Code No: RR220302 **Set No. 1**

II B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw a neat sketch of CPH crystal structure and calculate the theoretical c/a ratio for the above structure. [8]
   (b) Define the term co-ordination number. What is the significance of co-ordination number? Calculate the Co-ordination number of three cubic space lattices. [8]
2. (a) The Maximum solubility of carbon in gamma solid solution is 2% (interstecial void space is 26%) that of alpha Iron is 0.025%). (interstecial void space is 32%). Explain the reasons for the above behavior with neat sketches. [10]
   (b) Taking only 45 of the most common metals. Calculate maximum the number of possibly binary; ternary and tetranary alloy systems. [6]
3. (a) Describe completely the changes that take place during the slow cooling of a 0.5% carbon steel from the Austenetic range. [4]
   (b) Calculate the relative amounts of the structural constituents present in furnace cooled steels containing. [8]
      i. 0.3%C
      ii. 0.6% carbon
      iii. 0.8%C
      iv. 1.2%C.
   (c) Explain the limitations on the use of Iron-Iron carbide diagram. [4]
4. (a) Explain the Malleabilizing treatment given to white iron castings. Sketch the typical microstructure of malleable cast iron label the phases in it. [8]
   (b) What is High speed steel? Give the typical composition of High speed steel. Explain the part played by each of the alloying elements in tool steels. Explain the heat treatment process of High speed steel. [8]
5. (a) Draw a neat sketch of the TTT diagram for an eutectoid steel and explain the various heat treatment processes with the help of cooling curves. [8]
   (b) Distinguish between Flame hardening and induction hardening. [8]
6. Discuss the follows; giving composition microstructure, properties and applications, [4x4=16]
   (a) Gunmetal
   (b) Manganese Bronze

(c) Duralumin

(d) Muntz metal

7. Write short notes on the following: [8+8]

   (a) Activated sintering

   (b) Metal filters.

8. (a) Distinguish between agglomerated materials and laminates, mentioning suitable examples. [6]

   (b) Explain the importance of particle size in composite materials. [4]

   (c) Explain the differences between matrix and dispersed phase in a composite material. [6]

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Code No: RR220302 **Set No. 2**

II B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the relationship between atomic radius and lattice parameter for FCC materials and calculate it's packing factor. [8]
   (b) Draw a neat sketch of BCC crystal structure and calculate its packing factor and find out the effective number of atoms. [8]
2. (a) What is chemical affinity factor? Should this be high or low for the formation of substitutional solid solutions? Why? [8]
   (b) Distinguish fully with neat sketches between interstecial solid solutions & interstecial compounds. [8]
3. (a) Define and explain the structural phases. [3x3=9]
      i. Ferrite
      ii. Austenite
      iii. Cementite.
   (b) Describe the construction of the phase diagram for 2 metals completely soluble in liquid state and insoluble in solid state. [7]
4. (a) Explain the Malleabilizing treatment given to white iron castings. Sketch the typical microstructure of malleable cast iron label the phases in it. [8]
   (b) What is High speed steel? Give the typical composition of High speed steel. Explain the part played by each of the alloying elements in tool steels. Explain the heat treatment process of High speed steel. [8]
5. Write short notes on: [4x4=16]
   (a) Pack carburizing
   (b) Flame and induction hardening
   (c) Nitriding
   (d) Post-carburizing heat treatments.
6. (a) Mention atleast three compositions of copper alloys suitable for the following applications. [2x5=10]
      i. Ship propeller
      ii. Bearings
      iii. Non-sparking tools

iv. Springs

v. Heat Exchangers.

