



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (EEE)/SEM-6/EEE-603/2010**

**2010**

**POWER SYSTEM-I**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) ACSR stands for
  - a) All copper standard reinforced
  - b) Aluminium conductor steel reinforced
  - c) Aluminium copper steel reinforced
  - d) All copper steel reinforced conductor.



- ii) The charging current in the transmission line
  - a) lags the voltage by  $90^\circ$
  - b) leads the voltage by  $45^\circ$
  - c) leads the voltage by  $90^\circ$
  - d) leads the voltage by  $180^\circ$ .
- iii) Ferranti effect on long overhead lines is experienced when it is
  - a) lightly loaded
  - b) on full load at u.p.f.
  - c) on full load at 0.8 p.f. lag
  - d) in all these cases.
- iv) The string efficiency of a string of suspension insulator is dependent on
  - a) size of the insulator
  - b) no. of discs in the string
  - c) size of tower.
- v) Which of the following results in a symmetrical fault ?
  - a) Single phase to earth
  - b) Phase to earth
  - c) All the three phases to earth
  - d) Two phases to earth.



vi) The most common type of fault is

- a) single phase to ground
- b) phase to phase
- c) two phase to ground
- d) three phase to ground.

vii) Base impedance of a power system is given by

- a)  $\frac{\text{Base kV}^2}{\text{Base MVA}}$
- b)  $\frac{\text{Base kV}}{\text{Base MVA}}$
- c)  $\frac{\text{Base MVA}}{\text{Base kV}^2}$
- d)  $\frac{\text{Base mVA}^2}{\text{Base kV}}$  .

viii) Corona is accompanied by

- a) violet visible discharge in darkness
- b) hissing sound
- c) vibration
- d) power loss
- e) radio interference
- f) ozone
- g) all of these.



ix) For a 500 Hz frequency excitation, a 50 km long power line will be modelled as

- a) short line
- b) medium line
- c) long line
- d) data insufficient.

x) The self GMD of a conductor with three strands each of radius  $r$  and touching each other is

- a)  $(0.7788 \times 2 \times 2)^{1/3} \times r$
- b)  $(0.7788 \times 2 \times 2) \times r$
- c)  $(0.7788 \times 2 \times 2)^3 \times r$
- d)  $(0.7788 \times 2 \times 2 \times 2)^3 \times r$

xi) Disruptive corona begins in smooth cylindrical conductors in air at NTP if the electrical field intensity at the conductor surface goes up to

- a) 21.1 kV/cm ( r.m.s. )
- b) 21.1 kV/cm ( peak )
- c) 21.1 kV/cm ( average )
- d) 21.1 kV/m ( r.m.s. ).



**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

3 × 5 = 15

2. Discuss the effect of wind and ice on sag.
3. What is the advantage of expressing reactance in percentage values ?
4. Why do we use CT in the relay circuit ? Explain why CT secondary should not be operated without a burden.
5. What are the advantages of earthed neutral system over isolated neutral system ?
6. Explain Kelvin's law for the determination of conductor size.

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.

3 × 15 = 45

7. a) Define string efficiency.
- b) State the methods of improving string efficiency.
- c) In a 33 kV overhead line there are three units in the string of insulator. If the capacitance between each insulator pin and earth is 11% of self capacitance of each insulator, find the distribution of voltage over 3 insulators and string efficiency.

2 + 6 + 7



8. a) Find the  $A, B, C, D$  constants for nominal  $\Pi$  circuit of a medium transmission line.
- b) Draw the phasor diagram.
- c) A 3 phase 132 kV transmission line is connected to a 50 MW load at a power factor of 0.85 lagging. The line constants of the 80 Km long line are  $Z = 96 \angle 78^\circ \Omega$  and  $Y = 0.001 \angle 90^\circ S$ . Using nominal  $T$  circuit representation, calculate
- i) the  $A, B, C, D$  constants of the line
  - ii) sending end voltage
  - iii) sending end current.
9. a) What do you mean by corona ? How do you improve the ill effects of coronan.
- b) A 3 phase 220 kV, 50 Hz transmission line consists of 1 cm radius conductors spaced 2.5 m at the corners of an equilateral triangle. Find out the corona loss per km of the line. The temperature of weather is  $22^\circ C$  and pressure is 73 cm. The irregularity factor is 0.96.

5 + 3 + 7

5 + 10



10. a) Develop the expression for fault current in a power system for an L-G fault and draw the interconnection of sequence network for this type of fault.
- b) Determine the fault current of the system shown in figure when
- LLG
  - LL fault

occurs at point *F*.

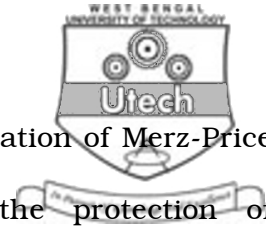
The per unit reactance all referred to the same base are as follows :

	<b>X0</b>	<b>X1</b>	<b>X2</b>
Generator G1	0.05	0.3	0.2
Generator G2	0.03	0.25	0.15
Line L1	0.70	0.3	0.3
Line L2	0.70	0.3	0.3
Transformer T1	0.12	0.12	0.12
Transformer T2	0.10	0.1	0.1

Both the generators are generating 1 pu voltage.

Dia.

5 + 10



11. a) Explain with neat diagram the application of Merz-Price circulating current principle for the protection of alternator.
- b) A star connected 3 phase, 10 MVA, 6.6 kV alternator is protected by Metz-Price circulating principle using 1000/5 ampere current transformer. The star point of the alternator is earthed through a resistance of  $7.5 \Omega$ . If the minimum operating current for the relay is 0.5A, calculate the percentage of each phase of the stator winding which is unprotected against earth fault when the machine is operating at normal voltage. 10 + 5
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