GOVERNMENT COLLEGE (A), RAJAHMUNDRY

I B.Sc Honors – I SEM

Course1: Essentials and Applications of Mathematical, Physical and Chemical Sciences

Model Paper

Time: 2 Hr. 30 Min. **MAX MARKS: 50M**

SECTION - A

Answer any Three of the following Essays **3x10= 30M**

1. If $(x + iy) = \frac{1}{1+cos\theta+isin\theta}$, Show that $4x^2 - 1 = 0$
2. State and explain Newton's laws of motion
3. Explain briefly about the electronic configuration
4. Explain how physics helps in environmental monitoring?
5. What is Internet and give its applications

SECTION - B

Answer All of the following Very Short Answers questions 12x1= 12M

6. If Secθ + Tanθ= 5, then find Secθ - Tanθ
7. Find the multiplicative inverse of 3-5i
8. Find the median of numbers 11,15,16,14,11,13,12,14,15,16
9. Prove that 2i+3j-k and 4i-2j+2k are perpendicular
10. Write any two applications of Mathematics in physics and chemistry
11. What is the derivative of integral of x^2
12. Give any two Applications of physics in automotive industry
13. Expand the forms NMR and FBDD in drug industry
14. What type of firewall operates as an intermediary between two systems?
15. What is the system that translates human-readable domain names into numerical IP addresses?
16. What is IP address?
17. Give two example of 3rd generation of computer?

SECTION - C

Match the following **2x4= 08**

Column 1		**Column 2**
18. Energy	( )	a.Quantum Mechanics
19. Microscopic domain	( )	b .Generator
20. Second Law of Thermodynamics	( )	c.Joul
21. Electro-Magnetic Induction	( )	d.Refrigerator

Column 1		Column 2
22. Proteins	( )	a. Monosaccharides
23. Carbohydrates	( )	b. Triglycerides
24. Lipids	( )	c. Nucleotides
25. Nucleic acids	( )	d. Amino acids

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
I B.Sc Honors – I SEM
Course 2: Advances in Mathematical, Physical and Chemical Sciences
Model Paper

Time: 2 Hr. 30 Min. **MAX MARKS: 50M**

SECTION - A

Answer any Three of the following Essays **3x10= 30M**

1. Transform $x + y - 2 = 0$
   i) Slop Intercept form ii) Normal form
2. Write about different Renewable Energy resources and energy storage methods?
3. What is Computer aided drug design and Delivery?
4. Write a note on solid waste management?
5. Explain the network devices?

SECTION - B

Answer All of the following Very Short Answers questions **12x1= 12M**

1. Find $\frac{d}{dx} e^x =$
2. Find $\frac{d}{dx} Sin\ 3x$
3. If A= $\begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ *Then find out* A^{-1}
4. write the slope intercept formula?

1. Energy _____ technologies play a crucial role in smoothing out fluctuations in enewable energy generation
2. _____ resources like batteries and pumped hydro storage can store excess energy for later use.
3. Nanoparticles can be engineered to carry drugs directly to the _____ of disease.
4. _____ is the process by which neurons adjust their sensitivity to incoming signals based on the level of simulation.
5. What is QSAR
6. What is Chemical Biology?
7. Write any two Applications of Nano sensors?
8. What is Fenton's Reaction?

SECTION - C

Answer All of the following Matching questions 2x4=8M

1.Match the following

1. Photovoltaic cells	( )	a. Heating buildings and water
2. Wind turbines	( )	b Converting flowing water into electricity
3. Hydropower plants	( )	c. Generating electricity from sunlight
4. Solar water heaters	( )	d. Harnessing wind energy

2. Match the following

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

GOVERNMENT COLLEGE (A) :: RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
B.Sc. Materials Science Single Major
Course 3: Concepts in Materials Science
SEM- 2 Model Question Paper

SECTION-A

Answer all the questions **5x7=35 Marks**

1. Basing on band theory in solids, distinguish between metals, insulators and semi-conductors

Or

2. Write briefly about different types of bonding's in crystals? Explain about Madelung constant?
3. Explain Bravais space lattices

Or

4. What are the different types of packing arrangements in crystals and how do they influence the packing fractions?
5. Explain about ionic conductivity in alkali halides.

