

M.E. ELECTRICAL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM 2024

HIGH VOLTAGE MEASUREMENTS (HV)

Time: Three hours

Full Marks: 100

Answer any five questions.

1. Discuss in brief the construction and principle of operation of a co-axial tubular shunt. Explain how the shortcoming of co-axial tubular shunt is overcome in co-axial squirrel cage shunt. 12+8
2. What steps are to be taken to reduce electromagnetic interference during recording of rapidly changing high voltage? Give necessary examples with sketches. 8+8+4
3. What is capacitance voltage transformer? Explain with phasor diagram how a tuned capacitance voltage transformer can be used for voltage measurements. State why capacitance voltage transformer is preferred for high ac voltage measurements. 4+10+6
4. Discuss in brief how fibre - optic is used in high voltage, high current measurements. Explain the working principle of magnetic optic current measuring device. Explain the physical processes i) Magneto – optic effect, ii) Electro – optic effect and iii) Electro – gyration effect. 4+6+4+2+4
5. a) A co-axial shunt is to be designed to measure an impulse current of 50 kA. If the bandwidth of the shunt is to be at least 10 MHz and if the voltage drop across the shunt should not exceed 50 V, find the ohmic value of the shunt and its dimensions. 10
- b) Explain the use of delay cables during recording of rapidly changing voltage waves. State the reasons for matching of cable ends for recording and measurement of impulse 5+5

[Turn over

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voltage by CRO.

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| 6. | State and explain what is meant by apparent charge. Why the concept of apparent charge has to be introduced in measuring partial discharge? Derive a relation between real charge and apparent charge. | 5+5+10 |
| 7. | State and explain the working principle of Haefely's voltmeter. Mention the limitations of the method, if any. Compare this voltmeter with Chubb and Fortescue's voltmeter. | 10+4+6 |
| 8. a) | Explain how a sphere gap can be used to measure the peak value of the voltages. State the parameters and factors that influence such voltage measurements. | 14 |
| b) | A Schering bridge was used to measure the capacitance and loss angle of a hv bushing. At balance, the observations were: the value of the standard condenser = 100 pF, $R_3 = 3180 \Omega$, $C_3 = 0.00125 \mu F$ and $R_4 = 636 \Omega$. What are the values of capacitance and $\tan \delta$. | 6 |