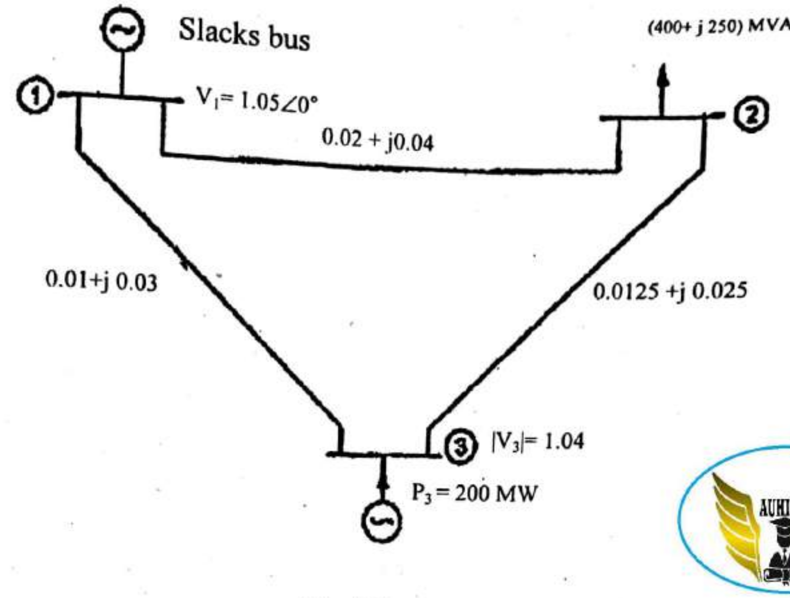


Fig.12.b.

13. (a) (i) A 3 phase. 5 MVA, 6.6 kV alternator with a reactance of 8% is connected to a feeder series impedance (0.12 + j0.48) ohm/phase/km through a step up transformer. The transformer is rated at 3 MVA, 6.6 kV/33 kV and has a reactance of 5%. Determine the fault current supplied by the generator operating under no load with a voltage of 6.9 kV, when a 3phase symmetrical fault occurs at a point 15 km along the feeder. (8)

(ii) Draw the detailed flowchart, which explains how a symmetrical fault can be analyzed using Z_{BUS}. (8)

Or

(b) A 100 MVA, 11 kV generator with X" = 0.20 p.u is connected through a transformer and line to a bus bar that supplies three identical motor as shown in Fig and each motor has X"= 0.20 p.u and X'= 0.25 p.u on a base of 20 MVA,33 kV ,the bus voltage at the motors is 33 kV when three phase balanced fault occurs at the point F. Calculate (i) Sub transient current in the fault (ii) Sub transient current in the circuit breaker B (iii) Momentary current in the circuit breaker B (iv) The current to be interrupted by C.B B in 5 cycles. (16)

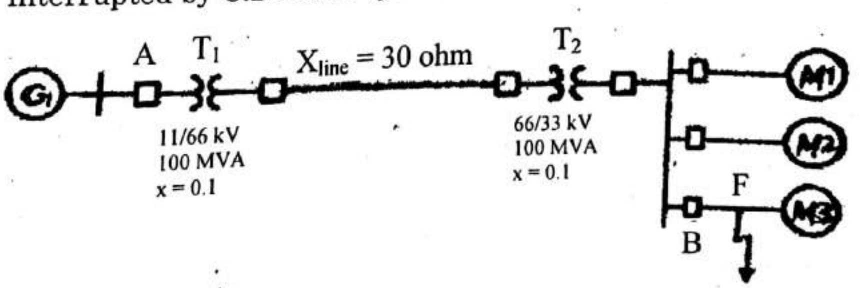


Fig.13.b.

14. (a) (i) Derive the expression for fault current in line to line fault on unloaded generator and draw an equivalent network showing the interconnection of networks. (10)

(ii) A 3 phase salient pole synchronous generator is rated 30 MVA, 11 kV and has a direct axis subtransient reactance of 0.25 p.u. The negative and zero sequence reactances are 0.35 and 0.1 p.u. respectively. The neutral of the generator is solidly grounded. Calculate the subtransient current in the generator when a line to line fault occurs at the generator terminals with generator operating unloaded at rated voltage. (6)

Or

(b) Two 11 kV, 20 MVA, three phase star connected generators operate in parallel as shown in Fig. The positive, negative and zero sequence reactance of each being respectively j 0.18, j 0.15, j 0.10 p.u. The star point of one of the generator is isolated and that of the other is earthed through a 2.0 ohm resistor. A Single line to Ground fault occurs at the terminals of one of the generators. Estimate (i) fault current (ii) current in grounded resistor and (iii) Voltage across grounding resistor. (16)

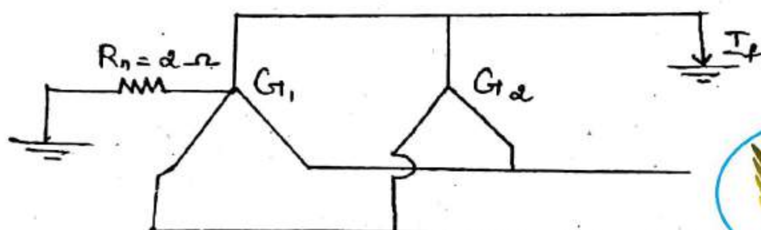


Fig.14.b.

15. (a) (i) Discuss the methods by which transient stability can be improved. (6)

(ii) Find the critical clearing angle of the system shown in Fig. 15.a., for a 3 phase fault at the point 'F'. The generator is delivering 1.0 pu. power under prefault conditions. (10)

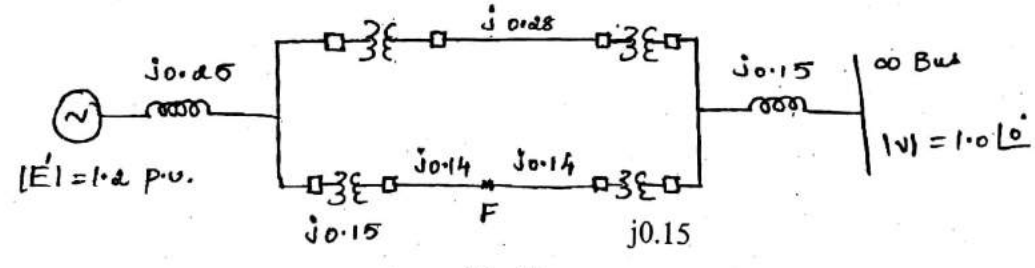


Fig.15.a.

Or

(b) Derive the swing equation of a single machine connected to an infinite bus system and explain the steps of solution by Runge -Kutta method. (16)