



- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Diagrams and chemical equations should be given whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Define Engineering materials. Give the detailed classification of Engineering material with their practical applications. **8**

b) Define various mechanical properties of engineering materials. **5**

**OR**

2. a) Explain the various types of imperfections (defects) found in crystals. **7**

b) Name the various crystal structures in metals. Calculate the packing efficiency of F.C.C. structure with the help of neat sketch. **6**

3. a) Draw and explain Binary phase diagram for two elements A and B which are completely soluble in each other in solid state. **7**

b) What is nucleation? Differentiate between homogeneous and heterogeneous nucleation. **7**

**OR**

4. a) Draw a neat Iron-Iron carbide equilibrium diagram. Show all the temperature, composition and various phases present in it. **8**

b) Write and explain three invariant reactions occurring in Iron-Iron carbide diagram. **6**

5. a) Define heat Treatment. What are various heat treatment process? Explain any one in brief. **7**

b) Define case Hardening. Explain the process of carburizing in brief. **6**

**OR**

6. a) Draw and Explain TTT diagram for 0.8%C eutectoid steel and show following processes on it. **8**

i) Austempering.

ii) Martempering.

iii) Patenting.

- b) What is Retained Austenite? How is it Eliminated? Explain. 5
7. a) Differentiate between ferritic and Austenite stabilizer. 6
- b) Explain the effect of Alloying element on the properties of steel. (Any four elements.) 7

**OR**

8. a) Define stainless steels and classify them in brief with applications. 7
- b) Write short notes on (**any two**). 6
- a) Hadfield manganese steel.
- b) Red Hardness.
- c) Maraging steel.
9. a) Distinguish between white cast iron and gray cast Iron. 6
- b) Draw and explain Cu-Zn diagram in brief. 7

**OR**

10. a) Explain how white cast iron is converted into malleable cast iron? State its application. 6
- b) Describe **any two** of following. 7
- a) Muntz metal.
- b) Cartridge Brass.
- c) Al-Si Alloy.
11. a) Define powder metallurgy. Explain various steps involved in manufacturing products by using powder metallurgy. 8
- b) What is NDT? Explain ultrasonic method of flaw detection. 6

**OR**

12. a) Explain Rockwell hardness test for determination of hardness. 7
- b) State advantages and limitations of powder metallurgy. 7

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**Engineering Metallurgy Paper – V**

P. Pages : 2

Time : Three Hours



TKN/KS/16/7319/7344

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Diagrams and chemical equations should be given whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Discuss the classification properties and applications of Engineering Materials. **7**
- b) Define the terms (a) Space Lattice (b) Unit Cell. Name the important crystal structure for metals. Draw neat sketch of any one. **6**

**OR**

2. a) What are the various Imperfections found in crystal structures? Explain in brief. **7**
- b) What is Plastic deformation? Explain slip mechanism in details with suitable sketch. **6**
3. a) What is Nucleation? Differentiate between homogeneous and heterogeneous nucleation. **7**
- b) Define Solid Solution. Explain Hume Rothery rule for formation of substitutional solid solution. **7**

**OR**

4. a) Draw Iron – Iron – Carbide Equilibrium diagram. Show all detail's on it. **8**
- b) Explain Three invariant reaction in Iron – Iron carbide diagram. **6**
5. a) What is Heat treatment? Explain Normalizing process in details. **7**
- b) Explain Jominy End Quench test to determine the hardenability of steel. **6**

**OR**

6. a) Draw and Explain TTT diagram for 0.8% C eutectoid steel and show following processes on it. **8**
- 1) Martempering
  - 2) Austempering
  - 3) Patenting
- b) What is Retained Austenite? How is it Eliminated? Explain. **5**

7. a) What is plain carbon steel? Classify it in details. 7  
b) What are the effects of adding alloying elements. Nickel, Chromium, Manganese, Tungsten on the properties of steel. 6

**OR**

8. Write short notes on **any three**. 13  
a) High Speed Steel.  
b) Red Hardness.  
c) Maraging Steel.  
d) Hadfield Manganese Steel.

