Reg. No.



(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, DECEMBER 2023

ENERGY AUDITING [ELE 4082]

REVISED CREDIT SYSTEM

Time: 3 Hours	09 December 2023	Max. Marks: 50			
Instructions to Candidates:					
Answer ALL the questions.					
Missing data may be suitably assumed.					
1A.	List and explain any SIX strategies for better energy security of the nation.	03			
1B.	Explain Perform, Achieve and Trade (PAT) Scheme. For which industrial sectors is PAT scheme applicable. 03				
1C.	 A) An ESCO company is required to invest in a waste hear recovery project, which is expected to yield an annual saving of Rs.10,00,000 and the life of the equipmen is 10 years. If the ESCO expects 25% IRR on this project, calculate the investment required to be made (2M) 	t t			
	B) In a textile plant monthly energy consumption is 7,00,000 kWh of electricity, 40 kL of furnace of (specific gravity=0.92) for thermic fluid heater, 360 tonnes of coal for steam boiler and 10 kL of HSE (specific gravity= 0.885) for material handling equipment. Compute the energy consumption in kca for the plant. (2M)	5)] 			
	Given Data: (1 kWh = 860 kcal, GCV of coal= 3450 kCal/kg, GCV of furnace oil= 10,000 kcal/kg, GCV o HSD= 10,500 kcal/kg, GCV of rice husk= 3100 kcal/kg, 1 kg oil equivalent = 10,000 kcal)) f) 04			
2A.	Explain how Energy Audit promotes Demand Side Management. List any FOUR options for Demand Side Management? 03				
2B.	A single-phase motor takes a current of 12A at 0.8 PF lag from a 230V, 50Hz supply. What size of the condenser is required to improve the PF to 0.95 lag when connected across the load?	0 0 0 3			
2C.	The daily demands of three consumers are given below:	04			

Time	Consumer 1	Consumer 2	Consumer 3
12 midnight to 8 AM	No Load	200 W	No Load
8 AM to 2 PM	600 W	No Load	200 W
2 PM to 4 PM	200 W	1000 W	1200 W
4 PM to 10 PM	800 W	No Load	No Load
10 PM to midnight	No Load	200 W	200 W

Determine

- (i) maximum demand of individual consumer
- (ii) maximum demand of the station
- (iii) load factor of individual consumer and
- (iv) load factor of the station
- **3A.** What are the three Ts of combustion? Explain principle of combustion with the help of chemical equation. Under what conditions we can say that the combustion incomplete?
- **3B.** Why is steam preferred for industrial heat applications? Give at least SIX reasons.

3C. Two identical biomass fired boilers of capacity 10 TPH are operated in a chemical industry. They each have a full load efficiency of 80%. The part load efficiencies at 70% and 40% load are 75% and 68% respectively. For meeting 14 TPH requirement of steam, would you prefer to run both the boilers at 7 TPH capacity or one at full load capacity and other at 40% capacity. Estimate the % savings in the preferred case.

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- **4A.** Explain the procedure of assessing performance of lighting systems based on **Installed Load Efficacy Ratio**.
- **4B.** A 20 kW, 415V, 38A, 4 pole, 50 Hz, 3 phase rated squirrel cage induction motor has a full load efficiency and power factor of 88% and 0.85 respectively. An energy auditor measures the following operating data of the motor.
 - 1) Supply voltage= 408V
 - 2) Current drawn= 30A
 - 3) PF=0.83

Find out the following at motor operating conditions.

- 1) Power input in kW
- 2) %age motor loading

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4C. It is required to choose a transformer to cater to a load which varies over a 24-hour period in the following manner:

ELE 4082

Purchase quotations have been received for two transformers, each rated at 1,500 kVA.

500 kVA for 6 hours, 1000 kVA for 6 hours and 1500 kVA for

Transformer-1 has an iron loss of 2.7 kW and a full load copper loss of 18.1 kW, while Transformer-2 has an iron loss of 3.2 kW and a full-load copper loss of 19.8 kW.

- (i) Calculate the annual cost of losses for each transformer at 365 days of operation if electrical energy cost is Rs. 6 per kWh.
- (ii) If the transformer-1 is to be purchased at an additional cost of Rs.25,000 over transformer-2, how would you justify it to the finance department?
- **5A.** Discuss at least SIX advantages of illuminating interiors using daylight.

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5B. List out the key electrical appliances which are required to be energy efficient. What should be the integrated policy approach that is needed to accelerate their large-scale adoption?

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5C. (A) What is Solar Constant and Solar Insolation? (2M)

(B) A 375 Watt rated solar panel of the size $1.20 \text{ m} \times 1.50 \text{ m}$ is installed in a solar photovoltaic power plant on a roof top area of a structure having dimensions of $10 \text{ m} \times 15 \text{ m}$. What will be the panel conversion efficiency if the solar insolation is 1000 Watt per square meter? (**2M**)

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