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Why do you need simulation and models? 9. (a)

Calculate the heat content of steam generated from a boiler at 96% (b) dryness fraction [given sensible heat at 170°c saturation temperature is 171 kcal/kg and latent heat =489.6 kcal/kg].

6 + 6 = 12

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### **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 anv 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	
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 $10 \times 1 = 10$ 

- Which of the following is most accurate instrument for surface (i) temperature measurement for a hot pipe line? (a) Infrared temperature gun (b) Optical pyrometer
  - (c) Leaf type contact thermocouple (d) All mentioned above.
- One tone of refrigeration has the ability to remove ------heat (ii) in 24 hour period. (a) 50 kcal
  - (b) 3014 kcal (c)72576kcal (d) 12000kcal.
- (iii) Which energy source release the most climate alarming carbon pollution per kg.

(a) Oil (b) Coal (d) Bagasse. (c)Rice husk

- Power factor in an alternating current (AC) circuit is given by. (iv) (a) KW/KVA (b)  $KW/\sqrt{KW2} + KVAR2$ (c)  $[(KVA + KVAr)(kVA - KVAr)]^{0.5}$  /KVA

  - (d) All mentioned above.
- If air contains 77% by weight of nitrogen and 23% by weight of (v)oxygen. The mean molecular weight of air is, (a) 11.9 (b) 28.8 kg (c) 17.7 (d) none.
- (vi) A 230 volt ,100 watt rated incandescent bulb is operated at a constant voltage of 250 volt. Approximate power consumption of bulb is (a) 100 watt (b) 118 watt (d) none of the above. (c) 85 watt

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- (vii) A documented energy policy in industry.
  - (a) Satisfies regulation
  - (b) Reflects top management commitment
  - (c) Indicated availability of energy audit skills
  - (d) None of the above.
- (viii) A process flow diagram does not include
  - (a) Process control instrumentation
  - (b) Major equipment items
  - (c) Process and stream name
  - (d) major by pass and recirculation streams.
- (ix) 10 MWH of electrical energy is equal to -----ton of oil equivalent?
  - (a) 860 (b) 0.86 (c) 8600 (d) 86000.
- (x) Latent heat of evaporation of steam at 1.0kg/square cm pressure absolute is

(a) 540 kcal/kg	(b) 517.15 kcal/kg
(c) 489.5 kcal/kg	(d) none of above.

## Group -B

- 2. (a) Explain the major differences between preliminary and detailed energy audit.
  - (b) In a chemical plant the details of energy consumption are given in following table Compute the total energy consumption in "kilocalorie"

Electricity	10,000kwh
Fuel Oil	5000 Litre
Coal	1000kg
Ground nut chips	1000 kg

[GCV of coal =6000kcal/kg,GCV of fuel oil : 9600 kcal/kg ,GCV of groundnut chips =3000kcal/kg ,sp gr of fuel oil =0.89].

5 + 7 = 12

5 + 7 = 12

- 3. (a) Draw a Sankey diagram of a oil fired boiler indicating % energy losses.
  - (b) It is proposed to utilize 10,000kcal/hr from a heat source at 500°K.The engine is designed to produce 2kw from the above heat source and atmosphere as heat sink. The recorded atmospheric temperature varies from 42°c and 0°c in winter. Comment on the performance of engine.

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## Group -C

- 4. (a) What is gross and net heat rate with respect to power plant?
  - (b) In a process industry, 12,000 kg/hr water is currently being heated from 18°C to 80°C by indirect heating of steam. An opportunity has been identified which would preheat the inlet water to 45°C to reduce the steam required.Estimate the reduction in steam in kg/hr considering latent heat of steam as 530 kcal/kg in both the cases.

6 + 6 = 12

- 5. (a) Define black body ,white body and explain the term absorptivity and reflectivity in "Radiation".
  - (b) A steam pipe has 7.5 cm diameter and 30 meter long conveys 1000kg of steam/hour at a pressure of 20kg/sq cm .The steam enters the pipe with a dryness fraction of 0.90 and leaves the outer end of pipe with minimum 0.88.Calculate the heat loss per hour [Data : latent heat of steam is 452.6kcal/kg ].

5 + 7 = 12

## Group -D

- 6. (a) Explain the term "Energy Modelling" or, "Energy system modeling". Name some of the model implementing language.
  - (b) What are the four pillars of successful energy management system? Explain them in brief.

5 + 7 = 12

- 7. (a) What applications use single phase power in an industry ? Explain the term "contract demand".
  - (b) What is the "Load factor" and "demand factor" of a continuously operating facility that consumed 800000kwh of energy during a 30 day billing period and established a peak demand of 2000KW with connected load of 4000kw?

# Group —E

- 8. (a) What is meant by the term "Top down" and "Botttom up" in energy modeling?
  - (b) Draw a process flow diagram of any chemical unit process.

5 + 7 = 12

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