

High Voltage Engineering

P. Pages : 2

Time : Three Hours



NJR/KS/18/4604

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. Illustrate your answers whenever necessary with the help of neat sketches.
 11. 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 5.2×10^{-8} amp. at 7.5kV of a distance of 35mm between plane electrodes. Keeping the field constant & reducing the distance to 0.1cm results in a current of 5.2×10^{-9} amp. Calculate primary ionization coefficient ' α '. 7

OR

2. a) Explain thermal breakdown in solid dielectrics and how is more significant than other breakdown mechanisms. 6
- b) What is Paschen's law? Justify the existence of two values of (pxd) corresponding to the same breakdown voltage in Paschen's curve. 7

Determine (pxd)_{min} and V_{b min} for Paschen's law if constants are A=12, B = 365 & $\gamma=0.02$

3. a) What is lightning arrester? Explain gapless type lightning arrester and write their probable ratings. 6
- b) What are the causes of switching and power frequency over voltages? How are they controlled in power system. 7

OR

4. a) What is a surge absorber? Explain in brief the ferranti surge absorber. 7
- b) A transmission line tower has resistance of 10Ω and inductance $10\mu H$. Compute the surge voltage to which tower top is subjected if lightning stroke current is 30kA. Compute the percentage reduction in this over voltage if tower resistance is reduced to 5Ω . 6
5. a) What is a travelling wave? Explain the development of such a wave on an overhead line. 7
- b) A 3-phase single circuit transmission line is 400km long. If the line is rated for 220kV and has the parameters, R = 0.1 ohms/km, L = 1.26 MH/km, C = 0.009 μF /km, and G = 0, find 7
- a) The surge impedance and
- b) The velocity of propagation neglecting the resistance of the line. If a surge of 150kV 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 term's "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 500Ω strikes a transmission line terminated with a capacitance of $0.004\mu\text{F}$. Calculate the extend to which the wave front is retarded. 7
7. a) Explain cascaded connection of transformer with isolating transformers for excitation, for producing AC high voltage. 7
- b) A Cock-Croft voltage multiplier circuit has 8 stages with capacitances equals to $0.05\mu\text{F}$. The supply transformer secondary voltage is 132kV at 150Hz . If the load current to be supplied is 4mA , Calculate: 7
- 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 the wave tail resistances connected are 800 ohms and 5000 ohms respectively. If the load capacitor is 1000Pf , 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 transformers? Explain with phasor how a tuned capacitance voltage transformer can be used for voltage measurement in power systems. 7
- b) A generating voltmeters has to be designed so that it can have a range from 20 to 200 kV dc. If the indicating meter reads a minimum current of $2\mu\text{A}$ and maximum current of $25\mu\text{A}$, What should the capacitance of the generating voltmeter be? 6

OR

10. a) Explain the principle and construction of an electrostatic voltmeter for very high voltages. What are its merits and demerits for high voltage a.c. measurements? 7
- b) Design a peak reading voltmeter along with a suitable micro ammeter such that it will be able to read voltage, up to 100kV (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 bridge. 7
- b) Explain how dry and wet flash over tests are performed on line insulator. 6

OR

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