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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

MECHANICAL ENGINEERING

VII Semester

ME 514 / ME 9021 - Energy Conservation and Management

(Regulations : 2004 / 2008)

Time: 3 Hours

Answer ALL Questions

Max. Marks 100

PART - A (10 x 2 = 20 Marks)

1. Differentiate Primary Energy and Secondary Energy.
2. How "Specific Energy Consumption" in a process industry is defined ?
3. Name 2 types of transformers used in power transmission.
4. What do you understand by Harmonic Distortion ?
5. State the concept of Pinch.
6. Define "Equivalent Evaporation" in a boiler.
7. State the working principle of a Heat Pump.
8. How Refrigeration and Air Conditioning differ technically ?
9. Draw a "Cash Flow Diagram" for an investment made in an Energy Conservation Scheme.
10. How "Energy Performance Contracting" is defined ?

Part – B (5 x 16 = 80 marks)

11. Write a note on (4x4)
 - Energy Resource Management
 - Energy Management Information System
 - Life Cycle Costing of an Utility
 - Any 4 methods of Financial Appraisal of an Energy Conservation Scheme.
 12. a) (i) How Energy Efficiency and Energy Conservation are defined and differentiated ? Explain with an example. (6)
(ii) Define the following as mentioned in EC Act 2010 :
 - Designated Consumer • Energy Benchmarking • ECBC (6)(iii) Name 4 major Energy Consuming Sectors in India. (4)
- (OR)
- b) (i) How Preliminary Energy Audit and Detailed Energy Audit are defined ? (6)
(ii) How Energy Consumption and "Acid Rain & Ozone Layer Depletion" are related? Explain. (6)
(iii) What do the following instruments measure?
 - Fyrite • Pitot Tube • Psychrometer • Lux Meter (4)

13. a) (i) List 5 losses taking place in a motor operation. Indicate the values of these losses in % and show by a Sankey Diagram. (8)
 [Hint : Assume Total Loss = 100 %]
- (ii) Define the concept "All Day Efficiency of a Transformer". (4)
- (iii) List the merits and limitation of GLS (General Lighting Service) Lamps. (4)
- (OR)
- b) (i) A 3 ϕ , 500 hp, 50 Hz, 11 Ku star connected induction motor has a full load efficiency of 85 % at a lagging PF of 0.75. If it is desired to correct the PF to 0.92 lagging, determine the size / rating of the Capacitor Bank to be added. (6)
- (ii) Define Two Laws of illumination (Hint : Inverse Square Law & Lambert's Cosine Law). (6)
- (iii) Name two methods employed for speed control in a motor and brief. (4)
14. a) (i) Write down 3 main functions of a Steam Trap and 3 mostly widely used types of Steam Traps. (6)
- (ii) State the need for "Blow down" in a boiler. (4)
- (iii) Saturated Steam flows at a rate of 5 tph at 7 ksc (abs) with a velocity of 25 m / s. Determine the pipe size. (6)
- (OR)
- b) (i) Estimate the Boiler Efficiency by indirect method using the following: (10)
- | | |
|-----------------------------------|---|
| Fuel Firing Rate | = 7 000 kg / h, |
| Calorific Value | = 40 000 kJ / kg |
| Steam Parameters | = 7 kg / cm ² (abs) : Saturated |
| Boiler Feed Water Temp. | = 60°C |
| Fuel Analysis (wt %) | : C = 84, H = 12, S = 3 %, O ₂ = 1 % |
| Flue Gas Analysis | : CO ₂ = 11 % : CO = 1000 ppm : O ₂ = 7 % |
| Flue Gas Temperature | = 220°C : Ambient Air Temp = 30°C |
| Ambient Humidity | = 0.02 kg H ₂ O / kg Dry Air |
| Loss due to Ash Heat and Unburnts | = 0.8 % of Fuel CV |
| CO Heat of Conversion | = 23630 kJ / kg |
- (ii) Write a short note on. Flash Steam Utilization and Condensate Recovery w.r.t a Boiler. (6)
15. a) (i) How the Fans and Blowers are differentiated ? (3)
- (ii) A pump at rated speed consumes 40 kW of power to deliver 100 m³ / h of water at 100 m head. How these numbers would get altered if the pump is made to operate at 80 % of the rated speed ? (6)
- (iii) Quality of air entering the Cooling Coil °C : DBT WBT (7)
- | | | | |
|--|------|----|------|
| Quality of air entering the Cooling Coil | °C : | 25 | 19.5 |
| Quality of air leaving the Cooling Coil | °C : | 15 | 14 |
- Estimate the quantity of atmospheric air to be sent to the cooling coil in order to achieve a refrigeration effect of 10 TR.
 Assume the data, if any, that are not given.
- (OR)
- b) (i) Name 4 indirect benefits accrue through Waste Heat Recovery from a process operation (4)
- (ii) Draw and explain the Fan Curve (Characteristic Curve) and System Curve with a neat sketch (6)
- (iii) Establish a method to evaluate energy loss due to Compressed Air leakage in an air compressor. (6)