

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VI EXAMINATION – WINTER 2025

Subject Code:3161919

Date:25-11-2025

Subject Name:Energy Conservation and Management

Time:02:30 PM TO 05:00 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) Enlist various schemes of the Bureau of Energy Efficiency (BEE) and its benefits.	03
	(b) Differentiate between primary and secondary sources and state examples of each.	04
	(c) Discuss the sectorial energy consumption of India and the challenges faced by our country in meeting its energy demands and achieving energy security.	07
Q.2	(a) Summarize the key features of the Energy Conservation Act 2001 and state its objectives.	03
	(b) Explain Energy Management Information Systems (EMIS) and its role in energy monitoring and targeting for industries.	04
	(c) Define the Energy Conservation Building Code (ECBC) and its significance in promoting energy-efficient building construction.	07
	OR	
	(c) Discuss the provisions of the Electricity Act 2003 related to energy conservation and analyze the impact of the Electricity Act on the Indian power sector for energy security.	07
Q.3	(a) List various energy audit instruments used for temperature and pressure data collection and analysis during an audit in process industry.	03
	(b) Explain the concept of the cumulative sum of differences (CUSUM) analysis for detecting changes in energy performance.	04
	(c) Explain the following terms: Simple payback period, return on investment (ROI), net present value (NPV), and internal rate of return (IRR).	07
	OR	
Q.3	(a) Explain the role of energy Service Companies (ESCOs) from the energy conservation point of view.	03
	(b) Classify Energy Audit and explain various phases of energy audit.	04
	(c) Explain how energy audits help to identify opportunities for improving the efficiency of lighting systems.	07
Q.4	(a) Enlist various energy conservation techniques for industrial furnaces.	03
	(b) Explain the direct and indirect methods of boiler efficiency evaluation.	04

	(c)	Enlist various energy conservation techniques for central air conditioning Plant.	07
	OR		
Q.4	(a)	Explain the importance of insulation in steam pipes. List common insulating techniques for steam pipes.	03
	(b)	Explain networking and Pinch analysis for heat exchanger performance evaluation,	04
	(c)	Differentiate between cogeneration and Trigeneration techniques.	07
Q.5	(a)	What is the Prototype Carbon Fund, and what are its objectives?	03
	(b)	Discuss the significance of the UNFCCC in addressing global climate change challenges.	04
	(c)	Explain the objectives of the Clean Development Mechanism and discuss how the CDM promotes sustainable development and greenhouse gas emission reductions.	07
	OR		
Q.5	(a)	Explain the objectives of Bachat Lamp Yojna.	03
	(b)	Assess the effectiveness of the Kyoto Protocol in reducing greenhouse gas emissions and addressing climate change.	04
	(c)	With examples explain how the organizations can reduce energy losses and improve process efficiency through better energy management practices.	07

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VI (NEW) EXAMINATION – WINTER 2024****Subject Code:3161919****Date:05-12-2024****Subject Name: Energy Conservation and Management****Time:02:30 PM TO 05:00 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.

- Q.1** (a) Define i) Renewable Energy ii) Non-Renewable Energy iii) Per Capita energy consumption **03**
 (b) Briefly explain various schemes relating to Bureau of Energy Efficiency (BEE) for designated consumers, State designated agencies. **04**
 (c) Write short note on Energy Conservation Act-2001. **07**
- Q.2** (a) Compare Net Present Value and Internal Rate of Return **03**
 (b) List benefits of Energy Monitoring and Targeting **04**
 (c) Answer the following questions in term of Energy Servicing Companies (ESCOs). 1) Types of Performance contract offered 2) Role and responsibilities 3) Limitation **07**
- OR**
- (c) Write note on 'Indian Energy scenario' **07**
- Q.3** (a) Define Energy Management and state its objective. **03**
 (b) List factors affecting refrigeration and air conditioning system performance and explain any one from it. **04**
 (c) List out key instruments used for energy audit and explain their function. **07**
- OR**
- Q.3** (a) List down the essential elements of monitoring and targeting System? **03**
 (b) Define the energy audit as per Energy Conservation Act 2001. List out the objectives of energy management. **04**
 (c) Distinguish between 'preliminary energy audit' and 'detailed energy audit'? **07**
- Q.4** (a) Define Present value and Net present value **03**
 (b) Explain techniques of energy conservation in refrigerated cold storage plants. **04**
 (c) List application, advantages of Thermic fluid heaters and super critical boilers from energy conservation point of view. **07**
- OR**
- Q.4** (a) Define the following terms: Dew Point temperature, HCV, Latent heat of fusion **03**
 (b) Compare topping cycle and bottoming cycle for cogeneration **04**
 (c) List application, advantages of Thermic fluid heaters and super critical boilers from energy conservation point of view. **07**
- Q.5** (a) List the various key instruments for carrying out energy audit **03**
 (b) Give recommendation for efficient design of furnace. **04**
 (c) Explain in brief about Clean Development Mechanism. **07**
- OR**
- Q.5** (a) Give tips for energy saving for future. **03**
 (b) Summarize the practices to be followed for proper steam trap installation. **04**
 (c) Explain Bachat Lamp Yojana, its aim and benefits. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – WINTER 2023****Subject Code:3161919****Date:13-12-2023****Subject Name: Energy Conservation and Management****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
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		MARKS
Q.1	(a) Classify energy sources.	03
	(b) Define the terms: Return on Investment, Net Present Value, Internal Rate of Return, Time value of money	04
	(c) Write short note on Indian Energy scenario.	07
Q.2	(a) Define energy management. Explain its benefits.	03
	(b) How BEE help in implementing Energy Conservation Act?	04
	(c) Define the following terms: (i) SPP (ii) Present value of money (iii) ROI (iv) NPV (v) IRR (vi) Sensitivity analysis (vii) Risk analysis.	07
OR		
	(c) Explain detailed energy audit.	07
Q.3	(a) What are the features and notifications made under Energy conservation Act 2001?	03
	(b) Discuss the role of Energy Service Companies (ESCOs)	04
	(c) Define and explain following terms (i) Plant energy performance (ii) Production factor (iii) Reference year equivalent energy use	07
OR		
Q.3	(a) Explain Sensitivity Analysis.	03
	(b) Write short note on Bench marking.	04
	(c) What are the benefits of monitoring & targeting system? Differentiate between (1) Energy monitoring & targeting (2) Internal & external benchmarking.	07
Q.4	(a) List various sources of waste heat and potential of energy generation out waste heat.	03
	(b) Write brief note on networking and pinch analysis of heat exchangers.	04
	(c) Explain selection procedure of optimum steam traps for condensate and flash steam recovery system in textile industry from energy conservation point of view.	07