Or

6. What are colour centres? Explain about the production of colour centres
7. Describe about the velocity of growth in crystals.

Or

8. What is twinning? Explain about Martensite transformation
9. Describe the Laue conditions for X-ray diffraction and Bragg,s law

Or

10. Explain about the Powder X-ray diffraction method

SECTION-B

Answer any FIVE questions **5x3=15 Marks**

11. Explain about the potential energy of ionic crystals
12. Write about miller indices
13. Describe briefly about the structure of NaCl
14. Discuss the role of dislocations in crystal growth
15. Write about Recrystallization process
16. Write about grain boundaries
17. Write any three applications of XRD
18. Discuss about Geometrical factor

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DEPARTMENT OF PHYSICS

B.Sc. Material Science Single Major

Course 4 - **Science of materials in daily life**

Model Question Paper

SECTION-A

Answer all the questions **5x7=35 Marks**

1. Explain the mechanical and optical properties of conductors

Or

2. What is doping? Describe the doping method in semiconductors to get P-type and N-type material?
3. Write the physical and chemical properties of polymers

Or

4. What are the most common processing techniques used for polymers and composites?
5. What is ceramic? What are the different forming techniques used in ceramics?

Or

6. Mention the properties and applications of ceramics?
7. Explain about photochromic and photosensitive glasses?

Or

8. How are the glasses synthesized explained? Mention the properties of glasses
9. Describe any two methods of synthesizing nano materials

Or

10. Write the properties and applications of nano materials

SECTION-B

Answer any FIVE questions **5x3=15 Marks**

11. Write the advantages of alloys
12. Explain about forward and reverse bias of p-n junction diode
13. How are polymers classified based on their structure?
14. Explain briefly about wood and concrete
15. Explain the structure of fullerene
16. Write a short note on different types of glasses
17. Describe about surface to volume ratio in nano materials.
18. Explain about top-down and bottom-up approach

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DEPARTMENT OF PHYSICS

B.Sc. Material Science Single Major

SYLLABUS (w.e.f. 2023-24)

SEM-III

COURSE 5 - Crystallography and Crystal Structures

Model Question Paper

SECTION-A

Answer ALL questions **7x5=35**

1. Explain different types of Bravais lattices with neat diagrams? [BT 1 & BT2]

[OR]

2. State crystal defects? Discuss point defects and line defects in detail? [BT 1 & BT2]
3. State and explain Bragg's Law? What is the physical significance of Bragg's law? [BT 2 & BT 3]

[OR]

4. Explain powder diffraction method to study the crystal structure? [BT2]
5. State principles of electron diffraction? Explain the LEED electron diffraction method? [BT 1 & BT2]

[OR]

6. Explain the interaction of neutrons with matter? Discuss the study of magnetic materials using neutron diffraction method? [BT 2 & BT 3]
7. Describe the role of crystal defects in electrical and thermal properties? [BT 3]

[OR]

8. Describe the role of crystal defects in mechanical properties? [BT 3]
9. Explain the construction of Ewald sphere and its applications? [BT 2 & BT 3]

[OR]

10. State principles of crystal growth? Explain Czochralski technique of crystal growth? [BT 1 & BT 2]

Answer Any FIVE questions **SECTION-B** **3 x 5 =15**

11. State crystal lattice and basis? [BT 1]
12. The intercepts made by the crystal plane are 1a, 2a and 3a. Determine the miller indices of the crystal plane? [BT 3]
13. Briefly explain the properties of x-rays? [BT 2]
14. Determine the strain using x-ray diffraction technique? [BT 3]
15. Discuss the similarities and differences between X-ray diffraction and electron diffraction? [BT 2]
16. State and explain creep and fatigue of the material? [BT 2]
17. State reciprocal lattice and briefly explain its properties? [BT 1 & BT 2]
18. Analyse the electron density maps to study the crystal structure? [BT 4]