(b) Discuss briefly the precipitation hardening procedure with specific reference to beryllium copper. [6]

7. (a) What are the advantages and disadvantages of hot pressing as compared with cold compacting and sintering? [8]

(b) Why is pore size important in the manufacture of self-lubricating bearings? How man pore size be controlled? [8]

8. (a) Discuss different types of fibers and matrices used in fiber composites. [8]

(b) Discuss the influence of fiber length, orientation and composition on fiber reinforced composites. [8]

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Code No: RR220302 **Set No. 3**

II B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw a neat sketch of CPH crystal structure and calculate the theoretical c/a ratio for the above structure. [8]
   (b) Define the term co-ordination number. What is the significance of co-ordination number? Calculate the Co-ordination number of three cubic space lattices. [8]
2. (a) Explain the differences between an alloy and alloy system. [4]
   (b) How are the alloy systems classified based on the number of elements present in it. Explain them with suitable examples. [8]
   (c) Distinguish between homogeneous alloy and heterogeneous alloys. [4]
3. (a) Explain the effect of increasing cooling rate on [8]
      i. temperature of Austenite transformation
      ii. Fineness of pearlite
      iii. amount proeutectoid constituent.
   (b) Explain the following with an examples: [8]
      i. Peritectic system
      ii. EUTECTOID system.
4. (a) Give at least 3 advantages of steels over the family of cast irons. [6]
   (b) What are the various heat treatments given to cast irons? Explain them in brief. [10]
5. (a) What is case hardening and are of how many types? Which methods of case hardening do you recommend for [3x3=9]
      i. small finished gear
      ii. Crankshaft to be finished grond after wards
      iii. absolutely true shaft.
   (b) Name the different quenchants used in the quenching operation. Explain their relative advantages and disadvantages. [7]
6. (a) Why Titanium alloys are widely used in space and aircraft industry. Indicate the composition structure and properties of any one $(\alpha + \beta)$ Titanium alloy. [8]
   (b) Describe what is Titanium martensite. What are it's properties. Comment on the stability of the phase. [8]

7. Compare and contrast mechanical and hydraulic compacting presses with respect to advantages; disadvantages; applications and working principle. [16]

8. (a) What is MMC? Where are they used? Classify the MMCs according to the type of reinforcement. [7]

   (b) Discuss about the following with relevant examples and applications:

      i. Continuous- fiber reinforced MMCs. [3]

      ii. Discontinuous- fiber reinforced MMCs. [3]

      iii. Particulate reinforced MMCs. [3]

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Code No: RR220302 **Set No. 4**

II B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
METALLURGY AND MATERIAL SCIENCE
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Discuss the various types of crystal structures in metals with appropriate examples. [8]
   (b) What are Miller indices? Explain in detail the procedure for the determination of Miller indices for planes and directions with suitable examples. [8]
2. (a) How are alloys classified according to the microstructures. Explain them fully with suitable examples. [6]
   (b) Explain the term 'Equillibrium conditions'. [3]
   (c) What do you mean by intermediate alloy phase? Explain any one type of intermediate alloy phase with suitable examples. [7]
3. (a) Explain how does the constitution of alloys affect their physical and mechanical properties? [8]
   (b) Illustrate your answer with diagrams covering the basic types of binary alloy systems. [8]
4. (a) What are the important properties of gray cast Irons? Mention their typical uses. Why gray cast Iron is brittle while malleable iron is not? [6]
   (b) Distinguish between malleable iron and ductile iron in terms of [2 1/4x4=10]
      i. Manufacturing proces
      ii. Structure
      iii. Properties and limitations
      iv. Applications.
5. (a) Explain the differences between hardness and hardenability. [4x4=16]
   (b) Describe Jominy End Quench test.
   (c) Discuss the effect of alloying elements on hardenability.
   (d) Explain critical cooling rate.
6. (a) 'Explain what is meant by alpha or beta stabilizer. [5]
   (b) Explain why the two phase titanium alloys are stronger than the single phase alpha alloys. [6]
   (c) How may alpha-beta titanium alloys be strengthened. [5]
7. (a) What is powder Metallurgy? [4]

(b) When is powder metallurgy preferred over conventional methods. [6]

(c) What are the advantages and limitations of power metallurgy. [6]

8. (a) Distinguish between agglomerated materials and laminates, mentioning suitable examples. [6]

(b) Explain the importance of particle size in composite materials. [4]

(c) Explain the differences between matrix and dispersed phase in a composite material. [6]

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