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Code : 031736

B.Tech 7th Semester Exam., 2018

HIGH VOLTAGE ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct option of the following (any *seven*) : 2×7=14

(a) Polar dielectrics are normally used for

(i) high frequencies

(ii) microwaves

(iii) d.c. and power frequencies

(iv) None of the above

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(b) The impurity in liquid dielectric which has significant effect in reducing the breakdown strength, is

(i) dust

(ii) dissolved gases

(iii) moisture

(iv) ionic impurity

(c) The relationship between the breakdown voltage V and gap d is normally given as

(i) $d = kV^2$

(ii) $d = kV^3$

(iii) $V = kd$

(iv) $v = kd^n$

(d) A good dielectric should have all the following properties, *except*

(i) high mechanical strength

(ii) high resistance to thermal deterioration

(iii) high dielectric loss

(iv) freedom from gaseous inclusions

(e) Corona effect can be identified by

(i) bushy sparks

(ii) faint violet glow

(iii) red light

(iv) arcing between conductors and earth

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(f) Van de Graaff generators are useful for

(i) very high voltage and low-current applications

(ii) very high voltage and high-current applications

(iii) constant high voltage and current applications

(iv) high-voltage pulses only

(g) A tesla coil is a

(i) cascaded transformer

(ii) coreless transformer

(iii) high-frequency resonant transformer

(iv) low-impedance transformer

(h) Impulse testing of transformers is done using

(i) full-wave standard impulse

(ii) chopped-wave standard impulse

(iii) half-wave standard impulse

(iv) Only (i) and (ii)

(i) For voltage measurements, the gap which gives highest accuracy is

(i) sphere gaps

(ii) field gaps

(iii) rod gaps

(iv) None of the above

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(j) Impulse testing of transformers is done to determine the ability of

(i) bushings to withstand vibrations

(ii) insulation to withstand transient voltages

(iii) windings to withstand voltage fluctuations

(iv) All of the above

2. (a) Why is a Cockcroft-Walton circuit preferred for voltage multiplier circuits? Explain its working with a schematic diagram.

(b) An impulse generator has 12 capacitors of 12 μF and 200 kV rating. The wave front and wave-tail resistances are 1·25 kΩ and 4 kΩ respectively. If the load capacitance including that of the test object is 1000 pF, find the wave-front and wave-tail times and the peak voltage of impulse produced. 6+8=14

3. (a) How are the wavefront and wavetail times controlled in impulse generator circuits?

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(b) A voltage doubler circuit has $C_1 = C_2 = 0 \cdot 01\,\mu F$ and is supplied from a voltage source of $V = 100\sin(314t)$ kV. If the d.c. output current is to be 4 mA, calculate the output voltage and the ripple. 6+8=14

4. (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?

(b) A coaxial shunt is to be designed to measure an impulse current of 50 kA. If the bandwidth of the shunt is to be at least 10 MHz and if the voltage drop across the shunt should not exceed 50 V, find the ohmic value of the shunt and its dimenstions. 7+7=14

5. (a) What is meant by insulation coordination? How are the protective devices chosen for optimal insulation level in a power system?

(b) A 500 kV, 2 μs rectangular wave travels on a line having a surge impedance of 350 Ω and approaches a termination with a capacitance of 200 pF. Determine the magnitudes of the reflected and transmitted waves. 7+7=14

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6. (a) How do the temperature and moisture affect the breakdown strength of solid dielectrics?

(b) Give the temperature classification for solid insulating materials. Why is this classification not done for liquids and gases? 7+7=14

7. (a) Explain the method of impulse testing of high-voltage transformers. What is the procedure adopted for locating the failure?

(b) An impulse generator has eight stages with each condenser rated for 0·16 μF and 125 kV. The load capacitor available is 1000 pF. Find the series resistance and damping resistance needed to produce 1·2/50 μs impulse wave. What is the maximum output voltage of the generator, if the charging voltage is 120 kV? 7+7=14

8. (a) Describe the various factors that influence breakdown in a gas.

(b) What is composite insulation? How does short-term breakdown differ from long-term breakdown? 7+7=14

9. Write short notes on the following : 7+7=14

(a) Hall-effect generators

(b) Capacitance voltage transformer

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