Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2020

Course: Electrical System Safety and Its Design **Semester:**
Program: B. Tech-FSE **Time: 03 hrs.**
Course Code: HSFS 2006 **Max. Marks: 100**

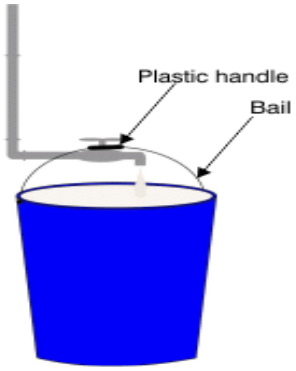
Instructions:

SECTION A

S. No.	Attempt all the questions	**20 Marks**	**CO**
Q1.	Justify the statement: " It's the 'amps' that kills not the 'volts' " with an appropriate example.	**4**	**CO1**
Q2.	Expand the following: a. HECP b. IE c. HRG d. LOTO	**4**	**CO2**
Q3.	Spot the differences between earthing and grounding in Indian as well international standards perspective.	**4**	**CO3**
Q4.	Draw the OLD of UPES supply systems.	**4**	**CO4**
Q5.	Define the following: a. Hazardous Area b. MIC ratio c. MESG d. MIE	**4**	**CO5**

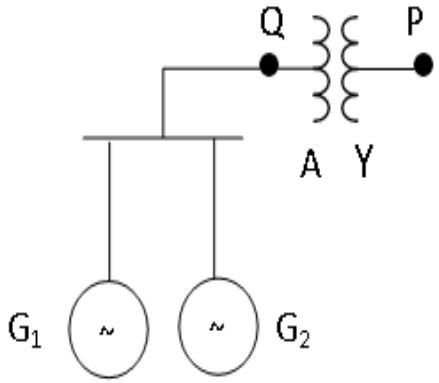
SECTION B

S. No.	Attempt all the questions	**40 Marks**	**CO**
Q6.	Read the following case study and identify the hazard occurred and its causes. At 12:15 p.m. on July 27, 2019, an employee was connecting new wiring for a new exterior spot light to the existing conduit box and wires using an extension ladder approximately 12 feet above the ground. The employee was working on the new installation while the power was energized using a non-insulated 7 inch Tekton wire stripper and was shocked for about approximately 15 seconds before falling from the ladder. The employee landed on his back and his head on the concrete ground. Later he was declared dead.	**10**	**CO1**
Q7.	Describe the steps involved in "first aid" to be given to victim of Electric Shock.	**10**	**CO2**
Q8.	Discuss about various types of fuses along with their applications and limitations.	**10**	**CO3**

Q9.	***Read the following case study and answer the questions following.*** This case study investigates the factors resulting in an electrostatic ignition incident involving toluene, a prolific charge generator filling a metal bucket via gravity fed 0.75" metal pipping. In this scenario, an operator opened a valve to draw toluene into a metal bucket with toluene from an overhead tank by gravity flow at approximately 5 gallons per minute. The operator hung a metal bucket with a wire bail and plastic handle over a globe valve. The plastic handle on the bail isolated the metal bucket from ground.  On opening the valve, the operator backed away from the bucket allowing the toluene to flow as he had previously done several times. Within a few moments, the toluene had ignited causing the operator to immediately leave the scene returning with a small fire extinguisher, which proved inadequate to put the fire out. The operator then left the scene returning with a larger fire extinguisher, however by the time he had returned the fire was out of control and he was unable to close the valve to prevent the flow of toluene to the bucket, which was already over flowing. The investigation into the incident outlined that the operator had opened the valve and backed away from the metal bucket. The operator stated "I was just standing there looking at it when it caught fire". As a result, discharge from the operator could be ruled out as a cause of the incident. A. Point out the causes and sequence of occurrence. B. Discuss the preventive and protective measures that could have avoided this occurrence. [OR] Discuss the causes & consequences associated with static accumulation in case of hazardous chemicals along with necessary preventive and protective measures.	**10 Marks**	**CO2**
	SECTION-C		
S. No	**Answer the following.**	**40 Marks**	
Q10.	Give the classification of hazardous areas as per IEC and NFPA. Also, detail about IP ratings given on electrical equipment with their significance.	**20 Marks**	**CO5**
Q11.	Discuss the AFHA methodology as per IEEE's Method and its comparison with NFPA's Methodology.	**20 Marks**	**CO4**

[OR]

Two synchronous generators are connected in parallel at the low voltage side of a three-phase Δ-Y transformer as shown in figure. Machine-1 is rated 50 MVA, 13.8 kV. Machine -2 is rated 25 MVA, 13.8 kV. Each generator has sub transient reactance of 25%, respectively. The transformer is rated 75 MVA, 13.8 Δ /69Y with a reactance of 10%. Before the fault occurs, the voltage on high voltage side of the transformer is 66 kV. The transformer is unloaded (fault occurred) on high voltage side of the transformer is 66 kV. The transformer is unloaded and there is no circulating current between the generators. Calculate the symmetrical fault current in amps, assume the generator values as reference.



