

GOVERNMENT COLLEGE (A), RAJAHMUNDRY

I B.Sc Honors – I SEM (Dec 2023)

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 $\|x + iy\| = \frac{1}{1+\cos\theta+i\sin\theta} \|x + iy\| = \frac{1}{1+\cos\theta+i\sin\theta}$, Show that $4\| \|^2 - 1 = 0 \| \|^2 - 1 = 0$
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 it's applications

SECTION - B

Answer All of the following Very Short Answers questions

12x1= 12M

6. If $\sec\theta + \tan\theta = 5$, then find $\sec\theta - \tan\theta$
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 (Dec 2023)
CourseII: 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

Transform $x + y - 2 = 0$

- i) Slope Intercept form ii) Normal form
- Write about different Renewable Energy resources and energy storage methods?
- What is Computer aided drug design and Delivery?
- Write a note on solid waste management?
- Explain the network devices?

SECTION - B

Answer All of the following Very Short Answers questions

12x1= 12M

- Find $\frac{d}{dx} e^x =$
- Find $\frac{d}{dx} \sin 3x$
- If $A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ Then find out A^{-1}
- write the slope intercept formula?
- Energy _____ technologies play a crucial role in smoothing out fluctuations in renewable energy generation
- _____ resources like batteries and pumped hydro storage can store excess energy for later use.
- Nanoparticles can be engineered to carry drugs directly to the _____ of disease.
- _____ is the process by which neurons adjust their sensitivity to incoming signals based on the level of stimulation.
- What is QSAR
- What is Chemical Biology?
- Write any two Applications of Nano sensors ?
- 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
MODEL PAPER FOR II- SEMESTER END EXAMINATION
MECHANICS AND PROPERTIES OF MATTER
(As Approved in the BOS meeting held on 2 AUG 2022 for batch 2022-2023)

Time: 2 Hr. 30 Min.

Max. Marks: 50

SECTION - A

Answer ALL Questions

5x7=35 Marks

1. State and proof of Gauss Divergence Theorem?
(OR)
2. State and Prove Stokes Theorem?
3. derive an expression for Velocity of Rocket?
(OR)
4. Derive an Expression for the Rutherford Scattering Cross section?.
5. Derive an Expression for the Precession Velocity of the Top?
(OR)
6. Discuss Classification of the Beams?
7. Define the Central Force and show the Central Force is a Conservative Force?
(OR)
8. State and Prove Kepler's 1st Law?
9. Explain the Michelson Morley Experiment with neat diagram?
(OR)
10. Derive equation for the Lorentz Transformations.

SECTION - B

Answer any five questions

5 × 3 = 15M

11. Define 3 vector Integrals.
12. Derive an Expression for Impact Parameter?
13. Write a note on Precession of Equinoxes?.
14. Discuss different Types of Beadings?.
15. Define the Central Force and state any 3 Examples ?
16. Derive an Expression for Length contraction?.
17. The Kinetic Energy of a Metal Disk Rotating at a Constant Speed of 5 revolutions per second is 100 Joules. Find the Angular Momentum of the Disk.
18. Show that $F = (y^2 - x^2)\mathbf{i} + 2xy\mathbf{j}$ is a Conservative Force?

GOVERNMENT COLLEGE(A)::RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
MODEL PAPER FOR II- SEMESTER END EXAMINATION
WAVES AND OSCILLATIONS
(As Approved in the BOS meeting held on 2 AUG 2022 for batch 2022-2023)

Time: 2Hr.30Min.

