

M.TECH / RE /3<sup>RD</sup> SEM/ REEN 6101/2017  
ENERGY MANAGEMENT AND AUDIT  
(REEN 6101)

Time Allotted : 3 hrs

Full Marks : 70

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

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

**Group - A**

**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) In force field analysis which one of the actions given below does not fall under positive force?  
(a) High price of energy  
(b) Energy efficient technology available  
(c) Top management commitment  
(d) Lack of awareness.
- (ii) What is the heat required to melt 2kg of ice from zero degree to liquid water at zero degree in "KJ" at atmospheric pressure ?  
(a) 672 (b)4520 (c)160 (d)1080.
- (iii) Which of the following is most accurate instrument for surface temperature measurement ?  
(a) Thermocouple (b)Pyrometer  
(c) Leaf type contact thermometer (d) All the above.
- (iv) Which of the following is not a duty of energy manager .  
(a)Report to BEE  
(b)Provide support to accredited energy auditing firm  
(c)Prepare a scheme for efficient use of energy  
(d)Sign an energy policy.
- (v) 50 MWh of energy and 2000 metric tonne of coal is equal to -----  
----metric-tons of oil equivalent(GCV of coal = 6000 kcal/kg) .  
(a) 1105 (b) 1050 (c) 1204.3 (d) 1404.5.

M.TECH / RE /3<sup>RD</sup> SEM/ REEN 6101/2017

- (vi) A furnace shell has to be cooled from 900°C to 50°C by circulating cooling water .The mass of the furnace shell is 2000kgs ,the specific heat of furnace shell material is 0.2 kcal/kg.°C ,water is available at 30°c .The maximum allowed outlet water temperature is 80°C. Neglecting the heat loss to surroundings, the quantity of water required to cool the furnace shell will be .  
(a) 3200kg (b) 3000 kg (c) 2000 kg (d)2800 kg.
- (vii) The cost of a heat exchanger is Rs.1.0 lakhs. The simple payback period (SPP) in years considering annual savings of Rs.60,000/- and annual operating cost of Rs.10,000 is  
(a) 0.5 (b) 1.66 (c) 2.0 (d) 6.0.
- (viii) If feed of 500 Tonnes per hour at 5% concentration is fed to a Crystallizer, the product obtained at 25% concentration is equal to \_\_\_\_\_ tonnes /hr.  
(a) 75 (b) 100 (c) 175 (d)200.
- (ix) Energy and production data are useful to calculate  
(a) specific energy consumption (b) specific production ratio  
(c) energy intensity (d) none of these.
- (x) A three phase induction motor is drawing 12 amperes at 440 volts. If the operating power factor is 0.8, then the power drawn by the motor is  
(a) 7.3 KW (b) 4.224 KW (c) 6.1 KW (d) 9.5 KW.

**Group - B**

2. (a) Energy conservation and Energy Efficiency are separate but related concepts. Justify the above statement in brief.  
(b) A gas fired water heater heats water flowing at the rate of 5 liters/min from 20°c to 75°c .If the GCV of the gas is 9569 kcal/kg ,what is the rate of combustion of gas in kg/min (Assume efficiency of water heater is 60%, density of water =1000 kg /m<sup>3</sup>,specific heat of water =1.0kcal / kg.°c).  
**5 + 7 = 12**
3. (a) A drilling machine drawing continuously 5 KW of input power and with an efficiency of 50%, is used in drilling a bore in an aluminum block of 5 kg of mass. How much will be rise in temperature of the block at the end of 200 seconds. Assume 20% of the energy imparted to the block is lost to surroundings and the balance is absorbed by the block in it's uniform heating (sp heat of aluminum = 0.212 kcal/kg °C).

- (b) Name the instruments used for following measurements
- This instrument has inbuilt chemical cells which measure various gases such as ----- O<sub>2</sub>, CO, NO<sub>x</sub>, SO<sub>x</sub>
  - Thermocouple which measure—flue gas, hot air, hot water temperature by inserting probe into stream
  - This is a non contact type measurement which when directed at heat source directly gives the temperature readout.
  - Illumination levels are measured with this meter. It contains a photocell which senses the light output, converts to electrical impulses which are calibrated in terms of illumination levels.

**8 + 4 = 12**

**Group - C**

4. (a) What is the purpose of material and energy balance ?
- (b) 1000 cubic meter of hot dye liquor is discharged at 90°C from the textile plant every day. How much water can be heated from 30°C to 60°C through waste heat recovery from the dye liquor? The other data are as follows
- Specific heat of water and dye liquor = 1 kcal/kg°C  
 Raw water temperature = 30°C  
 Desirable dye liquor discharge temperature = 40°C  
 Density of liquor = 1000 kg / litre

**5 + 7 = 12**

5. (a) Explain the steps involved in force field analysis, taking your own industry as an example. List down the positive and negative forces?
- (b) What are the actions requirement of good energy planning?

**6 + 6 = 12**

**Group - D**

6. (a) Explain why managerial skills are as important as technical skills in energy management?
- (b) What do you understand by the term fuel substitution? Give examples.
- 7.(a) Explain how accountability can be established at various levels of energy management?
- (b) Write short notes on "Energy Modelling".

**6 + 6 = 12**

**Group - E**

8. (a) Explain the key features of energy information system taking your own industry as example. List down the important data you would like to collect and monitor for effective energy management.
- (b) List from your own experience / thinking how employees can be motivated?

**7 + 5 = 12**

9. (a) Draw a sankey diagram of oil fired forging furnace indicating the % loss and loss areas .
- (b) Based on local pollution control department norms the maximum limit of dust in the gas stream leaving the industry should not exceed 1000 kg /day. A bag filter was installed to reduce the pollution from exhaust gas system.

Find out the dust collected in tons / day if the gas stream to the dust collector was entering at the rate of 150,000 cubic meter/ hr (inclusive of air ingress) containing 300mg/cubic meter of dust. Also find out whether, the industry meets the pollution norm if the plant operates for 24 hrs./day at same capacity.

**5 + 7 = 12**