PVP 14

Code: EE6T5

III B.Tech - II Semester – Regular/Supplementary Examinations August 2021

POWER SYSTEM ANALYSIS

(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer *all* the questions. All questions carry equal marks

11 x 2 = 22 M

1.

a) The per unit impedance of a circuit element is 0.15, If the base kV and base MVA are halved, then what is the new value of the per unit impedance of the circuit element.

b) Why per unit method is considered superior to percent method for short circuit calculation?

c) What is the short circuit current drawn by a 10 kVA, 400/200 V 1-phase transformer with 10% impedance.

d) Mention assumptions made in fast decoupled load flow.

e) A 183 bus power system has 150 PQ buses. What is the size of the Jacobian matrix used in Newton-Raphson method?

f) Mention the applications of Y-bus.

g) What is slack bus and explain its importance in load flow studies?

h) Explain the term (i) critical clearing angle and (ii) critical clearing time

i) Write the symmetrical component voltage of phase 'a' in terms of 3 phase voltages.

j) What is the significance of synchronizing coefficient for steady state stability analysis?

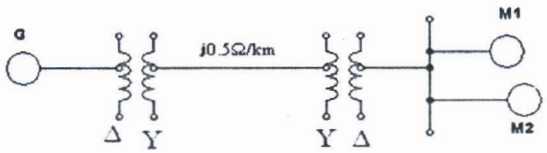
k) Write the expression for the fault current when a double line to ground fault occurs at unloaded generator terminals.

PART – B

Answer any *THREE* questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) What are the advantages of per unit system? Prove that the Per Unit impedance of a transformer referred to either side is same. 8 M

b) A 500 MVA, 20 kV, 3-Φ generator has reactance of 10%. The generator supplies 2 synchronous motors through a transmission line having transformers at both ends as shown in fig. In this, T_1 is a 3Φ transformer 250 MVA, 20/230 kV, 15% reactance & T_2 is made of 3 single phase transformers of rating 500 MVA, 13.2/127 kV, 20% reactance. The total length of transmission line is 200 km. The ratings of 2 motors are: M_1=150 MVA, 13.2 kV, 15% & M_2= 200 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. 8 M

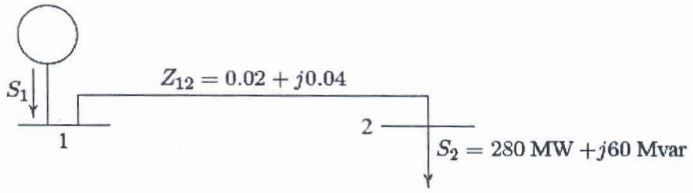


3. a) Develop the expression for fault current when a line to line fault occurs at the unloaded generator terminals. Also draw the sequence network diagram. 6 M

b) A 3 phase star connected alternator is rated 30 MVA, 13.8 kV and has the following sequence reactance values: X_1= 0.25 pu; X_2=0.35pu and X_o=0.10pu. The neutral of the alternator is solidly grounded. Determine the line currents when a line to ground fault occurs on its terminals. Assume that the alternator is unloaded and is operating at rated voltage when the fault occurs. 10 M

4. a) Discuss the classification of buses in a power system for load flow studies and derive static load flow equations. 8 M

b) In the power system network shown in Fig. below, bus 1 is a slack bus with $V_1 = 1.0\angle 0°$p.u and bus 2 is a load bus with $S_2 = 280$ MW $+ j60$ MVAR. The line impedance on a base of 100 MVA is $Z = 0.02 + j0.04$ p.u. Using Gauss-Seidel method, determine V_2. Use an initial estimate of $V_2^{(0)} = 1.0 + j0.0$ and perform two iterations. 8 M



5. a) With relevant equations, explain NR method in polar co-ordinates for obtaining the solution for the load flow problem. 8 M

b) For a 3 bus system where each bus is connected to the remaining two buses, the series impedance and shunt admittance of each line are 0.026+j0.11 p.u and j0.04 p.u respectively. The bus data is given below.

Bus	P_G	Q_G	P_L	Q_L	Bus Voltage
1	---	---	1.0	0.5	1.03 + j 0
2	1.5	---	0	0	1.03
3	0	0	1.2	0.5	---

At bus 2, minimum and maximum reactive power limits are 0 and 0.8 p.u. Find the bus voltages after the first iteration using NR method. 8 M

6. a) For a system having a generator connected to an infinite bus through a transmission line, a 3-phase fault occurs at the terminals of the generator. Derive the equation for critical clearing angle and time. 8 M

b) Find the steady state power limit of a system consisting of a generator with synchronous reactance of 0.5 p.u connected to an infinite bus through a transmission line having reactance 1 p.u. The terminal voltage of the generator is held at 1.2 p.u and the infinite bus voltage is 1 p.u. 8 M