

MOJOR - 1 QUESTION BANK

Govt (A) college

Essentials - Mathematics

Question Bank.

Essays:-

1. If $x+iy = \frac{1}{1+\cos\theta+i\sin\theta}$ Then show that

$$4x^2 - 1 = 0.$$

2. If the points whose position vectors are $3\bar{i} - 2\bar{j} - \bar{k}$, $2\bar{i} + 3\bar{j} - 4\bar{k}$, $-\bar{i} + \bar{j} + 2\bar{k}$, $4\bar{i} + 5\bar{j} + \lambda\bar{k}$ are coplanar then show that $\lambda = \frac{-146}{17}$

3. Find the mean of the following distribution

C.I	60-62	63-65	66-68	69-71	72-74
freq	15	118	142	127	18

V.S.Q's

1. find $\sin^{-1} 60^\circ + \cos^{-1} 60^\circ$
2. If $\sec\theta + \tan\theta = 5$, then find $\sec\theta - \tan\theta$
3. Find the multiplicative inverse of $3-5i$
4. find $\cos 42^\circ + \cos 78^\circ + \cos 162^\circ$
5. find the mean of 40, 50, 45, 35, 25
6. Find the median of 11, 15, 16, 14, 11, 13, 12, 14, 15, 16
7. find the mode of 1, 2, 3, 4, 4, 4, 5, 6, 7, 4
8. Write the formulae for median grouped data
9. If the vectors $2\bar{i} + \lambda\bar{j} - \bar{k}$ and $4\bar{i} - 2\bar{j} + 2\bar{k}$

are perpendicular to each other find the value of λ .

10. If $4\vec{i} + \frac{2p}{3}\vec{j} + p\vec{k}$ is parallel to the vector $\vec{i} + 2\vec{j} + 3\vec{k}$, find the value of 'p'

I Matching:

- | | | |
|--------------------|-----|--|
| 1. $\sin 60^\circ$ | () | a) $\frac{1 - \tan^2 A}{1 + \tan^2 A}$ |
| 2. $\tan 90^\circ$ | () | (b) $\frac{2 \tan A}{1 + \tan^2 A}$ |
| 3. $\sin 2A$ | () | (c) $\frac{1}{2}$ |
| 4. $\cos 2A$ | () | (d) ∞ |
| | | (e) $\frac{\sqrt{3}}{2}$ |

II

- | | | |
|---------------------------------------|-----|----------------------|
| 1. $2 + \sqrt{5}i$ additive inverse | () | (a) 30 |
| 2. $3 + 4i$ conjugate complex | () | (b) 4 |
| 3. The mode of 1, 4, 5, 4, 4, 6, 4, 1 | () | (c) $-2 - \sqrt{5}i$ |
| 4. The mean of 30, 40, 20, 10, 50 | () | (d) $3 - 4i$ |
| | | (e) $2 - \sqrt{5}i$ |

Application of maths

1. prove that $(\sin A \sin(60+A) \sin(60-A) = \frac{1}{4} \sin 3A$ and hence deduce that $\sin \frac{\pi}{9} \cdot \sin \frac{2\pi}{9} \cdot \sin \frac{3\pi}{9} \cdot \sin \frac{4\pi}{9} = \frac{3}{16}$

2. find the mode for the following data

C.I	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
f	5	8	7	12	28	20	10	10

PHYSICS Unit-2

Section A

Essay type answer Questions

1. State and explain Newton's Laws of motion
2. Explain about laws of thermodynamics and their significance
3. Explain various theories in understanding of Universe

Section B

One Sentence answer type Questions

1. What are the basic units?
2. Write two main domains of physics
3. State first law of thermodynamics
4. Give significance of 2nd law of thermodynamics
5. Write failures of Newtonian Mechanics
6. Write a short note on Relativistic Mechanics
7. What are acoustic waves?
8. What are electromagnetic waves?
9. Define electromagnetic induction
10. State uncertainty principle

Section C

Match the following

Column 1

1. Energy
2. Microscopic domain
3. Second Law of Thermodynamics
4. Electro-Magnetic Induction

Column 2

- () a. Quantum Mechanics
- () b. Generator
- () c. Joule
- () d. Refrigerator

Column 1	Column 2
5. Electron	<input type="checkbox"/> a. smallest unit of matter
6. Proton	<input type="checkbox"/> b. Negative
7. Neutron	<input type="checkbox"/> c. Neutral
8. Atom as a whole	<input type="checkbox"/> d. Positive

Unit-4

SECTION-A

1. How physics helps in environmental monitoring?
2. Write the applications of chemistry in Material Science.

SECTION-B

1. Integrated circuit industry is mainly based on which the principles ?
Ans: Solid state Physics
2. Development of high-performance electronic components and Nano scale devices requires the essential knowledge on _____(Quantum Mechanics)
3. Which principles help in designing robots with the desired range of motion, speed, and accuracy?(Kinematics and Dynamics)
4. An Application of Physics in automotive industry is _____ (Braking systems for improved stability, handling, and safety)
5. An Application of Physics in aerospace industry is _____(To design aircraft that can take off, maneuver, and land safely and efficiently.)
6. Write two types of calculus.

Ans:1. Differential Calculus 2. Integral Calculus

7. If we take the derivative of a function and then take the integral of it, we get _____(The same given function)

8. Give one physics problem that involves the application of differential equations

Ans: Newton's laws of motions and laws of thermodynamics

9. Give two application of chemistry in material science

Ans: To synthesis and fabricate various new materials and Material design and modifications

10. Write one application of complex analysis

Ans:To analyze sound waves in in speech recogniti

Unit III Chemistry

Essays

1. what are the branches in chemistry & give its significance.
2. Define Carbohydrate & explain its classification.

VSAQs

1. Give an example for physical change & chemical change.
2. Write the Electronic configuration of chromium.
3. What are water soluble & fat soluble vitamins.
4. Write any two functions of proteins.
5. Define Homogeneous & Heterogeneous mixtures.
6. Write the Structure of glucose.
7. What are Disaccharides.
8. What is peptide bond.
9. Write a note on vitamin B12.
10. Write a note on vitamin K.
11. Write any two application of food and beverages industries.
12. Write any two application of medicinal chemistry.

