BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: EEE **SESSION : MO/19**

SUBJECT: EE8215 HIGH VOLTAGE ENGINEERING

TIME: 3:00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Why generation of high d.c. voltages is required? [2]

Q.1(b) What is meant by the withstand strength of an insulation? Are the withstand strength and breakdown strength constant for an insulating material? [4]

Q.1(c) Explain with neat diagrams the procedure to control electric field intensity in high voltage equipment. [6]

Q.2(a) Define Townsend's first and second ionization co-efficient. [2]

Q.2(b) What is Paschen's law? How do you, account for the minimum voltage breakdown under a given 'pd' condition? [4]

Q.2(c) Air at atmospheric pressure breaks down at a stress of approximately 3 kV/mm. Consider the following configurations and estimate the voltage where breakdown (or corona) starts: [6]
Fields
i. A uniform field gap of 100 mm
ii. Two co-axial cylinders: radius of outer cylinder 110 mm, inside cylinder radius 10 mm.
iii. Two concentric spheres: radius of outer sphere 110 mm, inside sphere radius 10 mm.
Discuss the results.

Q.3(a) What is the effect of moisture content in the oil on the breakdown strength of liquids? [2]

Q.3(b) Why are both electrical and thermal properties important for liquid for use in an apparatus like a transformer? [4]

Q.3(c) In an experiment for determining the breakdown strength of transformer oil with standard electrode, the following observations were obtained. Determine the power law for breakdown and hence estimate the break down strength for a 1cm gap (kv/cm). [6]

Gap Spacing (mm)	3	6	9	12
Breakdown Voltage (kV)	84	143	192	214

Q.4(a) What do you understand by 'intrinsic strength of a solid dielectric'? [2]

Q.4(b) Describe the main requirements of solid insulating materials used for power apparatus. [4]

Q.4(c) A coaxial cylindrical capacitor is to be designed with an effective length of 20cm. The capacitor is expected to have a capacitance of 1000pF and to operate at 15kV, 500kHz. Select a suitable insulating material and give the dimensions of the electrodes. [6]

Q.5(a) What are the different types of voltages generated for testing purpose? [2]

Q.5(b) Explain with diagrams, different types of rectifier circuits for producing high d.c. voltage. [4]

Q.5(c) A Cockcroft - Walton type voltage multiplier has eight stages with capacitances all equal to 0.05μF the supply transformer secondary voltage is 125kV at a frequency of 150Hz. If the load current to be supplied is 5μA, find [6]
i. The percentage ripple ii. The regulation
iii. The optimum number of stages for minimum regulation or voltage drop.

Q.6(a) What is a tesla coil? [2]

Q.6(b) What are the different methods of measuring high dc voltages? What are the limitations in each method? [4]

Q.6(c) A generating voltmeter is required to measure voltage between 15kV to 250kV. If the indicating meter reads a minimum current of 2μA and maximum current of 35μA, determine the capacitance of the generating voltmeter. [6]

Q.7(a) What do you mean by a 2000kV, 1.2/50 impulse voltage? [2]

Q.7(b) List the common test facilities available in high voltage laboratories. [4]

Q.7(c) Why is grounding very important in an HV laboratory? Describe a typical grounding system used. [6]

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