9. a) Explain classification of cast iron in detail. 5  
b) Explain microstructure and characteristics of gray cast iron & give its uses. 8

**OR**

10. a) Explain Ni – Hard and Ni – Resist Cast iron with properties and applications. 6  
b) Draw and Explain Cu – Zn Diagram in brief. Explain in detail. 7  
11. a) Define Non – Destructive testing. Explain Ultrasound Test. 7  
b) Explain in detail the determination of hardness using Rockwell Hardness Tester. 7

**OR**

12. a) Define Powder Metallurgy. Explain the various steps involved in manufacturing products by using Powder Metallurgy. 8  
b) Give the advantages and Limitations of the Powder Metallurgy. 6

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- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Diagrams and chemical equations should be given whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Define Engineering materials. Write down the classification of Engineering materials in brief with practical applications. **8**  
b) Define the various mechanical properties of engineering materials. **5**  
**OR**
2. a) What is mean by Crystal Imperfections. Explain surface and volume imperfections. **7**  
b) Differentiate between metal and non-metal. **6**
3. a) Explain solidification process of pure metal. What is the effect of grain size on properties of metal? **7**  
b) What is solid solution. Explain Hume Rothery Rule for substitutional solid solution. **7**  
**OR**
4. a) Draw a neat sketch of Fe-Fe<sub>3</sub>C Diagram. Show all details on it. **8**  
b) Explain the three invariant Reactions occurs in Iron - carbide equilibrium diagram and prove it. **6**
5. a) Define Heat treatment. Explain the process of Annealing in detail with its industrial applications. **7**  
b) What is hardenability? Explain Jominy End Quench test to determine the hardenability of steel. **6**  
**OR**
6. a) What information is made available by T.T.T. - curve. Which lacks in the iron - iron carbide equilibrium diagram. **7**  
b) Explain flame hardening & induction hardening process with neat sketches. **6**

7. a) Explain the classification of plain carbon steel with its applications. 7  
b) Differentiate between ferritic and Austenite Stabilizer. 6

**OR**

8. Write short notes on **any three**. 13

- a) Tool steel  
b) Stainless steel  
c) Hadfield manganese steel  
d) Maraging steel.

9. a) Explain the classification of cast iron with its applications. 7  
b) Differentiate between white cast iron and Gray cast iron. 6

**OR**

10. a) Draw and explain (Cu - 50% Zn equilibrium) diagram in brief. 7  
b) Write note on following. 6  
i) Al - Si Alloy  
ii) Muntz Metal  
iii) Cartridge Brass

11. a) What is NDT. Explain Dic penetrant test to detect flaws in metal with industrial applications. 7  
b) Explain in detail how hardness measures by Rockwell hardness tester with application. 7

**OR**

12. a) What is powder metallurgy? Discuss its advantages and applications. 7  
b) Explain the production of cemented carbide tool by powder metallurgy technique. 7

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**Engineering Metallurgy**

P. Pages : 2

Time : Three Hours



**NKT/KS/17/7231/7256**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Diagrams and chemical equations should be given whenever necessary.
  10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) How the engineering materials are classified? Mention mechanical properties of it. **9**
- b) Differentiate between microscopic & macroscopic examination of materials. **4**

**OR**

2. a) Draw Schematic diagram of F.C.C. Crystal structure and calculate packing efficiency for it. **7**
- b) Define plastic deformation. Explain slip & twinning in brief. **6**
3. a) Define solid solution. Explain its various types. **7**
- b) Explain Hume Rothery rules. **6**

**OR**

4. a) Draw Iron - Iron carbide equilibrium diagram show all details on it. **7**
- b) Describe three invariant reactions in Fe-Fe<sub>3</sub>C equilibrium diagram. **6**
5. a) Define Heat Treatment. What are the various types of it? Explain any one in brief. **7**
- b) Define Hardenability. Explain Jominy End Quench test to find out Hardenability. **7**

**OR**

6. a) Draw and explain T-T-T curve in brief. **7**
- b) Explain flame hardening and induction hardening process with neat sketches. **7**
7. a) What are stainless steels? Give detailed classification and application of stainless steel. **7**

b) What are the effect of addition of 'Nickel' and 'Chromium' on the properties of steel. 6

**OR**

8. a) What do you understand by Red hardness? How is it achieved in H.S.S.? 7

b) Write short on **any two**. 6

i) Hadfield Manganese Steel.

ii) O. H. N. S. Steel.

iii) Maraging Steel.