Column I

i). Proteins

ii). Carbohydrates

iii). Lipids

iv). Nucleic acids

v) vitamin B1

Column II

a. Monosaccharides (d)

b. Triglycerides (a)

c. Nucleotides (b)

d. Amino acids (c)

e. thiamine (e)

2. Match the following

Column I

(A) Vitamin B1

(B) Vitamin B2

(C) Vitamin B12

(D) Vitamin B6

(E) Vitamin E

Column II

(i) Convulsions

(ii) Pernicious
anaemia

(iii) Beri beri

(iv) Cheilosis

v) anemia

(A) → (iv), (B) → (iii), (C) → (i), (D) → (ii) ,E) V

Major 1 : Computers

Essay answer questions

1. Explain milestones of computer evolution
2. Explain the types of networks
3. Explain the basics of cryptography including the differences between symmetric and asymmetric encryption.

One Word Question &Answers

1. what is VLSI ?
2. what is two example of 3rd generation of computer?
3. what is TCP ?
4. ICMP is used for communication
5. What is encryption?
6. what is firewalls
7. what is VPN
8. what type of firewall operates as an intermediary between two systems?
9. what is the system that translates human-readable domain names into numerical IP addresses?
10. What is IP address?

Match The Following:

Matching - I

- | | | |
|----------------------|-----|----------------------------|
| 1. First Generation | (d) | a. Artificial Intelligence |
| 2. Second Generation | (c) | b. Magnetic Tapes |
| 3. Third Generation | (b) | c. Punched Cards |
| 4. Fourth Generation | (e) | d. Machine Language |
| 5. Fifth Generation | (a) | e. Microprocessor |

Matching – II

- | | | |
|---------|-----|----------------------------------|
| 1. TCP | (b) | a. Dynamic Host Control Protocol |
| 2. VPN | (d) | b. Transmission Control Protocol |
| 3. DHCP | (a) | c. User Datagram Protocol |
| 4. UDP | (c) | d. Virtual Private Network |
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GOVERNMENT COLLEGE (A), RAJAHMUNDRY

Major 2 : ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCE

QUESTION BANK

Advances - maths
Question - Bank.

Essays:-

1. Show That $2x - 3y - 2z = 0$, $2x + y - 3z = 0$, $3x + 2y - 2z = 0$ lines are concurrent.
2. Evaluate $\int \sqrt{1 - \sin 2x} \cdot dx$
3. Show That
$$\begin{vmatrix} a+b+c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$

v.s.a :-

1. Find $\frac{d}{dx} (e^{3x})$
2. Find $\frac{d}{dx} (\sin 2x)$
3. Find The $\int (x^4 + \cos x) dx$
4. Evaluate $\int \frac{dx}{9+x^2}$
5. Evaluate $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$
6. Evaluate $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x^3 - 1}$
7. Evaluate $\lim_{x \rightarrow 0} \frac{e^{7x} - 1}{x}$
8. slope intercept formulae
9. If $A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ Then find AI
10. If $A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ Then find A^{-1}

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are perpendicular to each other find the value of λ .

10. If $4\vec{i} + \frac{2p}{3}\vec{j} + p\vec{k}$ is parallel to the vector $\vec{i} + 2\vec{j} + 3\vec{k}$, find the value of 'p'

I Matching:

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Physics major-2

Essay type answer Questions

1. Write about different Renewable Energy resources and energy storage methods?
2. Explain about Quantum communication?
3. What are the recent advances in medical Physics?

Section B

One Sentence answer type Questions

1. What is the primary advantage of solar photovoltaic technology in renewable energy?
2. How does a pumped hydro storage system function as an energy storage device?
3. What is nanotechnology?
4. What is the significance of quantum dots in nanotechnology?
5. What distinguishes quantum communication from classical methods?
6. What is the significance of artificial intelligence in medical physics applications?
7. In what way have radiation therapy techniques advanced in medical physics?
8. How has advanced fluorescence microscopy contributed to recent breakthroughs in biophysics?
9. What role does single-cell biophysics play in understanding cellular heterogeneity?
10. How do recent advancements in magnetic resonance techniques contribute to studying biological systems?

Section C

Matching type Questions

I. Match the renewable energy technology with its application:

- | | |
|------------------------|--|
| 1. Photovoltaic cells | A. Heating buildings and water |
| 2. Wind turbines | B. Producing electricity in remote areas |
| 3. Hydropower plants | C. Generating electricity from sunlight |
| 4. Solar water heaters | D. Harnessing wind energy |
| 5. Biomass generators | E. Converting flowing water into electricity |

Ans: 1.C 2.D, 3.E 4.A 5.B

II. Match the medical imaging technique with its description:

- | | |
|---------------------------------------|---|
| 1. Magnetic Resonance Imaging (MRI) | A. Uses X-rays to create detailed cross-sectional images |
| 2. Computed Tomography (CT) | B. Utilizes strong magnetic fields and radio waves |
| 3. Ultrasound | C. Provides real-time imaging using sound waves |
| 4. Positron Emission Tomography (PET) | D. Visualizes metabolic activity in the body |
| 5. Nuclear Medicine | E. Produces three-dimensional images of internal structures |

Ans : 1B 2.A 3.C 4. E 5.D

Unit -4

I. Essays questions

1. Explain nano medicine and write applications?
2. Write a note on solid waste management?
3. Write a note on environmental remediation?

II. One word Sentence answer type Questions

1. Energy _____ technologies play a crucial role in smoothing out fluctuations in renewable energy generation (Storage)
2. Grid _____ refers to the ability of a power system to accommodate and manage large amounts of renewable energy. (Integration)
3. _____ converters are used to convert DC power from solar panels or wind turbines into AC power for the grid. (Inverters)
4. _____ resources like batteries and pumped hydro storage can store excess energy for later use. (Energy)
5. Smart grids use advanced _____ and control systems to improve the efficiency and reliability of the electrical grid. (Technology)
7. _____ is a key aspect of a smart grid, allowing utilities to better respond to changes in supply and demand. (Demand response)
8. Nano medicine involves the application of _____ and nanotechnology to the field of medicine. (Nano Particles)
9. Nanoparticles can be engineered to carry drugs directly to the _____ of disease. (Site)
10. Fluorescence _____ is a method used to visualize cellular structures and molecules in living organisms. (Microscopy)
11. Scanning _____ microscopy is a technique that allows for high-resolution imaging of surfaces. (tunnelling)
12. The study of the mechanical aspects of living organisms is known as _____ (bio mechanics)

