B.E. Mechanical Engineering (Model Curriculum) Semester - III
PCC-ME205 - Material Engineering

P. Pages : 2

Time : Four Hours

2796

Max. Marks : 80

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Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. I.S. Hand Book for structural steel section, I.S. Code 8000/1962 or 1964, I.S. 456 (Revised), I.S. 875 may be consulted.
7. Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.

1. a) Draw a miller indices for following planes: **8**
i) 111
ii) 101
iii) 001
iv) 100

b) Compare and contrast between metals and non - metals with suitable example. **8**

OR

2. a) Draw a miller indices for following directions: **8**
i) 011
ii) 101
iii) 111
iv) -1, 1, 1

b) Explain the effect of crystal structure on properties of metal with suitable example. **8**

3. a) What is 'Hook's law? Compare and contrast between True stress strain curve and engineering stress strain curve. **8**

b) Classify the 'Engineering Materials' in detail with suitable example. **8**

OR

4. a) Explain the difference between destructive and non – destructive type of testing. Enlist various NDT techniques and explain any one in detail. **8**

b) What are the different hardness tests? Explain them in brief. Which test do you think to be best and why? **8**

5. a) What are 'Solid solution'? What are the different types of solid solutions? Explain them in detail with suitable example. **8**

b) From the data given below for Cu - Ni system, plot the equilibrium diagram to scale and label the diagram. **8**

Weight % Ni	0	20	40	60	80	100
Liquidus temperature (ºC)	1084	1200	1275	1345	1440	1455
Solidus temperature (ºC)	1084	1165	1235	1310	1380	1455

Answer the following for 70% Ni alloy:
i) What is the composition of first solid crystallizing out of liquid?
ii) What is the composition of last solid formed at the end of solidification?
iii) What are the amount of solid and liquid at 1360ºC?

OR

6. a) What do you mean 'Phase diagrams'. Draw a conceptual phase diagram for following: **8**
   i) Isomorphous system.
   ii) Partial eutectic system.
   iii) Fully eutectic system.

   b) State Gibb's phase rule. With the help of cooling curve, justify why pure metal solidifies at constant temperature while alloys over a range. **8**

7. a) Explain the following in detail. **8**
   i) Austempering.
   ii) Ausforming.

   b) What do you mean 'Hardenability' and 'critical cooling rate'? Explain jominy end quench test in detail. **8**

OR

8. a) Draw a $Fe - Fe_3C$ equilibrium phase diagram showing critical lines, temperatures, composition and respective phases. **8**

   b) What are the different invariant reactions involved in $Fe - Fe_3C$ equilibrium phase diagram? Calculate the amount exact amount of phases present at equilibrium temperatures. **8**

9. a) What do you mean by 'High speed steel'? Give its composition and application. Explain the heat treatment cycle of a high speed tool steel with suitable diagram. **8**

   b) Classify cast iron in brief. Explain their microstructures in detail. **8**

OR

10. a) With the help of malleablizing heat treatment cycle, explain how malleable cast irons are produced? Depending on cooling rate, how different malleable cast irons are produced? **8**

    b) Give composition and application for following: **8**
    i) Gun metal. ii) Cartridge brass.
    iii) Phosphor bronze. iv) Mentz metal.

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