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

Question Paper Code : 80505

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Sixth Semester

Electrical and Electronics Engineering

EE 2353 — HIGH VOLTAGE ENGINEERING

(Regulations 2008)

(Common to PTEE 2353 – High Voltage Engineering for BE. (Part-Time)
Fifth Semester — Electrical and Electronics Engineering — Regulations 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the sources which determine the wave shape of switching surges.

2. Write down the causes of power frequency and its harmonic over voltages.

3. What is meant by corona discharges?

4. What are electronegative gases?

5. What is the need for HVDC generation?

6. What is a 'Trigatron gap' ? What are its function?

7. Explain the basic principle of Hall generator.

8. List some advantages of Faraday generator.

9. What are called type tests?

10. What is BlL?

PART B — (5 × 16 = 80 marks)

11. (a) Explain briefly about power frequency over voltages in power systems. (16)

Or

(b) Show the charge distribution patterns in the cloud following Wilson's and Simpson's theories. (16)

12. (a) (i) Describe the various mechanisms of vacuum break down. (8)

(ii) What are treeing and trenching? Explain clearly the two processes in solid dielectrics. (8)

Or

(b) (i) Explain the various theories that explain break down in commercial liquid dielectrics. (8)

(ii) What is corona discharge? Explain clearly anode and cathode Coronas. (8)

13. (a) A Cockcroft-Walton type voltage multiplier has eight stages with capacitances equal to 0.05 μ F. The supply transformer secondary voltage is 125 kV at a frequency of 150 Hz. If the load current to be supplied is 5 mA, find : (16)

(i) the percentage ripple

(ii) the regulation and

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

Or

(b) A six-stage impulse generator designed to generate the standard waveform (1.2/50 μ s) has a per stage capacitance of 0.06 μ F to be used to test transformers with an equivalent winding to earth capacitance of 1 nF. A peak output voltage of 550 kV is required for testing the transformer. The wavefront time is to be defined based on 30% and 90% values. With the aid of appropriate calculations select the values of the resistive elements in the circuit to produce the required waveform. State any assumptions made. (16)

14. (a) (i) Explain the operation of the hall effect generator for measuring high DC currents. (8)

(ii) Discuss the factors influencing the spark over voltage on Sphere gaps. (8)

Or

(b) Tabulate the various methods of High AC and DC voltage and current measurements. (16)

15. (a) With neat diagram, explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure? (10 + 6)

Or

(b) What is meant by Insulation Coordination? Explain how the protective devices are chosen for optimum insulation level in a power system. (4 + 12)

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Question Paper Code : 90528

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Seventh Semester

Electrical and Electronics Engineering

EE 8701 – HIGH VOLTAGE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define corona critical disruptive voltage.

2. What are the methods employed for protection of overhead lines against lightning?

3. What is mean free path?

4. Why should the electrode surface not have sharp points?

5. Name the methods used to generate high voltage DC.

6. Differentiate impulse voltage and switching surge.

7. What is the use of Rogowski coil?

8. What are the advantages of electrostatic voltmeter?

9. Define creepage distance.

10. Why is the impulse test important for power transformer?

PART B — (5 × 13 = 65 marks)

11. (a) (i) How is the lightning modeled mathematically? (5)

(ii) Explain the methods of switching surge formation in detail. (8)

Or

(b) (i) Explain the procedure to draw Bewley Lattice Diagram for a two Substations system. (8)

(ii) Explain briefly about expulsion type arrester. (5)

12. (a) Explain the mechanisms involved in composite and vaccum dielectric breakdown.

Or

(b) Describe the Townsend's theory involved in gaseous breakdown and derive the breakdown criteria.

13. (a) Describe the construction and operation of vande graff generator from the first principle with neat sketch and also give the limitations.

Or

(b) Design and explain the cock craft Walton multiplier circuit for high DC voltage generation and derive the expression for optimum number of stages.

14. (a) Explain the measurement of high voltage using generating voltmeters and give the factors affecting the measurement.

Or

(b) With neat diagram, discuss the operation of CVT and resistive shunts deployed for measurements.

15. (a) Describe the various tests conducted on circuit breakers.

Or

(b) Explain the tests conducted on bushings and power cables.

