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

CLASS: BE **SEMESTER : VII**
BRANCH: EEE **SESSION : MO/18**

SUBJECT: EE8215 HIGH VOLTAGE ENGINEERING

TIME: 3 HRS. **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) What are the different numerical methods available for estimation of electric field distribution in dielectric media? [2]

Q.1(b) How is the Electric Stress / Electric Field intensity controlled? [4]

Q.1(c) In a certain experiment relating to study of breakdown in gases, the ratio of current obtained to initial current was 1.20, 1.80 and 2.25 for gap distances of 1.0, 3.0 and 4.0 cm respectively if E/p was constant at 160V/cm-torr and pressure of 0.1 torr, calculate the value of γ and α. [6]

Q.2(a) Explain the term 'electron attachment'. [2]

Q.2(b) What will be the breakdown voltage of a spark gap in a gas at pr=760 torr at 25^0 C if A=15/cm, d=1mm at $\gamma=1.5x10^{-4}$? [4]

Q.2(c) Derive the criterion for breakdown in electronegative gas. [6]

Q.3(a) What are commercial liquid dielectrics and how are they different from pure liquid dielectric? [2]

Q.3(b) In an experiment for determining the breakdown strength of transformer oil, the following observations were made. Determine the power law dependence between gap spacing and applied voltage of oil. [4]

Gap Spacing (mm)	3	6	9	10
Voltage at Breakdown (kV)	86	148	169	219

Q.3(c) Explain the various theories that explain breakdown in commercial liquid dielectric. [6]

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

Q.4(b) What is thermal breakdown in solid dielectric and how is it practically more significant than other mechanism? [4]

Q.4(c) A coaxial cylindrical capacitor is to be designed with an effective length of 20 cm. 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) Define the front and tail times of an impulse wave. [2]

Q.5(b) What is the principle of operation of a resonant transformer? How it is advantageous over the cascade connected transformer? [4]

Q.5(c) A tesla coil has a primary winding rated for 10kV. If L_1, L_2 and coefficient of coupling K are 10mH, 2000mH and 0.6 respectively find the peak value of output voltage if the capacitance in the primary side is 2.0μF and that on the secondary side is 1nF. Neglect the winding resistance. Find also the highest resonant frequency produced with rated voltage applied. If the energy efficiency is 5%, calculate the output voltage [6]

Q.6(a) What is capacitance voltage transformer? [2]

Q.6(b) Describe the generating voltmeter used for measuring high dc voltages. [4]

Q.6(c) A Rogowski coil is to be designed to measure impulse current of 10kA having a rate of change of current of 10^{11} A/s. The current is read by a TVM as potential drop across the integrating circuit connected to the secondary. Estimate the values of mutual inductance, resistance and capacitance to be connected, if the meter reading is to be 10V for full scale deflection. [6]

Q.7(a) Why electromagnetic shielding is required in high voltage laboratories? [2]

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

Q.7(c) Classify the various high voltage laboratories and their salient features. [6]

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