

Ref No.: Ex/EE/PE/B/T/413B/2025 & Ex/EE/PE/B/T/414B(O)/2025

B.E. ELECTRICAL ENGINEERING FOURTH YEAR FIRST SEMESTER - 2025

SUBJECT: HIGH VOLTAGE TECHNIQUE-I

Time: Three Hours

Full Marks 100
(50 Marks for each part)

Use a separate Answer-Script for each part

Question No.	Part I	Marks
Answer Question No. 1 and any two from the rest		
1.	(a) Discuss about a one-dimensional field distribution with an example.	4
	(b) Explain the difference between two-dimensional and axi-symmetric field distributions with proper diagrams.	3+3
	(c) Explain why the fictitious charges simulating the actual charges on the surface of the conductor are placed within the conductor in the Charge Simulation Method.	4
	(d) Explain why unequal nodal distances are necessary for electric field computation by FDM. With the help of proper diagram discuss where and why the nodal distances should be smaller or larger.	2+2+2
2.	(a) Explain how the problem of electric field computation can be converted to solution of simultaneous linear equations with scalar variables in FDM. Consider 3-D system with equal nodal distances.	7
	(b) What is the basis of electric field computation by variational approach in FEM? Explain with 2-D case.	8
3.	(a) Discuss about two criteria each for conductor-dielectric boundary and dielectric-dielectric boundary for estimating the accuracy of numerical electric field computation.	4×2
	(b) Explain using deductions why metallic dust particles should be avoided at all costs for gas insulated systems.	7

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| 4. | (a) | Mention the four types of fictitious charges, which are most commonly used in CSM. Give one example for the usage of each of these four charges. | 4×1.5 |
| | (b) | Find the magnitudes and locations of three successive image charges in the case of two identical spheres of radius 25cm with a gap distance of 1.4 cm and excitation potential of 42.9kVp using the Method of Successive Images. | 3×2×
1.5 |
| 5. | (a) | Consider that a point charge of +1nC is located in air at a distance of 50cm from the center of a grounded sphere of radius 10cm. Determine the maximum value of the induced surface charge density on the grounded sphere. Derive the formula used. | 4+5 |
| | (b) | Explain how the breakdown voltage in air at STP can be determined with the help of field factors for a long horizontal transmission line. | 6 |

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B.E. ELECTRICAL ENGINEERING FOURTH YEAR FIRST SEMESTER EXAMINATION, 2025

HIGH VOLATGE TECHNIQUE - I

Time: Three hours

Full Marks: 100

(50 marks for each part)
 Use separate answer script for each part.

Part – II

Answer any three questions.
 Two marks are reserved for neat and well organized answers.

- 1.a) Explain generation of charged particles by collision ionization, photo ionization and thermal ionization respectively. 6+3+3
- 1.b) State what do you mean by "Yield". Explain why yield is higher for insulators than metals. 1+3
- 2.a) State what is meant by partial discharge. Comment on the development of partial discharge in solid insulating material under the application of ac and dc voltages respectively. 2+10
- 2.b) State whether the breakdown of a gap occurs instantly after the application of voltage – if not, state why the gap does not break instantly. 4
3. Explain the phenomenon of surface flashover in a) Post insulator and b) Bushing respectively. 8+8
4. Explain the following: 8+8
 - (i) Electro mechanical breakdown of solid dielectric material.
 - and
 - (ii) Breakdown of commercial liquids due to suspended particles.
5. Write notes on (i) breakdown in vacuum and (ii) SF₆ as a gaseous dielectric. 8+8