

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER 2013****Subject Code: 150902****Date: 16-05-2013****Subject Name: Power System Analysis and Simulation****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Give reasons for following: **06**
1. The analysis of unsymmetrical faults can be more easily done with the help of symmetrical components than by a direct solution of the unbalanced circuit.
 2. A travelling wave suffers reflection when it reaches discontinuity.
 3. The disruptive critical voltage is less than visual critical voltage.
- (b)** Figure 1 shows the single line diagram of a simple system. The transformer ratings, generator rating, line impedance and load impedance are shown. Draw impedance diagram. Find actual value of generator current, line current, load current, load voltage and load power. Carry out the calculation in p. u. neglecting phase shift in transformer. **08**

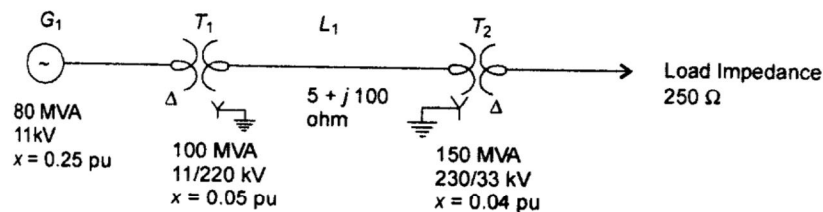


Figure 1.

- Q.2 (a)** What is an equivalent π and equivalent T circuit of a long transmission line? Derive expression of parameters of these circuits in terms of line parameters. **07**
- (b)** A 300 km 132 kV 3-phase overhead line has a total series impedance of $52 + j200 \Omega$ /phase and a total shunt admittance of $j1.5 \times 10^{-3}$ siemens per phase to neutral. The line is supplying 40 MVA at 0.8 p.f. lagging at 132 kV. Using long line equations find sending end voltage, current, power factor and power. **07**
- OR**
- (b)** Find the disruptive critical voltage and visual corona voltage (local as well as general corona) for a 3-phase 220 kV line consisting of 22.26 mm diameter conductors spaced in a 6 m delta configuration. The following data can be assumed: Temperature 25°C , pressure 73 cm of mercury, surface factor 0.84, irregularity factor for local corona 0.72, and irregularity factor for general (decided) corona 0.82. **07**
- Q.3 (a)** Discuss principle of symmetrical components. Derive the necessary equations to convert: (i) phase quantities into symmetrical components (ii) symmetrical components in to phase quantities. **06**
- (b)** A 50 MVA, 11 kV, 3-phase alternator was subjected to different types of faults. The fault currents were: 3- ϕ fault 1870A, line to line fault 2590 A, single line to ground fault 4130 A. The alternator neutral is solidly grounded. Find pu values of the three sequences reactance of the alternator. **08**

OR

- Q.3 (a)** Draw a general circuit which can be used to determine zero sequence network of a two-winding transformer. Using this circuit, draw the zero sequence networks for (i) delta-star transformer with star point grounded. (ii) delta-delta transformer. (iii) star-star transformer with star point grounded. **06**
- (b)** A 33 KV line has a resistance of 4 ohm and reactance of 16 ohm **08**
respectively.

The line is connected to generating station bus bars through a 6000 KVA step up transformer which has a reactance of 6%. The station has two generators rated 10,000 KVA with 10% reactance and 5000 KVA with 5% reactance. Calculate the fault current and short circuit KVA when a 3-phase fault occurs at the h.v. terminals of the transformers and at the load end of the line. (See figure 2)

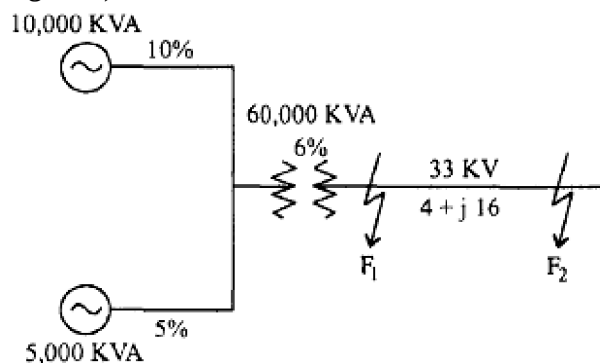


Figure 2

- Q.4 (a)** Derive an expression for the fault current for a single line-to ground fault as an unloaded generator. **07**
- (b)** A generator rated 100 MVA, 20kV has $X_1 = X_2 = 20\%$ and $X_0 = 5\%$. Its neutral is grounded through a reactor of 0.32 ohms. The generator is operating at rated voltage with load and is disconnected from the system when a single line to ground fault occurs at its terminals. Find the sub-transient current in the faulted phase and line to line voltages. **07**

OR

- Q.4 (a)** Derive an expression for the fault current for a double-line fault as an unloaded generator. **07**
- (b)** A generator rated 100 MVA, 20kV has $X_1 = X_2 = 20\%$ and $X_0 = 5\%$. Its neutral is grounded through a reactor of 0.32 ohms. The generator is operating at rated voltage with load and is disconnected from the system when a line to line fault occurs at its terminals. Find the sub-transient current in the faulted phase and line to line voltages. (Repetition of example Q-4(b) for line to line fault). **07**

- Q.5 (a)** Discuss the phenomenon of wave reflection and wave refraction. Derive expression for refraction and reflection coefficients. **07**
- (b)** Why it is necessary to earth neutral? Explain the difference between resistance and reactance grounding. **07**

OR

- Q.5 (a)** Discuss the behavior of a travelling wave when it reaches the end of (i) open circuited (ii) short circuited transmission line. Draw diagrams to show voltage and current on the line before and after the wave reaches at the end. **07**
- (b)** With help of circuit & phasor diagram explain resonant grounding method. **07**
