Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ME)/SEM-2/PTM-205(a)/2012

2012

ENERGY MANAGEMENT AND AUDIT

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) Twenty five barrels of crude oil is approximately equal to

   a) 2500 litres b) 4000 litres

   c) 6000 litres d) 12500 litres.

   ii) A 10 kW motor is drawing 5 kW. If the rated efficiency of the motor at full load is 0·90, the % loading of the motor is

   a) 50% b) 55·55%

   c) 45% d) 90%.

iii) The four pillars of successful energy management are technical ability, monitoring system, top management support and

a) energy audit plan b) strategy plan

c) financial plan d) quality plan.

iv) The present value of an equipment is Rs. 8000 and discount rate is 10%. The future value of the cash flow at the end of 2 years is

a) Rs. 8,000 b) Rs. 6,480

c) Rs. 9,680 d) Rs. 9,600.

v) Non-contact speed measurement can be carried out by

a) tachometer b) speedometer

c) stroboscope d) oscilloscope.

vi) Name plate kW or, HP rating of a motor indicates

a) input kW or, HP to the motor at full load

b) output kW or, HP of the motor at full load

c) minimum input kW or, HP to the motor

d) output kW or, HP of the motor at 90% of full load.

vii) The Designated National Agency (DNA) of India for Clean Development Mechanism (CDM) is

a) Ministry of New and Renewable Energy (MNRE)

b) Ministry of Environment and Forests (MOEF)

c) Bureau of Energy Efficiency (BEE)

d) Central Electricity Regulatory Commission (CERC).

viii) In a Cumulative Sum (CUSUM) chart, if the graph is horizontal for two consecutive periods then

a) actual energy consumption is reduced

b) specific energy consumption is going up

c) actual and calculated energy consumption are the same

d) each one of the above may be true.

ix) Return on Investment (ROI) as a fraction means

a) (annual net cash flow) / (capital cost)

b) (initial investment) / (annual return)

c) (annual cost) / (cost of capital)

d) Net Present Value (NPV) / Future Value of Cash Flow (FV).

x) One Certified Emission Reduction (CER) in equivalent of CO_2 emission is

a) 1 kg of CO_2 b) 1 tonne of CO_2

c) 10 kg of CO_2 d) 10 tonne of CO_2.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Briefly explain the 'Time of Day' (TOD) Tariff and how it is beneficial for the power system and consumers ? Name any two industries where TOD benefits can be utilized. 3 + 2
3. Write a note on 'Targeted Energy Audit'.
4. What do you mean by 'Energy Security' ? Name few strategies that a country may adopt to ensure this. 2 + 3

5. Calculate the Net Present Value (NPV) over a period of 3 years for a project with the following data. The discount rate is 15% :

Year	Investment (Rs.)	Savings (Rs.)
0	1,00,000	—
1	50,000	75,000
2	—	75,000
3	—	75,000

6. An Energy Manager in a factory has gathered following data to arrive at the Plant Energy Performance (PEP). Reference year (2010) energy use = 15 million kCal. Production factor for the current year (2011) = 0·92, current year's energy use = 14 million kCal. Find the PEP of the factory for the year 2011 :

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Briefly define Active and Reactive Power. 4
   b) What are the main purposes of Material and Energy Balance ? 4
   c) The production capacity of a paper drying machine is 500 TPD (Tonne per Day) and is currently operating at an output of 480 TPD. To find out the steam requirement for drying, the Energy Manager measures the dryness of the paper both at inlet and outlet of the paper drying machine, and are found to be 60% and 95% respectively.

The steam is supplied at 3·50 kg/cm^2, having a latent heat of 513 kCal/kg. The evaporated moisture temperature is around 100°C having enthalpy of 640 kCal/kg.

i) Estimate the quantity of moisture to be evaporated per hour

ii) Also estimate the input steam quantity requirement for moisture evaporation per hour.

4 + 3

8. a) Define 'Energy Audit' following EC-Act, 2001. 3

b) State main objectives of 'Energy Management'. 4

c) A 500 MW coal plant based on conventional pulverised fuel has a gross efficiency of 38%. The Gross Calorific value of the coal used is 4000 kCal/kg with 40% total carbon. A supurcritical unit of 500 MW replaces the plant with a gross efficiency of 40% using the same coal. Calculate the following :

i) Specific coal consumption after replacement. 3

ii) Amount of coal and carbon-di-oxide saved during a year if the plant works for 8000 hours. 5

9. a) What is Energy Service Company (ESCO) ? 2

b) Explain the function of an ESCO in performance contracting. 6

c) Name any two macro factors considered in the sensitivity analysis of major energy saving projects ? 2

d) An energy saving proposal involves an investment of 20 lakh in an industry and is expected to provide an average annual net saving of Rs. 5 lakh/annum. The cost of borrowing the interest is 15%. What is the return on investment (ROI) ? State with reason whether the investment is justified. 5

10. a) Define 'Energy Monitoring and Targeting'. 4

b) What are the benefits of Energy Monitoring and Targeting ? 4

c) Use CUSUM technique to develop a Table and to calculate energy savings for 6 (six) months period. For calculating total energy saving, average production can be taken as 8000 MT per month. Refer to field data given in the table below : 7

Month	Actual Specific Energy Consumption (SEC), kWh/MT	Predicted SEC, kWh/MT
July	1310	1330
August	1302	1330
September	1340	1330
October	1335	1330
November	1332	1330
December	1324	1330

11. a) Define sustainable development and give two examples of how it can be practised in day to day life. 2 + 2

b) Write short a note on 'Clean Development Mechanism' (CDM) following Kyoto Protocol. 3

c) Compare the performance of Centrifugal Chiller with Vapour Absorption Chiller (VAM):

Parameter	Centrifugal Chiller	VAM
Chilled water flow (m3/h)	189	180
Condenser water flow (m3/h)	238	340
Chiller inlet temp (°C)	13·0	14·6
Condenser water inlet temp (°C)	27·1	33·5
Chiller water outlet temp (°C)	7·7	9·0
Condenser water outlet temp (°C)	32·0	39·1
Compressor power consumption (kW)	190	—
Steam consumption (kg/h)	—	1570
Chilled water pump power requirement (kW)	28	28
Condenser water pump power requirement (kW)	22	33
Cooling tower fan power requirement (kW)	6·0	15

i) Evaluate Tonnes of Refrigeration (TR) of both the systems.

ii) Compare both the Chillers' auxiliary power consumptions, give the reason. 4 + 4

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