B.E. / B.Tech. Mechanical Engineering (Model Curriculum) Semester-III

PCC-ME205 - Materials Engineering

P. Pages : 2 **GUG/W/24/14059**

Time : Four Hours * 5 5 7 6 * Max. Marks : 80

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. 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) What do you mean by "Bravais lattices"? Explain crystal structure of cubic unit cell. **8**

B) Draw a miller indices for following planes: **8**

i) (111) ii) (101)
iii) (001) iv) (100)

OR

2. A) Draw a miller indices for following directions: **8**

a) <011> b) <101>
c) <321> d) $< \bar{1},1,0 >$

B) Differentiate between metals and non-metals with suitable example. **8**

3. A) What are the different hardness tests? Explain the scales used in 'Rockwell hardness test' in detail. **8**

B) Differentiate between destructive and non-destructive type of testing. Enlist various destructive and Non-destructive types of test used in industries. **8**

OR

4. A) What do you mean 'High temperature alloys'? Explain the importance of high temperature alloys (creep resistant alloys) in power plant and nuclear application. **8**

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

5. A) Construct a phase diagram for the system Metal:A and Metal:B from the following data: **8**

Melting point of A = 1000ºC
Melting point of B = 800ºC
Euctectic point = 500ºC at 40 atomic %
Maximum solubility of A in B at 500ºC = 10 atomic %
Maximum solubility of B in A at 500ºC = 20 atomic %
Limits of solid solutions at 300ºC = 10 atomic % in A, 5 atomic % in B

Label the phase diagram, calculate fractions of proeutectic phase and eutectic mixture at the eutectic temperature for the alloy containing 25 atomic % B.

B) Justify why 'pure metal solidifies at constant temperature while alloys over a range'? With the help of cooling curves and Gibb's phase rule. **8**

OR

6. A) What do you mean 'Phase diagrams'. Draw a conceptual phase diagram for following: **8**
i) Two metals having complete solubility in liquid state as well as solid state.
ii) Two metals having complete miscibility in liquid state and incomplete solubility in Solid state.
iii) Two metals having complete miscibility in liquid state partial solubility in solid state.

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

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

B) Classify 'steels' in detail based on definite criteria. **8**

OR

8. A) Write a short note on following: **8**
a) High speed steels
b) Ausforming treatment.

B) What do you mean "Hardenability' and 'critical cooling rate'? Explain them with the help of TTT curve. **8**

9. A) With the help of 'Malleablizing heat treatment' diagram, explain how malleable caste irons are produced? Depending on cooling rate, how different malleable cast irons are produced? **8**

B) What are the different factors which influencing microstructure of Cast Irons? **8**

OR

10. A) Classify cast Iron based on different types of microstructure. **8**

B) Give composition and application for following: **8**
i) Tin bronzes
ii) Cartridge brass
iii) Beryllium bronzes
iv) LM13

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