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DEPARTMENT OF PHYSICS

B.Sc. Material Science Single Major

SYLLABUS (w.e.f. 2023-24)

SEM-III

COURSE 6 - Thermodynamics and Kinetics of Materials

Model Question Paper

SECTION-A

Answer ALL questions **7 x 5 =35M**

1. Explain Carnot Cycle and derive the expression for efficiency. [BT 2 & BT3]

[OR]

2. Write the thermodynamic applications in material science. [BT3]
3. Explain a unary phase diagram of water. [BT 2]

[OR]

4. Explain binary phase diagrams with an example. [BT2]
5. Write the differences between Maxwell-Boltzmann statistics, Fermi-Dirac statistics and Bose-Einstein statistics [BT 4]

[OR]

6. Write the applications of statistical mechanics in material science. [BT 3]
7. Explain Fick's law of diffusion and Kirkendall effect. [BT 3]

[OR]

8. Explain kinetic models and reaction mechanisms. [BT 2]
9. Explain thermodynamics of biomolecules. [BT 2]

[OR]

10. Explain synthesis and growth of nanomaterials. [BT 2]

Answer any FIVE questions **SECTION-B** **3 x 5 =15M**

11. Explain heat, work and the first law of thermodynamics. [BT 2]
12. Explain open system, closed system and isolated system. [BT 2]
13. Explain lever rule and tie line rule. [BT 2]
14. Explain phase rule and its applications. [BT 3]
15. Explain Microstates and Macrostates. [BT 2]
16. Explain sintering and densification. [BT 2]
17. Explain homogeneous and heterogeneous nucleation. [BT 2]
18. Explain thermodynamics of nanomaterials [BT 2]

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DEPARTMENT OF PHYSICS

B.Sc. Material Science Single Major SYLLABUS (w.e.f. 2023-24)

COURSE 7: Mechanical Properties of Materials

MODEL PAPER

Section-A

Answer all five questions **7x5 = 35M**

1. Explain the difference between elastic and plastic deformation. *(BL-2: Understanding)*

OR

2. Discuss the mechanical testing methods for materials, including tensile, hardness, and impact tests. (BL-4: Analyzing)
3. Describe ductile and brittle fracture. How do microstructural aspects influence these types of fractures? (BL-2: Understanding)

OR

4. Explain the factors affecting fatigue strength and interpret the significance of S-N curves in predicting fatigue life. (BL-4: Analyzing)
5. Explain the Hall-Petch relationship. How does grain size influence the mechanical properties of materials? (BL-2: Understanding)

OR

6. Discuss precipitation hardening. Provide examples of alloy systems that utilize this technique, such as Al-Cu alloys. (BL-3: Applying)
7. Compare the mechanical properties of ferrous and non-ferrous alloys. What makes these materials suitable for different industrial applications? (BL-4: Analyzing)

OR

8. Describe the deformation mechanisms in polymers and explain how their viscoelastic behavior affects their applications. (BL-2: Understanding)
9. Discuss the role of mechanical properties in material selection for structural components in aerospace and automotive industries. (BL-4: Analyzing)

OR

10. Explain the mechanical properties that are critical for biomedical implants. Provide case studies of material selection for prosthetics. (BL-5: Evaluating)

Section-B

Answer any five questions. **3x5 = 15M**

11. Define stress and strain, and differentiate between tensile and compressive stress. (BL-1: Remembering)
12. What are the elastic constants, and how are they related? (BL-1: Remembering)
13. Explain the mechanisms of work hardening and its impact on material properties. (BL-3: Applying)
14. What is fracture toughness, and why is it important in material design? (BL-2: Understanding)
15. Describe the basic mechanisms of creep in materials. (BL-2: Understanding)
16. Define viscoelasticity and give examples of materials. (BL-2: Understanding)
17. Explain the significance of the matrix and reinforcement in fiber-reinforced composites. (BL-3: Applying)
18. Describe the importance of wear-resistant materials in industrial applications. (BL-3: Applying)

