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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2013

B.E MATERIAL SCIENCE & ENGINEERING

Sixth Semester

ML 9029 FUELS FURNACES & REFRACTORIES

(Regulation R 2008)

30

Time: 3 Hours

Answer ALL Questions

Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Define thermo-electric effect.
2. How convection mode of heat transfer takes place in liquids?
3. What are fossil fuels? Give examples.
4. Name the fuel used in breeder type nuclear reactors.
5. State the principle of working of an electric arc furnace.
6. Give an example of a multi-zone furnace.
7. List out any two requirements of a refractory.
8. State the applications of refractories in power production.
9. Define green house effect.
10. State the merits of waste heat recovery.

Part – B (5 x 16 = 80 marks)

11. i) Consider a solid cylindrical rod of length 0.15 m and diameter 0.05 m. The top and bottom surfaces of the rod are maintained at constant temperatures of 20°C and 95°C, respectively, while the side surface is perfectly insulated. Determine the rate of heat transfer through the rod if it is made of (a) Copper, $k = 380 \text{ W/m}^\circ\text{C}$, (b) Steel, $k = 18 \text{ W/m}^\circ\text{C}$, and (c) Granite, $k = 1.2 \text{ W/m}^\circ\text{C}$. Repeat the above when the internal and external surface resistance values are 20 and 35 $\text{W/m}^2\text{K}$ respectively. (12)
- ii) Discuss the principle of measuring temperature with the help of a thermocouple. (4)
12. a)i) List out the requirements of a fuel. (4)
- ii) The percentage composition by mass of a solid fuel used in a boiler is as follows:
C=90%, $\text{H}_2=3.5\%$, $\text{O}_2=3\%$, $\text{N}_2=1\%$ and S=1%, the remainder being ash. Find the mass of air required per kg of fuel for complete combustion and mass analysis of dry products of combustion. If 20% excess air is supplied, determine the volumetric analysis of the products. (12)

OR

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- b)i) Briefly explain the various fossil fuels with their energy content. (8)
ii) Explain with a sketch how solar and geothermal heating can be utilised in winter conditions for warming up the room. (8)

13. a)i) Differentiate between induction type and resistance type furnaces. (4)
ii) Describe how a high frequency induction furnace melts cast iron with a sketch. (12)

OR

- b)i) Draw a sketch of a multi-zone furnace and label the parts. (6)
ii) Explain the temperature control in a furnace using a PID controller. (10)

14. a) What are heat resistant materials? Explain in detail any two heat resistant materials used in power & chemical industries. (3+13)

OR

- b) Name the commonly used refractory materials used in furnaces. Explain their properties and characteristics. (4+12)

15. a)i) Discuss the implications of long term use of fossil fuels on environment. Suggest a few measures to minimise their effect on environment. (11)
ii) Briefly discuss about carbon credits and carbon foot print. (5)

OR

- b)i) How waste heat can be recovered from thermal power sources. Support your answer with simple sketches. (12)
ii) List out major emissions from a fossil fuel power plant. (4)