Name:

Enrolment No:

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Programme : M Tech Energy Systems **Semester: III**

Course : Energy Management and Audit **Time: 03 hrs.**

Course Code : EPEC – 8002 **Max. Marks: 100**

Instructions: Internal choice is given in Q9 And Q11.

SECTION A

S. No.		Marks	CO
Q1	Discuss the importance of energy audit in reference to the company and environment.	**4**	**CO1**
Q2	Discuss any five benchmarking parameters used by different industries with their benefits.	**4**	**CO2**
Q3	Draw and explain the cyclic process of ISO-50001 Energy Management System.	**4**	**CO3**
Q4	List down the benefits of PAT scheme with reference to the Designated Consumers and environment.	**4**	**CO5**
Q5	Explain the objective of the energy policy in an organization and give one example of energy policy.	**4**	**CO3**

SECTION B

Q6	Discuss in detail how Bachat Lamp Yojna played the crucial role in Indian economy also discuss the methodology how this scheme was introduced and implemented in India.	**10**	**CO4**
Q7	A company has invested Rs.20 lakhs for installing WHR Boiler to recover waste heat from the flue gas in DG Set. Find out the IRR if the annual net savings cash flow accured for 6 years as given below: The company got a bank loan for the investment at 8% interest rate. Whether the company can recover the investment and repay the bank loan.	**10**	**CO1**

Year	**Annual Net Saving, Rs. lakhs**
1	6
2	6
3	7
4	7
5	8
6	8

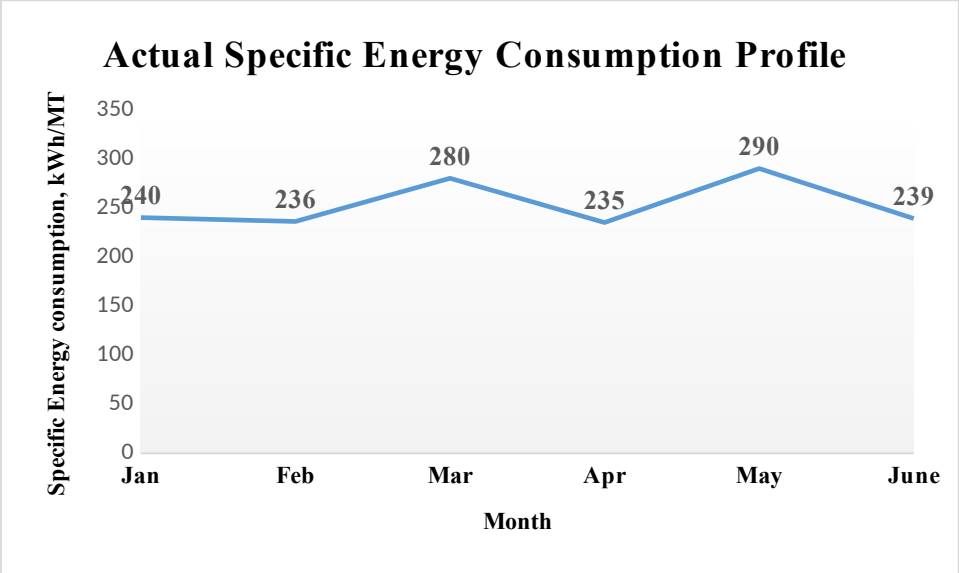
<table>
<tr>
<td>Q8</td>
<td>In a textile plant the average monthly energy consumption is 7,00,000 kWh of purchased electricity from grid, 40 kL of furnace oil (specific gravity = 0.92) for thermic fluid heater, 60 tonne of coal for steam boiler, and 40 kL of HSD (specific gravity = 0.885) for material handling equipment.
a. Calculate the energy consumption in terms of Metric Tons of Oil Equivalent for the plant.
b. Calculate the percentage share of energy sources used based on consumption in MTOE basis.
c. Comment weather the textile plant qualifies as a notified designated consumer under the energy conservation act.</td>
<td>10</td>
<td>CO2</td>
</tr>
<tr>
<td>Q9</td>
<td>(a) Discuss the key elements of monitoring and verification
(b) Consider a foundry which during a monitoring program produces the following sample data
<table>
<tr><th>Month</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr>
<tr><td>Production, Tonnes/Month, x</td><td>380</td><td>440</td><td>460</td><td>520</td><td>320</td><td>520</td><td>240</td><td>620</td><td>600</td></tr>
<tr><td>Energy Use, TOE/month, y</td><td>340</td><td>340</td><td>380</td><td>380</td><td>300</td><td>400</td><td>280</td><td>424</td><td>420</td></tr>
</table>
Draw the best fit straight line by deriving the equation of the line for energy benchmarking.

