

CS/B.Tech(PWE)/SEM-6/PWE-606 B/2012

2012

HIGH VOLTAGE ENGINEERING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) Ionization coefficients α , γ are functions of

- a) Applied voltage
- b) Pressure and temperature
- c) Electric field
- d) Ratio of electric field to pressure.

ii) Conduction and breakdown in commercial liquids is affected by

- a) Solid particles b) Vapour or air bubbles
- c) Electrode material d) All of these.

iii) Paper insulation is mainly used in

- a) Cables and capacitors b) Transformers
- c) Rotating machines d) Circuit breakers.

iv) Tesla coil is used for

- a) Generation of sinusoidal output voltages
- b) Generation of very high voltages
- c) Generation of rectangular voltages
- d) Generation of high frequency a.c. voltages.

v) Electrostatic voltmeters can measure

- a) Only DC voltages
- b) Both DC & AC voltages up to high frequency

- c) Impulse voltages
 - d) AC, DC and impulse voltages.
- vi) Most important tests conducted on isolators and circuit breakers are
- a) Voltage withstand tests
 - b) Short circuit tests
 - c) High current tests
 - d) Temperature rise tests.
- vii) Making capacity of a circuit breaker is equal to the
- a) 2 times of its symmetrical breaking capacity
 - b) 3.55 times of its symmetrical breaking capacity
 - c) 3 times of its symmetrical breaking capacity
 - d) 2.55 times of its symmetrical breaking capacity
- viii) The breakdown strength of mineral oil is about
- a) 50KV/mm b) 1MV/mm
 - c) 20KV/mm d) 3 to 5 KV/mm.
- ix) Surge impedance of loss less transmission line is
- a) $\sqrt{C/L}$ b) $\sqrt{L/C}$
 - c) \sqrt{LC} d) $1/\sqrt{LC}$.
- x) Time lag for breakdown is
- a) Time taken for the voltage to rise before breakdown occurs.
 - b) Time difference between instant of applied voltage and occurrence of breakdown
 - c) Time required for gas to breakdown under pulse application
 - d) None of these.
- xi) Mineral transformer oil is used
- a) Only for insulation
 - b) For cooling and insulation
 - c) To protect from vibration

d) Only for cooling.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Briefly explain the breakdown phenomenon in Electronegative gases.
3. Discuss the suitability of SF₆ as an arc quenching medium.
4. Write down the different testing for power transformer.
5. State Paschen's law. What does 1.2/50 μ s, 1000k V impulse wave represents ?
6. Describe the various methods of Arc extinction in a Circuit Breaker.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What are pure and commercial liquids ?
b) Explain the different mechanisms for describing the breakdown phenomenon in Vacuum.
c) Briefly explain the breakdown in solid dielectrics due to treeing and tracking. $4 + 6 + 5$
8. a) Explain the various drawbacks of Townsend's theory.
b) In an experiment in a certain gas it was found that the steady state current is 4.5×10^{-8} A at 6kV at a distance of 0.4cm between the plane electrodes. Keeping the field constant and reducing the distance to 0.1 cm results in a current of 4.5×10^{-9} A. Calculate Townsend's primary ionization coefficient α .
c) Write down the different testing for power transformer.

$3 + 6 + 6$

9. a) Explain with diagrams, different types of rectifier circuits for producing high D.C. voltages.
b) Explain the Van-de-Graaf generator for high voltage.

c) Explain the working principle of Hall generators.

5 + 5 + 5

10. a) Briefly explain the principle operation and limitations of Generating Voltmeters.

b) A circuit breaker is rated 1500A, 2500 MVA, 33 kV, 3sec, 3-phase oil circuit breaker. Determine :

i) The rated normal current.

ii) Breaking current.

iii) Making current

iv) Short time rating current. 8 + 5 + 2

c) Explain the terms i) Disruptive Discharge voltage

ii) Creepage distance as referred to high voltage testing.

11. Write short notes on any *three* of the following : $3 \times 5 = 15$

a) Streamer theory of breakdown in gases.

b) Voltage multipliers

c) Corona discharge.

d) Cascade transformer.

e) Marx circuit.

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