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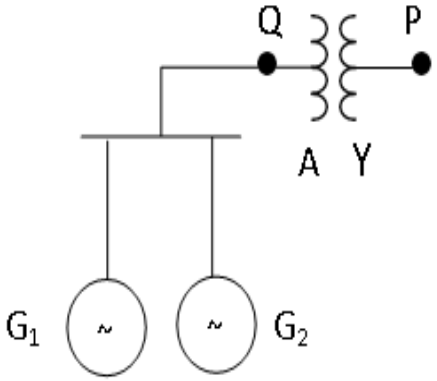
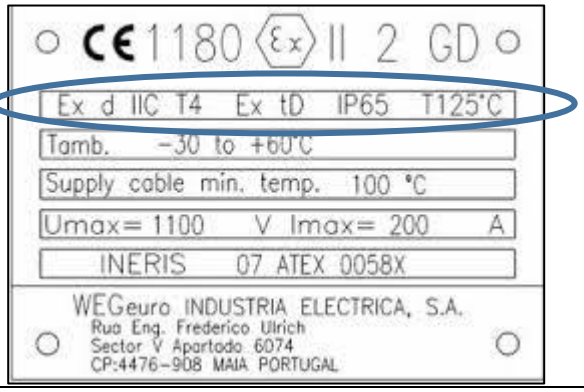
Instructions:

SECTION A

S. No.	Attempt all the questions	**20 Marks**	**CO**
Q1.	List the classification of equipment based on voltage level and classification of voltage levels.	**4**	**CO1**
Q2.	Define the following: a. AFCI b. FPB c. GFCI d. LOTO	**4**	**CO2**
Q3.	Give the significance of earthing with appropriate examples.	**4**	**CO3**
Q4.	Define symmetrical fault. List the steps involved in symmetrical analysis along with assumptions.	**4**	**CO4**
Q5.	Expand the following: a. Ex “i” b. Ex “d” c. Ex “o” d. Ex “n”	**4**	**CO5**

SECTION B

S. No.	Attempt all the questions	**40 Marks**	**CO**
Q6.	Discuss about various factors that affect the intensity of electric shock.	**10**	**CO1**
Q7.	Discuss about various distances to be maintained around an electrical equipment that is prone to produce arc flash. Also, list the PPEs (ratings) required for each boundary	**10**	**CO2**
Q8.	Discuss about various types of fuses along with their applications and limitations.	**10**	**CO3**
Q9.	Discuss the AFHA methodology as per Raphlee’s Method and its comparison with IEEE Methodology. [OR] Two synchronous generators are connected in parallel at the low voltage side of a three-phase Δ-Y transformer as shown in figure. Machine-1 is rated 50 MVA, 13.8 kV. Machine -2 is rated 25 MVA, 13.8 kV. Each generator has sub transient reactance of 25%, respectively. The transformer is rated 75 MVA, 13.8 Δ /69Y with a	**10**	**CO4**

	reactance of 10%. Before the fault occurs, the voltage on high voltage side of the transformer is 66 kV. The transformer is unloaded on high voltage side of the transformer is 66 kV. The transformer is unloaded and there is no circulating current between the generators.  		
	SECTION-C		
S. No	**Answer the following.**	**40 Marks**	
Q10.	Detail the terms imprinted on nameplate of the equipment as given in figure below.(the highlighted/marked portion).  	**20 Marks**	**CO5**
Q11.	Discuss the steps involved in AFHA as per both IEEE and NFPA along with applications and limitations of each. [OR] Calculate the amount of fault current for a 3-phase fault occurred at the terminals on fully loaded DG of UPES Bidholi substation. Assume that the supply from state electricity board is unavailable and sub transient reactance of generator and transformers are 30% and 15% on their respective bases. Consider generator values as reference.	**20 Marks**	**CO4**