Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, MAY 2024

ENERGY AUDITING [ELE 4301] (Open Elective)

REVISED CREDIT SYSTEM

Time: 3 Hours **10 MAY 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. With respect to Energy Conservation Act, 2001 –
a) What are the thrust areas for energy efficiency?
b) List out any TWO Designated consumers. ***(03)***

1B. A paper industry implemented energy saving retrofits prior to January 2023.

Using CUSUM (**Cumulative Sum**) analysis calculate the energy savings for SIX months period of 2023.

For calculating total energy savings, average production can be taken as 4500MetricTonne/Month. The retrofits were not functioning during March and May 2023 due to component failure.

Refer data given in the table for analysis.

Months in 2023	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Actual SEC	242	238	287	237	295	246
Predicted SEC	265	265	265	265	265	265

SEC – Specific Energy Consumption in kwh/MetricTonne

If the cost of energy saving retrofit is Rs 2,00,000=00, what is the simple payback period? ***(03)***

1C. Calculate the Net Present Value over a period of 4 years for a project with an investment of Rs 75,000 at the beginning of the first year and another investment of Rs 75,000 at the beginning of the second year and fuel cost saving of Rs 70,000 in second year and Rs. 65,000 each in third and fourth year. The discount rate is 11%.

Suggest whether the project can be accepted or rejected. ***(04)***

2A. Explain the factors involved in deciding final cost of purchased electricity? ***(03)***

2B. A power station must meet the following demand of different groups of customers:

- Group A: 200 kW between 8 A.M. and 6 P.M.
- Group B: 100 kW between 6 A.M. and 10 A.M.
- Group C: 50 kW between 6 A.M. and 10 A.M.
- Group D: 100 kW between 10 A.M. and 6 P.M. and then between 6 P.M. and 6 A.M.

Determine

(i) Maximum demand
(ii) Units generated per day.
(iii) Load factor.

(03)

2C. List out at least TWO benefits of Demand side management for the customers, society, government, and electrical utilities.

(04)

3A. With respect to lighting schemes, what is effectiveness and efficiency, explain?

(03)

3B. An office replaces its existing lighting system comprising of 10 Compact Fluorescent Lamp (30 Watt each) with equal number of LED (10 Watt each). If the average use (operational hours per lamp) is 2000 hours per annum, calculate the annual energy savings, the annual monetary savings as well as the payback period. Take the cost of LED lamp as Rs. 60 per lamp and the electricity tariff as Rs.9 per kWh.

If 1 KG of CO2 is emitted per KWH of energy consumed, what is the saving in CO2 emissions with LED light replacements?

(03)

3C. The input parameter measured for a 15 kW, 3 phase, 415 V induction motor is 25 A and 12 kW at 410 V.
Calculate the following:
(a) Apparent Power drawn by the motor at the operating load
(b) Reactive Power drawn by the motor at the operating load
(c) Operating power factor
(d) Percentage loading on the motor.

(04)

4A. Give suitable reasons for preferring steam as heating/driving medium in industrial applications.

(03)

4B. Draw a neat sketch of Water tube and Fire tube boiler and label their parts.

(03)

4C. The ultimate analysis of Indonesian coal is as given below:
Carbon (%C): 59%, Hydrogen(%H_2): 4%, Sulphur(%S) : 0.56%, Mineral Matter (%MM): 14% Oxygen(%O_2) : 12%, Moisture (%M): 9.43%, Nitrogen (%N): 1.01% a.

a) Find out actual mass of air supplied for combustion of 2000 kg/hr of coal with 60% excess air.
b) Find out NCV of the fuel if GCV of the coal is 5500 kcal/kg.

If needed, following formulas may be used: ***(04)***

1. GCV = NCV + 584x(9%H+%M)/100 kcal/kg
2. Theoretical air required for complete combustion

= [(11.6 x %C) + {34.8 x (%H_2-%O_2/8)}+ (4.35 x %S)]/100 kg/kg of fuel

5A. List out ANY THREE energy efficient electrical appliances whose global adoption must be accelerated to reduce electricity consumption and mitigate climate change.

(03)

5B. (a) What is Solar Constant and Solar Insolation?

(b) A 375 Watt solar panel of the size 1.20 m x 1.50 m is installed in a solar photovoltaic power plant on a roof top area of a structure having dimensions of 10 m x 15 m. What will be the panel conversion efficiency if the solar insolation is 1000 Watt per square meter?

(03)

5C. A load which is situated near a river requires continuous power of 600 kW all through the year. Head available is 25m. The water flow in a year is i) 5 m^3 /s for 4 months ii) 3 m^3 /s for 4 months and iii) 6 m^3 /s for 4 months. Assuming the overall plant efficiency as 80%, Find the following:

i) the rating of standby unit required to supply the deficit power if there is no reservoir and water is utilised as and when it flows.

ii) with reservoir, what will be the excess power available?

(04)