Seat No.: _____ Enrolment No._____

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.**
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)**	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). 1) Types of Performance contract offered 2) Role and responsibilities 3) Limitation	**07**
		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 (kWh)	3000	3000
Energy consumption/Year (kWh)	525 / fixture	300/ fixture
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 (UNFCC) **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?

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