Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech**

Sub_Code: RAU4G001/RCI4G001/RME4C003

4th Semester Back Examination: 2024-25

SUBJECT: Introduction to Physical Metallurgy and Engineering Materials

BRANCH(S): AUTO, CIVIL, MECH

Time: 3 Hours

Max Marks: 100

Q.Code: S510

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Draw the stress versus strain diagram of mild steel and show the salient points in it.

b) Name 2 crystal structures of the monoclinic system.

c) Show $[\bar{1}\bar{1}1]$ and $(1\bar{1}0)$ in a simple cubic unit cell.

d) What is solid solution?

e) What is the effect of temperature on concentration of vacancy?

f) What do you mean by isomorphous system?

g) What is cast iron? Why is it named so?

h) What is the difference between thermosetting and thermoplastics?

i) Why are grain boundaries the favourable sites for nucleation or growth for precipitates?

j) Define Composite.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Show that the c/a ratio of HCP unit cell is 1.633.

b) Explain yield point phenomena in mild steel.

c) Explain Lever rule and its application w.r.t. an isomorphous system.

d) Differentiate: Tetrahedral void vs. Octahedral void.

e) Explain the factors affecting hardenability.

f) Explain recovery, recrystallization, and grain growth of an annealed sample.

g) What is Metallography? Discuss about polishing techniques for metals and alloys. Give the requirements of etching in microscopic observation.

h) What is a phase? State Gibb's phase rule for metals and alloys. Find out the degrees of freedom at peritectic, eutectic, and eutectoid point of Fe-Fe_3C diagram.

i) Explain Hume-Rothery rules for the formation of alloys.

j) What is cooling curve? Draw the cooling curves for binary solid solution alloy and binary eutectic alloy.

k) Differentiate between PMC vs. MMC.

l) Mention the properties and applications of Grey cast iron and compare it with white cast iron.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 Give a brief Classification of engineering materials and explain Engineering requirements of materials. **(16)**

Q4 Draw a neat sketch of Fe-Fe_3C phase diagram. Show different phase fields. Explain different invariant reactions taking place in the system. **(16)**

Q5 Explain the effects of grain size, heat treatment, and alloying elements on properties of single-phase material. **(16)**

Q6 What are “Optical fibres”? Explain the principle, structure, and application of optical fibres. **(16)**