

Code No: 127DQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, December - 2019

HIGH VOLTAGE ENGINEERING

(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B. Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) What is meant by electric field stress? How it is computed? [2]
- b) List out the insulating materials used in different parts of transformers. [3]
- c) What is meant by Intrinsic breakdown? [2]
- d) What are the drawbacks of Townsend theory? [3]
- e) Write the specifications of impulse voltage and current waveforms. [2]
- f) What are the advantages of CVT? [3]
- g) What are the causes for switching over-voltages? [2]
- h) Define surge impedance of a line. How it is different from normal impedance. [3]
- i) Define withstand voltage and flashover voltage. [2]
- j) What information is obtained from radio interference measurement? How this information is useful in testing of equipment. [3]

PART-B

(50 Marks)

- 2.a) Discuss applications of gases and gaseous mixtures as insulating medium in HV cables. [5+5]
 - b) List the insulating materials used in rotating machines. [5+5]
- OR**
- 3.a) What is Finite Element Method? Give the outline of this method for solving electric field problems. [5+5]
 - b) What is a surge voltage? What is the difference between a power frequency voltage and a surge voltage? What are the various sources that produce surge voltages? [5+5]
- 4.a) Explain the phenomena of thermal breakdown in solid dielectrics. [5+5]
 - b) Estimate the static breakdown voltage of air gap at 100 mm of Hg pressure between two parallel plates of 1 cm gap that ensure a uniform field. Assume the E/p value for this gas at the above pressure is 54 V/cm/mm.Hg. If the breakdown occurs at the above field, and assuming γ as 10^3 electrons/ incident of positive ion, calculate the Townsend's first ionization coefficient for the same gap. [5+5]
- OR**
- 5.a) Explain, in detail, electromechanical breakdown in solid insulating materials. [5+5]
 - b) State the Pachen's law and explain about its Pachen's curve. Derive an expression for the minimum 'pd' value of the Pachen's curve from the first principles. [5+5]

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- 6.a) Draw typical impulse current generator circuit and explain operation and applications.
b) A 10-stage Cockroft -Walton circuit has all capacitors of $0.06 \mu\text{F}$. The secondary voltage of supply transformer is 100 kV at a frequency of 150 Hz. If load current is 1mA, find
i) Optimum number of stages for maximum output voltage (ii) Maximum output voltage. [5+5]

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- 7.a) Explain with a neat sketch, three electrode gap requirement for high current switching.
b) Discuss and compare the performance of (i) resistance (ii) capacitance potential dividers for measurement of impulse voltages. [5+5]

- 8.a) Give the mathematical models for lightning discharges and explain them.
b) What are the different methods employed for lightning protection of overhead lines? [5+5]

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9. Explain the different aspects of insulation design and insulation co-ordination adopted for EHV systems. [10]

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

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- b) Why is synthetic testing of circuit breakers advantageous over the other testing methods for short circuit tests? Give the layout for synthetic testing. [5+5]

- 11.a) Explain, with a schematic diagram, one method of measuring RIV of transmission line hardware.

- b) What are the significances of power factor tests and partial discharge tests on bushings? How are they conducted in the laboratory? [5+5]

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