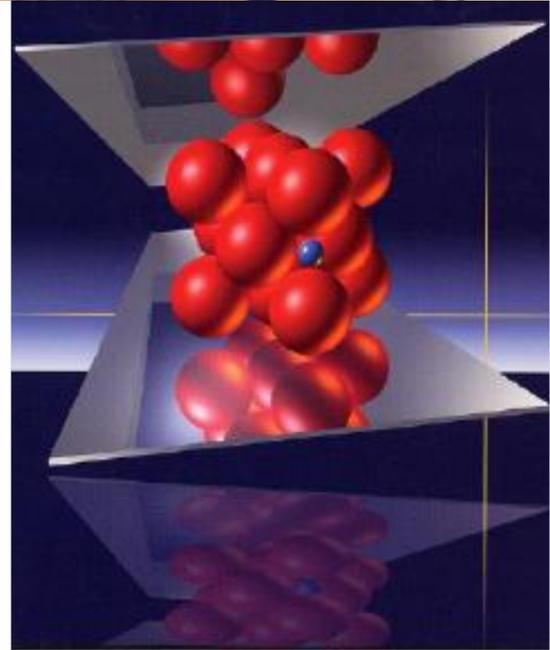
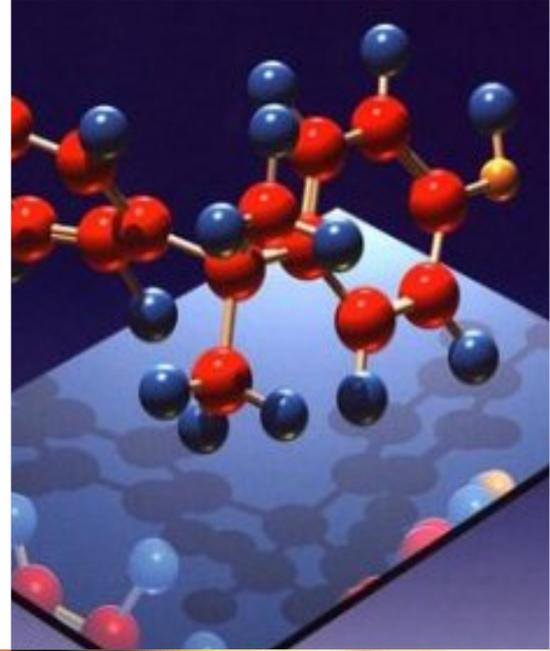


# Materials Science

and Engineering Materials



Previous Years Question Papers  
IV<sup>th</sup> Semester  
RGPV : June 2005 - June 2011

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**B.E. (fourth semester) EXAMINATION, June, 2005**

**(Mechanical Engg. Branch)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**ME-403**

Note: Attempt any five questions. All question carry equal marks

- 1 (a) List the various of bonds occurring in a crystal. Describe any one of them in brief.  
(b) Draw neat sketches of unit cells of simple cubic, BCC and FCC crystal structures. Calculate the number of atoms in each case. Derive the relationship between atomic radius and unit cell parameter  $a_{\text{FCC}}$ .
- 2 (a) State the difference between elastic and plastic deformation. Explain each in details.  
(b) Explain the terms 'SLIP' and 'TWIN'. How does slip occur? Explain what is slip system.
- 3 (a) What is or working hardening? State the effects of strain Hardening.  
(b) What is hot and cold working? Explain their effects on the properties of materials.
- 4 (a) State Hume Rothay's rules for the formation of substitution type of solid solutions. Given examples.  
(b) State and explain Gibbs phase rule with example.
- 5 (a) Draw Fe-C (iron-carbon) phase diagram. Label all the phase and temperature properly.  
(b) Describe the process of austenite decomposition of steel with T.T.T. diagram. What information is supplied by these diagrams?
6. (a) Define the term heat treatment. Why are steels heat treated? What are the effects of faulty heat treatment?  
(b) Describe flame hardening and compare it with induction hardening. Describe the merits and Demerits and mention its application.
7. (a) What are the requirement for bearing metals? Suggest a few materials possessing these required

properties.

(b) Why is steel more widely used as compared to other ferrous and non ferrous alloys?

8. Write short notes on any four of the following:

(a) Refractories

(b) Creep

(c) Grey cast iron

(d) Various types of plastics

(e) Brass

(f) Duralumin

(g) Ductile fracture

**B.E. (fourth semester) EXAMINATION, Dec, 2005**

**(Mechanical Engg. Branch)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**ME-403**

Note: Attempt any five questions. All question carry equal marks. Different parts of the same question should be attempted in continuation.

