Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET B

SCHOOL OF ENGINEERING
END TERM EXAMINATION – MAY/JUNE 2024

Semester : Semester VIII-2020

Course Code : EEE3026

Course Name : Energy Auditing and Demand Side Management

Program : B.Tech.

Date : May 31, 2024

Time : 1:00 PM - 4:00 PM

Max Marks : 100

Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

Part - A

Answer any 5 questions **5 x 4M= 20M**

1. Outline the function of surplus air in boiler efficiency and how its reduction improves the boiler's overall performance.

(CO1) [Knowledge]

2. Boilers are devices that heat water or steam for use in producing electricity or heating spaces in a variety of industrial processes. Heating, electricity generation, cooking, and other thermal energy-requiring processes can all benefit from the steam or hot water that a boiler produces. Outline how the boiler's efficiency is impacted by the significance of routine maintenance of its parts.

(CO2) [Knowledge]

3. From individual homes to massive manufacturing facilities, there is a wealth of energy-saving potential. Lowering costs, reducing energy use, and helping the environment are all possible outcomes of adopting energy-saving practices. Find out how energy audits help find ways to save energy in current buildings.

(CO1) [Knowledge]

4. A building energy audit is an in-depth analysis of the building's energy use with the goal of finding ways to cut expenses and increase efficiency. The sophistication of these audits ranges from basic walkthroughs to in-depth investigations using sophisticated monitoring and simulation tools. Recall the unique difficulties of conducting energy audits on newly constructed versus older structures, and compare the methods used for each.

(CO2) [Knowledge]

5. Which boiler-specific energy-saving measures have the greatest impact on lowering energy consumption rates?

(CO1) [Knowledge]

6. A building energy audit is an in-depth analysis of the building's energy use with the goal of finding ways to cut expenses and increase efficiency. The sophistication of these audits ranges from basic walkthroughs to in-depth investigations using sophisticated monitoring and simulation tools. Evaluate the unique difficulties of conducting energy audits on newly constructed versus older structures, and compare the methods used for each.

(CO2) [Knowledge]

7. What are the main components of an air-conditioning system, and how do they function together to regulate indoor temperature and humidity?

(CO3) [Knowledge]

Part - B

Answer any 4 questions **4 x 10M = 40M**

8. Review the vapor-compression refrigeration cycle, delineating each stage of the process, including compression, condensation, expansion, and evaporation, while also explaining the function of key components such as compressors, condensers, expansion valves, and evaporators.

(CO4) [Comprehension]

9. Provide a detailed examination of variable-frequency drives (VFDs) and their role in enhancing energy efficiency, operational flexibility, and motor control precision in HVAC systems, discussing their underlying principles, installation considerations, programming parameters, and potential applications across various HVAC equipment and subsystem.

(CO4) [Comprehension]

10. Recall a thorough DSM plan for a city that aims to decrease overall energy consumption and promote sustainable development. Analyze several tariff choices and recommend the most suitable one for a commercial establishment.

(CO5) [Comprehension]

11. Explain the concept of demand-side management (DSM) in the context of energy conservation and also the various strategies involved in load management as part of DSM?

(CO5) [Comprehension]

12. Put contrast into the calculation and interpretation of energy use indices such as Energy Efficiency Ratio (EER), Seasonal Energy Efficiency Ratio (SEER), and Coefficient of Performance (COP), elucidating their significance in quantifying the energy efficiency and performance of HVAC systems.

(CO4) [Comprehension]

13. Ballasts regulate the current to the lamps and provide sufficient voltage to start the lamps. Energy-efficient ballasts reduce energy consumption by efficiently controlling the electrical flow. Explain how ballasts contribute to energy efficiency in lighting systems.

(CO5) [Comprehension]

Part - C

Answer any 2 questions **2 x 20M = 40M**

14. A 50 hp fan needs to supply air 10 hours/day for 250 days. The cost of running the fan at full speed would be 50 hp* 0.746 kW/hp*2500 hrs* (speed)^3 * Rs 6/kWh= INR 5,59,500.
It is assumed that the fan runs at different speeds during the year as per the given schedule: 25% of the time at 100%, 50% of the time at 80%, 25% of the time at 60%.
a) Identify the unknown parameters that could be computed from the given data.
b) Compute the unknown parameters

(CO4) [Application]

15. Consider a commercial building with the following specifications:

- **Total Floor Area:** 15,000 square meters
- **HVAC System:**
- Rated Power Consumption: 180 kW
- Operating Hours: 10 hours per day
- Operational Days: 250 days per year
- **Lighting System:**
- Total Number of Fluorescent Bulbs: 500
- Power Consumption per Bulb: 40 watts
- Operating Hours: 12 hours per day
- Operational Days: 300 days per year
- **Water Consumption:**
- Cooling System: 120,000 liters per day
- Restrooms: 50,000 liters per day
- Landscaping: 30,000 liters per day
- Operational Days: 250 days per year

i) HVAC System Analysis : a. Compute the annual energy consumption of the HVAC system. b. Suggest and calculate the potential energy savings if the HVAC system's efficiency can be improved by 20%.

ii) Lighting Efficiency Improvement : a. Compute the total annual energy consumption for the current lighting system. b. Propose an energy-efficient LED lighting system that consumes only 25 watts per bulb. Calculate the potential energy savings per year if the LED system is implemented.

iii) Water Efficiency Measures : a. Compute the total annual water consumption for the building. b. Suggest one water-saving measure for the building's cooling system and calculate the potential annual water savings by 15% if implemented.

(CO4) [Application]

16. There is a total of 15,000 square meters of floor space.
Speaking about the heating, ventilation, and air conditioning system:
A power rating of 180 kW is possible.
Every day, there are ten hours of operation, and there are 250 operating days in a year.
The lighting system makes use of 500 fluorescent lights, each of which consumes 40 watts of power.
The daily schedule consists of twelve hours of operation. The annual operating season lasts for 300 days.
A Review on Water Use:
There are 250 operational days per year, a cooling system capacity of 120,000 liters, a restroom capacity of 50,000 liters, a landscaping capacity of 30,000 liters, and so on.
Be sure to calculate the HVAC system's yearly energy consumption when you conduct your analysis.
a. Estimate the amount of money that could be saved on energy bills if the HVAC system could be 20% more efficient.
Improving the lighting system's efficiency requires first calculating the total annual energy usage of the current lighting system.
b. Propose an energy-efficient LED lighting system where each bulb requires no more than 25 watts. Find out how much money you could save on energy bills each year by switching to the LED system.
Steps to Maximize Water Savings:
a. Add up all the water use for the entire year by the building.
b. Determine the potential annual water savings by recommending a single remedy to improve the building's cooling system and by developing a plan to put that plan into action.

(CO5) [Application]