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

Total Number of Pages: 02 **B.Tech**
PCME4203

3rd Semester Back Examination 2017-18
Introduction To Physical Metallurgy And Engineering Materials
BRANCH: AUTO, MANUTECH, MECH, PE
Time: 3 Hours
Max Marks: 70
Q.CODE: B1124
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

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

a) Draw the [] direction and () plane in a cubic unit cell.
b) Differentiate between substitutional and interstitial solid solutions.
c) Draw the stress –strain diagram for brittle and ductile materials.
d) What is Burgers vector ? What is its significance?
e) Differentiate between eutectic and eutectoid reaction.
f) Contrast the microstructure between spheroidite and tempered martensite.
g) Write two types of cast iron.
h) What are nano materials?
i) Differentiate between thermosetting and thermoplastic materials.
j) What is sintering process?

Q2 **a)** Describe and illustrate the edge and screw dislocations. What are the principal slip planes and slip directions for FCC metals? **(5)**

b) Calculate the number of vacancies per cubic meter in gold at 900^0c. the energy for vacancies formation is 0.98eV/atom. Furthermore, the density and atomic weight for Au are 19.32g/cm³ and 196.9g/mol, respectively. **(5)**

Q3 **a)** Explain and find an expression for resolved shear stress. What is critical resolved shear stress? **(5)**

b) A single crystal of a metal that has the FCC crystal structure is oriented such that a tensile stress is applied parallel to the [100] direction. If the critical resolved shear stress for this material is 0.45 MPa , calculate the magnitude of applied stress necessary to cause slip to occur on the (111) plane in [011] direction. **(5)**

Q4 **a)** What are the Hume-Rothery rules for the solid solubility ? **(3)**

b) Draw binary isomorphous phase diagram of any two component system (say AB system) and show salient points on it **(3)**

c) Consider a Pb-70% Sn alloy. Determine **(4)**
(i) The amounts and compositions of each phase at 184^0C,
(ii) The amounts and compositions of each phase at 182^0C

Q5 **a)** Draw Iron-carbon equilibrium diagram and label the phase fields. Discuss in brief the different reactions that take place in this system. **(5)**

b) From the iron-iron carbide phase diagram , for a 0.2%C steel, name the phases and their fractions at equilibrium at the following temperatures: **(5)**
i) just above eutectoid temperatures and , ii) just below eutectoid temperature.

Q6 **a)** What is a T-T- T diagram? Why it is also called as isothermal transformation diagram? How is this transformation influenced by addition of chromium and nickel? **(5)**

b) With respect to isothermal transformation diagram explain what transformations will take place when a steel with 0.5%C is cooled at a (i) slow rate and (ii) fast rate. **(5)**
How is this transformation influenced by addition of chromium and nickel?

Q7 **a)** Describe the Jominy end quench test. Draw the hardenability curves for plain carbon steel and different alloy steels. What is the significance of these curves. **(5)**

b) Describe how steel is designated. What are alloy steels? Explain the composition, properties and applications of following stainless steels: **(5)**
I)austenitic and ii) martensitic.

Q8 **a)** Discuss the structure of an optical fibre. What are various types of fibres? Explain their advantages over conventional transmission devises. **(5)**

b) What do you mean by naonmaterial? **(5)**