Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CT)/SEM-4/CT-403/2011

2011

ENERGY ENGINEERING & FURNACES

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 × 1 = 10

   i) The macro component, resembling charcoal, occurring as patches of soft fibrous material, highly friable and responsible for dirty and dusty character of coal, is

   a) vitrain b) fusion

   c) clarain d) durain.

   ii) The coal, powdery form of which is capable of producing lumpy semi coke or coke on heating, is named as

   a) peat b) lignite

   c) bitunumous d) anthracite.

   iii) In which of the following processes, petroleum fraction is upgraded without greatly disturbing the average molecular weight of parent material ?

   a) Cracking b) Reforming

   c) Sweetening d) Visbreaking.

iv) High temperature carbonization of coal for manufacture of metallurgical coke is carried out at

a) 300 deg. C b) 700 deg. C

c) 1100 deg. C d) 1500 deg. C.

v) Steaming upward and downward through the fuel bed helps maintaining a uniform bed temp. in order to produce good quality

a) natural gas b) liquefied petroleum

c) blast furnace gas d) water gas.

vi) Minimum temperature of a furnace or kiln should be

a) 300 deg. C b) 350 deg. C

c) 400 deg. C d) 450 deg. C.

vii) Efficiency of recuperator is more for

a) cross flow type b) parallel flow type

c) counter flow type d) vertical flow type.

viii) Sp. fuel consumption means

a) heat utilized by the product/total tonnage

b) fuel utilized by the product/total tonnage

c) total heat input/total tonnage

d) fuel input/total tonnage.

ix) LTM kiln furniture means

a) low thermal mass type

b) low temperature modular type

c) low temperature muffle type

d) all of these.

x) For stoichiometric combustion of 1 kg of fuel, amount of air required is

a) 12.1 kg b) 13.1 kg

c) 14.1 kg d) 15.1 kg.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Write a note on energy audit and its management.

3. Complete combustion with minimum excess air improves fuel economy of a furnace. Discuss.

4. What is weathering of coal ? What are the properties that get affected due to this ? What are the measures for preventing weathering or spontaneous combustion of coal ? 1 + 2 + 2

5. Describe the basic principles of water gas generation. What is carbureted gas ? 3 + 2

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

6. Describe how crude petroleum is distilled to obtain useful products with the help of a flow sheet. What do you mean by Octane no. and Cetane no. ? How is the performance of petrol and diesel engine related to the hydrocarbon structure of the fuel ? What is the significance of determination of flash point and fire point of a fuel oil ? 6 + 4 + 2 + 3

7. What is the reason behind spontaneous ignition of coal ? Suggest some measures for prevention of weathering or spontaneous ignition of freshly mined coal. Describe the effect of heat on coal when it is heated in a furnace in absence of air, the temperature being gradually increased.

   What is the difference between gross calorific value and net calorific value ? Define inflammability limits. Indian coal tend to show comparatively high ash content. Why ?

   3 + 2 + 4 + 2 + 2 + 2

8. Show graphically how efficiency of a furnace varies with the temperature. Why dies it vary like this ? In what way optimum capacity utilization reduces firing cost ? What is the role of a burner for liquid / gaseous fuel ? explain classification of recuperators. Why is actual draught always less than the theoretical one ? 2 + 2 + 3 + 1 + 5 + 2

9. Classify draught. Discuss the mechanism of natural draught. What are the advantages of metallic heat exchangers over ceramic one ?

   Calculate the draught in mm of water column produced by a chimney of 32 meters height when temperature of gases within the chimney is 300 deg. C and temperature of outside air is 20 deg. C. The quantity of air supplied per kg of fuel is 18 kg. If the actual draught is 80% of the theoretical draught, calculate the actual draught.

   3 + 3 + 3 + 6