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DEPARTMENT OF PHYSICS

B.Sc. Material Science Single Major
SYLLABUS (w.e.f. 2023-24)
COURSE 8: Electrical and Magnetic Properties of Materials

MODEL PAPER
Section-A

Answer all five questions **7x5 = 35M**

1. Explain the differences between conductors, semiconductors, and insulators based on their band structure. (BL-2: Understanding)

OR

2. Derive the expression for carrier concentration in intrinsic semiconductors. How does doping modify the carrier concentration? (BL-3: Applying)
3. Describe the construction and working of a p-n junction diode. How is it used in rectification? (BL-2: Understanding)

OR

4. Compare the structure and operational characteristics of BJTs and MOSFETs. Highlight their applications in amplification. (BL-4: Analysing)
5. Discuss the various polarization mechanisms in dielectric materials. How does the frequency affect polarization? (BL-3: Applying)

OR

6. Explain the working principle of piezoelectric materials and their applications in sensors and actuators. (BL-3: Applying)
7. Describe the magnetic hysteresis loop and its significance in the classification of soft and hard magnetic materials. (BL-2: Understanding)

OR

8. Discuss the working principles of Type I, Type II superconductors, and their applications in modern technology. (BL-4: Analysing)
9. Explain the concept of Nano electronics and its significance in the development of quantum dots and nanowires. (BL-2: Understanding)

OR

10. Discuss the role of thermoelectric materials in energy harvesting devices. How do these materials contribute to sustainable energy solutions? (BL-5: Evaluating)

Section-B

Answer any five questions **3x5 = 15M**

11. Define Ohm's Law and explain its significance in electrical circuits. (BL-1)
12. What are the key differences between intrinsic and extrinsic semiconductors? (BL-2)
13. What are the applications of light-emitting diodes (LEDs) in modern electronics? (BL-3)
14. Describe dielectric constant and dielectric loss in materials. (BL-2: Understanding)
15. What is the significance of Curie temperature in magnetic materials? (BL-2)
16. Explain the piezoelectric effect and name two applications of piezoelectric materials. (BL-2)
17. What are the basic principles behind molecular electronics? (BL-2)
18. Define organic semiconductors and discuss their role in flexible electronics. (BL-3)

GOVERNMENT COLLEGE (A) RAJAHMUNDRY

DEPARTMENT OF PHYSICS
B.Sc. (Hons.) Material Science.
Semester-IV,
Course 9: **Characterization Techniques in Material Science**
Model Paper

Time : 2.5 Hr. Max Marks : 50

Section A – Essay Questions (7 Marks Each)

(Answer all the questions)

1) Explain the principles of light microscopy, detailing the basic components of an optical microscope.

OR

2) Describe the differences between bright field and dark field microscopy, and discuss their applications in material science.

3) Discuss the principles and applications of scanning electron microscopy (SEM) in analyzing surface morphology.

OR

4) Explain the working principle of transmission electron microscopy (TEM) and its applications in crystallography.

5) Describe the principles of X-ray photoelectron spectroscopy (XPS) and its applications in surface chemistry analysis.

OR

6) Explain the principles of Fourier transform infrared (FTIR) spectroscopy and its applications in functional group identification.

7) Explain thermogravimetric analysis (TGA) and its applications in determining material stability.

OR

8) Describe differential scanning calorimetry (DSC) and its role in measuring thermal transitions such as glass transition temperature (Tg) and melting temperature (Tm).

9) Explain the principles and applications of atomic force microscopy (AFM) in surface topography analysis.

OR

10) Describe X-ray computed tomography (CT) and discuss its applications in non-destructive testing.