OR

- Q.4** (a) Explain typical ice bank system and energy savings derived out of it. **03**
- (b) How to save energy in Compressed air delivery system as well as compressor? **04**
- (c) What do you mean by co-generation? Classify co-generation system & explain bottoming cycle with sketch. **07**

- Q.5** (a) Explain boiler blowdown with advantages. **03**
- (b) What do you mean by co-generation? Classify co-generation system & explain bottoming cycle **04**
- (c) Calculate indirect efficiency of boiler for the following data **07**

Fuel firing rate = 5599.17 kg/hr Steam generation rate = 21937.5 kg/hr, steam pressure = 43 kg/cm², Steam temperature = 377°C, Feed water temperature = 96°C, percentage of CO₂ in Flue gas = 14, percentage of CO in flue gas = 0.55 Average flue gas temperature = 190°C, Ambient temperature = 31°C, humidity in ambient air = 0.0204 kg / kg dry air, surface temperature of boiler = 70°C, wind velocity around the boiler = 3.5 m/s, total surface area of boiler = 90 m², GCV of Bottom ash = 800 kCal/kg, GCV of fly ash = 452.5 kCal/kg, Ratio of bottom ash to fly ash = 90:10, Fuel Analysis (in %) Ash content in fuel = 8.63, Moisture in coal = 31.6, Carbon content = 41.65, Hydrogen content = 2.0413, Nitrogen content = 1.6, Oxygen content = 14.48, GCV of Coal = 3501 kCal/kg

OR

- Q.5** (a) What are the disadvantages of 'direct method' of boiler efficiency evaluation over 'indirect method'? **03**
- (b) Define the following terms: Boiler efficiency, Evaporation ratio, Turn down ratio, HCV. **04**
- (c) The following are the data collected for a boiler using furnace oil as the fuel. Find out the boiler efficiency by indirect method. **07**

Ultimate analysis (%)

Carbon = 84 Hydrogen = 12 Nitrogen = 0.5 Oxygen = 1.5 Sulphur = 1.5 Moisture = 0.5

GCV of fuel = 10000 kCal/kg, Fuel firing rate = 2648.125 kg/hr, Surface Temperature of boiler = 80°C, Surface area of boiler = 90 m², Humidity = 0.025 kg/kg of dry air, Wind speed = 3.8 m/s

Flue gas analysis (%)

Flue gas temperature = 190°C Ambient temperature = 30°C, Co₂% in flue gas by volume = 10.8, O₂% in flue gas by volume = 7.4

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI(NEW) EXAMINATION – WINTER 2022****Subject Code:3161919****Date:17-12-2022****Subject Name:Energy Conservation and Management****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
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MARKS

