

- N.B. (1) Question No. 1 is compulsory.  
 (2) Solve any four questions from remaining six questions.  
 (3) Assume suitable data if necessary.

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1. (a) State and explain the 'Fortescue Theorem' for the analysis of unbalanced systems. 10  
 (b) Derive the interconnection of sequence network for L-L fault. 10
2. (a) Explain in detail "Symmetrical Component—Transformation". 10  
 (b) Show the variation of voltage and current in a short ended line for a travelling wave. 10
3. (a) A three-phase transmission line has conductor 1.5 cms in diameter spaced one meter apart in equilateral formation. The resistance and leakage are negligible. Calculate :— 12
  - (i) The Natural Impedance of the line
  - (ii) The line current if a voltage wave of 11 kV travels along the line.
  - (iii) The rate of energy absorption, the rate of reflection and state and the form of reflection, if the line is terminated through a star connected load of 1000 ohm per phase.
  - (iv) The value of the terminating resistance for no reflection.
  - (v) The amount of reflected and transmitted power over if the line is connected to a cable extension with inductance and capacitance per phase per cm of  $0.5 \times 10^{-8}$  H and  $01 \times 10^{-6}$  micro-farad-respectively.
- (b) Explain the advantages and disadvantages of Corona in details. 8
4. (a) Write a detail note on zero sequence network of synchronous generator and three-phase transformer with the help of neat diagrams. 10  
 (b) A voltage having a crest value of 3000 kV is travelling on a 750 kV line. The protective level is 1700 kV. The surge impedance of line is 300 ohm. Calculate :— 10
  - (i) The current in the line before reaching the arrester
  - (ii) Current through the arrester
  - (iii) The value of arrester resistance for this condition
  - (iv) Reflected voltage.
5. A synchronous generator is rated at 25 MVA, 11 kV. It is star connected with the neutral-point solidly grounded. The generator is operating at no load at rated voltage. Its reactances are  $X'' = X_2 = 0.2$  P.U.;  $X_0 = 0.08$  P.U. 20  
 Calculate the symmetrical subtransient line current for—
  - (i) Single Line to Ground Fault
  - (ii) Double Line to Ground Fault
  - (iii) Line to Line.
6. (a) A 110 kV, 50 Hz, 3-Phase, Transmission Fault line 175 km long consisting of three one cm dia stranded copper conductor spaced in three meter delta-arrangement. Temp. = 26 °C and barometric pressure is 74 cm.,  $m = 0.85$ ,  $M_v$  for local Corona = 0.72 and  $M_v$  for General Corona = 0.82. Find— 12
  - (i) Disruptive critical voltage
  - (ii) Visual critical voltage
  - (iii) Power loss using peaks formula for fair weather conditions and stormy weather conditions.
- (b) Explain 'Biopolar-Link' type of HVDC system. Give its advantages and Disadvantages. 8
7. Write short notes on :—
  - (a) Fault calculation using Z bus
  - (b) Significance of surge impedance loading
  - (c) Advantages of HVDC over EHV-AC