

Government College of Engineering, Amravati
(An Autonomous Institute of Government of Maharashtra)

Third Semester B. Tech. (Mechanical Engineering)

Winter – 2017

Course Code: MEU301

Course Name: Material Science and Engineering

Time: 2 hr. 30min.

Max. Marks: 60

Instructions to Candidate

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

1 Solve any two

- a Draw a neat iron-carbon equilibrium diagram 6
and label its phases, temperatures and critical lines.
- b Calculate the packing efficiency, effective 6
number of atoms and coordinate number of BCC crystal structure. State the examples of BCC crystals.
- c What are of solid solutions? State Hume- 6
Rothery rules for forming extensive substitutional solid solutions. Describe various types of solid solutions with neat sketches.

Cont.

2 Solve any three

- a** What is slip? Derive an expression for critical resolved shear stress required to cause slip. 4
- b** How TTT curves are determined for given steel. 4
- c** Distinguish clearly between annealing and normalizing. 4
- d** What are high speed steels and how red hardness is achieved in it? 4

3 Solve any three

- a** What is pack carburizing? What are its advantages and limitations? 4
- b** What is season cracking in brass? How it can be avoided? 4
- c** What is dezincification of brass? Suggest remedies to avoid it. 4
- d** Discuss the factors which affect the mode of solidification of cast iron as white cast iron and grey cast iron. Distinguish between white cast iron and grey cast iron. Draw its microstructures. 4

4 Solve any three

- a** With neat discuss the effect of alloying elements on (i) TTT diagram (ii) eutectoid temperature and on (iii) eutectoid composition. 4

b Why tempering is required for hardened steel? 4
Discuss various stages of tempering.

4 c By giving suitable examples differentiate 4
between hot working and cold working.

d What is creep failure in metals? Describe how 4
creep test is conducted?

5 Solve

a Describe in short any four methods of 4
production of metal powders for powder
metallurgy.

b Discuss the causes which induce thermal 4
stresses in welding? Suggest remedies to
remove these thermal stresses.

c List out the advantages and the limitations of 4
powder metallurgy process.

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1 Solve any two

- a Draw a neat iron-carbon equilibrium diagram 6
and label its phases, temperature and critical
lines.
- b Calculate the packing efficiency, effective 6
number of atoms and coordinate number of
BCC crystal structure. State the examples of
BCC crystals.
- c Describe the various types of solid solutions 6
with neat sketches. State the conditions for
forming extensive substitutional solid solutions.

Cont.

2 Solve any three

- a What are crystal defects? Describe them with neat sketches. 4
- b Draw a TTT diagram for eutectoid steel. What is the effect of alloying elements on TTT diagram. 4
- c By giving suitable examples discuss the classification of steels. How they are designated? 4
- d What are high speed steels and how red hardness is achieved in it? 4

3 Solve any three

- a Compare and contrast pack carburizing and gas carburizing. 4
- b Describe season cracking in brass and how it can be prevented? 4
- c What is dezincification of brass? How it can be avoided? 4
- d How malleable cast iron can be produced? What are its uses? 4

4 Solve any three

- a With neat sketches differentiate between annealing and normalizing. 4
- b Why tempering is required for hardened steel? Discuss the various stages of tempering. 4

c Differentiate between hot working and cold working. 4

d Write a short note on induction hardening. 4
Mention its salient features.

5 Solve

a Describe the various steps involved in the manufacture of a component by powder metallurgy?. 4

b Discuss the metallurgical effects of welding? 4

c List out the advantages and the limitations of powder metallurgy process. 4

strength property in cold working

Government College of Engineering, Amravati
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Third Semester B. Tech. (Mechanical Engineering)

Winter – 2013

Course Code: MEU301

Course Name: Material Science and Engineering

Time: 2 Hrs. 30 Min.

Max. Marks: 60

Instructions to Candidate

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

Q.1: Solve any two of the followings.

- (a) Draw Iron-Iron Carbon equilibrium diagram and label the temperature, composition and phases. (6)
- (b) Calculate the atomic packing factor for simple cubic, body centered cubic and face centered cubic structure. (6)
- (c) Calculate the relative thickness of thorium (Th) and titanium (Ti) lamellae in the Th/Ti eutectic.
Given : Density of Th = 11.5 gm/cm^3
Density of Ti = 4.54 gm/cm^3

Eutectic composition = 12.1% Ti (by weight)
(Th and Ti are completely insoluble in the liquid state and also in solid state.) (6)

Q 2: Solve any three of the followings.

- (a) What are the classification and application of steels? (4)
- (b) Draw and explain time-temperature-transformation diagram for the steel containing 0.8% carbon. (4)
- (c) What are the general requirements of tool steel steels? How would you select the composition of steel for a particular application? Give some guidelines? (4)
- (d) What are stainless steels? Give typical composition and two uses of the various types of stainless steels. Why these steels are stainless? (4)

Q 3: Solve any three of followings.

- (a) Draw and explain the microstructures of gray cast iron and malleable cast iron? (4)
- (b) Give composition, properties and uses of Cartridge brass, Muntz metal, Gun metal and Monel. (4)
- (c) Describe season cracking of brasses. How it can be prevented? (4)
- (d) What are the requirement of a journal bearings? How are these fulfilled in practice? (4)

Q 4: Solve any three of the followings.

- (a) Compare and contrast austempering, patenting and martempering. (4)
- (b) Distinguish clearly between Brinell hardness test and Vickers hardness test. (4)
- (c) Differentiate between hot working and cold working. (4)
- (d) What is creep in metals? Draw a typical creep curve and explain the various stages in creep. (4)

Q 5: Solve the followings

- (a) Describe three methods by which powders suitable for powder metallurgy can be produced. (4)
- (b) What do you mean by weldability? Explain various factors affecting weldability of steel. (4)
- (c) Discuss with neat sketch the weld decay phenomena. (4)

Government College of Engineering, Amravati
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4th Semester B. Tech. (Mechanical Engineering)

Winter - 2015

Course Code: MEU301

Course Name: Material Science and Engineering

Time: 2 hr. 30min.

Max. Marks: 60

Instructions to Candidate

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

1 Solve any two

- a With neat sketches describe imperfections in crystals. State the role of dislocations in plastic deformation. 6
- b Calculate the packing efficiency, effective number of atoms and coordinate number of FCC crystal structure. Give examples of FCC crystals. 6
- c Draw iron-carbon equilibrium diagram and label its phases, temperature and critical lines. 6

Cont.

2 Solve any three

- a Describe the methods of strengthening against yield in metals and alloys. 4
- b How TTT diagram is determined for a given steel. Draw a TTT diagram for eutectoid steel. 4
- c How red hardness is achieved in high speed steel? Explain with neat sketches. 4
- d Define hardenability and discuss the factors affecting it. 4

3 Solve any three

- a Explain why post carburizing treatments are required for steels? How these treatments are carried out? 4
- b Describe season cracking and how it can be prevented? 4
- c What is sensitization of stainless steel and how it can be avoided? 4
- d Differentiate between white cast iron and grey cast iron with neat sketches. 4

4 Solve any three

- a What is fatigue? What are the factors which cause fatigue? State the protection methods employed to avoid fatigue failure. 4

- b With neat sketches compare and contrast slipping and twinning. 4
- c Differentiate between hot working and cold working. 4
- d Write a short note on induction hardening. 4

Solve

- a What are the various methods of production of metal powders? Describe in brief. 4
- b Discuss the thermal effects of welding. 4
- c Discuss the advantages and the limitations of powder metallurgy process. 4