B.Tech. (E) / III   J

Paper EEE–305 – HIGH VOLTAGE ENGINEERING

Time : 3 hours   *Maximum Marks* : 70

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Answer any five questions.
All questions carry equal marks.

Assume missing data, if any, suitably.

1. (a) Describe briefly various mechanisms of break-down in liquids.   7

   (b) State and explain Paschen's law. Derive expressions for $(Pd)_{min}$ and $V_{b\ min}$.

   Assume A=12, B=365, and $\gamma=0 \cdot 02$ for air. Determine $(Pd)_{min}$ and $V_{b\ min}$ 7

2. (a) What is a cascaded transformer? Explain why cascading is done. Describe with neat diagram a three stage cascaded transformer.   7

   (b) A ten stage Cockroft-Walton circuit has all capacitors of $0 \cdot 06 \mu F$. The secondary voltage of the supply transformer is 100 kV at a frequency of 150 Hz. If the load current is 1 mA, determine (i)

P. T O.

voltage regulation, (*ii*) ripple, (*iii*) optimum
number of stages for maximum output voltage.   7

3. (*a*) Draw a neat schematic diagram of a generating
voltmeter and explain its principle of operation.
Discuss its applications and limitations.   7

(*b*) A ten-stage impulse generator has $0 \cdot 250 \, \mu$F con-
densors. The wavefront and wavetail resistances
are 75 ohms and 2600 ohms respectively. If the
load capacitance is $2 \cdot 5$ nF, determine the
wavefront and wavetail times of the impulse wave.

7

4. (*a*) Explain the procedure for testing of string
insulators.   7

(*b*) Determine the breakdown voltage for air gaps of
2 mm and 15 mm length under uniform field and
standard atmospheric conditions. Also determine
the voltage if the atmospheric pressure is 750 mm
Hg and temperature 35°C.   7

5. (*a*) What is non-destructive testing of insulating
materials? Give very briefly the characteristics of
these methods.   7

(*b*) Draw a neat diagram of HV Schering Bridge and
analyse it for balanced condition. Draw its phasor
diagram.   7

6. (*a*) Explain Penning effect when referred to gaseous discharges.   3

   (*b*) What are 'Tracing' and 'Tracking'? Explain clearly the two processes in solid dielectrics.   4

   (*c*) What are partial discharges? Differentiate between internal and external discharges.   7

7. (*a*) Explain with neat sketches the mechanism of lightning discharge.   7

   (*b*) A surge of 15 kV magnitude travels along a cable towards its junction with an overhead line. The inductance and capacitance of the cable and overhead line are respectively $0 \cdot 3$ mH, $0 \cdot 4\,\mu$F and $1 \cdot 5$ mH, $0 \cdot 012\,\mu$F per km. Find the voltage rise at the junction due to the surge.   3

   (*c*) A surge of 100 kV travelling in a line of natural impedance 600 ohms arrives at a junction with two lines of impedances 800 ohms and 200 ohms respectively. Find the surge voltages and currents transmitted into each branch line.   4

8. Write short notes on:

   (*a*) Breakdown mechanism in gases

   (*b*) Origin of overvoltages on transmission system.   14