- Q.1**
- (a) Define energy security. Enlist different strategies to achieve it. **03**
- (b) Discuss India's present energy scenario and long-term energy scenario. **04**
- (c) Discuss in brief Energy Conservation Act-2001 and its features. List four important duties of energy manager in industry as per Energy conservation act-2001. **07**
- Q.2**
- (a) What is the objective of carrying out sensitivity analysis? **03**
- (b) Calculate the Net Present Value for boiler replacement project. Annual savings after replacement of boiler for three years is Rs. 5, 00,000, Rs. 5, 50,000, Rs. 6, 50,000. Total project cost is Rs 13.5 lakh. Considering cost of capital as 12%. **04**
- (c) Answer the following questions in term of Energy Servicing Companies (ESCOs). **07**
- 1) Types of Performance contract offered
 - 2) Role and responsibilities
 - 3) Limitation
- OR**
- (c) Look at two purely fictitious lighting systems, A and B. Lighting System A is the existing system and Lighting System B is a proposed retrofit system which simply includes more-energy-efficient lamps and ballasts. They produce comparable light output. **07**

	Lighting System (A)	Proposed Lighting System (B)
No. of fixtures	100	100
Input Watts / Fixtures	175	175
Hours of operation / Year	3000	3000
(kWh)		
Energy consumption/Year	525 / fixture	300/ fixture
(kWh)		
Utility cost/kWh	Rs 1.0	Rs 1.0
Cost of implementation	-	Rs.
(Rs.)		700/fixture

Define the following for above case study and also calculate:

- 1) Simple payback
- 2) Five-year cash flow
- 3) Simple return on Investment

- Q.3** (a) List down the essential elements of monitoring and targeting System? **03**
 (b) What are the base line data that an audit team should collect while conducting detailed energy audit? **04**
 (c) List steps involved in 'detailed energy audit'. Give a typical energy audit reporting format. **07**

OR

- Q.3** (a) Define the energy audit as per Energy Conservation Act 2001. List out the objectives of energy management. **03**
 (b) Consider a foundry which during a monitoring Programme produces the following sample data: **04**

Month	1	2	3	4	5	6	7	8	9
Production Tonnes/month	380	440	460	520	320	520	240	620	600
Energy use, (Toe/month)	340	340	380	380	300	400	280	424	420

Calculate equation of line for predicted energy calculation.

- (c) Distinguish between 'preliminary energy audit' and 'detailed energy audit'? **07**
- Q.4** (a) Which instruments are required for indirect efficiency testing of boiler? **03**
 (b) Testing coal-fired boiler is more difficult than oil-fired boiler. Give reasons. **04**
 (c) A multi-storied shopping mall has installed 5 x 110 TR reciprocating compressors of which four compressors are in use for 16 hours per day. Due to higher energy cost shopping mall chief engineer has decided to replace reciprocating compressors with screw compressors. Chief engineer need following input from energy consultant. The specific power consumption for reciprocating and screw compressor are 0.8 and 0.65 kW/TR. **07**
- 1) Comparison of power consumption of both reciprocating and screw compressors?
 - 2) Annual cost savings (for 350 days operation). Present unit cost Rs 6.50 per kWh, investment for 220 TR machine Rs 30 lakh.

OR

- Q.4** (a) Why cogeneration system efficiency will be higher? Give the difference between "Topping Cycle" and "Bottoming Cycle"? **03**
 (b) What are the major points to be considered for developments of Waste heat recovery system? **04**
 (c) The following are the data collected for a boiler using coal as the fuel. **07**

% Excess air supplied = 45.17
 Average flue gas temperature = 190°C
 Ambient temperature = 31°C
 GCV of Bottom ash = 800 kCal/kg
 GCV of fly ash = 452.5 kCal/kg
 Ratio of bottom ash to fly ash = 90:10
 Actual mass of dry flue gas = 7.54 kg / kg of coal
 Specific heat of flue gas = 0.23 kJ/kg°C
Fuel Analysis (in %)
 Ash content in fuel = 8.63
 Moisture in coal = 31.6
 Carbon content = 41.65

Hydrogen content = 2.0413

Nitrogen content = 1.6

Oxygen content = 14.48

GCV of Coal = 3501 kCal/kg

Calculate:

- 1) Theoretical air requirement per kg of coal
- 2) Actual mass of air supplied per kg of coal
- 3) % Heat loss in dry flue gas
- 4) % Heat loss due to unburnt in fly ash
- 5) % Heat loss due to unburnt in bottom ash

- Q.5 (a)** Why steam condensate recovery is important? **03**
- (b)** What are the precautions to be taken for effective steam distribution and utilization in any heating application? **04**
- (c)** Give the answer for following: **07**
- 1) Principle of Kyoto Protocol
 - 2) Clean Development Mechanism (CDM)
- OR**
- Q.5 (a)** List out the benefits for Clean Development Mechanism (CDM) to Developed and Developing countries. **03**
- (b)** What is the mission of Prototype Carbon Fund (PCF)? List out its objectives as per United Nations Framework Convention on Climate Change (UNFCCC) **04**
- (c)** Answer the following questions: **07**
- 1) What are the parameters to be considered in the design of an efficient furnace?
 - 2) What care should be taken when using furnace for proper heat distribution in a furnace?
