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NEW SCHEME

Seventh Semester B.E. Degree Examination, May 2007

Electrical and Electronics Engineering

High Voltage Engineering

Time: 3 hrs.]

[Max. Marks:100

Note : Answer any FIVE full questions.

- 1
 - a. List the advantages of HVDC bulk power transmission over HVAC bulk power transmission. (04 Marks)
 - b. Discuss the need of generating high voltages in a laboratory. (03 Marks)
 - c. Mention the important applications of high voltage. (05 Marks)
 - d. Write the preferred properties of a gaseous dielectric for high voltage applications. Give any four examples of gaseous dielectric. (08 Marks)

- 2
 - a. Write about CORONA discharges in non-uniform fields. (10 Marks)
 - b. Briefly write about Paschen's law. (05 Marks)
 - c. Explain the time lags for breakdown with a diagram for step function voltage pulse. (05 Marks)

- 3
 - a. Explain the suspended particle theory of breakdown in commercial liquids. (05 Marks)
 - b. Explain the 3 stage cascade connection of transformers for generation of HVAC with a schematic diagram. (15 Marks)

- 4
 - a. Describe the Tesla coil with its equivalent circuit and output waveform. Give the application of the Tesla coil. Show that $V_2 = V_1 \sqrt{\frac{C_1}{C_2}} \eta$ with usual notations. (10 Marks)
 - b. A ten stage Cockraft-Watton generator circuit has all capacitors of 0.06 μ F. The secondary voltage of the supply transformer is 100 kV peak at a frequency of 150 Hz. If the load current is 1 mA, determine
 - i) Voltage regulation
 - ii) Percentage ripple
 - iii) The optimum number of stages for maximum output voltage
 - iv) Maximum output voltage. (10 Marks)

- 5
 - a. Draw the lightning impulse voltage and both the components in the same graph of $V = V_0(e^{-\alpha t} - e^{-\beta t})$ and comment on α and β . (05 Marks)
 - b. Draw the exact equivalent circuit of an impulse generator, single stage. (03 Marks)
 - c. Discuss the components of a multistage impulse generator of less than 1 MV. (12 Marks)

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- 6 a. Mention the advantages and limitations of generating voltmeter. (06 Marks)
- b. Explain the series resistance microammeter used in HVDC measurement. Write the limitations of the method. (10 Marks)
- c. A generating voltmeter has to be designed so that it can have a range from 20 kV to 200 kV dc. If the indicating meter reads a minimum current of 2 μ A and maximum current of 25 μ A, what should be the capacitance of the generating voltmeter be? The driving motor has a synchronous speed of 1500 rpm. (04 Marks)
- 7 a. Discuss the various factors that affect the spark over voltage of a sphere gap. (12 Marks)
- b. Discuss the dry and wet flashover tests on an insulator. (08 Marks)
- 8 a. Obtain an expression for the dielectric power loss 'P' in terms of voltage 'V', capacitance 'C', frequency f and loss angle 'S'. (04 Marks)
- b. A 20 kV, 50 Hz Schering bridge has a standard capacitance of 106 μ F. In a test on a bakelite sheet, balance was obtained with a capacitance of 0.35 μ F in parallel with a non-inductive resistance of 318 Ω , the non-inductive resistance in the remaining arm of the bridge being 130 Ω . Determine the equivalent
- i) Series resistance and capacitance and the power factor of the test specimen.
- ii) Parallel resistance and capacitance and the power factor of test specimen. (12 Marks)
- c. Draw the basic circuit for measuring narrow band partial discharge. (04 Marks)
