

Sessional Examination - 2023

Class : B. Sc. 2nd Semester

Subject : Physics (Honours)

Paper : PHY-HC-2016

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any Six :

6 X 5

1. Write few properties of electric field lines.
2. State and establish Gauss's law of electrostatics.
3. State and establish Laplace's equation.
4. Find the potential and electric field of a dipole.
5. Find the capacitance of a parallel plate capacitor in air.

Write the expression for it when the space between the plates is filled with a dielectric medium.

6. Calculate the divergence of magnetic field.
7. Find an expression of magnetic vector potential.
8. Using Biot-Savart law, find the magnetic field due to an infinitely long straight current carrying conductor.
9. State and proof Ampere's circuital law.
10. Deduce an expression of force between two parallel current carrying conductors.

Sessional Examination - 2023

Class : B. Sc. 2nd Semester

Subject : Physics (Honours)

Paper : PHY-HC-2026

(Waves and Optics)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six of the following questions

5 x 6 = 30

1. State the superposition principle. Explain the term linearity. 3+2=5
2. Find the resultant equation due to the superposition of two collinear harmonic oscillations having equal frequencies. 5
3. Explain the phenomenon of beats graphically. 5
4. Find the resultant equation due to the superposition of two collinear harmonic oscillations perpendicularly having equal frequencies. 5
5. Explain Lissajous Figures. 5
6. What is interference of light? Show that in Young's double slit experiment fringe widths are equally spaced. 1+4=5
7. Establish the Stoke's relations. 5
8. What are Fizeau and Haidinger Fringes? 5
9. In Newton's Ring experiment show that the diameter of the n^{th} bright ring is proportional to the square root of odd natural numbers. 5
10. How can the refractive index of a liquid be determined from Newton's Rings experiment? 5

Sessional Examination - 2023

Class : B. Sc. 2nd Semester

Subject : Physics (Generic)

Paper : PHY-HG-2016

(Electricity and Magnetism)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six questions :

5 x 6 = 30

1. Define scalar and vector product with example. 5
2. Define Gradient and Divergence. 5
3. Evaluate $\vec{A} \times \vec{B}$ or express $\vec{A} \times \vec{B}$ in determinant form. 5
4. If $\vec{A} = 2x^2z\hat{i} - 2xy^2\hat{j} + 2x^2y^2\hat{k}$, find $\text{div } \vec{A}$ at point (1, 0, 1) 5
5. Define electrostatic field, electric flux and Gauss's law. 1+2+2= 5
6. Prove Gauss's law. 5
7. Using Biot-Savart law find the magnetic field due to an infinite long straight current carrying conductor. 5
8. Find an expression of a force acting on a current carrying conductor in a magnetic field. 5
9. State and prove Ampere's circuital law. 5
10. State Faraday's law of electromagnetic induction. What are self and mutual inductance ? 1 + 2 + 2 = 5

Sessional Examination - 2023

Class : B. Sc. 4th Semester

Subject : Physics (Honours)

Paper : PHY-HC-4016

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six questions :

5 x 6 = 30

1. Write the different forms of complex representation.
2. What is a complex variable ? Define analytic function.
3. State and establish Cauchy-Reimann conditions.
4. State and establish Cauchy Integral formula.
5. Write Taylor's expansion.
6. Evaluate $\int_0^{\infty} \frac{dx}{1+x^2}$.
7. Find the residue of $f(z) = \frac{1}{(z+1)^3}$.
8. Evaluate $\int_0^{2\pi} (1 + \sin \theta) d\theta$.
9. Define Laplace transform. Prove $L(1) = \frac{1}{S}$
10. Find the Laplace transform of $(1 + \sin 2t)$

Sessional Examination - 2023

Class : B. Sc. 4th Semester

Subject : Physics (Honours)

Paper : PHY-HC-4026

(Elements of Modern Physics)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six of the following questions :

5 x 6 = 30

1. What do you mean by photoelectric effect? Derive Einstein's photoelectric equation. 1 + 4 = 5
2. Explain Compton scattering. 5
3. How did de Broglie relate wave nature with particle nature? What do you mean by matter wave? 3 + 2 = 5
4. Explain in brief the two-slit experiment with electron. 5
5. Explain Blackbody Radiation in light of Quantum Theory. 5
6. What is radioactivity? What are the different types of radioactive decay? Explain. 1 + 4 = 5
7. Deduce the semi-empirical mass formula. 5
8. Write briefly on Nuclear Shell Model. 5
9. What is binding energy? Write the significances of binding energy. 1 + 4 = 5
10. What are magic numbers? Using semi-empirical mass formula find the binding energy of $^{20}\text{Ca}_{40}$. 1 + 4 = 5

Sessional Examination - 2023

Class : B. Sc. 4th Semester

Subject : Physics (Honours)

Paper: PHY-HC-4036

(Analog System & Application)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any Six:

6 x 5 = 30

1. Define the term Feedback in amplifier. Write the difference between Positive feedback and Negative feedback.
2. Define the term CMRR. Write the basic characteristics of an ideal OPAMP.
3. Explain an Integrator amplifier by using an OPAMP.
4. Explain differential amplifier by using an OPAMP.
5. By using h-parameter, to find current gain of a RC couple amplifier.
6. Define current gain in CB and CE- transistor. Establish a relation between α and β .
7. Establish an expression of Voltage gain with feedback.
8. Explain zero- crossing detector.
9. Distinguish between Class-A, Class- B and Class-C amplifier.
10. What is dc load line? What is the importance of it?

