Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code: 59031

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Elective

Electrical and Electronics Engineering

15UEE903 - HIGH VOLTAGE ENGINEERING

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 3 = 15 Marks)

1. Illustrate the Bewley's lattice diagram for reflection and transmission of wave on the line with two terminals?

2. Develop the condition for breakdown in gaseous dielectric medium based on Townsend's conditions.

3. A 12 stage impulse generator has $0.126\mu F$ capacitors. The wave front and wave tail resistances are 800Ω and 5000Ω respectively. If the load capacitor is 1000pF. Evaluate front and tail times of impulse wave produced.

4. Extend the Hall generator principle for measuring high impulse current.

5. Explain the terms disruptive discharge voltage, routine test and type test as per international standards.

PART - B (5 x 14 = 70 Marks)

6. (a) Outline the causes and effects of switching and power frequency over voltages. Also explain the measures to be taken for the mitigation of effect during the occurrence of over voltages. (14)

Or

   (b) Explain charge formation in clouds with Simpson's theory and Reynolds Mason theory. (14)

7. (a) Describe the functioning of HV generation circuit of high alternating voltages using cascaded transformers with suitable construction. (14)

Or

(b) Adapt the capacitor concept to generate impulse voltage by Marx impulse generators. (14)

8. (a) Summarize the breakdown mechanisms in commercial liquid dielectrics. (14)

Or

(b) Interpret breakdown mechanisms in vacuum insulation using field emission theory and clump mechanism. (14)

9. (a) Explain how a sphere gap can be used to measure the peak value of voltages and what are the parameters and factors that influence such voltage measurement. (14)

Or

(b) Explain the principle and construction of an electrostatic voltmeter for high voltages and list its merits and demerits for high voltage A.C measurement. (14)

10. (a) Analyze the testing procedure to verify the quality of insulators as per international standards. (14)

Or

(b) Discuss the various tests carried out in a circuit breaker at HV labs. (14)

PART - C (1 x 15 = 15 Marks)

11. (a) (i) A solid dielectric specimen has a dielectric constant of 4.2 and tan δ of 0.001 at a frequency of 50 Hz. If it is subjected to an alternating field of 50kV/cm, calculate the heat generated in the specimen due to dielectric loss. (5)

(ii) A solid dielectric specimen of dielectric constant of 4 has an internal void of thickness 1mm. The specimen is 1cm thick and subjected to a voltage of 80kV$_{(rms)}$. If the void is filled with air and if the breakdown strength of air can be taken as 30kV$_{(peak)}$/cm, find the voltage at which an internal discharge can occur. (5)

(iii) Calculate the correction factors for atmospheric conditions, if the laboratory temperature is 37°C, the atmospheric pressure is 750mmHg, and the wet bulb temperature is 27°C. (5)

Or

(b) A Cockcroft-walton type voltage multiplier has eight stages with capacitances all equal to 0.05 µF. The supply transformer secondary voltage is 125kV at a frequency of 50Hz. If the load current to be supplied is 5mA, evaluate (i) the percentage ripple, (ii) the regulation and the optimum number of stages for minimum regulation or voltage drop. (16)

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