

B.E. / B.Tech. Mechanical Engineering (Model Curriculum) Semester-III  
**PCC-ME 205 - Materials Engineering**

P. Pages : 2

Time : Three Hours



**GUG/S/25/14059**

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. 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
- |          |          |
|----------|----------|
| a) (111) | b) (110) |
| c) (100) | d) (210) |

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

**OR**

2. A) Explain the following: 8
- a) Slip and twinning.
  - b) Dislocation strengthening mechanism.

- B) Draw a miller indices for following 'Directions': 8
- |                          |                                |
|--------------------------|--------------------------------|
| a) $\langle 110 \rangle$ | b) $\langle 1\bar{1}0 \rangle$ |
| c) $\langle 001 \rangle$ | d) $\langle 210 \rangle$       |

3. A) Compare and contrast between 'True stress strain curve and Engineering stress strain curve'. 8

- B) What are the different types of hardness test used in industries? Explain the significance of Scale A, Scale B and Scale C used in Rockwell hardness test. 8

**OR**

4. A) What are the different types of Non-destructive testing used in industries? Explain 'Ultrasonic testing' in detail with neat sketch. 8

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

5. A) What do you mean 'Substitutional' type of solid solution? Explain their types in detail with suitable example. 8

- B) Explain the following: 8
- a) Coring mechanism.
  - b) Polymorphism/Allotropy.

**OR**

6. A) 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(°C) | 1084 | 1200 | 1275 | 1345 | 1440 | 1455 |
| Solidus temperature (°C) | 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 1360 °C?

- B) 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.

7. A) What do you mean 'Hardenability' and 'critical cooling rate'? Explain them with the help of Time Temperature Transformation (TTT) curve. 8

- B) Write a short note on following: 8
- i) Austempering treatment.
  - ii) Patenting treatment.

**OR**

8. A) What are the different invariant reactions involved in Fe – Fe<sub>3</sub>C equilibrium phase diagram? Calculate the amount exact amount of phases present at equilibrium temperatures. 8

- B) Draw a conceptual Fe – Fe<sub>3</sub>C equilibrium phase diagram with scale, showing critical lines, temperatures, composition and respective phases. 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) Explain the factors influencing microstructure of cast irons. 8

- B) Give composition and application for following: 8
- i) White metal alloy. (Babbits)
  - ii) Cartridge brass.
  - iii) Silicon bronzes.
  - iv) Gun metal.

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