13. In neurophysics, the _____ equation describes how electrical signals propagate along neurons. (cable)
14. _____ is the process by which neurons adjust their sensitivity to incoming signals based on the level of simulation. (plasticity)
15. Radiation therapy may be used as a _____ treatment or in combination with other treatments like surgery or chemotherapy. (primary)

III match the following

- | | | |
|-------------------------|-----|---|
| 1. Smart Grid | () | a) A localized group of interconnected loads and distributed energy resources that can operate independently from the traditional grid. |
| 2. Frequency Regulation | () | b) A system that allows utilities to communicate with and control various elements of the electrical grid in real-time. |
| 3. Energy Storage | () | c) The ability to change electricity usage in response to signals indicating a need to reduce demand. |
| 4. Micro grid | () | d) The ability of a power system to match generation and consumption in real-time. |

ANS: 1. C 2. B 3. D 4. A 5. E

- | | | |
|---|-----|---|
| 1. Demand Response | () | a) Real-time monitoring and control devices that provide synchronized measurements of the power grid. |
| 2. Advanced Metering Infrastructure (AMI) | () | b) Technology that allows utilities to adjust electricity usage in response to grid conditions or pricing signals. |
| 3. Distribution Automation | () | c) A system that enables two-way communication between utilities and customers, providing detailed information about electricity usage. |
| 4. Energy Efficiency | () | d) Implementing technologies to improve the use of electricity, reduce waste, and conserve energy. |
| 5. Phasor Measurement Units (PMUs) | () | e) Automation of the distribution system, including devices that can automatically re-route power and isolate faults. |

Ans 1) B 2). C 3). E 4). D 5). A

Advances in Chemistry

Unit III & IV

MAJOR-2

10M Essays

1. What is Computer aided drug design and Delivery?
2. What are Nano sensors?
3. Explain the impact of Chemical pollutants on human health
4. Explain the impact of Chemical pollutants on ecosystem
5. what is chemical biology?

VSAQs. 1M

1. What is QSAR?
2. What is Pharmacophore modelling?
3. What are the types of Nano sensors including?
4. What is Chemical Biology?
5. What is Chemical Genetics?
6. What is Chemical pollutants on Ecosystem?
7. What is Heterogeneous Catalysis?
8. Explain Biodiversity Loss Impact of Chemical pollutants on Ecosystem?
9. Write any two Applications of Nano sensors?
10. Write advantages for dye removal?
11. What is bio orthogonal chemistry?
12. What is Fenton's Reaction?

1. Match the following

Part A

1. Particle size of Nano sensor
2. Semiconductor of CNT
3. Rolled of carbon lattice
4. Carbon bonding in CNT
5. Gaseous chemicals

part B

- a) nickel (e)
- b) CO₂ (a)
- c) covalent (b)
- d) SWCNT (c)
- e) 10- 200nm (d)

2. Match the following

Part A

1. CADD (C)
2. intradermal (e)
3. Nano sensors (a)
4. Emil fisher proposed by (b)
5. catalyst (d)

part B

- a) tiny particles of 10- 100nm
- b) lock and key model
- c) applied to the majority of drug development
- d) rate of reaction
- e) drugs and injected into the top layer of the skin

Major 2 : Computers

Essay answer questions

1. Classification of number system
2. Explain the transmission media
3. Explain the network devices

Short answer questions

1. Which number system is foundational for computer science and digital electronics?
A. Binary
2. Conversion of Octal number $(540)_8$ to binary number? A.
 $(101100000)_2$
3. What is the speed of data transmission in 4G network of telecom?
A. 100 mbps to 1 gbps
4. What is the primary function of a modem?
A. Converting analog signals to digital signals
5. What is the primary function of a codec?
A. multiplexing and demultiplexing signals
6. What is the purpose of the parity bit in parity check?
A. to indicate the presence of errors in the data
7. What types of errors can parity check detect?
A. both single-bit and burst errors
8. What is the primary purpose of a repeater?
A. Signal amplification and extension
9. What is the primary function of a gateway?
A. Protocol translation and network interconnectivity
10. What do routers use to determine the best path for data packets to travel?
A. internet protocol (IP) addresses

Following Matchings

Matching - I

- | | | |
|-------------------|-----|-------------------------------------|
| 1. Modem | (c) | a. continuity |
| 2. Analog | (a) | b. Bluetooth |
| 3. Codec | (d) | c. modulation-demodulation |
| 4. Wireless media | (b) | d. multiplexing and de multiplexing |

Matching - II

- | | | |
|--------|-----|---------------------------------|
| 1. MAC | (c) | a. Local area network |
| 2. LAN | (a) | b. Internet protocol |
| 3. WWW | (d) | c. media access control address |
| 4. IP | (b) | d. world wide web |

GOVERNMENT COLLEGE (A) :: RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
B.Sc. Materials Science Single Major
Course 3: Concepts in Materials Science
Question Bank

[Essay Questions](#)

[Unit -1](#)

1. Basing on band theory in solids, distinguish between metals, insulators and semi-conductors
2. Write briefly about different types of bonding's in crystals? Explain about Madelung constant?
3. Discuss the different types of weak bonding forces, including van der Waals forces and hydrogen bonding

Unit-2

1. Explain Bravais space lattices
2. What are the different types of packing arrangements in crystals and how do they influence the packing fractions?
3. Explain the crystal structures of Diamond, and ZnS with diagram

Unit-3

1. Explain about ionic conductivity in alkali halides.
2. What are colour centres? Explain about the production of colour centres
3. Explain the concept of a stacking fault. How do they originate?

Unit-4

1. Describe about the velocity of growth in crystals.
2. What is twinning? Explain about Martensite transformation
3. Explain the different types of twinning that can occur in crystals

Unit-5

1. Describe the Laue conditions for X-ray diffraction and Bragg's law
2. Explain about the Powder X-ray diffraction method
3. Discuss the significance of the atomic scattering factor in understanding crystal structures

Short Answer Questions

UNIT-1

1. What is the difference between intrinsic and extrinsic semiconductors?
2. Explain about the potential energy of ionic crystals
3. How do energy bands form in solids?

