# ENERGY ENGINEERING AND FURNACES ( SEMESTER - 4 )

## CS/B.TECH (CT)/SEM-4/CT-403/09

1. .....
*Signature of Invigilator*

2. .....
*Signature of the Officer-in-Charge*

***Reg. No.*** | | | | | | | | | | | | | | |

***Roll No. of the Candidate*** | | | | | | | | | | | | | | |

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**CS/B.TECH (CT)/SEM-4/CT-403/09**

**ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009**

**ENERGY ENGINEERING AND FURNACES ( SEMESTER - 4 )**

Time : 3 Hours ] [ Full Marks : 70

***INSTRUCTIONS TO THE CANDIDATES :***

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

**No additional sheets are to be used and no loose paper will be provided**

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**FOR OFFICE USE / EVALUATION ONLY**

Marks Obtained

| | Group – A | | | | | | | | | | Group – B | | | Group – C | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Question Number*** | | | | | | | | | | | | | | | | | ***Total Marks*** | ***Examiner's Signature*** |
| ***Marks Obtained*** | | | | | | | | | | | | | | | | | | |

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**Head-Examiner/Co-Ordinator/Scrutineer**

**4660 (16/06)**

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**ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009**

# ENERGY ENGINEERING AND FURNACES

**SEMESTER - 4**

Time : 3 Hours ] [ Full Marks : 70

## GROUP – A

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following : 10 × 1 = 10

i) Constant composition of a particular coal seam over a wide area suggests that the coal is of

a) In situ origin b) Drift origin

c) both (a) and (b) d) none of these. ☐

ii) Very low volatile matter content is the characteristic of

a) Peat coal b) Anthracite coal

c) Lignite coal d) Bituminous coal. ☐

iii) The component which has the highest anti-knock value in gasoline is

a) Olefin b) Paraffin

c) Napthene d) Aromatic. ☐

iv) Natural gas has the highest percentage of

a) CO b) $H_2$

c) $CH_4$ d) $CO_2$ . ☐

v) The Caking Index of coal blend charge for producing metallurgical coke is about

a) 8 - 10 b) 9 - 12

c) 15 - 16 d) 21 - 22. ☐

vi) As temperatures increases, efficiency of furnace

a) increases

b) is constant

c) decreases

d) depends on type of furnace.

vii) Heat of reaction during combustion of fuel is highest for

a) sulphur b) hydrogen

c) carbon d) oxygen.

viii) Veneering means

a) to replace full refractory bricks with ceramic fibre for existing kilns

b) to put extra layer of ceramic fibre on existing structure

c) to replace part layer refractory brick of existing kilns by ceramic fibre

d) both (b) and (c).

ix) Atomisation of fuel-oil is done

a) to increase flame length

b) to decrease length of the flame

c) both (a) and (b)

d) for complete combustion.

x) One percent fuel is saved for every rise of combustion air temperature by

a) 17 deg. C b) 19 deg. C

c) 21 deg. C d) 23 deg. C.

## GROUP – B

### ( Short Answer Type Questions )

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

2. How is petroleum classified in accordance with Lane and Garten method ? Name four components for crude oil distillation along with their approximate boiling range.

3. What is coal petrography ? Briefly discuss the characteristics of major macro- and micro-components of coal.

4. Write about components of total furnace system.

5. Give an overview of energy audit.

## GROUP – C

### ( Long Answer Type Questions )

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

6. What is the difference between Gross and Net calorific value ? Why do flashback and blow-off occur in a Bunsen burner ? What are Inflammability limits ?

   Calculate the limits of inflammability of a gas containing 25% $CH_4$ , 45% $H_2$ 10% CO, 8% $CO_2$ and 12% $N_2$ .

| | $L_1$ | $L_2$ |
|---|---|---|
| CO | 12·5 | 74·0 |
| $H_2$ | 4·0 | 75·0 |
| $CH_4$ | 5·3 | 14·0 |

2 + 5 + 2 + 6

7. Describe the construction and operation of a bee-hive coke oven. State the merits and demerits of the process. With the help of a neat sketch, describe the method of recovery of valuable chemicals from the by-product recovery section of the coke oven plant. 5 + 3 + 7

8. "Complete combustion with minimum excess air can enhance fuel economy." Discuss. Why is negative draught better than positive draught though there are some advantages of positive draught ? Express specific fuel consumption. What is fuel gas ? Discuss the purpose of providing chimney to the furnace.

Calculate the effectiveness of a heat exchanger having the following parameters :

$T_{h,\,in}$ = 900 deg. C, $t_{h,\,out}$ = 800 deg. C, $t_{c,\,in}$ = 35 deg. C, $t_{c,\,out}$ = 240 deg. C,

$C_h$ = 980 × 0·25 and $C_c$ = 490 × 0·25. 6 + 2 + 1 + 1 + 2 + 3

9. Classify draught and explain each of them. Deduce an equation for natural draught of a chimney.

Calculate the draught in mm of water column produced by a chimney of 50 metre height where the temperature of the gases within the chimney is 400 deg. C and that of outside air is 30 deg. C. The amount of air supplied for burning of 1 kg of fuel is 18·0 kg. 4 + 7 + 4

END