

(Set-1)

B.Tech-8th
High Voltage Engineering

Full Marks : 70

Time : 3 hours

**Q. No. 1 is compulsory and answer
any five from the rest**

The figures in the right-hand margin indicate marks

1. Justify the following statements adequately : 2×10

(i) Capacitance Divider can not be used for a high voltage dc measurement.

(ii) Hollow spheres can be used for triggering an Impulse Voltage Generator.

(iii) There is an upper limit on number of stages in a dc Voltage Multiplier.

(iv) Impulse Voltage breakdown of a sphere gap is statistical.

(Turn Over)

- (v) High Voltage Dividers need over voltage protectors in the low voltage arm.
 - (vi) Impulse test on a transformer is a type test.
 - (vii) Attaching gases are suitable for high voltage insulation.
 - (viii) SiC based arrestors need a series gap.
 - (ix) Wave forming resistors in impulse generators should be non-inductive.
 - (x) Rod gaps protect the apparatus by shorting the apparatus.
2. (a) Derive the equation for current growth in a Gas in the presence of secondary processes and hence derive Townsend's breakdown criterion in a gas. 5
- (b) When two plane electrodes are placed in a gas draw a current of 55 nA at 10 kV at a gap distance of 0.5 cm. Keeping the field constant current becomes 5.5 nA on reducing the gap to 0.1 cm. Determine the value of primary ionization coefficient α . 5

3. (a) What are commercial liquids ? What are the mechanisms of breakdown in commercial liquids ? 5
- (b) What do you understand by intrinsic breakdown in a solid ? Derive the expression for Electromechanical breakdown. 5
4. (a) Explain how high voltage testing transformers are connected in cascade, with the help of a neat sketch. 5
- (b) For a 3 stage cascade connected transformer draw a sketch showing complete power ratings of each winding in each stage. 5
5. (a) What do you understand by Cascading Error ? Explain how it can be measured.
- (b) Using a 100 pF, 400 kV rated standard capacitor how can you measure an applied voltage of 300 kV (rms, 50 Hz) employing an ESV of 10 M Ω input impedance capable of measuring up to 400 V. Explain with neat circuit diagram.

6. (a) Derive the expression for optimum number of stages in a Cockcroft-Walton voltage multiplier. 6
- (b) Specify a standard impulse current waveform with tolerances with the help of a sketch. 4
7. (a) With the help of a neat circuit diagram explain the principle of impulse voltage generation and derive the expression for impulse voltage. 5
- (b) Why multi-stage impulse voltage generators are necessary? What are their components? How does it generate an impulse voltage? 5
8. (a) Explain (i) NDT, (ii) Wet Test of insulators. 4
- (b) What tests are carried out on a surge arrester? Why are high current tests carried out on surge arrestors? 6