

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

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

**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/cm<sup>2</sup>, Steam temperature = 377°C, Feed water temperature = 96°C, percentage of CO<sub>2</sub> 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 m<sup>2</sup>, 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 m<sup>2</sup>, 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, CO<sub>2</sub>% in flue gas by volume = 10.8, O<sub>2</sub>% in flue gas by volume = 7.4

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