Code : 103605

B.Tech 6th Semester Exam., 2022

(New Course)

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. Answer any *seven* of the following questions : 2×7=14

(a) Define 'impulse voltage' and draw its characteristics.

(b) What are the disadvantages of sphere gap for measurement of high voltage?

(c) What is Rogowski coil?

(d) Name various tests to be carried out on CB.

(e) Mention various factors which affect breakdown of gases.

(f) What is surge impedance loading?

(g) What do you mean by 'treeing' and 'tracking' in solid dielectrics?

(h) What is corona discharge?

(i) Mention the application of gases in electric power apparatus.

(j) What do you mean by CVT?

2. (a) Explain the streamer theory of breakdown in air at atmospheric pressure. 6

(b) The following observations were made in an experiment for determination of dielectric strength of transformer oil. Determine the power law equation : 8

Gap Spacing	4	6	8	10
Breakdown Voltage (kV)	88	135	165	212

3. (a) What is stressed oil volume theory? How does it explain breakdown in large volumes of commercial liquid dielectrics? 8

(b) Discuss the effect of the following parameters on the breakdown strength of liquids : 6

(i) Hydrostatic pressure

(ii) Solid impurities

(iii) Moisture content in the oil

4. (a) What is 'thermal breakdown' in solid dielectrics, and how is it practically more significant than other mechanisms? 6

(b) A solid specimen of dielectric has a dielectric constant of 4·2, and $\tan\delta = 0 \cdot 001$ at a frequency of 50 Hz. If it is subjected to an alternating field of 50 kV/cm, calculate the heat generated in the specimen due to the dielectric loss. 8

5. (a) Explain one method of controlled tripping of impulse generators. Why is controlled tripping necessary? 6

(b) Three 350 kV, 350 kVA testing transformers are connected in cascade and have a short-circuit impedance of 5%. Determine *(i)* the full-load current, *(ii)* the short-circuit current and *(iii)* the maximum capacitive load that can be tested without exceeding the power rating. 8

6. (a) What is a mixed potential divider? How is it used for impulse voltage measurements? 6

(b) A compensated resistance divider has its high-voltage arm consisting of a series of resistance whose total value is 25 kilo-ohms shunted by a capacitance of 400 pF. The LV arm has a resistance of 75 ohms. Calculate the capacitance needed for the compensation of this divider. 8

7. (a) Explain the high-voltage Schering bridge for the $\tan\delta$ and capacitance measurement of insulators or bushings. 7

(b) The capacitance and loss angle of the above specimen were measured using the same electrode setup. The capacitance and $\tan\delta$ with the specimen are 147 pF and 0·0012 respectively. The air capacitance of the electrode system was 35 pF. What are the dielectric constant and complex permittivity of Bakelite? 7

8. (a) What are the causes for switching and power frequency overvoltages? How are they controlled in power systems? 7

(b) A Rogowski coil is to measure 20 kA peak current with a maximum di/dt of 10^4 A/μs. A 0–10 V electronic voltmeter is connected across the integrating circuit of the coil. Estimate the mutual inductance of the coil and resistance and capacitance of the integrating circuit to be used. 7

9. Write short notes on the following : 14

(a) Protection against overvoltages

(b) Switching surge voltage and its characteristics

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