MATERIAL SCIENCE AND TECHNOLOGY (SEMESTER - 4)

CS/B.TECH (CHE-N)/SEM-4/CHE-403/09
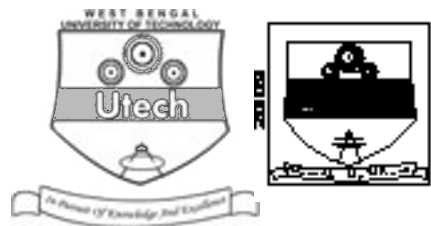
1. ....
    Signature of Invigilator

2. .... **Reg. No.**
    Signature of the Officer-in-Charge

Roll No. of the Candidate

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
MATERIAL SCIENCE AND TECHNOLOGY (SEMESTER - 4)

Time : 3 Hours]   [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a)   In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
    b)   For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

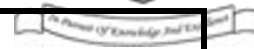### No additional sheets are to be used and no loose paper will be provided

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FOR OFFICE USE / EVALUATION ONLY
Marks Obtained

					Group – A				Group – B		Group – C			
Question Number													**Total Marks**	**Examiner's Signature**
Marks Obtained														

....
Head-Examiner/Co-Ordinator/Scrutineer

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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

MATERIAL SCIENCE AND TECHNOLOGY

SEMESTER - 4

Time : 3 Hours]   [Full Marks : 70

Graph sheet is provided on Page 31.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :   10 × 1 = 10

    i)   Carbon content of steel is .... per cent.

         a)   0·1 – 2   b)   4 – 6

         c)   2 – 4   d)   0·001 – 0·01.

    ii) How many atoms are there per unit cell in a body centred cubic lattice ?

         a)   2   b)   3

         c)   4   d)   6.

    iii) Corrosion resisting property of cast iron are significantly improved by the
         addition of 12% – 15% of

         a)   tungsten   b)   vanadium

         c)   silicon   d)   all (a), (b) and (c).

    iv) The ability of a material to offer resistance to scratching or indentation is a
         measure of its

         a)   brittleness   b)   toughness

         c)   hardness   d)   resilience.

v) The electrical conductivity of a .... decreases with rise in temperature.

    a) metal/alloy   b) semi-conductor

    c) dielectric   d) none of these.

vi) Creep is not exhibited at low temperature by

    a) rubber   b) acrylics

    c) lead   d) plastics.

vii) For hexagonal crystal structure, the relation between the lattice constants a, b, c and angles α, β, γ is

    a) $a = b = c$ and $\alpha = \beta = \gamma = 90°$

    b) $a = b = c$ and $\alpha = \beta = \gamma \neq 90°$

    c) $a = b \neq c$ and $\alpha = \beta = 90°, \gamma = 120°$

    d) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$.

viii) An elastic behaviour of materials is expressed in terms of

    a) hysteresis loop area   b) stress-strain curve

    c) relaxation time   d) none of these.

ix) Which of the following heat treatment processes is used for softening the hardened material ?

    a) Normalising   b) Tempering

    c) Annealing   d) None of these.

x) A material is called 'ductile', if it can be

    a) drawn into wires

    b) hammered into a thin sheet

    c) fractured without deformation

    d) made lustrous by heating it.

xi)   Leaching is an unit operation under

a)   Electro-metallurgy   b)   Pyro-metallurgy

c)   Hydro-metallurgy   d)   None of these.

xii)   The main difference between calcination and roasting is

a)   calcination is done in excess oxygen whereas roasting is done in limited oxygen

b)   calcination is done in limited oxygen whereas roasting is done in excess oxygen

c)   calcination is done in excess oxygen whereas roasting is done in absence of oxygen

d)   calcination is used in oxide ores, roasting is done in sulphide ores.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following questions. $3 \times 5 = 15$

2.   What do you understand by Bravais lattices ? Differentiate between monoclinic and triclinic crystal systems.   1 + 4

3.   Define atomic packing factor. Determine atomic packing factor for a BCC crystal.

2 + 3

4.   Define plastic deformation of a material. Define strength and toughness of engineering materials.   1 + 4

5.   What do you mean by slag ? Differentiate between calcination and roasting with example.   1 + 4

6.   Write short notes on slip and twining mechanism.   5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions.   3 × 15 = 45

7.   a)   What do you mean by dislocation in a material ? Explain edge dislocation.   1 + 5

    b)   What is creep ? Describe the mechanism of creep with a single graph.   1 + 5

    c)   What do you understand by strain hardening ?   3

8.   a)   Draw the iron-carbon phase diagram showing different phase fields and explain salient points.   7

    b)   Draw the T-T-T curve of eutectoid steel and explain the main transformations.   8

9.   a)   What is fatigue fracture ? How can the fatigue life of a component be improved ?   2 + 2

    b)   What is corrosion current ? With suitable examples, describe galvanic protection, cathodic protection and different types of non-metallic coatings.   2 + 9

10. a)   Write down the chemical reactions that occur in the blast furnace during the extraction of iron.   5

    b)   Explain the L.D. process of making steel. Write down the advantages of L.D. process over open hearth process.   7 + 3

11. a)   What are the principles of Hydrometallurgy and Electrometallurgy ?   2

    b)   How can Aluminium be extracted by using Hall-Heroult process ?   6

    c)   What is Electrorefining ? Describe the electrorefining process of Cu.   7

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END