- 1 (a) What is meant by the term, refractory? Describe its properties. Explain the differences between acid, basic neutral refractories.
- (b) What do you understanding by the term 'Crystal Lattice' and how many types of this are found in me metals? Explain 'Miller' indices for denoting crystal planes. Draw the following plans and direction in an FFC structure (i) [321], (ii) [102] (iii) [201] (iv) [111]
- 2 (a) What is meant by crystal deformation? Classify them in order of their geometry.  
What is Burger's vector? Where and why this used?
- (b) What is strain hardening? Explain the change in propites when a severely cold work metal is annealed at successively higher temperatures.
- 3 (a) Explain the difference between slipping and twinning. How does twinning occur in metals? Name and explain two types of twins.
- (b) Compare elastic and plastic materials when they are subjected to tensile loads. Explain the mechanism for dislocation in plastic deformation, with neat sketches.
- 4 (a) Explain the following:  
(i) Hume- Rothery's rules (ii) Gibb's phase rule
- (b) Describe the working of iron – carbon diagram with the help of neat sketches.
- 5 (a) Describe the process of austenite decomposition of alloyed steel with the help of TIT diagrams.
- (b) Why are metals heat- treated? Explain the operation and consequent effect on metals due to annealing, normalizing amd tempering.

6 (a) What are the difference types of fractures in metals.

What is creep? Draw the typical creep curve and explain the different stage of creep.

(b) Distinguish between thermosetting plastic. Name the different plastic moulding process and explain any one of them.

7. (a) Explain either the process of manufacturing wrought iron. Or the process of converting the pig iron into steel.

(b) Explain the process of decomposition of austenite into pearlite, fearlite, cementile, bainite, martensite, and retaind austenite. Compare their properties and structures.

8. Write explanatory notes on any four of the following:

(i) Metallurgical coke- manufacture and uses

(ii) Fatigue failure

(iii) Calculation of atomic packing factor (APF) of BBC structure.

(iv) Precipitation hardening process

(iv) Fiber reinforced plastic and their uses.

**B.E. (fourth semester) EXAMINATION, Nov-Dec, 2007**

**(Mechanical Engg. Branch)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**ME-403**

Note: Attempt any five questions. All question carry equal marks.

1. (a) What are refractory materials ? Differentiate between acidic and basic refractories.  
(b) Draw a (110) and a (111) plan inside the unit cell of cubic crystal. Determine the miller indices of the direction that is common in both in these plans.
2. (a) What is Van der Waal's cooling? Enumerate with examples.  
(b) Explain why a covalent bond is directional while ionic and metallic bonds are non-directional.
3. (a) Draw a typical 'creep test' curve, Showing different stage of elongation for a long time high Temperature creep test. State how the information is helpful to designer?  
(b) Discuss with example the ductile and brittle fracture.
4. (a) Explain the difference between slipping and twinning . How does twinning occur in metals?  
(b) Discuss the effect of imperfection on metal properties.
5. (a) Explain Gibbs' phase rule in detail as applied equilibrium diagram .Define the terms space lattice , crystal symmetry, eutectic and eutectoid.  
(b) Explain with examples, the cooling from liquid to solid state of a peritectic transformation.
6. (a) What is TTT curve? Why should the TTT curve for eutectic steel be different from that of alloy Nickel-chromium steels?  
(b) What are the objectives of heat treatment? Describe annealing. its types and advantages.
7. (a) Differentiate between the hypoeutectic and hypereutectic cast irons.  
(b) Differentiate between the gray cast iron and white cast iron.
8. (a) Give composition and uses of the following :  
(i) Duralumin                      (ii) Y-alloys  
(b) Discuss briefly the differentiate polymerization mechanisms.

**B.E. (fourth semester) EXAMINATION, June, 2008**

**(Mechanical Engg. Branch)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**ME-403**

Note: Attempt any five questions. All question carry equal marks.