Section B – Short Answer Questions (3 Marks Each)
(Answer any five questions)

11. Define magnification and resolution in optical microscopy and their importance in material analysis.

12. What are the differences between secondary and backscattered electron imaging in SEM?

13. Explain the principle behind Raman scattering and one of its applications in material science.

14. What information does nuclear magnetic resonance (NMR) spectroscopy provide about a material?
15. Mention two applications of dynamic mechanical analysis (DMA) in material science.
16. Define tunneling current in scanning tunneling microscopy (STM) and its sgnificance.
17. What are the primary applications of surface plasmon resonance (SPR) in biosensing?
18. List two applications of X-ray tomography in material science.

GOVERNMENT COLLEGE (A) RAJAHMUNDRY

DEPARTMENT OF PHYSICS

B.Sc. (Hons.) Material Science Model Paper

Semester-IV

Course 10: Polymer Science

Time : 2.5 Hr. Max Marks : 50

Section A – Essay Questions (7 Marks Each)

(Answer all the questions)

1) Explain the mechanism of condensation polymerization and discuss its significance in polymer science.

OR

2) Describe the methods used to determine molecular weight in polymers and explain the concept of polydispersity index.

3) Discuss the factors affecting the crystallinity of polymers and explain how crystallinity is measured.

OR

4) What is the glass transition temperature (Tg)? How does it affect the mechanical properties of polymers?

5) Explain the process of injection molding and its importance in the fabrication of polymer products.

OR

6) What are polymer blends? Discuss the impact of polymer blending and the role of additives.

7) Describe the types and properties of polymer nanocomposites. How do nanofillers improve the performance of these materials?

OR

8) Discuss the applications of smart polymers and hydrogels in drug delivery and tissue engineering.

9) Explain how FTIR and NMR spectroscopy are used in the characterization of polymers.

OR

10) Describe the principles of thermogravimetric analysis (TGA) and how it is used to determine the thermal stability of polymers.

Section B: Short Answer Questions (3 Marks each)

Answer any five questions.

11. Define thermoplastics, thermosets, and elastomers.
12. What is the significance of the melting temperature (Tm) in polymers?
13. Briefly explain the blow molding technique used in polymer fabrication.
14. List the main types of biodegradable polymers and mention one application for each.
15. What are conductive polymers? Give two examples and their applications.
16. How tensile testing is performed on polymer samples?
17. Explain the basic principle of Differential Scanning Calorimetry (DSC).
18. What is polymer rheology and why is it important in processing?

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DEPARTMENT OF PHYSICS

B.Sc. (Hons.) Material Science.

Semester-IV

Course 11: Ceramics and Composite materials

Model Paper

Time : 2.5 Hr. Max Marks : 50

Section A – Essay Questions (7 Marks Each)

(Answer all questions)

1) Explain the historical development and applications of ceramics in various industries.

Or

2) Describe the process of sintering and its impact on the properties of ceramic materials.

3) Discuss the properties and applications of bioceramics in the medical field.

Or

4) Explain the different types of advanced ceramics and their applications in aerospace and electronics.

5) Describe the classification of composites based on matrix materials and provide examples.

Or

6) Discuss the various fabrication methods used in composite materials, such as filament winding and pultrusion.

7) Compare and contrast fiber-reinforced composites and particle-reinforced composites, mentioning their properties and uses.

Or

8) Explain the fabrication, properties, and applications of nanocomposites.

9) Describe the mechanical testing methods used for ceramics and composites, including hardness and fracture toughness measurements.

Or

10) Discuss the significance of non-destructive testing (NDT) methods, such as ultrasonic and radiography testing, in material characterization.

Section B

(Answer any five questions. Each question carries 3 marks)

11. Define ceramics and explain how they are classified.
12. What is the role of bonding in determining ceramic properties?
13. Explain the impact of crystallinity on the properties of ceramics.
14. Describe the importance of dielectric ceramics in electronics.
15. Outline the primary components of composite materials.
16. Discuss the economic and environmental considerations in using composites.
17. What are the advantages of using laminates in structural composites?
18. Describe the use of SEM in analyzing ceramic microstructures.