PART C — (1 × 15 = 15 marks)

16. (a) (i) With suitable diagram show that the deflecting torque of an electrostatic voltmeter is proportional to the product of the square of the applied voltage and the rate of change of capacitance. (8)

(ii) Analyse with suitable diagrams, why a potential divider connected at the output of an impulse generator needs to be matched to the cable connecting it to an oscilloscope and how matching may generally be achieved. (7)

Or

(b) (i) Analyse the construction and operation of triggering and control setup used for impulse generator. (9)

(ii) An impulse generator has 8 stages with each condenser rated for 0.16 μF and 125 KV. The load capacitor available is 1000 pF. Find the series resistance and damping resistance needed to produce 1.2/50 μs impulse wave. What is the Maximum output voltage of the generator, if the charging voltage is 120 KV? (6)

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Question Paper Code : 50545

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

Seventh Semester

Electrical and Electronics Engineering

EE 8071 – HIGH VOLTAGE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the basic requirements of a lightning arresters?

2. What are the effects of corona on power system?

3. State Paschen's law.

4. Name the different types of breakdown mechanisms in commercial liquid dielectrics.

5. Why is controlled tripping necessary in impulse generators?

6. What are the applications of high voltages?

7. What are the design used in high resistive shunt for reducing stray effects?

8. What are the limitation of series resistance micro-ammeter method for high voltage measurements?

9. Define disruptive discharge voltage.

10. What is meant by insulation coordination?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss briefly about the various causes of power frequency overvoltage in power system and methods to control them. (8)

(ii) Explain with neat sketches the mechanism of lightning discharge. (5)

Or

(b) (i) Explain how overvoltage in transmission line due to lightning can be minimized by ground rods and counterpoises? (8)

(ii) What is tower-footing resistance? Discuss the two methods to reduce this resistance. (5)

12. (a) (i) Explain the mechanism of development of anode and cathode streamers and explain how these lead to breakdown in gaseous dielectrics. (8)

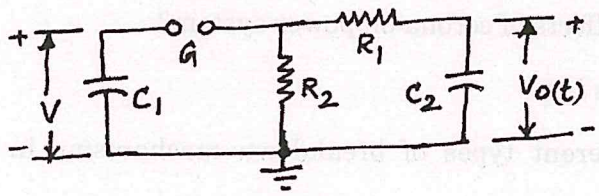
(ii) Explain the breakdown due to internal discharges in solid dielectrics. (5)

Or

(b) (i) Explain the various mechanism of breakdown in composite dielectrics in detail. (8)

(ii) What are the important properties of composite dielectrics to be considered for their performance? (5)

13. (a) Give complete analysis of the given single-stage impulse voltage generator circuit and derive the condition for physical realization of wave front and wave tail resistances. (13)



Or

(b) What is a Tesla coil? Derive an expression for damped high frequency oscillation output voltage in a Tesla coil. Also give its advantages. (13)

14. (a) (i) Explain with neat schematic diagram, the working principle and operation of generating voltmeter for measuring high DC voltages. (8)

(ii) Explain the operation of digital peak voltmeter for measurement of high AC voltages. (5)

Or

(b) (i) With phasor diagram, explain how a tuned capacitance voltage transformer can be used for measuring high alternating voltages in power system. (8)

(ii) Discuss the performance of various capacitance potential dividers for measurement of impulse voltages. (5)

15. (a) Explain in details about the procedure for conducting power frequency, impulse voltages and pollution tests on high voltages insulators. (13)

Or

(b) Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating failure? (13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider a long transmission line is energized by a unit step voltage 1.0 V at the sending end and is open circuited at the receiving end. Construct the Bewley Lattice diagram and obtain the value of voltage at the receiving end after a long time. Take the attenuation factor $\alpha = 0.8$. (15)

Or

(b) A ten stage cockcroft-Walton voltage multiplier circuit has all capacitors of 0.06 μF. The secondary voltage of supply transformer is 100 kV at a frequency of 150 Hz. If the load current is 1 mA, determine the following (15)

(i) voltage regulation,

(ii) the ripple voltage,

(iii) the optimum number of stages for maximum output voltage, and

(iv) the maximum output voltage.