Max.Marks:50

SECTION – A

Answer ALL Questions 5x7=35

1. State the Characteristics of SHM ? Deduce solution for the Simple Harmonic Oscillator
(OR)
2. Derive the Expression for the Displacement of resultant wave Due to the Superposition of the Two Harmonic Waves with Same Frequencies?
3. What are the Damped Oscillations? Deduce the Equations of the Motion of a Damped Oscillator and obtain its Solution?
(OR)
4. What are the Forced Oscillations? Deduce the Equations of the Motion of a Forced Oscillator and obtain its Solution?
5. Explain the Fourier Coefficients in the analysis of the Square Wave?
(OR)
6. Explain the Fourier Coefficients in the analysis of the Saw Tooth Wave?
7. Deduce the Expression for the Velocity of the Transverse Wave along stretched String?
(OR)
8. Derive Frequencies of the modes of Vibrations of Stretched String clamped at both ends?
9. Explain the Production of the Ultrasonics in Magnetostriction Method?
(OR)
10. Explain the Production of the Ultrasonics in Piezo Electric Method?

SECTION – B

Answer any five questions

5 × 3 = 15M

11. Write note on Lissajous Figures?
12. Derive expression for the Logarithmic Decrement?
13. Derive expression for Quality Factor?
14. State the Fourier Theorem and Write Fourier Coefficients?
15. Write a short note on Tuning Fork?
16. Write Application for the Ultrasonic Waves?
17. Write the Detection Methods of the Ultrasonics?
18. The Speed of the Ultrasonic wave on a stretched string is 500 m/s, when it is stretched under a Tension of 19.6 N. If the Tension is changed to a value of 78.5 N, What will be the Speed of the Wave?

GOVERNMENT COLLEGE(A)::RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
MODEL PAPER FOR II- SEMESTER END EXAMINATION
MODULE -II: WAVE OPTICS
(As Approved in the BOS meeting held 12/07/2024 for batch 2022-2023)

Time: 2Hr.30Min.

Max.Marks:50

SECTION-A

Answer ALL Questions 5x7=35

1. Describe the Principle, construction and working of a Michelson Interferometer. Explain how the wavelength of light is determined with it.
(OR)
2. Describe how the wavelength of sodium light can be determined using Newton rings. Derive the formula used for it.
3. Describe the Fraunhofer Diffraction due to a single slit and deduce the positions of maxima and minima
(OR)
4. What is Fresnel's half period zones. Give the theory of Fresnel's diffraction of light Explain the intensity distribution in diffraction pattern.
5. Explain the construction and working of Nicol Prism
(OR)
6. Define specific rotation. Describe the construction and working of Laurent's half shade polarimeter.
7. What is Chromatic Aberration? Derive the condition for achromatism when two lenses are in contact and separated by a distance.
(OR)
8. Discuss the Modes (i) Step index (ii) Graded index Fibres and their structures?
9. Describe the construction and working of Helium- Neon Laser
(OR)
10. Define Einstein Coefficients. And obtain the relation between them.

SECTION - B

Answer any five questions

5 × 3 = 15M

11. Explain the formation of colors in thin films.
12. Distinguish between Interference and Diffraction
13. Explain what is meant by half wave plate.
14. Explain about Brewster's law.
15. Calculate the focal length of the lens with dispersive power 0.031 placed in contact with a convex lens of focal length 84cm and dispersive power 0.021 to make an achromatic doublet
16. In Newton's rings experiment, the diameter of 5th ring was 0.3 cm and that of 25th ring was 0.8cm. If the radius of curvature of plano convex lens is 80cm, find the wavelength of the light source used.
17. A plane grating with 10520 lines per cm is illuminated with light of wavelength 5×10^{-5} cm at normal incidence. How many orders are visible in the grating spectra?
18. Calculate the thickness of Half wave plate. Given $\mu_o = 1.5442, \mu_e = 1.5533$ and $\lambda = 5 \times 10^{-5}$ cm

GOVERNMENT COLLEGE (A): RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
MODEL PAPER FOR III - SEMESTER END EXAMINATION
MODULE - III: THERMODYNAMICS

Time: 2 Hr. 30 Min.