UNIT-2

1. Define the terms "translational vector," "lattice," and "basis." How are they related?
2. Write about miller indices
3. Describe briefly about the structure of NaCl

UNIT-3

1. What is the Burger vector? How is it related to the displacement of atoms around a dislocation?
2. Define a plane defect. Give examples.
3. What is a grain boundary?

UNIT-4

1. Discuss the role of dislocations in crystal growth
2. What are the different types of crystal defects?
3. Write about Recrystallization process

UNIT-5

1. What is the atomic scattering factor, and how does it depend on the scattering angle?
2. Write any three applications of XRD
3. Discuss about Geometrical factor

QUESTION BANK
COURSE 4: Science of materials in daily life (Major 2)

UNIT-1

Essay questions

1. Explain the mechanical and optical properties of conductors
2. What is doping? Describe the doping method in semiconductors to get P-type and N-type material?
3. What is an alloy? Explain the preparation of gold alloy and mention the uses of it

Short questions

1. Write the advantages of alloys
2. Explain about forward and reverse bias of p-n junction diode
3. Write the uses and drawbacks of metals

UNIT-II

Essay questions

1. Write the physical and chemical properties of polymers
2. What are the most common processing techniques used for polymers and composites?
3. Write the properties and applications of composite materials

Short questions

1. How are polymers classified based on their structure
2. Explain briefly about composites like wood and concrete
3. What is Fibre? Mention different types of natural and synthetic fibres

UNIT-III

Essay questions

1. What is ceramic? What are the different fabrication methods used in ceramics?
2. Mention the properties and applications of ceramics?
3. Explain the structure of graphite and diamond with diagrams

Short questions

1. Mention about the types of ceramics
2. Write the uses of ceramics in daily life
3. Explain the structure of fullerene

UNIT-IV

Essay questions

1. Explain about photochromic and photosensitive glasses?
2. How are the glasses synthesized explained? Mention the properties of glasses

Short questions

1. Write the applications of glasses in daily life
2. Write a short note on different types of glasses

UNIT-V

Essay questions

1. Describe Sol-gel and PVD methods of synthesizing nano materials
2. Write the properties and applications of nano materials

Short questions

1. Describe about surface to volume ratio in nano materials.
2. Explain about top-down and bottom-up approach

III SEMESTER
MATERIALS SCIENCE
COURSE 5: CRSTALLOGRAPHY AND CRYSTAL STRUCTURE
QUESTION BANK

ESSAY QUESTIONS

UNIT-1

1. Describe the Bravais Lattices in 3-Dimensional crystal with neat diagrams? **(BL-1 &2)**
2. State crystal defect? Explain the point defect and line defect in the crystal? **(BL-1 &2)**
3. Derive the expression for interplaner spacing in the crystal? **(BL-2)**

UNIT-2

1. State and explain Bragg's Law? Mention it's physical significance? **(BL-1, BL2 & BL-3)**
2. Explain the Laue equations of a 3-Dimensional crystal and derive Bragg's law from Laue equations? **(BL-1, BL2 & BL-3)**
3. Describe the powder diffraction method to determine the crystal structure? **(BL-2)**

UNIT-3

1. State principles of electron diffraction? Explain LEED technique to study crystal surface? **(BL-1 &BL-2)**
2. Explain the neutron diffraction to study the magnetic properties of the crystal? **(BL-1 &BL-2)**
3. Differences and similarities between X-ray diffraction and electron diffraction? **(BL-2)**

UNIT-4

1. Explain the role of defects on electrical and thermal properties of crystals? **(BL-3)**
2. Explain the working of Scanning Electron Microscope (SEM)? **(BL-1 &BL-2)**
3. Explain the working of Transmission Electron Microscope (TEM)? **(BL-1 &BL-2)**

UNIT-5

1. Describe the construction of Ewald Sphere and its applications? **(BL-3)**
2. Discuss the principles of crystal growth? Describe any one method of crystal growth? **(BL-1 &BL-2)**

SHORT QUESTIONS

UNIT-1

1. State crystal lattice and basis? **(BL-1)**

2. State unit cell and primitive cell? **(BL-1)**
3. Determine the miller indices of a crystal plane, if the intercepts of the plane are $1a$, $2a$ and $3a$ with x , y and z axis where a is lattice constant? **(BL-3)**

UNIT-2

1. Write a short note on the properties of X-rays? **(BL-2)**
2. Briefly explain about continuous and characteristic X-rays? **(BL-2)**
3. Write a short note on applications of X-ray diffraction? **(BL-3)**

UNIT-3

1. State applications and limitations of electron diffraction? **(BL-3)**
2. Principles of electron diffraction? **(BL-1)**

UNIT-4

1. Briefly explain the interaction of neutrons with matter? **(BL-2)**
2. Write a short note on creep and fatigue? **(BL-2)**
3. Briefly explain structure and energy of grain boundary? **(BL-1 & BL-2)**

UNIT-5

1. State and explain reciprocal lattice? **(BL-1 & BL-2)**
2. Write a short note on interpretation of electron density maps? **(BL-3)**
3. Discuss the principles of crystal growth? **(BL-1)**
4. Discuss the applications of crystal growth in semiconductor industry? **(BL-3)**

III SEMESTER B.Sc (Hons) Material Science

(2023-2024 admitted batch of students)

Course: 6 Thermodynamics and Kinetics of Materials

Question bank

Unit 1: Thermodynamic Principles

Essay questions:

1. Explain Carnot cycle and derive the expression for efficiency?
2. Explain how the thermodynamic principles are used understanding the properties of materials, particularly in alloys and phase changes.
3. Explain the concepts of internal energy, work, and heat. Discuss the First Law of Thermodynamics.
4. Explain the concept of entropy and its significance in the second law of thermodynamics. Discuss how entropy relates to the spontaneity of processes and provide examples of spontaneous and non-spontaneous processes in nature.
5. Explain Gibbs free energy and chemical potential in detail.

Short answer questions:

1. Write short notes on Specific heats and calorimetry.
2. Explain Entropy and its physical meaning.
3. Define a closed system in thermodynamics. How does it differ from an open system?
4. Define the terms Thermodynamics, System, Surroundings, State and Process

Unit 2: Phase Diagrams

Essay questions:

1. How do you interpret a unary phase diagram for water? What phases are present at different temperatures?
2. Explain binary phase diagram with an example.
3. Explain ternary phase diagram with an example

Short answer questions:

1. Explain Lever rule and tie-line rule.
2. Explain Peritectic and monotectic reactions
3. Explain Nucleation and growth in phase transformations.

