Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 11222

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Elective

Power Systems Engineering

PS 4014 – HIGH VOLTAGE TECHNOLOGY

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the requirement of HIV generation in laboratory.
2. Define voltage stress.
3. What is Tesla coil?
4. Why is it preferable to use isolation transformer for excitation with cascaded transformer units, if power requirement if large?
5. How are the wave front and wave tail times controlled in impulse transformer circuits?
6. What is trigatron gap?
7. Why are capacitance-voltage dividers preferred for high ac voltage measurements?
8. What is a mixed potential divider?
9. State the basic law of electrostatic electricity.
10. Brief Turboelectric series.

PART B — (5 × 13 = 65 marks)

11. (a) Derive the ripple factor for the voltage multiplier circuit and compare with the full wave rectifier.

Or

(b) A Cockcroft-Walton-type voltage multiplier has eight stages with capacitances, all equal to 0.05 μF. The supply transformer secondary voltage is 125kV at a frequency of 150Hz. If the load current to be supplied is 5 mA, find

(i) the percentage ripple,

(ii) the regulation, and

(iii) the optimum number of stages for minimum regulation or voltage drop.

12. (a) A 100 kVA, 400 V/250 kV testing transformer has 8% leakage reactance and 2% resistance on 100kVA base. A cable has to be tested at 500 kV using the above transformer as a resonant transformer at 50 Hz. If the charging current of the cable at 500kV is 0.4 A, find the series inductance required. Assume 2% resistance for the inductor to be used and the connecting loads. Neglect dielectric loss of the cable. What will be the input voltage to the transformer?

Or

(b) What is the principle of operation of a resonant transformer? How is it advantageous over the cascade connected transformer?

13. (a) An impulse generator has eight stages with each condenser rated for 0.16 μF and 125kV. The load capacitor available is 1000pF. Find the series resistance and the damping resistance needed to produce 1.25/50 μs impulse wave. What is the maximum output voltage of the generator, if the charging voltage is 120kV?

Or

(b) Illustrate the structure of Very Fast Transient Voltage (VFTO) and explain its operation with IS and IES standard for the transient voltage.

14. (a) A Rogowski coil is to be designed to measure impulse currents of 10 kA 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 10 V for full-scale deflection.

Or

(b) Explain the principle and construction of an electrostatic voltmeter for high voltages. What are the merits and demerits of high-voltage ac Measurements?

15. (a) Give the electrical safety measures that should take for electrostatic discharge and other electrical hazards.

Or

(b) With a neat diagram explain the protection measures from lightning.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the Chubb Fortescue method of high voltage measurements.

Or

(b) Discuss the standards for electrical safety and protection.