OR

(b) Energy saving measures was implemented in a process plant prior to Jan-2008. Use CUSUM technique and calculate energy savings for 6 months period of 2008. The company produced consistently 3000 T/month in each of the six months. Refer the graph given in table below. The predicted Specific energy consumption for 3000 MT production is 260 kWh/MT.
It may be noted that retrofits were not functioning during March & May 2008</td>
<td>2

8</td>
<td>CO2

CO5</td>
</tr>
</table>

		**8**	**CO5**
	SECTION-C		
Q10	Discuss how Energy Management System can be implemented in educational building by listing the mandates as per ISO-50001 Energy Management System standard.	**20**	**CO3, CO5**
Q11	(a) Discuss in detail Space-by-Space Method of Calculating Interior Lighting Power Allowance as per ASHRAE 90.1 Building Energy standard. (b) Discuss the steps how Demand Side Management Programs are designed. **OR** (b) Discuss the process flow diagram and Sankey diagram of Paper and Pulp industry.	**10** **10** **10**	**CO4** **CO4** **CO4**

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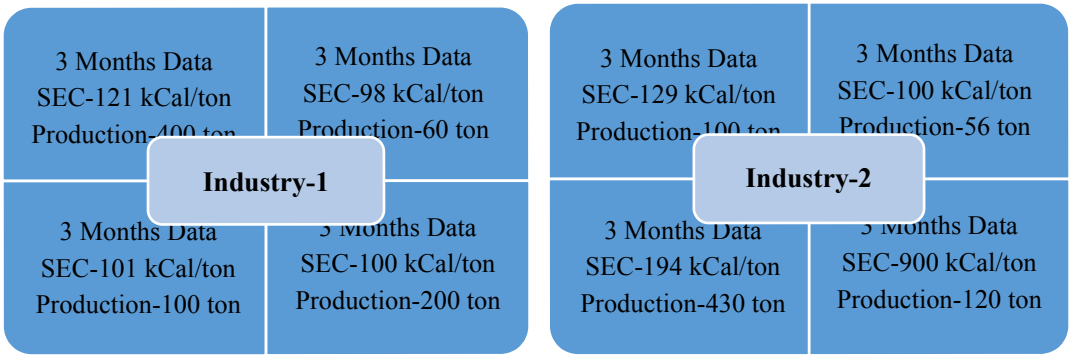
SECTION A

S. No.		Marks	CO
Q1	List down the main aspects of ISO-50001 Energy Management Systems Standard.	**4**	**CO3**
Q2	Explain the concept of Benchmarking and on what criterion benchmarking parameters are different from Specify Energy Consumption parameters.	**4**	**CO2**
Q3	Explain the objectives of Energy Conservation Building Code.	**4**	**CO4**
Q4	List down the methodology of conducting detail energy audit.	**4**	**CO1**
Q5	A thermal power plant uses 0.65 kg of coal to generate one kWh of electricity. If the coal contains 54% carbon by weight, calculate the amount of CO2 emissions/ kWh generated under complete combustion conditions.	**4**	**CO2**
	SECTION B		
Q6	Renovation and Modernization (R&M) of a 210 MW coal fired thermal power plant was carried out to enhance the operating efficiency from 28% to 32%. The specific coal consumption was 0.7 kg/kWh before R&M. For 8000 hours of operation per year, and assuming the coal quality remains the same, calculate **i)** the coal savings per year and **ii)** the expected avoidance of CO2 into the atmosphere in Tons/year if the emission factor is 1.53 kg CO2/kg coal	**10**	**CO4**
Q7	A 500 MW coal plant based on conventional pulverized fuel has a gross efficiency of 38%. The Gross calorific value of the coal used is 4000 kCal/kg with 40% total carbon. A supercritical unit of 500 MW replaces the plant with a gross efficiency of 40% using the same characteristic coal. Calculate the following **(a)** Specific coal consumption after replacement **(b)** Amount of coal and carbon di-oxide saved during a year if the plant works for	**10**	**CO2**

