Dr. Brij Kishor. Dept of Mat. Sc (192)

# Fuels Refractory and Furnaces (MS-432)

End Semester Examination (Nov-Dec, 2022)
B. Tech. 7th Semester (Materials Science and Engineering)

**Time**: 3 ***hrs***
**Max Marks:** 50

| Roll No. | 1 | 9 | 8 | 0 | | |
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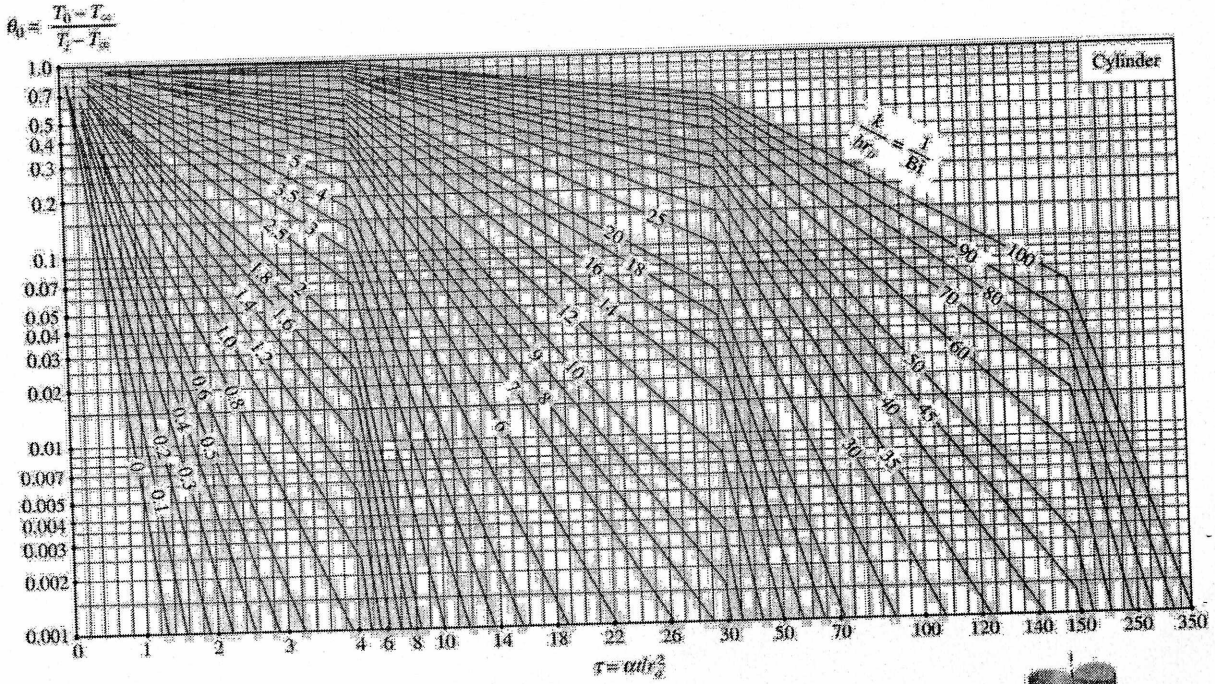
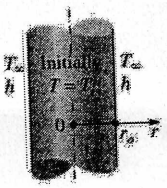
***Note:*** *Attempt all question as per instructions. If required, explain answer with the suitable neat sketches. Useful data is given at the end of the question paper.*

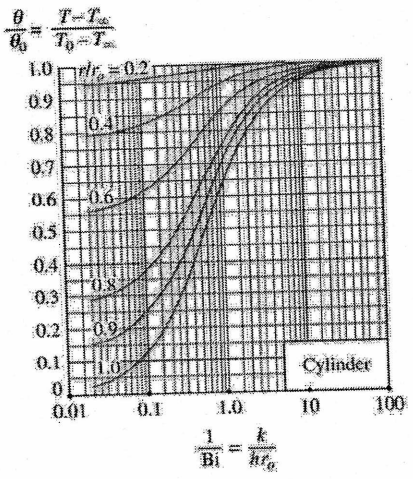
1. Write short note on following
   (a) Ellingham diagram (b) Caking coals (c) Soaking pit (d) Sankey Diagram **8**
2. Differentiate the following **15**
   a) Walking hearth and Walking beam reheating furnace
   b) Regenerators and Recuperators
   c) Batch type and continuous pusher type furnaces
   d) Carbide theory and Engler theory
   e) Pyrometric cone and Pyrometric cone equivalent
3. What is the purpose of energy balance sheet? What is the difference between bar chart and Sankey diagram for showing energy balance? **3**
4. What is difference between Refractoriness and Refractory? Give the characteristic of ideal refractory commonly used in Industries. **3**
5. What do you mean by draft in furnace? Discuss the various classification of draft. Draw a draft profile in case of natural draft and balanced draft. **5**
6. What do you mean by metallurgical furnaces? Name the raw materials required for the production of pig Iron in Blast furnace. Discuss the working principle and construction details of Blast furnace. **5**
7. How we solve the transient heat conduction problems? Discuss the necessary conditions for applying the Heisler charts. What information we can get through Heisler charts?. **5**
8. Along 6.5cm diameter solid cylinder steel (k=16.3 W/m.K, ρ=7817 kg/m3, Cp=460 J/kg.K). It's initially a uniform temperature Ti = 150°C. It's suddenly exposed to a convective environment at T∞ = 50°C and h = 285 W/m$^2$.K. Calculate the temperature at
   a) The axis of cylinder, and
   b) 2.5cm radial distance after 5min of exposure to the cooling flow
   c) c) Determine the total energy transferred from the cylinder per meter length during the first five min. of cooling. **6**

# Heisler Charts (For Infinite Cylinder)

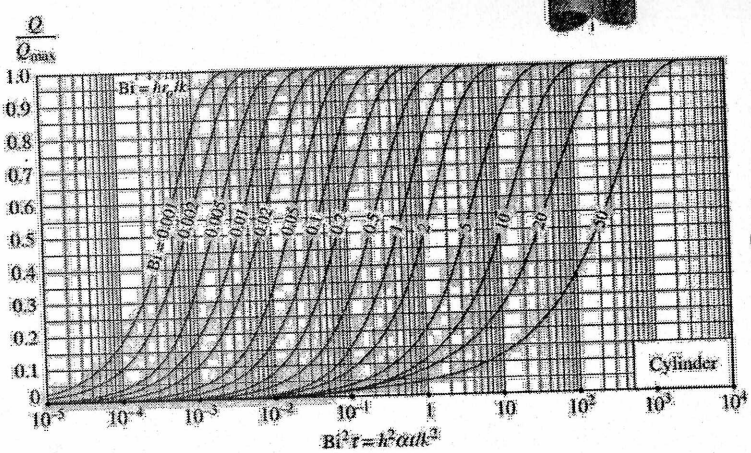



(*a*) Centerline temperature




(*b*) Temperature distribution




(*c*) Heat transfer

Transient temperature and heat transfer charts for a long cylinder of radius $r_o$ initially at a uniform temperature $T_i$ subjected to convection from all sides to an environment at temperature $T_\infty$ with a convection coefficient of $h$.