1. (a) Name the various method of making Iron and steel and explain any one process with neat sketch.  
(b) Write down the specific application of different types of Iron and steel.
2. (a) Explain crystal system arrangement of atoms in BCC, FCC and HCP crystal giving example.  
(b) A F.C.C. crystal has an atomic produce of  $1.246\text{\AA}$  . What are the  $d_{200}$ ,  $d_{220}$  and  $d_{111}$  spacing?
3. (a) Explain the dislocation theory of plastic deformation  
(b) Derive an equation for the calculation of critical resolved stress for a signal crystal
4. (a) Explain the difference between hot and cold working of metals also explain the effect of cold Working on the mechanical properties of the metals.  
(b) What are the cases of fracture of metals?
5. (a) Explain Hume –Rothery’s rules for solid solution.  
(b) Explain iron –carbon equilibrium diagram.
6. (a) What is heat treatment process and its objectives ?  
(b) What are different types of heat treatment process and their specific application?
7. (a) Explain the properties of non-ferrous matals and alloys .  
(b) Write a brief note on plastics, Composites and ceramics.
8. Write short notes on any two of the following :
  - (a) Properties and types of refractories
  - (b) Bonds in solid
  - (c) Point and line defects in crystals
  - (d) Phase rule and lever rule
  - (e) Plastic molding Technology

**B.E. (fourth semester) EXAMINATION, June, 2009**

**(Mechanical Engg. Branch)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**ME-403**

Note: Attempt any five questions. All question carry equal marks.

1. (a) What are the characteristics and uses of refractory materials ? Explain acid refractory and its Applications.  
(b) Explain any two methods of steel making process.
2. (a) Explain different type of imperfection in crystal structure.  
(b) Explain space lattice and crystal system arrangement of atom in BCC, FCC and HCP crystal.
3. (a) Write a note on cold and hot working of metal and their effect on mechanical properties.  
(b) Explain Griffith's theory of fracture.
4. (a) Explain Hume-Rothery's of substitution solid solution.  
(b) What information do you, get from a phase diagram? Explain.
5. (a) Explain equilibrium diagram of an eutectic system. How solidification characteristics of eutectic System is different from isomorphism system?  
(b) What type of heat treatment would you give to a high carbon steel to be used as a tool?
6. (a) What is the meaning of 'holding or soaking' time in heat treatment ? How does it effect the Properties of steel?  
(b) What type of heat treatment would you give to a high carbon steel to be used as a tool?
7. (a) What are elastomers ? How do they differ from plastics?  
(b) Explain various processes of powder metallurgy techniques.
8. Write short notes on any two of the following:
  - (i) Classification in bonds in solids
  - (ii) Metallurgical coke
  - (iii) Principle of recrystallization and grain growth
  - (iv) Iron-carbon phase diagram
  - (v) TTT curve
  - (vi) Properties and uses of brasses

**B.E. (fourth semester) EXAMINATION, DEC 2009**

**(New scheme)**

**(Common for IP&ME engg.)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**ME-403**

Note: Attempt any five questions. Internal choices are given with each one.

1. Explain with suitable example the following bindings:

Metallic bindings, Van der Waals's bindings, ionic bindings, covalent bindings.

OR

2. What do you understand by unit cell? Discuss the following arrangement of atoms in unit cell :

(i) Plain cubic unit cell

(ii) Body centered cubic unit cell

(iii) Face centered cubic unit cell

(iv) Hexagonal close packed unit cell

3. Discuss the following classes of refractories in detail:

(i) Acid (ii) Basic (iii) Neutral

Write down the properties of a good refractory material.

4. Discuss cold and hot working of metals. What effect of hot and cold working is seen on properties of metals? Explain annealing of cold worked metals.

5. What is peritectic reaction? Explain the formation of the beta phase in brass by peritectic Reaction.

6. (a) Explain the following

(i) Martensite (ii) Ferrite (iii) Austenite (iv) Solid solution

(b) Distinguish between alpha iron and gamma iron

7. Write short notes of the following
  - (i) Spherodizing
  - (ii) Tempering
  - (iii) Case hardening
  - (iv) Austempering
  - (v) Martempering
8. Explain TTT curve. How are they Constructed? Explain isothermal Transformation of alloy steels.
9. Write short notes on the following Non ferrous metal alloys:
  - (i) Bronze (ii) Brasses (iii) Copper base bearing metals (iv) Gun metals
10. Explain briefly the manufacturing of tungsten carbide and cobalt powders. What is exactly meant by sintering.

**B.E. (fourth semester) EXAMINATION, June, 2010**  
**(Common for AU,IM,IP&ME Engg. Branch)**  
**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**  
**[AU/IM/IP/ME-401(N)]**

Note: Answer all questions.

