Name:

Enrolment No:

UPES

End Semester Examination, December 2024

Course: Electrical Safety **Semester : 1st**

Program: M. Tech- HSE **Time : 03 hrs.**

Course Code: HSFS7014 **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	List the types of power transformers and briefly explain why oil-filled transformers are commonly used in high-voltage applications.	**4**	**CO1**
Q 2	Describe the working principle of a relay and discuss the role of overcurrent relays in power systems. Why is accurate relay coordination critical in grid protection?	**4**	**CO1**
Q 3	Explain the construction and operation of a vacuum circuit breaker. Highlight why vacuum circuit breakers are preferred in medium-voltage applications.	**4**	**CO1**
Q 4	Enumerate the different types of busbars used in substations and explain their role in ensuring system reliability. What are the key considerations in busbar design?	**4**	**CO1**
Q 5	Explain the principle of operation of a fuse and describe the types of fuses used in electrical circuits. Why are fuses often used as backup protection devices?	**4**	**CO2**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Compare synchronous motors and induction motors in terms of efficiency, maintenance, and industrial applications. What factors make induction motors more suitable for general industrial use?	**10**	**CO2**
Q 7	What is the purpose of a capacitor bank in a substation, and how does it improve the overall power factor of the system? Discuss the risks associated with capacitor banks in high-voltage systems.	**10**	**CO2**
Q 8	Explain the operating principle of a soft starter and its application in motor control. Why are soft starters preferred over traditional starting methods for large motors?	**10**	**CO3**
Q 9	Discuss the role of transformers in managing voltage levels across transmission lines. How do step-up and step-down transformers contribute to efficient power distribution?	**10**	**CO3**

	Or, Explain the advantages and disadvantages of synchronous compensators compared to static VAR compensators in reactive power management.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	Srisailam Hydroelectric Plant Fire (2020) Overview: A fire broke out at the Srisailam hydroelectric power plant on the Telangana-Andhra Pradesh border in 2020, killing nine people. The fire was caused by a short circuit in the electric panel of the plant's powerhouse. Key Issues: Inadequate fire safety mechanisms in the powerhouse. Delayed response due to lack of emergency preparedness. Failure of safety systems to contain the fire at the early stages. Outcome: The incident led to an urgent review of fire safety standards in hydroelectric plants across India. Central Electricity Authority (CEA) implemented additional fire safety audits for hydroelectric power stations and issued stricter guidelines for fire hazard management. Analyze the causes and consequences of the 2020 Srisailam hydroelectric plant fire, highlighting the importance of fire safety measures in electrical installations. (Hint: Focus on the technical failures, response to the fire, and how this incident influenced fire safety audits and policies in power plants.) Or, Examine the design and implementation of an electrical safety system in a newly constructed residential building, outlining the objectives, challenges, and outcomes. Describe the use of a transformer in industry along with its working principle. Also substantiates that why transformer coils are submerged in mineral oil with high dielectric strength and the purpose of silica gel for transformer?	**20**	**CO4**
Q 11	Tata Power Electrical Safety Initiatives (Mumbai, 2019) Overview: Tata Power initiated a series of electrical safety measures after several fatal electrical accidents were reported in Mumbai due to faulty wiring and illegal connections. Key Issues: Widespread illegal tapping of power from overhead cables. Poor safety standards in unauthorized residential constructions. Lack of awareness about electrical safety in lower-income areas. Outcome:	**20**	**CO4**

	Tata Power launched the Electrical Safety Week campaign, focusing on public education about electrical safety, and initiated large-scale maintenance and upgrades to ensure compliance with the Indian Electricity Act, 2003 and the CEA Regulations. The company also collaborated with local authorities to implement community safety audits and launched a hotline for reporting faulty electrical systems. Evaluate Tata Power's Electrical Safety Initiatives (2019) in Mumbai. How did these initiatives address the issues of electrical accidents and illegal connections? (Hint: Discuss public awareness campaigns, the role of technology in improving safety, and measures to reduce illegal power connections.)		