Unit3: Statistical Thermodynamics

Essay questions :

1. Compare and contrast Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein statistics.

2. Discuss the significance of the Boltzmann distribution in statistical mechanics.

How does it relate microstates to macro states, and what implications does it have for understanding thermodynamic systems?

3. What are the applications of statistical mechanics in material science?

Short answer questions:

1. Define a Macrostate and explain how it differs from a Microstate.

2. How is entropy defined in the context of statistical mechanics?

3. What is the significance of the concept of degeneracy in statistical mechanics?

Unit 4: Kinetics of Materials

Essay questions:

1. What is Fick's First Law of Diffusion, and Kirkendall effect?

2. Explain kinetic models and reaction mechanisms.

3. What are some common methods for synthesizing nanomaterials?

Short answer questions:

1. Define the Kirkendall effect and its significance in materials science.

2. Explain sintering and densification.

3. Explain homogeneous and heterogeneous nucleation.

4. What are the main differences between interstitial and vacancy diffusion mechanisms?

Unit 5: Thermodynamics and Kinetics of advanced Materials

Essay Questions

1. Explain the thermodynamics of biomolecules.

2. Explain the synthesis and growth of nanomaterials.

3. Discuss the significance of surface energy and surface tension in materials science

Short answer questions:

1. What is the difference between surface energy and surface tension?

2. Explain the thermodynamics of nanomaterials.

3. Applications of thermodynamics in biotechnology.

DEPARTMENT OF PHYSICS
II B.Sc, MATERIAL SCIENCE (HONS) – SEM III (COURSE-7)
COURSE 7: MECHANICAL PROPERTIES OF MATERIALS

QUESTION BANK

Unit 1: Introduction to Mechanical Properties

Essay Questions (7 marks)

1. Explain the concept of Hooke's law and its application in elastic deformation. (BL2: understanding)
2. What is Young's modulus? Explain its significance in determining material stiffness. (BL2: understanding)
3. Explain what yield strength is and how it influences the design of mechanical components. (BL2: understanding)
4. Explain the significance of true stress and true strain in plastic deformation. (BL2: understanding)

Short Answer Questions (3 marks)

1. Define stress and strain. (BL1: remembering)
2. What is the difference between elastic and plastic deformation? (BL1: remembering)
3. State Hooke's law. (BL1: remembering)
4. Define yield strength. (BL1: remembering)
5. What is work hardening? (BL2: understanding)

Unit 2: Fracture Mechanics

Essay Questions (7 marks)

1. Define ductile fracture and describe its characteristics. (BL1: remembering)
2. What is fatigue? Explain how it affects the longevity of materials. (BL2: understanding)
3. Describe the basic form of an S-N curve and its relevance in predicting fatigue life. (BL2: understanding)
4. Explain the creep mechanisms and how they affect the mechanical properties of materials at high temperatures. (BL3: applying)
5. Describe the methods used in failure analysis to identify the cause of material failure. (BL3: applying)

Short Answer Questions (3 marks)

1. Define brittle fracture. (BL1: remembering)
2. What is fracture toughness? (BL2: understanding)
3. What is an S-N curve? (BL2: understanding)
4. What is failure analysis? (BL1: remembering)
5. Name two factors that affect fatigue strength. (BL2: understanding)

Unit 3: Strengthening Mechanisms

Essay Questions (7 marks)

1. Define work hardening and explain how it strengthens materials. (BL2: understanding)
2. Explain the Hall-Petch relationship and its role in grain boundary strengthening. (BL2: understanding)
3. What is solid solution strengthening? Describe how it enhances material properties. (BL2: understanding)
4. Explain the significance of controlling grain size in the mechanical properties of materials. (BL2: understanding)

5. Explain the basic heat treatment process for precipitation hardening in Al-Cu alloys. (BL3: applying)

Short Answer Questions (3 marks)

1. What is cold working? (BL1: remembering)
2. What factors affect solid solution strengthening? (BL2: understanding)
3. Name two examples of alloys that undergo precipitation hardening. (BL1: remembering)
4. What is the effect of grain size on material strength? (BL2: understanding)
5. What are the key differences between work hardening and precipitation hardening? (BL4: analyzing)

Unit 4: Mechanical Properties of Specific Materials

Essay Questions (7 marks)

1. Compare the mechanical properties of ferrous and non-ferrous alloys. (BL3: applying)
2. Explain the brittle behavior of ceramics and its implications for their use in engineering applications. (BL2: understanding)
3. What is viscoelastic behavior in polymers? Describe how it affects the mechanical performance of plastics. (BL2: understanding)
4. Explain the role of biomaterials in medical implants and their key mechanical properties. (BL2: understanding)

Short Answer Questions (3 marks)

1. What are fiber-reinforced composites? (BL1: remembering)
2. Name two toughening mechanisms used in ceramics. (BL2: understanding)
3. What is the significance of matrix materials in composites? (BL2: understanding)
4. What are the primary applications of titanium alloys in aerospace? (BL2: understanding)
5. Name two polymers used in biomedical applications. (BL1: remembering)

Unit 5: Applications and Case Studies

Essay Questions (7 marks)

1. What role do mechanical properties play in material selection for engineering design? (BL2: understanding)
2. Describe the importance of lightweight materials in automotive and aerospace industries. (BL2: understanding)
3. Explain the mechanical properties that make materials suitable for biomedical implants. (BL2: understanding)
4. Describe the process of material selection for a high-performance component in the aerospace industry. (BL3: applying)
5. Compare the wear and tear mechanisms encountered in different industrial environments. (BL3: applying)

Short Answer Questions (3 marks)

1. Why are mechanical properties crucial in material selection? (BL2: understanding)
2. Name two design criteria for selecting materials in aerospace applications. (BL1: remembering)
3. Define wear and tear in industrial applications. (BL2: understanding)
4. Name two wear-resistant materials used in industry. (BL1: remembering)
5. What are the mechanical requirements of prosthetics? (BL2: understanding)
6. What is nanomechanics? (BL2: understanding)
7. Name two materials used in automotive applications. (BL1: remembering)

B.Sc. Materials Science Question Bank
Course 8: Electrical and Mechanical Properties of Materials

