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Question Paper Code : 81276

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fifth/Sixth/Seventh/Eighth Semester

Electrical and Electronics Engineering

**EE 3036 — SUSTAINABLE AND ENVIRONMENTAL FRIENDLY HV
INSULATION SYSTEM**

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Enlist the key factors, in Global Warming Potential (GWP) calculation.
2. How is carbon footprint measured?
3. Justify why SF₆ gas is considered to be hazardous.
4. List the alternate greenhouse gas insulators for superior performance.
5. Define biodegradability.
6. Point out the hazardous effects of existing liquid dielectric insulating materials.
7. State the functions of solid insulators in high-voltage equipment.
8. List out four thermosetting electrical insulation materials commonly used in electrical insulators.
9. How bio-based polymers offer sustainability benefits on the environment?
10. Enlist the testing methods to find the life of a green insulation material.

PART B — (5 × 13 = 65 marks)

11. (a) What are the harmful effects related in using conventional hazardous materials in high voltage electrical systems and explain how electrical industry is moving towards sustainable and environmental friendly insulation system.

Or

- (b) Elaborate on the open challenges faced by the electrostatic experts to reduce the carbon footprint and explain the technologies adopted in high voltage electrostatics.
12. (a) Discuss in detail the products formed during the working cycle of SF₆ gas and their implications.

Or

- (b) What is a g3 gas and explain why g3 gases are creating a breakthrough in high-voltage insulation.
13. (a) Summarize the characteristics of natural ester-insulating fluids and discuss the advantages in using natural ester oil.

Or

- (b) Discuss in detail about the properties of ecofriendly liquid insulators and their significance in enhancing the sustainability of electrical systems. Include discussions on their biodegradability, fire resistance, and other dielectric characteristics for HV applications.
14. (a) What is the need for moving towards alternate green solid insulators and discuss the changes it will create on the environment.

Or

- (b) Why thermoset composites are ideal insulation for transformers and switchgears? Justify.
15. (a) What does evolving standards in high-voltage (HV) insulation management emphasize and discuss the challenges in standardizing the safety and reliability.

Or

- (b) Discuss in detail on the traditional methods involved in disposing the insulation materials. Will the alternating insulating materials meet the evolving standards?

PART C — (1 × 15 = 15 marks)

16. (a) Conduct a case study on the journey of evolution of High-Voltage (HV) insulators and create a road map focusing towards the sustainable environment.

Or

- (b) Analyze the lifecycle impact of replacing SF₆-based insulation systems with a novel gaseous mixture in a major substation, focusing on their dielectric performance, environmental benefits, economic viability, and safety considerations.
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