CLASS: M.Tech.   SEMESTER : II
BRANCH: EE   SESSION : SP/2022

SUBJECT: EE593 High Voltage Engineering
TIME: 2 Hrs.   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 7 questions each of 10 marks and total 70 marks.
2. Candidates may attempt any 5 questions maximum of 50 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.

-Graph Paper Required

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

Q.2(a)	What is Paschen's law? How do you, account for the minimum voltage breakdown under a given 'pd' condition?	[4]
Q.2(b)	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)	Why are both electrical and thermal properties important for liquid for use in an apparatus like a transformer?	**[4]**
Q.3(b)	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)	Describe the main requirements of solid insulating materials used for power apparatus.	[4]
Q.4(b)	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)	Explain with diagrams, different types of rectifier circuits for producing high d.c. voltage.	[4]
Q.5(b)	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 are the different methods of measuring high dc voltages? What are the limitations in each [4] method?

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

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

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