Unit 1: Fundamentals of Electrical Properties

Essay Questions:

1. Explain the differences between conductors, semiconductors, and insulators based on their band structure. (Level 2: Understand)
2. Describe the concept of intrinsic and extrinsic semiconductors. Explain the role of doping in modifying the electrical properties of semiconductors. (Level 3: Apply)
3. Discuss the free electron theory of electrical conductivity in metals. How does Matthiessen's rule help explain the influence of temperature and impurities on conductivity? (Level 3: Apply)

Short Answer Questions:

1. What is the temperature dependence of electrical conductivity in metals and semiconductors? (Level 2: Understand)
2. Briefly explain how electron and hole mobility affect the conductivity of semiconductors. (Level 2: Understand)
3. Define Matthiessen's rule and explain its significance in understanding the conductivity of metals. (Level 1: Remember)

Unit 2: Semiconductor Materials and Devices

Essay Questions:

1. Explain the difference between intrinsic and extrinsic semiconductors. How does doping affect the electrical properties of semiconductors? (Level 2: Understand)
2. Discuss the formation of a p-n junction and describe its current-voltage characteristics. (Level 3: Apply)
3. Explain construction and working of photovoltaic cell (Solar Cell)

Short Answer Questions:

1. What are the electrical properties of pure (intrinsic) semiconductors? (Level 1: Remember)
2. How do diodes function as rectifiers in electronic circuits? (Level 2: Understand)
3. Define the basic structure and operation of a BJT. (Level 2: Understand)
4. Explain working of LED? Give two examples of their applications. (Level 1: Remember)

Unit 3: Dielectric Materials and Applications

Essay Questions:

1. Explain the different mechanisms of polarization in dielectric materials. How do these mechanisms vary with frequency? (Level 2: Understand)
2. Discuss the concept of dielectric constant and dielectric loss. Explain their significance in determining material performance in capacitors. (Level 3: Apply)
3. Explain piezoelectric effect. Write some applications. (Level: Apply)

Short Answer Questions:

1. What is dielectric relaxation and why is it important? (Level 2: Understand)
2. How does temperature affect the dielectric properties of materials? (Level 2: Understand)
3. Explain the measurement of dielectric constant.
4. Define piezoelectric effect and mention one of its uses. (Level 1: Remember)

Unit 4: Magnetic Materials and Applications

Essay Questions:

1. Compare the magnetic properties of diamagnetic, paramagnetic, and ferromagnetic materials. (Level 2: Understand)
2. Discuss the concept of magnetic hysteresis. Explain the significance of the hysteresis loop in designing magnetic storage media and transformers. (Level 3: Apply)
3. Explain the domain theory of ferromagnetism and describe the process of magnetization in materials. (Level 3: Apply)

Short Answer Questions:

1. What is magnetic susceptibility and how is it measured? (Level 1: Remember)
2. Explain the difference between hard and soft magnetic materials. (Level 2: Understand)
3. What are Curie and Neel temperatures? Why are they important for magnetic materials? (Level 1: Remember)

Unit 5: Emerging Trends in Electronic Materials

Essay Questions:

1. Discuss the basics quantum dots and nanowires and how they are used in advanced electronic devices? (Level 3: Apply)
2. Explain the structure and operation of organic light-emitting diodes (OLEDs). How do they differ from traditional LEDs in terms of materials and applications? (Level 3: Apply)
3. Explain thermoelectricity and discuss the importance of thermoelectric materials for energy harvesting (Level 4: Analyze)

Short Answer Questions:

1. What are the key features of conducting polymers? (Level 1: Remember)
2. What are quantum dots? Mention one of their applications. (Level 2: Understand)
3. Define spintronics and explain its potential application in future electronic devices. (Level 2: Understand)

B.Sc. Material Science

Semester-IV

Course 9: Characterization Techniques in Material Science

Question Bank

Unit 1: Optical Microscopy

Essay Questions:

1. Explain the principles of light microscopy and discuss the components of an optical microscope. (Blooms Level 2: Understand)
2. Describe the process of sample preparation for optical microscopy, highlighting etching techniques for metals and polymers. (Blooms Level 3: Apply)
3. Compare and contrast bright field and dark field microscopy. Discuss their practical applications in material science. (Blooms Level 4: Analyze)
4. Discuss the applications of polarized light microscopy in the analysis of birefringent materials and their importance in material science. (Blooms Level 4: Analyze)

Short Answer Questions:

1. What is the role of magnification and resolution in optical microscopy? (Blooms Level 1: Remember)
2. Define bright field microscopy and mention one of its applications. (Blooms Level 2: Understand)
3. Explain the significance of phase contrast microscopy. (Blooms Level 2: Understand)
4. How is failure analysis conducted using optical microscopy? (Blooms Level 3: Apply)

Unit 2: Electron Microscopy

Essay Questions:

1. Explain the principles of scanning electron microscopy (SEM) and discuss its applications in surface morphology analysis. (Blooms Level 2: Understand)
2. Describe the differences between secondary and backscattered electron imaging in SEM. How do they provide different information? (Blooms Level 3: Apply)
3. Discuss the sample preparation techniques for transmission electron microscopy (TEM). How are thin samples prepared for TEM analysis? (Blooms Level 4: Analyze)
4. Explain the advanced techniques in electron microscopy such as High-Resolution TEM (HRTEM) and Scanning Transmission Electron Microscopy (STEM). (Blooms Level 4: Analyze)

Short Answer Questions:

1. What is selected area electron diffraction (SAED) and how is it used in material analysis?

(Blooms Level 2: Understand)

2. Define the basic working principle of transmission electron microscopy (TEM). (Blooms Level 2: Understand)
3. What are the primary applications of SEM in material science? (Blooms Level 2: Understand)
4. Mention two advantages of using cryo-preparation methods in electron microscopy. (Blooms Level 1: Remember)

Unit 3: Spectroscopy Techniques

Essay Questions:

1. Explain the principles of Raman spectroscopy. Discuss its applications in material identification and stress analysis. (Blooms Level 2: Understand)
2. Describe the instrumentation and techniques used in X-ray photoelectron spectroscopy (XPS). How is it applied in elemental analysis? (Blooms Level 3: Apply)
3. Compare the principles and applications of FTIR and UV-Vis spectroscopy in material analysis. (Blooms Level 4: Analyze)
4. Discuss the principles of NMR spectroscopy and its applications in the structural analysis of organic compounds. (Blooms Level 4: Analyze)

