

Code No: R09221803

**R09****Set No. 2**

**II B.Tech II Semester Examinations, APRIL 2011**  
**FUELS FURNACES AND REFRACTORIES**  
**Metallurgy And Material Technology**

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions  
 All Questions carry equal marks

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1. With the help of a schematic diagram explain the working of Roller and Table mill for the pulverization of coal. What are its advantages, disadvantages and applications. [15]
2. Explain the following:
  - (a) Thermal cracking
  - (b) Catalytic Cracking. [15]
3. (a) What is thermal diffusivity? Derive an expression for thermal diffusivity of an insulating material from first principles, under steady state heat conduction.  
 (b) Give a thermodynamic definition of heat.  
 (c) Give the expression for thermal resistance for conduction for a hollow cylinder in terms of inner and outer radii and explain it. [8+2+5]
4. (a) Compare and contrast cannel coals and boghead coals.  
 (b) How is the proximate analysis of a coal conducted and what is its significance in determining the utility of a coal for a particular purpose. [6+9]
5. Discuss the spalling resistance of magnesite and chrome refractories and suggest suitable remedies to overcome the problems. [15]
6. Silica refractories have an advantage over others in the method of production and properties. Explain. [15]
7. State whether the following statements are true or false and justify with proper reasoning.
  - (a) Proximate analysis is approximate
  - (b) Ash percentage in coke is always less than that of coal.
  - (c) Ultimate analysis is helpful in designing the furnace and auxiliaries.
  - (d) Coal is washed before the high temperature carbonisation process. [15]
8. Draw the following furnaces and indicate the refractories used for various parts of the furnaces.
  - (a) Iron blast furnace
  - (b) Cupola. [7+8]

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**R09****Set No. 4**

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1. What is cracking and what for it is used? What are the various types of cracking? Describe the working fluid bed catalytic cracking unit. [15]
2. Write short notes on:
  - (a) High temperature carbonisation of coal
  - (b) Cochrane Abrasion index of coke
  - (c) Methods of representing the composition of coals. [5+5+5]
3. With neat sketches of various steps, explain the method of determining the pyrometric cone equivalent for refractories. [15]
4. (a) Write down the expression for the total thermal resistance of a composite sphere made up of two materials having thermal conductivities  $K_1$  and  $K_2$  and then explain it.  
 (b) Distinguish between
  - i. One dimensional heat conduction and
  - ii. Two dimensional heat conduction.
- (c) Sketch & explain the temperature profile in the wall of a hollow cylinder of which the inner & outer surfaces are maintained at 2 different constant temperatures. [5+5+5]
5. (a) Explain Flash point and fire point. Discuss the significance of the above.  
 (b) Explain the effect of temperature of carbonization on the quality of products formed during carbonisation of coal.  
 (c) Distinguish between charcoal, briquettes & coke. [6+5+4]
6. (a) Discuss the polymorphic transformations of silica with a neat sketch.  
 (b) What are the applications of silica refractories. [9+6]
7. (a) What is Bituminous coal? Give the rough composition of Bituminous coals?  
 (b) What do you mean by banded structure in Bituminous coals? How are the banded structures in this coals classified?  
 (c) Explain the following with respect to Bituminous coals.
  - i. Vitrain
  - ii. Clarain

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iii. Durain

iv. Fussain.

[3+5+7]

8. Why burning of carbon refractories should be done carefully? Explain the method of burning of carbon refractories. [15]

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FIRSTRANKER

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**R09****Set No. 1**

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1. (a) Write an essay on the 'Origin of coal formation'.  
 (b) What are the undesirable features of ash in coal?  
 (c) Explain what do you mean by banded coals. [9+4+2]
2. Explain the properties of magnesite refractories. [15]
3. (a) What are insulating refractories and how are they produced?  
 (b) Mention the applications of graphite refractories. [9+6]
4. (a) Explain the treatment that the coke oven gas is subjected to recover the by products before it is used as a fuel gas.  
 (b) List out various gaseous fuels and state their advantages and disadvantages. [7+8]
5. (a) Explain the following with respect to the requirements of a good metallurgical coke.
  - i. Porosity
  - ii. Calorific value
  - iii. Combustibility
  - iv. Strength
  - v. Reactivity.
 (b) Write briefly about 'Sundgren drum index of coke'. [9+6]
6. (a) Define calorific value of fuel and distinguish between gross calorific value and net calorific value.  
 (b) Discuss the method of "Blast furnace gas processing and cleaning". [7+8]
7. (a) State and explain the general conduction equation in cartesian co-ordinates.  
 (b) Under what conditions the general heat conduction equation reduces to Fourier equation? Explain.  
 (c) Define and explain conduction shape factor.  
 (d) When do we say that two different physical phenomenon are analogous? [5+4+4+2]
8. With a neat sketch of the dilatometer explain the method of determining the linear changes in the refractories. [15]

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1. (a) What is meant by the term one-dimensional when applied to conduction problem? Explain.
- (b) What do you mean by thermal resistance? Discuss.
- (c) Write down the expression for thermal resistance of a wall, and annular cylinder and spherical shell. Explain the same. How does thermal resistance depend upon the area of heat transfer. [4+4+7]
2. What is the raw material used for the production of chromite refractories? Discuss the various steps involved in the production of chromite refractories. [15]
3. Discuss the method of determining the cold crushing strength of refractories with a suitable sketch of crushing test assembly. [15]
4. (a) Discuss the various theories related to the origin of coal.
- (b) Explain the characteristic properties and applications of anthracite coal. [6+9]
5. Explain in detail about the following types of coals
  - (a) Peat
  - (b) Lignite
  - (c) Bituminous
  - (d) Anthracite. [15]
6. Explain
  - (a) Low temperature carbonization of coal
  - (b) High temperature carbonization of coal. [15]
7. (a) With the help of neat sketch and necessary chemical reactions, explain the manufacture of carburetted water gas.
- (b) Give the properties and applications of carburetted water gas. [11+4]
8. What is allotropy? Which refractory material has this allotropic properties? Explain. [15]

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