

R13

Code No: 117DQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, April/May - 2018

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) State insulating materials used in rotating machines. [2]
- b) Give the application of gases and gas mixtures as insulating medium in high voltage switchgear and high voltage power cables. [3]
- c) What is the critical threshold distance for sustained discharge if $\alpha = 2.43/cm$ and $\gamma = 6.823 \times 10^{-4}$ [2]
- d) What are the factors that influence conduction in pure liquid dielectrics and in commercial liquid dielectrics? [3]
- e) What are the factors that influence the spark over voltages of sphere gaps? [2]
- f) Describe the limitations of generating voltmeter. [3]
- g) Describe the characteristics of switching surges. [2]
- h) What is BIL? Explain its significance in power system studies [3]
- i) A Schering bridge was used to measure the capacitance and loss angle of an HV bushing. At balance, the observations were: the value of the standard condenser is 100 pF, $R_3 = 3180 \text{ ohm}$, $C_3 = 0.00125 \mu\text{F}$ and $R_4 = 636 \text{ ohm}$. What is the value of unknown capacitance and $\tan \delta$ of the bushing? [2]
- j) Write a short note on the use of an oscilloscope as a PD measuring device. [3]

PART- B

(50 Marks)

2. Describe Finite Element Method for evaluation of field distribution. Discuss the procedure associated with this method and mention its advantages and limitations. [10]

OR

- 3.a) Discuss briefly the "Charge Simulation Method" for solving field problems and estimation of potential distribution.
- b) Distinguish between Boundary Element Method and charge simulation method. [5+5]

4.a) State and explain Paschen's law. How do you account for the minimum voltage for breakdown under a given 'p*d' condition?

- b) Explain thermal breakdown in solid dielectrics and its significance. [5+5]

OR

- 5.a) Explain streamer theory breakdown in gases.
- b) Describe the current growth phenomenon in a gas subjected to uniform electric fields. [5+5]

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6.a) Describe with a neat sketch the working of a Van de Graaff generator. What are the factors that limit the maximum voltage obtained?

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b) A Rogowski coil is to be designed to measure impulse currents of 10kA having a rate of change of current of 10^{11} A/s. The current is read by a TVM as a potential drop across the integrating circuit connected to the secondary. Estimate the values of mutual inductance, resistance, and capacitance to be connected, if the meter reading is to be 10V for full-scale deflection. [5+5]

OR

7.a) Explain how a sphere gap can be used to measure the peak value of voltages. What are the parameters and factors that influence such voltage measurement?

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b) An electrostatic voltmeter has an effective plate diameter of 50cm with a gap separation of 30cm. Find the force between the plates when measuring a dc voltage of 100kv. What is the maximum voltage that can be measured if the electric field E is to be not more than 5 kv/cm? [5+5]

8.a) Explain the terms 'attenuation and distortion' of travelling waves propagating on overhead lines. What is the effect of corona on the transmission lines?

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b) A transmission line has the following line constants: $L=1.26\text{mH/km}$ and $C=0.009\mu\text{F/km}$. if the line is a 3-phase line and is charged from one end at a line voltage of 400kv, 50Hz, find the rise in voltage at the other end, if the line length is 250km. the line resistance and leakage conductance is neglected. [5+5]

OR

9.a) What is arcing ground? Explain its effect on the performance of a power system.

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b) What are the basic requirements of a lightning arrester? Differentiate between i) lightning arrester and a lightning conductor, and (ii) a surge diverter and a surge absorber. [5+5]

10.a) What is non-destructive testing of insulating materials? Give very briefly the characteristics of these methods.

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b) A length of cable is tested for insulation resistance by the loss of charge method. An electrostatic voltmeter of infinite resistance is connected between the cable conductor and earth forming there with a joint capacitance of 600 pF. It is observed that after charging the voltage falls from 250 volts to 92 volts in one min. Determine the insulation resistance of the cable. [5+5]

OR

11.a) Explain the high voltage Schering bridge for the $\tan \delta$ and capacitance measurement of insulators or bushings.

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b) What is 'Wagner's earthing device' and how is it used for eliminating stray capacitances? [5+5]

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