9. a) What is white Cast Iron? Why it is brittle? Explain how it is converted into malleable cast iron. 7

b) Define brass. What are the various types of brasses? Mention their applications. 6

**OR**

10. a) Draw Cu - 50% Zn. diagram and explain it in brief. 7

b) Explain the variation in the mechanical properties of brasses with respect to zinc content. 6

11. a) Explain in detail the determination of hardness using Brinell Hardness Tester with advantages and industrial applications. 7

b) Define non - destructive test. Explain ultrasound testing on materials. 7

**OR**

12. a) Define Powder Metallurgy. State the advantages and limitations of powder metallurgy. Technique. 7

b) Explain the compaction process involved in powder metallurgy in details. 7

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NTK/KW/15/7319/7344

Faculty of Engineering and Technology  
Third Semester B.E. (Metallurgy Engg.) (C.B.S.)  
Examination

**ENGINEERING METALLURGY**

Time : Three Hours]

[Maximum Marks : 80

**INSTRUCTIONS TO CANDIDATES**

- (1) All questions carry marks as indicated.
  - (2) Solve **SIX** questions as follows :  
Que. No.- 1 OR Que. No.- 2  
Que. No.- 3 OR Que. No.- 4  
Que. No.- 5 OR Que. No.- 6  
Que. No.- 7 OR Que. No.- 8  
Que. No.- 9 OR Que. No.- 10  
Que. No.- 11 OR Que. No.- 12
  - (3) Due credit will be given to neatness and adequate dimensions.
  - (4) Illustrate your answers with necessary figures/drawings wherever necessary.
  - (5) Assume suitable data wherever necessary.
1. (a) Discuss the characteristics, properties and applications of :
- (i) Metals
  - (ii) Polymers
  - (iii) Composites
  - (iv) Ceramics.

8

- (b) Explain the important mechanical properties of metals. 5

**OR**

2. (a) What is meant by imperfections in crystal ? Explain the various line defects. 5
- (b) Calculate packing efficiency of FCC crystal structure. 4
- (c) Differentiate between slip and twinning. 4
3. (a) Distinguish clearly between homogenous nucleation and heterogeneous nucleation. 4
- (b) Describe the solidification of liquid metal in an ingot mould. 4
- (c) What are the various phases obtained in an Alloy ? Explain the types of intermediate phases formed in an alloy. 5

**OR**

4. (a) Draw a neat Iron-Iron carbide equilibrium diagram. Show all the temperature, composition and various phases present in it. 7
- (b) Write and explain three invariant reactions occurring in Fe-Fe<sub>3</sub>C diagram. 6
5. (a) Define Hardenability. Explain Jominy End Quench test to find out Hardenability. 7
- (b) Differentiate between Annealing and Normalizing of steel. 6

**OR**

6. (a) Indicate the temperature range of following heat treatments on Fe-Fe<sub>3</sub>C diagram :
- (1) Full Annealing

- (2) Normalizing
  - (3) Hardening
  - (4) Spherodising
  - (5) Stress relieving annealing. 5
- (b) Explain the procedure to construct the TTT diagram. Discuss the process of :
- (1) Austempering
  - (2) Martempering by using it. 8
7. (a) Differentiate between Ferrite stabilizers and Austenite stabilizers. 5
- (b) Explain the general effect of alloying elements on properties of steel. 5
- (c) Write short notes on Maraging steel and its application. 4

OR

8. (a) What do you understand by Red hardness ? How is it achieved in H.S.S ? 5
- (b) Why austenitic stainless steel is most popular ? Explain the process of 'Sensitization' and the methods to get rid of it. 5
- (c) Write short notes on Hadfield Mn-steel and its application. 4
9. (a) Explain, how white cast iron is converted into malleable cast iron. State its applications. 5
- (b) Write the production process, composition, microstructure and applications of grey cast iron. 5

- (c) Write short notes on "Nodular cast iron". 4

**OR**

10. (a) Draw Cu-50 % Zn equilibrium diagram and explain the effect of increasing Zn content on mechanical properties of Brass. 6
- (b) Describe any 'TWO' of the following :  $2 \times 4 = 8$
- (1) Muntz metal
  - (2) Cartridge Brass
  - (3) Al-Si Alloy
  - (4) ( $\alpha$ - $\delta$ ) Bronze.
11. (a) Explain the procedure for measurement of hardness with the help of Rockwell hardness tester. What are its advantages over other hardness test ? 7
- (b) What is NDT ? Explain Ultrasonic method of flaw detection. 6

**OR**

12. (a) Explain the steps involved in the production of components by powder metallurgy technique. 4
- (b) Explain the production of cemented carbide tool by powder metallurgy technique. 5
- (c) What are the advantages and limitations of powder metallurgy technique ? 4