

**High Voltage Engineering**

P. Pages : 2

Time : Three Hours

**NRJ/KW/17/4604**

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) Write short note on "Streamer theory of Breakdown in gases." 7  
 b) In an experiment it was found that, the steady current is  $5.2 \times 10^{-8}$  Amp at 7.5 kV at a distance of 35 mm between the plane electrodes. Keeping the field constant and reducing the distance to 0.1cm results in a current of  $5.2 \times 10^{-9}$  Amp. Calculate the primary ionization coefficient ' $\alpha$ '. 6
- OR**
2. a) Write short note on: 'Mechanism of vacuum breakdown' 7  
 b) A solid dielectric specimen of dielectric constant  $\epsilon_r = 3$ , has internal void of thickness 1.5mm. The specimen is 1.0cm thick and it is subjected to a voltage of 80 kV (RMS). If void is filled with air and breakdown strength of air is 30 kV (Peak/cm). Find voltage of internal discharge. 6
  3. a) Explain classification of Lightning strokes according to their effect on power system. 6  
 b) A transmission line tower has a resistance of  $15 \Omega$  and inductance 30 mH. Compute the surge voltage to which tower top is subjected if Lightning stroke current is 35 kA. Compute the percentage reduction in overvoltage if tower resistance is reduced to  $5 \Omega$ . Draw the equivalent circuit to explain the above phenomenon and waveform of lightning stroke. 8
- OR**
4. a) Explain clearly how the rating of L. A. is selected. What is best location of L.A. and why? 6  
 b) What are the causes for switching & power frequency over voltages & how they are controlled in power system? 8
  5. a) Explain the behavior of travelling waves with a voltage & current waveform of open ended transmission line. 7  
 b) A long tailed unit function 500 kV surge voltage on an overhead transmission line a surge impedance of  $400 \Omega$  arrives at a point where the line continues into a cable 1km long having a total inductance of  $256 \mu H$  and total capacitance of  $0.165 \mu F$ . At the end of the cable a transformer is connected having surge impedance  $1000 \Omega$ . Find the surge voltage distribution 12  $\mu sec$  after the surge arrives at the live cable junction. 6

**OR**

6. a) Explain "Attenuation and distortion" of travelling waves. Propagating on overhead lines. 7
- b) What is Bewley's lattice diagram. Explain its application. 6
7. a) Explain how AC voltage is generated using resonant transformer. What are its advantages and limitations. 6
- b) A impulse generator has 8 stage with each condenser rated for  $0.16\mu\text{F}$  and 125 kV. This is the use to generate a standard switching impulse to test an object having capacitance of 1nf. The charging voltage is 120 kV. 8
- i) Find the series & damping resistance
- ii) Find maximum operating voltage
- iii) Find rate of rise and decay of voltage
- iv) Find efficiency & gross energy.

**OR**

8. a) Explain the principle of Electrostatic voltmeter with neat sketches. Also state its advantages & limitations. 6
- b) Explain the Cockcroft-Walton voltage multiplier circuit used for generation of high D.C. voltage. Write its advantages & limitations. 8
9. a) Explain sphere gap method for measurement of AC. What is the effect on near by objects while measurements are done? 6
- b) Explain peak reading voltmeter in detail with neat sketch and also write its advantage and limitations. 7

**OR**

10. a) Explain the principle, construction and working of generating voltmeter. Enumerate its advantages & limitations. 6
- b) Explain the measurement of high AC. Voltage by capacitance voltage transformer. 7
11. a) Explain measurement of dielectric constant and loss factor by high voltage Schering Bridge. 6
- b) Explain in details the partial discharge Phenomenon. 7

**OR**

12. a) What is the significance of non-destructive testing. What are the different non-destructive test performed on insulation. Explain the importance of each test. 6
- b) What is the purpose of High voltage testing? What are the different High voltage test performed on transformer bushings. 7

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