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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B,Tech.

SEM: III - THEORY EXAMINATION (2022 - 2023)

Subject: Materials Science and Engineering

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A

20

1. Attempt all parts:-

- | | | |
|------|---|---|
| 1-a. | The space lattices with two lattice parameters belong to the crystal systems (CO1) | 1 |
| | (a) Tetragonal | |
| | (b) Rhombohedral | |
| | (c) Hexagonal | |
| | (d) All of above | |
| 1-b. | The minimum number of ions in the unit cell of an ionic crystal with FCC space lattice is (CO1) | 1 |
| | (a) 4 | |
| | (b) 8 | |
| | (c) 12 | |
| | (d) 16 | |
| 1-c. | Cold working of steel is defined as working (CO2) | 1 |
| | (a) At its recrystallisation temperature | |
| | (b) Above its recrystallisation temperature | |

- (c) Below its recrystallisation temperature
- (d) At two thirds of the melting temperature of the metal
- 1-d. As per Gibb's phase rule, if number of components is equal to 2 then the number of phases will be (CO2) 1
- (a) less than and equal to 2
- (b) less than and equal to 3
- (c) less than and equal to 4
- (d) less than and equal to 5
- 1-e. Diffusion taking place along a dislocation edge is known as (CO3) 1
- (a) Inter-diffusion
- (b) vacancy diffusion
- (c) surface diffusion
- (d) pipe diffusion
- 1-f. Calcium carbonate is used in the case of (CO3) 1
- (a) Hardening
- (b) Cyaniding
- (c) Tempering
- (d) Nitriding
- 1-g. Composite materials are classified based on (CO4) 1
- (a) Type of matrix
- (b) Size-and-shape of reinforcement
- (c) Both
- (d) None
- 1-h. Monel metal is an alloy of (CO4) 1
- (a) Molybdenum and nickel
- (b) Nickel and copper
- (c) Molybdenum and aluminium
- (d) Molybdenum and zinc
- 1-i. Which of the following is the function of the flame or emission system in atomic absorption spectroscopy? (CO5) 1
- (a) To split the beam into two
- (b) To break the steady light into pulsating light

- (c) To filter unwanted components
- (d) To reduce the sample into atomic state
- 1-j. X-rays required for industrial applications generally need a voltage of (CO5) 1
- (a) 500 V
- (b) Below 50 kV
- (c) Above 500 kV
- (d) Above 50 kV

2. Attempt all parts:-

- 2.a. Explain in brief atomic packing factor.(CO1) 2
- 2.b. Describe in brief Gibb's phase rule. (CO2) 2
- 2.c. Differentiate between microscopic and macroscopic diffusion.(CO3) 2
- 2.d. What are natural composites? Give an example.(CO4) 2
- 2.e. Explain in brief metallography.(CO5) 2

SECTION B

30

3. Answer any five of the following:-

- 3-a. Differentiate between the Non destructive testing and the Destructive testing with examples. (CO1) 6
- 3-b. Explain the creep test with neat sketch and what is its importance? (CO1) 6
- 3-c. Explain the recrystallization and grain growth in working of metals. (CO2) 6
- 3-d. Differentiate between the cold and hot working of metals. (CO2) 6
- 3.e. Explain the martempering and austempering heat treatment. (CO3) 6
- 3.f. Draw the stress-strain diagram for a composite material and explain it. (CO4) 6
- 3.g. Explain the procedure of specimen preparation for microstructure examination. (CO5) 6

SECTION C

50

4. Answer any one of the following:-

- 4-a. Explain the fatigue test with a neat sketch and draw a S-N curve.(CO1) 10
- 4-b. What are the imperfections in materials and write their types, explain with a neat sketch.(CO1) 10

5. Answer any one of the following:-

- 5-a. Draw the iron-carbon equilibrium diagram and explain it. (CO2) 10
- 5-b. What is meant by plain carbon steel and alloy steel ? Write about the various types of plain 10

carbon steel and their applications. (CO2)

6. Answer any one of the following:-

- 6-a. Draw the Time-Temperature-Transformation (T-T-T) diagram and explain it.(CO3) 10
- 6-b. Explain the Fick's laws and its application in diffusion.(CO3) 10

7. Answer any one of the following:-

- 7-a. What is meant by reinforcement materials? Write about their classification and applications.(CO4) 10
- 7-b. What is meant by nano-materials? Write about their classification and applications.(CO4) 10

8. Answer any one of the following:-

- 8-a. Explain the X-Ray diffraction technique with a neat sketch in details.(CO5) 10
- 8-b. Draw the planes of Miller Indices (2 1 2) in a cubic unit cell. Also find the inter planer spacing (2 0 0) in FCC crystal structure having atomic radius $1.246A_0$ (A_0 is Angstrom). (CO5) 10