



ROLL NO: \_\_\_\_\_

**PRESIDENCY UNIVERSITY, BENGALURU**  
**SCHOOL OF ENGINEERING**

Weightage: 20 %

Max Marks: 40

Max Time: 1 hr.

Tuesday, 25<sup>th</sup> September, 2018

**TEST – 1**

Odd Semester 2018-19

Course: **MEC 205 Structure and properties of materials**

III Sem. Mechanical

**Instruction:**

- (i) Read the question carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.

**Part A**

(3 Q x 4 M = 12 Marks)

1. Explain the nature of bonding in metals with the help of suitable sketch and examples. How does it affect the conductivity of metals?
2. Define coordination number. With a neat sketch derive the coordination number in a simple cubic crystal structure.
3. What are the various types of materials? Give an example and an application for each.

**Part B**

(3 Q x 6 M = 18 Marks)

4. State any five differences between screw and edge dislocation.
5. Na crystallizes in Body Centered Cubic crystal structure. The atomic weight of Sodium is 23gm/mole. The density of Na is 0.971 gm/cm<sup>3</sup>. Determine the value of Avogadro's constant given that the lattice constant for Na is 0.428 nm.
6. Describe the different types of point defects in crystals with the help of a neat sketch.

**Part C**

(1 Q x 10 M = 10 Marks)

7. With the help of a neat sketch derive the "a/r" ratio for BCC crystal structure. Using the above ratio find the atomic packing fraction for the crystal structure.  $\alpha$ -iron of atomic weight 56gm/mole solidifies into BCC crystal structure and has a density of 7900 Kg/m<sup>3</sup>. Calculate the atomic radius of each atom in Angstroms.



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TEST 2

Odd Semester: 2018-19

Course Code: MEC 205

Course Name: Structure & Properties of Materials

Branch & Sem: MEC & III Sem

Date: 28 November 2018

Time: 1 Hour

Max Marks: 20

Weightage: 20%

**Instructions:**

- (i) Read the question properly and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.

**Part A**

Answer **all** the Questions. **Each** question carries **four** marks. (3x4=12)

1. Briefly describe any two methods of manufacturing ceramic materials.
2. Differentiate between thermoplastic and thermosetting polymers with examples.
3. With the help of a neat sketch describe the mechanism of interstitial and vacancy diffusion in crystalline solids.

**Part B**

Answer **all** the Questions. **Each** question carries **six** marks. (3x6=18)

4. Explain the step by step process of solidification in pure metals with the help of neat sketches.
5. State and explain Fick's first law of diffusion. Support the statement with a suitable mathematical expression. Mention any two applications of diffusion.
6. Describe briefly the synthesis of polymers by addition polymerization and condensation polymerization. Support your answer with suitable examples.

**Part C**

Answer the Question. Question carries **ten** marks. (1x10=10)

7. State Gibb's phase rule with all the parameters involved. Under what circumstances is the condensed Gibb's phase rule applicable? The following figure shows the phase diagram of H<sub>2</sub>O. Calculate the degree of freedom for the system at the points 1, 2 & 3 mentioned in the figure.



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**PRESIDENCY UNIVERSITY  
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**END TERM FINAL EXAMINATION**

**Odd Semester:** 2018-19

**Course Code:** MEC 205

**Course Name:** Structure and Properties of Materials

**Programme & Sem:** MECH & III Sem

**Date:** 29 December 2018

**Time:** 2 Hours

**Max Marks:** 80

**Weightage:** 40%

**Instructions:**

- (i) Read the question carefully and answer accordingly.
- (ii) Question paper consists of 3 parts and all are compulsory.
- (iii) Scientific and Non-programmable calculators are permitted.
- (iv) Support your answers with suitable sketches wherever possible.

**Part A**

Answer **all** the Questions. **Each** question carries **five** marks.

(4Qx5M=20)

1. State the various single phase regions involved in Iron-Carbon system. Mention the properties and structure of these phases.
2. Briefly explain the phenomenon of fatigue and creep involved in materials along with the conditions under which they occur.
3. Describe the significance of A1, A2, A3 and Acm curves present in iron carbon phase diagram along with the phases involved.
4. Explain briefly case hardening of steel using pack carburizing and flame hardening.

**Part B**

Answer **all** the Questions. **Each** question carries **ten** marks.

(3Qx10M=30)

5. Construct Time-Temperature-Transformation curve for eutectoid steel along with all the possible phases. Briefly explain the conditions under which TTT diagram is useful in identifying the phases which will form during heat treatment.
6. Define hardenability of steel. What are the various factors affecting the hardenability of steel. Describe Jominy Quench test for determining the hardenability of steel. Support your answer with setup sketch and procedure.
7. Describe the process of recovery, recrystallization and grain growth of mild steel when it is subjected to full annealing.

### Part C

Answer **both** the Questions. **Each** question carries **fifteen** marks. (2Qx15M=30)

8. (a) Briefly explain the significance of the following mechanical properties with examples of materials which exhibit them: (10 M)

(i) Hardness.

(ii) Malleability.

(iii) Ductility.

(iv) Toughness.

(v) Elasticity.

(b) Draw and briefly explain the engineering stress-strain curve for ductile and brittle materials. (5 M)

9. Construct iron carbon phase diagram with the important temperatures, compositions and phases involved. Write the three major reactions taking place in the Iron-Carbon system along with the compositions of each phase involved and temperature at which these reactions take place.