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Question Paper Code : 70567

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Seventh Semester

Electrical and Electronics Engineering

EE 8701 – HIGH VOLTAGE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Isokeraunic level and flashover.
2. List out various methods of protection against over voltages.
3. What is the effect of corona on transmission lines?
4. State Paschen's Law.
5. What is the principle of operation of a resonant transformer?
6. Define the front and tail times of an impulse wave.
7. Why are capacitance voltage dividers preferred for high ac voltage measurements?
8. How the stray effect is reduced in resistive shunt type of measurement?
9. How rod gaps used as protective devices?
10. Define 'surge impedance' of a line.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the importance of switching over voltages in EHV power systems. How is protection against over voltages achieved? (13)

Or

(b) (i) .What are the different methods employed for lightning protection of overhead lines? (8)

(ii) Give the mathematical models for lightning discharges and explain them. (5)

12. (a) Discuss the various mechanisms of vacuum breakdown. (13)

Or

(b) Explain the phenomenon of corona discharge and breakdown mechanism in non uniform fields. (13)

13. (a) Why is a Cockcroft-Walton circuit preferred for voltage multiplier circuits? Explain its working with a schematic diagram. (13)

Or

(b) Give the Marx circuit arrangement for multistage impulse generators. How is the basic arrangement modified to accommodate the wave time control resistances? (13)

14. (a) (i) Describe the generating voltmeter used for measuring high dc voltages. (7)

(ii) Explain the principle and construction of an electrostatic voltmeter for very high voltages. (6)

Or

(b) Give the schematic arrangement of an impulse potential divider with an oscilloscope connected for measuring impulse voltages. Explain the arrangement used to minimize errors. (13)

15. (a) With suitable illustrations, explain how insulation level is chosen for various equipment in a 230/132 kV sub-station. (13)

Or

(b) (i) Explain the method of impulse testing of high voltage transformers. (7)

(ii) What are the different power frequency tests done on insulators? Mention the procedure for testing. (6)

PART C — ($1 \times 15 = 15$ marks)

16. (a) (i) A 12-stage impulse generator has 0.126 μF capacitors. The wave-front and the wave-tail resistances connected are 800 ohms and 5,000 ohms respectively. If the load capacitor is 1,000 pF, find the front and tail times of the impulse wave produced. (5)

(ii) Describe the mechanism of short-term breakdown of composite insulation. (10)

Or

(b) 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? (15)

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Question Paper Code : 80580

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Seventh Semester

Electrical and Electronics Engineering

EE 8701 — HIGH VOLTAGE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between different types of over voltages in a power system.

2. Write the cause of Corona.

3. State the properties of composite dielectric.

4. What is thermal breakdown in solid dielectrics?

5. What is the principle of operation of a resonant transformer?

6. Define trigatron gap.

7. A resistance divider of 1400 kV [impulse] has a high-voltage arm of 16 kilo-ohms and a low-voltage arm consisting 16 members of 250 ohms, 2 watt resistors in parallel. The divider is connected to a CRO through a cable of surge impedance 75 ohms and is terminated at the other end through a 75 ohm resistor. Calculate the exact divider ratio.

8. Capacitance voltage dividers are preferred for high ac voltage measurements. Justify.

9. What is insulation coordination?

10. Compare type and routine tests.

PART B — (5 × 13 = 65 marks)

11. (a) Describe the various methods implemented for protection against lightning over-voltages in an electrical power system.

Or

(b) (i) Describe about surge arresters with their general characteristics. (9)

(ii) Explain the reasons for power frequency over voltages in an electrical power system. (4)

12. (a) Discuss the various breakdown theories involved in commercial liquid dielectrics.

Or

(b) Describe the current growth phenomenon in a gas subjected to uniform electric fields.

13. (a) Explain with diagrams, different types of rectifier circuits for producing high dc voltages.

Or

(b) (i) Sketch the Marx circuit arrangement for multistage impulse generators. (4)

(ii) How is the basic arrangement modified to accommodate the wave time control resistances? (9)

14. (a) Describe the generating voltmeter used for measuring high dc voltages. How does it compare with a potential divider for measuring high dc voltages?

Or

(b) Summarize with schematic diagrams how dc current can be measured using dc current transformers.

15. (a) Explain the various HV testing's carried out on Insulators and Bushings.

Or

(b) Narrate in sequence the various high voltage tests being carried out in a Power Transformer.

PART C — (1 × 15 = 15 marks)

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

(1) the percentage ripple, (2)

(2) the regulation, and (1)

(3) the optimum number of stages for minimum regulation or voltage drop. (2)

(ii) Give the mathematical model for lightning discharges and explain them. (10)

Or

(b) Derive Townsend's criteria for the breakdown of gaseous dielectric medium.