

## High Voltage Engineering

P. Pages : 2

NRT/KS/19/3549

Time : Three Hours

\*0250\*

Max. Marks : 80

- 
- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Use of non programmable calculator is permitted.

1. a) Explain Townsend's breakdown criteria state the limitations of Townsend's Criteria. **6**
- b) In an experiment it was found that the steady current is  $5.2 \times 10^{-8}$  Amp. At 7.5 kV for a distance of 35 mm between plane electrodes. Keep the field constant and reducing the distance to 0.1 cm results in a current of  $5.2 \times 10^{-9}$  Amp. Calculate primary ionization coefficient ' $\alpha$ '. **7**

**OR**

2. a) Explain thermal breakdown in solid dielectrics and how is it more significance than other breakdown mechanisms. **6**
- b) Define Paschen's Law. Justify the existence of two values of (pxd) corresponding to the same breakdown voltage in Paschen's curve. **7**  
Determine (pxd)<sub>min</sub> and V<sub>bmin</sub> for Paschen's law if constants are A = 12, B = 365,  $\gamma = 0.02$
3. a) Explain mechanism of lightning. Discuss various types of lightning strokes. **6**
- b) Explain gapless type lightning arrester with diagrams and ratings. **7**

**OR**

4. a) What is the function of surge absorber ? Explain in brief the Ferranti surge absorber. **7**
- b) A transmission tower has resistance of 10  $\Omega$  and inductance 10  $\mu$ H. Compute the surge voltage to which tower top is subjected it lightning stroke current is 30 kA. Compute the percentage reduction in this over-voltage if tower resistance is reduced to 5 $\Omega$ . **6**
5. a) Explain the development of travelling waves on an overhead line. **7**
- b) A 3-phase single circuit transmission line is 400 km long. If the line is rated for 220 kV and has the parameters R = 0.1 ohms/km, L = 1.2 mH/km, C = 0.009  $\mu$ Fd/km, and G = 0, find **7**
- i) The surge impedance
  - ii) The velocity of propagation neglecting the resistance of the line.
  - iii) If a surge of 150 kV and infinitely long tail strikes at one end of the line, what is the time taken for the surge to travel to the other end of the line ?

**OR**

- 6.** a) Explain the terms "attenuation and distortion" of travelling waves propagating on overhead lines. What is the effect of corona on the transmission lines ? **7**
- b) An infinite rectangular wave on a line having a surge impedance of  $50\Omega$  strikes a transmission line terminated with a capacitance of  $0.004\mu\text{F}$ . Calculate the extent to which the wave front is retarded. **7**
- 7.** a) Explain the cascaded connection of transformer with isolating transformers for excitation, for producing AC high voltages. **7**
- b) A Cock-Croft voltage multiplier circuit has 8 stages with capacitance equal to  $0.05\ \mu\text{F}$ . The supply transformer secondary voltage is 132 kV at 150 Hz. If the load current to be supplied is 4 mA. Calculate :
- i) Percentage ripple ii) Percentage regulation
- iii) Maximum output voltage

**OR**

- 8** a) A 12-stage impulse generator has  $0.126\mu\text{F}$  capacitors, the wave front and wave tail resistances connected are 800 ohms and 5000 ohms respectively. If the load capacitor is 1000 pf, find the front and tail times of the impulse wave produced. **7**
- b) Describe with a neat sketch, the working of a Van De Graaff generator. What are the factors that limit the maximum voltage obtained ? **7**
- 9.** a) What is capacitance voltage transformer ? Explain with phasor how a tuned capacitance voltage transformer can be used for voltage measurement in a power system. **7**
- b) A generating voltmeter has to be designed so that it can have a range from 20 to 200 kV d.c. If the indicating meter reads a minimum current of  $2\ \mu\text{A}$  and maximum current at  $25\ \mu\text{A}$ , what should be the capacitance of the generating voltmeter ? **6**

**OR**

- 10.** a) Explain the principle and construction of an electrostatic voltmeter for very high voltages. What are the merits and demerits of high voltage AC measurement ? **7**
- b) Design a peak reading voltmeter along with a suitable micro-ammeter such that it will be able to read voltage up to 100 kV (peak). The capacitance potential divider available is of the ratio 1000:1. **6**
- 11.** a) Explain measurement of dielectric constant and loss factor by high voltage Schering's bridge. **7**
- b) Explain how dry and wet flash over tests are performed on line insulation. **6**

**OR**

- 12.** a) Discuss the significance of non-destructive tests and list the different non-destructives tests. **6**
- b) Explain :
- i) Partial discharge measurement. **3**
- ii) Methods of testing cable. **4**

\*\*\*\*\*