Short Answer Questions:

1. What is the significance of chemical shift in NMR spectroscopy? (Blooms Level 2: Understand)
2. How is band gap determined using UV-Vis spectroscopy? (Blooms Level 3: Apply)
3. Explain the principle behind energy-dispersive X-ray spectroscopy (EDS). (Blooms Level 2: Understand)
4. What are the key applications of FTIR spectroscopy in polymer analysis? (Blooms Level 1: Remember)

Unit 4: Thermal Analysis Techniques

Essay Questions:

1. Discuss the principles and operation of differential scanning calorimetry (DSC). How is it used to measure thermal transitions in materials? (Blooms Level 3: Apply)
2. Explain thermogravimetric analysis (TGA) and its applications in determining material stability. (Blooms Level 2: Understand)
3. Compare differential thermal analysis (DTA) with DSC. Discuss their respective applications in material analysis. (Blooms Level 4: Analyze)
4. Describe dynamic mechanical analysis (DMA) and its applications in analyzing viscoelastic properties of polymer materials. (Blooms Level 4: Analyze)

Short Answer Questions:

1. What are the key thermal transitions measured in DSC? (Blooms Level 1: Remember)
2. How is TGA used in material composition analysis? (Blooms Level 2: Understand)

3. What is the basic principle of DMA? (Blooms Level 2: Understand)
4. Mention two applications of thermal analysis techniques in quality control. (Blooms Level 1: Remember)

Unit 5: Advanced Characterization Methods

Essay Questions:

1. Explain the principles of atomic force microscopy (AFM). How is it used to study surface topography? (Blooms Level 2: Understand)
2. Discuss the principles of scanning tunneling microscopy (STM) and its applications in nanostructure analysis. (Blooms Level 3: Apply)
3. Describe the working principles of X-ray computed tomography (CT) and its applications in non-destructive testing. (Blooms Level 4: Analyze)
4. Discuss the role of surface plasmon resonance (SPR) in biosensing applications. Explain how it is used to study surface interactions. (Blooms Level 4: Analyze)

Short Answer Questions:

1. What are the imaging modes used in AFM? (Blooms Level 2: Understand)
2. Define tunneling current and its importance in STM. (Blooms Level 2: Understand)
3. Mention one application of X-ray tomography in material science. (Blooms Level 1: Remember)
4. What are the current research trends in integrating multiple characterization methods? (Blooms Level 3: Apply)

B.Sc. Material Science
Semester IV
Course 10: Polymer Science
Question Bank

Unit 1: Basics of Polymer Science

Essay Questions

1. Define polymers and discuss their classification. Explain the historical development and significance of polymers in modern applications. (BL2)
2. Describe the mechanisms of addition (chain-growth) and condensation (step-growth) polymerization, with examples. (BL2)
3. Explain the terms number average and weight average molecular weight. How is polydispersity index calculated, and what does it signify? (BL3)
4. Outline IUPAC polymer nomenclature and list some commercial polymers with their trade names and common applications. (BL2)

Short Answer Questions

1. Differentiate between thermoplastics and thermosets. (BL2)
2. Define homopolymers and copolymers, providing examples of each. (BL2)
3. Briefly explain copolymerization and its types. (BL1)
4. What is meant by molecular weight distribution in polymers? (BL2)

Unit 2: Polymer Structure and Properties

Essay Questions

1. Explain crystallinity in polymers and discuss factors affecting it. How is crystallinity measured? (BL3)
2. Describe the glass transition temperature and melting temperature, and explain their significance in amorphous and semi-crystalline polymers. (BL2)
3. Discuss tensile strength, modulus, and elongation at break in polymers. Why are these mechanical properties important? (BL3)
4. Explain the dielectric properties of polymers and the characteristics of conductive polymers. (BL2)

Short Answer Questions

1. Define amorphous and semi-crystalline polymers, with examples. (BL2)
2. What is thermal stability, and how is it measured in polymers? (BL2)
3. Describe optical clarity in polymers and its significance in applications. (BL2)
4. Differentiate between creep and stress relaxation in polymers. (BL3)

Unit 3: Polymer Processing and Fabrication

Essay Questions

1. Describe the extrusion and injection molding processes. How are these processes used in polymer fabrication? (BL2)

2. Discuss the different methods of fiber spinning, including melt, dry, and wet spinning, and their applications in industry. (BL2)
3. Explain the roles of additives such as stabilizers, plasticizers, and fillers in polymer properties. (BL3)
4. Describe the environmental impacts of polymer recycling and outline some recent advances in biodegradable polymers. (BL3)

Short Answer Questions

1. What are the primary differences between injection molding and blow molding? (BL2)
2. List two techniques for forming polymer films and their applications. (BL2)
3. Explain the significance of polymer blending and compounding. (BL2)
4. What are reinforcement materials in polymers, and how do they affect polymer properties? (BL3)

Unit 4: Advanced Polymer Systems

Essay Questions

1. Describe the synthesis, properties, and applications of conductive polymers, with a focus on polyaniline and polythiophene. (BL2)
2. Explain biodegradable polymers, their mechanisms of biodegradation, and applications in the medical field. (BL3)
3. Discuss the properties and applications of polymer nanocomposites, focusing on types of nanofillers used. (BL2)
4. Describe stimuli-responsive polymers and hydrogels, and explain their applications in drug delivery. (BL3)

Short Answer Questions

1. Define polymer nanocomposites and list two common nanofillers. (BL1)
2. What are smart polymers? Give one example. (BL2)
3. Explain how polymers are used in electronic displays. (BL2)
4. List two applications of biodegradable polymers in environmental fields. (BL3)

Unit 5: Characterization and Testing of Polymers

Essay Questions

1. Explain FTIR spectroscopy and its application in analyzing functional groups in polymers. (BL2)
2. Describe the principles and applications of differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA) in polymer testing. (BL3)
3. Discuss tensile testing in polymers, including stress-strain behavior, and its relevance to material properties. (BL3)
4. Explain polymer rheology, the importance of viscosity measurement, and its applications in processing. (BL3)