	8000 hours.		
Q8	A chemical plant has a contract demand of 2500 kVA with the power supply company. The average maximum demand of the plant is 2100 kVA at a power factor of 0.95. The maximum demand is billed at the rate of Rs.300/kVA. The minimum billable maximum demand is 75 % of the contract demand. An incentive of 0.5 % reduction in energy charges component of electricity bill are provided for every 0.01 increase in power factor over and above 0.95. The average energy charge component of the electricity bill per month for the company is Rs.11 lakhs. The plant decides to improve the power factor to unity. **A.** Determine the power factor capacitor kVAr required, annual reduction in maximum demand charges and energy charge component. **B.** What will be the simple payback period if the cost of power factor capacitors is Rs.800/kVAr.	**10**	**CO1**
Q9	**(a)** During energy audit following data were obtained on a 3 phase induction motor: Rated capacity:37 kW Rated voltage: 415 V Rated current: 65 A Rated power factor: 0.89 Operating voltage: 410 V Operating current: 40 A Operating power factor: 0.75 Note: Motor efficiency does not change between 50 –100 % loading. The plant operates for 7000 hours per year with the electricity cost of Rs. 4 per unit. It is proposed to replace the original motor by a 30 kW energy efficient motor with 93% efficiency. • Determine the rated efficiency and the loading of the original motor. • Calculate the loading of the replaced motors. • If replacing the existing motor with energy efficient motor costs Rs.75,000, determine the payback period for the investment required for the energy efficient motor over the ordinary motor. **(b)** Explain in detail any 3 methods of relating plant energy consumption with production.	**5**	**CO1**

	OR **(b)** Explain the process flow diagram of Indian Railways, draw and explain its Sankey Diagram.	**5** **5**	**CO2** **CO2**
	SECTION-C		
Q 10	In the production department while reviewing weekly records, you note that energy consumption in the June 4th week has significantly increased from expected energy consumption. No reasons for this are documented and no actions are recorded. The energy manager says consumption probably increased because of a heat wave and states that no further evaluation or analysis is necessary. **a.** What is the potential nonconformity implied in the incident. **b.** What is the potential impact of the incidence for the auditee organization. **c.** Is there sufficient evidence to raise nonconformity at this stage explain your views in detail. **d.** What further audit evidence would you seek in order to establish the full extent and significance of the incident.	**20**	**CO3**
Q11	**(a)** During the Energy Audit of two pharmaceutical industries average SEC and production data was recorded for every 3 months in a year (4*3=12 one year) which is given below,  Make suitable assumptions and plot monthly Specific Energy Consumption of each Pharma Industry. It is proposed to implement energy efficiency project in both the industries by replacing the LDO fired boiler by biomass-fired boiler where it was calculated that energy dependency would be cut by 38.7% each		

	month. Keeping the operating hours same for both the campus determine the new monthly Specific Energy Consumption for each campus and show the results by using the common plot for both campus, give your comments on the performance of both industries.	**10**	**CO2**
	(b) Write short notes on • Energy cost • Industrial Benchmarking • Bachat Lamp Yojna • ISO-50002	**10**	**CO1** **CO2** **CO4** **CO5**
	OR		
	(b) Write short notes on • UDAY scheme • UJALA scheme • PAT Scheme • ECBC	**10**	**CO1** **CO2** **CO4** **CO5**