Max. Marks: 50

SECTION – A

Answer ALL the Questions

(5x7=35)

1. On the basis of kinetic theory of gases, derive expression for Coefficient of viscosity.

[OR]

2. Describe the Toothed wheel experiment for verification of Maxwell's law of distribution of molecular velocities

3. Describe the working of Carnot's engine and derive expression for its efficiency.

[OR]

4. State and prove Carnot's theorem.

5. Explain Joule-Kelvin effect from Maxwell's thermodynamic relations.

[OR]

6. Derive the four Maxwell thermodynamic relations

7. Describe porous plug experiment. Obtain expression for cooling produced by Joule-Thomson effect.

[OR]

8. Explain the liquid fication of Helium by Kapitza method.

9. State Planck's hypothesis. Deduce Planck's distribution formula.

[OR]

10. Define solar constant. Explain the working of Angstrom Pyrheliometer.

1. **SECTION – B**

Answer Any FIVE Questions

5x3 = 15

11. Discuss about the postulates of kinetic theory of gases.

12. What are reversible and irreversible processes?

13. Show that Joule-Kelvin effect for perfect gas is zero

14. What is solar constant? Describe Stefan-Boltzmann law

15. Calculate the RMS speed of Hydrogen molecules at 5000K. Given $K=1.38 \times 10^{-23} \text{J/K}$.

16. Calculate the change in entropy of helium gas when its temperature changes from 298K to 1000K. C_p for Helium gas is $5/2 R$.

17. Calculate the temperature of inversion for H_2 and CO_2 gases. Given T_c for H_2 is -239.9°C and that for CO_2 is 31°C .

18. Calculate the surface area of Tungsten bulb of 100W with operating temperature of 2450K and emissivity of 0.3

8. Define binding energy and explain with examples.
9. What are magic numbers?
10. Discuss about G.M. Counter and Cloud chamber for nuclear radiation detection.

UNIT-V

1. Define nano materials. Discuss about electron confinement, size effect and surface to volume ratio.
2. Discuss about various types of nanomaterials.
3. Explain about carbon nano tubes and Graphene.
4. Discuss about the properties of nanomaterials.
5. Explain about the vital applications of nanomaterials
6. Explain Type-I and Type-II superconductors?
7. Explain the Meissner effect.
8. Mention the applications of superconductors
9. Discuss about BCS theory.
10. Define critical temperature, critical magnetic field and isotope effect.

Time: 2 Hr. 30 Min.

Max. Marks: 50

SECTION – A

Answer ALL Questions 5X7=35

1. Describe stern and Gerlach experiment. What is its importance?
(or)
2. What is Raman Effect? How it is experimentally studied.
3. Explain De-Broglie hypothesis for matter waves. Derive an expression for De-Broglie wavelength.
(or)
4. Explain Davison and Germer experiment for detection of matter waves.
5. Derive Schrödinger's time independent wave equation.
(or)
6. Obtain an expression for the energy of a particle in one dimensional potential wall.
7. Explain magic numbers using nuclear shell model.
(or)
8. Explain Gamow theory of α –decay.
9. Define Nano materials. Discuss about electron confinement, size effect and surface to volume ratio.
(or)
10. What is super conductivity? Explain Meissner effect. Mention the properties of super conductivity.

SECTION – B

Answer Any FIVE Questions

5x3 = 15

11. Explain L-S coupling and J-J coupling.
12. Explain Raman Effect and symmetry of Raman lines on the basis of quantum theory.
13. Explain liquid drop model.
14. Discuss about the properties of nanomaterials.
15. Explain Basic Postulates of Quantum Mechanics.
16. Calculate the de-Broglie wave length associated with a proton moving with a velocity of $2200\text{m}\backslash\text{sec}$. ($h=6.625\times 10^{-34}\text{J}\cdot\text{s}$, $m=1.6 \times 10^{-27}\text{kg}$)
17. A neutron breaks into a proton and an electron. Calculate the mass defect in thereaction.
($m_p=1.6725\times 10^{-27}\text{Kg}$, $m_e=9\times 10^{-31}\text{kg}$, $m_n=1.6747\times 10^{-27}\text{Kg}$)
18. Explain about carbon nano tubes and Graphene.