GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code: 3161919   **Date: 30-05-2025**

Subject Name: Energy Conservation and Management

Time: 10:30 AM TO 01:00 PM   **Total Marks:70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Explain: (1) Power factor (2) Energy audit (3) Non-commercial energy	**03**
	(b)	Discuss sector wise energy consumption scenario in India.	**04**
	(c)	List out the schemes of BEE. Discuss any two in detail.	**07**
Q.2	**(a)**	Explain Benchmarking in short.	**03**
	(b)	Explain working of Fluidized Bed Combustion (FBC) boiler with neat sketch.	**04**
	(c)	Discuss detailed audit or ten step methodology for energy conservation.	**07**

<div align="center">OR</div>

	(c)	Discuss main features of the Energy Conservation Act, 2001 in detail.	**07**
Q.3	**(a)**	Explain the terms: Payback period, Cashflow and Return on Investment.	**03**
	(b)	What is ESCOs? Discuss the role of ESCOs.	**04**
	(c)	Define the term Net Present Value (NPV). Using the net present value analysis technique, evaluate and comment on the NPVs of the two proposed projects shown in the table. The annual discount rate is 8% for each project. Also find the future value of the projects for the 7th year.	**07**

	Project 1	Project 2
Capital cost (Rs.)	20000	20000
Year	Net annual saving (Rs.)	Net annual saving (Rs.)
1	5000	5500
2	5000	5300
3	5000	5200
4	5000	5000
5	5000	4500
6	5000	4500
Total net savings at the end of the 6th year	30000	30000

<div align="center">OR</div>

Q.3	**(a)**	List out the elements of monitoring and targeting.	**03**
	(b)	State the techniques used for data analysis. Explain any one using neat sketch.	**04**
	(c)	The energy production data of an industry follows a relationship:	**07**

Energy consumption = 0.5 P(Production)+220 in a year 2012. After installation of waste heat recovery system, the collected data for six months is given the table below:

Using CUSUM technique, calculate energy savings in terms of ton of oil equivalent (toe) and the saving in specific energy consumption achieved from waste heat recovery system. Also draw a CUSUM Chart for the data.

2012 – Month	Actual Energy Consumption, toe/month	Actual production, Ton/month
July	590	760
Aug	605	820
Sept	670	940
Oct	582	750
Nov	512	610
Dec	540	670

Q.4 (a) Explain the terms: Boiler efficiency, cogeneration, heat exchanger effectiveness. **03**
(b) Write a short note on Boiler blow down and how to calculate it. **04**
(c) Discuss the energy conservation opportunities for the boiler **07**

OR

Q.4 (a) Differentiate between insulation and refractories. **03**
(b) What is the economic thickness of insulation. Discuss the factors affecting it. **04**
(c) List out the steam traps and explain any two steam traps with neat line sketches. **07**

Q.5 (a) Classify the types of furnaces according to their use. **03**
(b) Write a note on energy efficiency measures in the industrial furnaces. **04**
(c) A counter flow double pipe heat exchanger using hot process liquid is used to heat **07**
the water. The water flows at 12 m^3/hr. The process liquid enters the heat exchanger
at 200°C and leaves at 140°C. The inlet and exit temperature of water are 30°C and
100°C respectively. Specific heat of water is 4.2 kJ/kg$^\circ$C.
Determine:
  (a) The heat transfer area, if overall heat transfer coefficient is 814 W/m$^{2\circ}$C.
  (b) The percentage increase in area, if the fluid flows were parallel?

OR

Q.5 (a) What is waste heat recovery and list out devices used for waste is recovery. **03**
(b) Differentiate between topping and bottoming cycle in cogeneration. **04**
(c) Explain working of heat pipe with neat sketch and discuss its two applications for **07**
waste heat recovery.

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