Total No. of Questions : 8]

SEAT No. :

PB-4744

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S.E. (Automobile & Mechanical / Mechanical Sandwich / Automation & Robotics)

ENGINEERING MATERIALS AND METALLURGY

(2019 Pattern) (Semester - III) (202044)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Logarithmic tables, slide rule, electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What is solid solution? Explain substitutional & interstitial solid solution? Explain Hume-Rothery's rule for solid solubility? **[10]**

b) What is nucleation? What are its types? Explain solidification of pure metal? **[7]**

OR

Q2) a) Draw the cooling curves & show the application of Gibbs phase rule in each region. **[8]**

i) Pure metal
ii) Binary solid solution alloy
iii) Binary Eutectic alloy
iv) Off-eutectic binary alloy

b) Draw neat labelled Iron - Iron carbide equilibrium diagram & write 3 transformation reactions in it? **[9]**

Q3) a) What are the various transformation products of austenite? Explain any one in detail with respect to transformation mechanism, temperature, characteristics and structure? Arrange the transformation products in descending order with respect to hardness. **[9]**

b) What is retained austenite? What are its effects? Differentiate between TTT & CCT curve? **[9]**

OR

P.T.O.

Q4) a) What is hardenability? Which test is used to find it? Explain the test in detail? Enlist Surface hardening heat treatments? **[9]**

b) Differentiate between : **[9]**

i) Annealing & Normalizing

ii) Austempering & Martempering

iii) Induction hardening & Flame hardening

Q5) a) Mention the names of alloying elements used and the amount in present of alloy used in the following steels **[8]**

i) C40

ii) AISI 1040

iii) Fe 410 K

iv) St 42

v) Fe E 270

vi) 80 T 11

vii) 25 C 5

viii) T 75 W 18 Cr 4 V 2

b) What is stainless steel? Classify it with application? Explain sensitization of stainless steel? **[9]**

OR

Q6) a) What is Cast Iron? Enlist its important properties & applications? Write composition, properties & application of gray cast Iron? **[9]**

b) Draw the microstructure of **[8]**

i) Nodular cast iron

ii) Gray cast iron

iii) Malleable cast iron

iv) White cast iron

Q7) a) Suggest suitable nonferrous material for the following. Give typical composition of it. **[10]**

i) Cartridge case

ii) Measuring Tape

iii) Gun Barrel

iv) Coins

v) Bell

b) What is Additive Manufacturing? What are the advantages of it over conventional manufacturing? Give the properties, composition & application of any two materials used for it. **[8]**

OR

Q8) a) What is Age Hardening? Explain steps involved in it? Which are the factors influencing aging process? **[9]**

b) What are the requirements for good bearing alloys? Enlist important bearing alloys? Explain any two with properties, composition & application. **[9]**

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