Short Answer Questions

1. Briefly describe the use of UV-Vis spectroscopy in analyzing optical properties. (BL2)
2. What does NMR spectroscopy reveal about polymer structure? (BL2)
3. Define creep testing and its significance in polymers. (BL3)
4. What is the purpose of viscosity measurement in polymers? (BL2)

B.Sc. Material Science
Semester IV
Course 11: Ceramics and Composite Materials
Question Bank

Unit 1: Fundamentals of Ceramic Materials

Essay Questions (7 marks)

1. Explain the historical development and applications of ceramics in various industries. *(Bloom's Level 2 - Understanding)*
2. Describe the mechanical, thermal, and electrical properties of ceramics. *(Bloom's Level 2 - Understanding)*
3. Discuss common crystal structures found in ceramics, including examples of silicates and oxides. *(Bloom's Level 3 - Applying)*
4. Explain the process of sintering in ceramics and its role in material densification. *(Bloom's Level 2 - Understanding)*
5. Describe the applications of ceramics in structural, functional, and biomedical fields, with relevant examples. *(Bloom's Level 3 - Applying)*

Short Answer Questions (3 marks)

1. Define ceramics and list their primary classifications. *(Bloom's Level 1 - Remembering)*
2. What role does bonding play in determining the properties of ceramic materials? *(Bloom's Level 2 - Understanding)*
3. Differentiate between hardness and brittleness in ceramics. *(Bloom's Level 2 - Understanding)*
4. List two forming techniques used in ceramic processing. *(Bloom's Level 1 - Remembering)*
5. Explain the significance of ceramic materials in biomedical applications. *(Bloom's Level 2 - Understanding)*

Unit 2: Types of Ceramics and Their Properties

Essay Questions (7 marks)

1. Describe the properties and applications of traditional clay-based ceramics and glass. *(Bloom's Level 3 - Applying)*
2. Explain the differences between oxide and non-oxide ceramics, giving examples of each. *(Bloom's Level 3 - Applying)*
3. Discuss the biocompatibility of bioceramics and their use in medical applications. *(Bloom's Level 2 - Understanding)*
4. Explain the working principles and applications of dielectric and piezoelectric electroceramics. *(Bloom's Level 2 - Understanding)*
5. Provide a case study that demonstrates the use of ceramics in modern technology. *(Bloom's Level 3 - Applying)*

Short Answer Questions (3 marks)

1. List two examples of traditional ceramics and their applications. (*Bloom's Level 1 - Remembering*)
2. What are bioinert ceramics, and where are they used? (*Bloom's Level 2 - Understanding*)
3. Define ferroelectric materials and give one application. (*Bloom's Level 1 - Remembering*)
4. How are ferrites utilized in magnetic applications? (*Bloom's Level 2 - Understanding*)
5. Name one advanced ceramic material used in aerospace and its benefit. (*Bloom's Level 2 - Understanding*)

Unit 3: Introduction to Composite Materials

Essay Questions (7 marks)

1. Define composite materials and discuss the role of matrix and reinforcement components. (*Bloom's Level 2 - Understanding*)
2. Describe the filament winding process and its applications in composite fabrication. (*Bloom's Level 3 - Applying*)
3. Explain the impact of fiber orientation on the mechanical properties of composites. (*Bloom's Level 2 - Understanding*)
4. Discuss environmental and cost considerations involved in composite material selection. (*Bloom's Level 3 - Applying*)
5. Describe applications of composite materials in aerospace, automotive, and construction industries. (*Bloom's Level 2 - Understanding*)

Short Answer Questions (3 marks)

1. List three types of composite materials based on the matrix material. (*Bloom's Level 1 - Remembering*)
2. What is pultrusion, and where is it used? (*Bloom's Level 2 - Understanding*)
3. Define toughness in the context of composites. (*Bloom's Level 1 - Remembering*)
4. Why is recycling of composite materials challenging? (*Bloom's Level 2 - Understanding*)
5. Give one example of a composite material used in automotive applications. (*Bloom's Level 1 - Remembering*)

Unit 4: Types of Composites

Essay Questions (7 marks)

1. Compare the properties and applications of glass, carbon, and aramid fiber-reinforced composites. (*Bloom's Level 3 - Applying*)
2. Explain the differences between thermosets and thermoplastics as matrix materials in composites. (*Bloom's Level 2 - Understanding*)
3. Discuss the properties and applications of particle-reinforced composites. (*Bloom's Level 2 - Understanding*)
4. Describe the unique properties of nanocomposites and their applications in electronics. (*Bloom's Level 3 - Applying*)

5. Analyze environmental considerations when designing and using composite materials. (*Bloom's Level 4 - Analyzing*)

Short Answer Questions (3 marks)

1. What is a structural composite, and where is it used? (*Bloom's Level 1 - Remembering*)
2. List two common particles used in particle-reinforced composites. (*Bloom's Level 1 - Remembering*)
3. What are nanofillers, and why are they added to composites? (*Bloom's Level 2 - Understanding*)
4. Explain the concept of a sandwich panel. (*Bloom's Level 2 - Understanding*)
5. Why are cost considerations important in the use of composite materials? (*Bloom's Level 3 - Applying*)

Unit 5: Characterization and Testing of Ceramics and Composites

Essay Questions (7 marks)

1. Explain the process and importance of hardness testing in ceramics. (*Bloom's Level 2 - Understanding*)
2. Describe how thermal and electrical conductivity of ceramics are tested. (*Bloom's Level 3 - Applying*)
3. Compare the applications of optical, SEM, and TEM microscopy in ceramics characterization. (*Bloom's Level 4 - Analyzing*)
4. Discuss the principles and applications of ultrasonic and radiographic non-destructive testing. (*Bloom's Level 3 - Applying*)
5. Analyze current advancements in testing techniques for ceramics and composites with examples. (*Bloom's Level 4 - Analyzing*)

Short Answer Questions (3 marks)

1. Define Vickers hardness testing. (*Bloom's Level 1 - Remembering*)
2. What is the purpose of thermal shock resistance testing? (*Bloom's Level 2 - Understanding*)
3. List one advantage of using SEM in materials characterization. (*Bloom's Level 1 - Remembering*)
4. Name two non-destructive testing methods for ceramics. (*Bloom's Level 1 - Remembering*)
5. Why is creep testing important in ceramics and composites? (*Bloom's Level 2 - Understanding*)