1. (a) Explain why covalently bonded materials are generally less dense than ionically or metallically bonded ones.  
(b) Show that the atomic packing factor (volume of atoms/volume of unit cell) for FCC and BCC structures are 0.74 and 0.68 respectively.
2. (a) Classify the refractory materials. Give examples with their application.  
(b) Explain working of Blast furnace with schematic diagram.
3. (a) Differentiate clearly between the following :
  - (i) Point defect and line defect
  - (ii) Edge and screw dislocation  
(b) What is hot and cold working? How do they differ? Explain their effect on the properties of material.
4. (a) Explain terms slip and twin. How does slip occur? Explain slip direction and slip planes with diagram.  
(b) Write short notes on the following:
  - (i) Recrystallisation
  - (ii) Grain growth
5. (a) Draw the iron-carbon equilibrium diagram and explain it.  
(b) Give explanation of Hume-Rothery's rules

OR

6. (a) Distinguish between the following :
- (i) Intermediate phase and intermediate compound
  - (ii) Iron-cementite and iron-graphite phase diagram
- (b) Write equation for the eutectoid and peritectoid invariant reaction. Explain the reactions.
7. (a) Draw T-T-T diagram for eutectoid steel and explain the effect of cooling rate on transformation products and address obtained .
- (b) Explain briefly the following :
- (i) Nitriding (ii) Carburizing
8. (a) Define the term hardenability . What factors affect hardenability
- (b) Explain briefly the following:
- (i) Normalizing (ii) Flame hardening
9. (a) With a neat sketch , Explain the creep testing method for metal
- (b) Explain the objectives of preheating and sintering
- 10.(a) Explain the advantages and disadvantages of using powder metallurgy .
- (b) Explain each type of steel with chemical composition. Properties and application.

**B.E. (fourth semester) EXAMINATION, June, 2011**

**(Common for AU,IM,IP&ME Engg. Branch)**

**(MATERIAL SCIENCE AND ENGINEERING MATERIALS)**

**[AU/IM/IP/ME-401(N)]**

Note: (i) Attempt any five questions. All questions carry equal marks. Assume missing data suitably.

1. What are the different methods for producing iron in the industry? Explain any one in detail.

OR

2. (a) Explain Van der Waals', ionic and covalent bonds.

(b) What properties should be considered while selecting acid, basic and neutral refractory?

3. Explain the following mechanical properties:

(i) Ductility

(ii) Brittleness

(iii) Hardness

(iv) Toughness

(v) Stiffness

(vi) Malleability

(vii) Resilience

(viii) Strength

(ix) Fatigue

(x) Creep

OR

4. (A) Explain the fracture mechanism of mild steel in tensile loading.

(b) Differentiate between point and line defects in a crystal.

5. (a) Explain the following:
- (i) Eutectic system
  - (ii) Peristaltic system
  - (iii) Eutectoid system
- (b) How does alloy formation takes place?

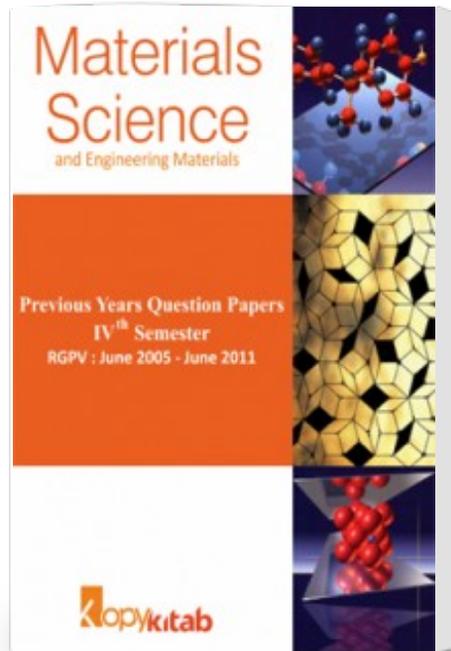
OR

6. Draw iron-carbon equilibrium diagram. Explain in detail.
7. What do you mean by TTT diagram? What is the effect of cooling rate and cooling medium on properties obtained after heat treatment? Explain with diagram.

OR

8. Explain the following:
- (i) Normalization
  - (ii) Annealing
  - (iii) Spheroid zings
  - (iv) Hardening
9. (a) What are different applications of power metallurgy?.
- (b) With composition write down advantages and applications of mild steel.
10. Differentiate between plastic composites and ceramics. Classify plastic. What are different properties of plastic?

# Material Science and Engineering Material Previous Year Question Papers For RGPV



Publisher : Faculty Notes

Author : Kopykitab

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