	Utech
Name :	
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Invigilator's Signature :	

ADVANCED 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

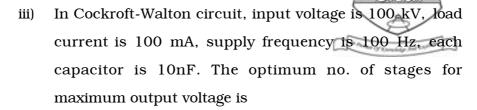
(Multiple Choice Type Questions)

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

 $10 \times 1 = 10$

- i) Sphere gap is used for measurement of
 - a) a.c. voltage only
 - b) d.c. voltage only
 - c) impulse voltage of any shape
 - d) (a) and (b).
- ii) A generating voltmeter
 - a) generates voltage
 - b) generates current
 - c) is a variable capacitor device
 - d) (b) and (c).

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a) 1

b) 10

c) 15

d) 35.

iv) The short-circuit impedance of a 3-stage cascaded transformer as compared to a single unit transformer is

- a) 3 to 4 times
- b) 8 to 9 times
- c) 15 to 16 times
- d) 352 to 452 times.

v) The electric field in a gas bubble which is immersed in a liquid is

- a) higher than that of the field in the liquid
- b) lower than that of the field in the liquid
- c) same as that in the liquid
- d) none of these.

vi) The Townsend's criterion for threshold sparking is given as

- a) $e^{\alpha d} = 1$
- b) $\gamma e^{\alpha d} = 1$
- c) $e^{\alpha d} / \gamma = 1$
- d) $\gamma e^{\alpha d} = 2$.

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- vii) Trichel pulses are noticed in a point plane gap in air when
 - a) point is positive
 - b) point is negative
 - c) these pulses are seen in plane-sphere gap
 - d) these pulses are seen in point-sphere gap.
- viii) Liquids with solid impurities
 - a) have higher dielectric strength
 - b) of large size have higher dielectric strength
 - c) have lower dielectric strength as compared to pure liquids
 - d) none of these.
- ix) If a single stage system using resonance test voltage is required, it is better to use
 - a) series resonant circuit
 - b) parallel resonant circuit
 - c) series-parallel resonant circuit
 - d) any one of these.
- x) The impulse ratio for any particular object
 - a) is a constant
 - b) depends upon shape of wave
 - c) depends upon polarity of the impulse wave
 - d) (b) and (c)

- xi) In order that impulse circuit operates consistently, it is essential that
 - a) the first gap is slightly less than the second and so on
 - b) the axes of the gaps should be in the same vertical plane
 - c) (a) and (b)
 - d) none of these.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following.

- $3 \times 5 = 15$
- 2. What are field intensity coefficients when referred to Charge Simulation Method?
- 3. Discuss the advantages and limitations of Charge Simulation Method.
- 4. What is the difference between Statistical and Formative time lags?
- 5. Explain the effect of polarity of conductor on corona inception voltage and breakdown voltage.
- 6. An absolute electrostatic voltmeter has a movable circular plate of 8 cm in diameter. If the difference between the plates during a measurement is 4 mm, determine the potential difference when the force of attraction is 0.2 gm-wt.

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GROUP - C

(Long Answer Type Questions)

Answer any three of the following.

- $3 \times 15 = 45$
- 7. a) Compare the performances of half-wave rectifier and voltage doubler circuits for generation of high d.c. voltages.
 - b) Explain with neat sketches, Cockroft-Walton voltage multiplier circuit.
 - c) Compare the performance of series and parallel resonant circuits for generation of high a.c. voltages.

5 + 6 + 4

- 8. a) Draw Chubb-Fortescue circuit for measurement of peak value of a.c. voltages.
 - b) Discuss the advantages of the above circuit over other methods.
 - c) A peak reading voltmeter is required to measure voltage upto 150 kV. The peak voltmeter uses an RC circuit, a micrometer and capacitance potential divider. The potential divider has a ratio of 1200 : 1 and micrometer can read upto 10 μ A.

Determine the value of R and C, if the time constant of RC circuit is 8 secs. 5 + 5 + 5

- 9. a) What are the requirements of a sphere gap for measurement of high voltages?
 - b) Discuss the advantages of sphere gap for measurements.
 - c) Discuss the effects of
 - (i) nearly earthed objects
 - (ii) humidity and
 - (iii) dust particles on the measurements using sphere gap.
 - d) What is corona discharge?

3 + 4 + 6 + 2

- 10. a) Define the following terms :
 - (i) Impulse voltage
 - (ii) Impulse flashover voltage
 - (iii) Impulse puncture voltage
 - (iv) Impulse ratio for puncture.
 - b) Describe the principle of operation of multistage Marx's surge generator. 8 + 7

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- 11. a) What are partial discharges?
 - b) Differentiate between internal and external partial discharges.
 - c) What is apparent charge in relation to partial discharges.
 - d) Show that the calculation of apparent charge as a measure of partial discharges even though is more realistic than calculation of change in voltage across the electrode, has limited application for partial discharge measurement. 3 + 3 + 3 + 6
- 12. a) Derive the expression of Paschen's law.
 - b) How do you account for the minimum voltage for breakdown in the Paschen's curve ?
 - c) What are 'Treeing' and 'Tracking' ? 5 + 6 + 4