Sessional Examination - 2023

Class : B. Sc. 4th Semester

Subject : Physics (Generic)

Paper: PHY-HG-4016

(Wave and Optics)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six questions :

5 x 6 = 30

1. State superposition principles. Explain linearity. 2 + 3 = 5
2. Find the resultant equation due to the superposition of two harmonic oscillations having equal frequencies. 5
3. Discuss the electromagnetic nature of light. 5
4. Define spherical and plane wave fronts. 5
5. State Huygens principle. Explain laws of refraction with the help of it. 5
6. Deduce an equation of a progressive wave. 5
7. Show that $\frac{d^2y}{dx^2} = \frac{1}{C^2} \frac{d^2y}{dt^2}$, where $C = \sqrt{\frac{T}{\rho}}$. 5

C → Speed of transverse wave in a string

8. Deduce an expression of a speed of transverse wave, $V = \sqrt{\frac{T}{m}}$, by using dimensional formula. 5
9. What is diffraction of light ? Write the differences between Fraunhofer and Fresnel diffraction. 2 + 3 = 5
10. What are Fresnel's half-period zones ? Find the expression of radius of nth half period zones. 2 + 3 = 5

Sessional Examination - 2023

Class : B. Sc. 6th Semester

Subject : Physics (Honours)

Paper : PHY-HC-6016

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six questions :

5 x 6 = 30

1. What is displacement current ? Find the expression for it.
2. Write the Maxwell's equation and write their significance.
3. Define vector potential and find the expression for it.
4. Give solution of plane wave equation and hence find the expression for speed of electromagnetic wave.
5. State and establish Poynting theorem.
6. Establish the laws of reflection of a plane wave at the plane interface between two dielectric media.
7. Establish Fresnel's formula and hence deduces Brewster's law.
8. Prove that $\vec{S}_{av} = \vec{E}_{rms} \times \vec{F}_{rms}$
9. Define step and graded index fibres. What is a multimode fibre ?
10. What is numerical aperture ? Find the expression for it.

Sessional Examination - 2023

Class : B. Sc. 6th Semester

Subject : Physics (Honours)

Paper: PHY-HC-6026

(Statistical Mechanics)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any Five :

5 x 6 = 30

1. What is Phase space? Distinguish between micro state and macro state.
2. Deduce Maxwell-Boltzmann distribution law.
3. Deduce Bose-Einstein distribution law.
4. Establish the relation, $S = K \log w$.
5. Establish an expression of Partition function.
6. Explain Bose Einstein Condensation.
7. What is Gibbs paradox? Explain it.
8. Deduce Sackur Tetrode equation.
9. Give the compression of MB, BE and FD statistics.
10. Find an expression of Fermi energy.

Sessional Examination - 2023

Class : B. Sc. 6th Semester

Subject : Physics (Honours)

Paper : PHY-HE-6046

(Astronomy and Astrophysics)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six of the following questions :

5 x 6 = 30

1. Who first proposed a classification system for galaxies based on shape? Give a brief outlines on Galaxy. 1+4=5
2. Draw Hubble's tuning fork diagram for the morphology of galaxies and also give a short introduction on it 5
3. Which constellation does our Milky Way belong to? Draw the edge on view of the Milky Way. 1 + 4 = 5
4. What is the name of the centre of the Milky Way galaxy? Explain briefly the properties of the centre of the Milky Way galaxy. 1 + 4 = 5
5. Write a short note on active galaxy. 5
6. What is the full form of SMBH? Explain it briefly. 1+4=5
7. Write about the existence of black holes in galaxies. 5
8. Define the terms CS and ecliptic. 3+2=5
9. What do you mean by vernal equinox and autumnal equinox? 2+3=5
10. Define solar time, mean solar time and sidereal time. 2+1+2=5

Sessional Examination - 2023

Class : B. Sc. 6th Semester

Subject : Physics (Honours)

Paper : PHY-HE-6056

(Classical Dynamics)

Time : 1 Hour 20 minutes

Full Marks : 30

Answer any six questions :

5 x 6 = 30

1. Find the Lorentz transformation equations : 5
2. Write the postulates of special theory of relativity.
Show that $x^2 + y^2 + z^2 - c^2t^2$ is invariant
(using Lorentz transformation). 2 + 3 = 5
3. What is Minkowski's space ?
Show that $E^2 = P^2 C^2 + m_0^2 C^4$. 2 + 3 = 5
4. What is time dilation ? At what velocity will be mass of an object
will become twice its rest mass ? 3 + 2 = 5
5. Show that to the observer is S it would appear that the length of
the rod (in S') has contracted by the factor $\sqrt{1 - \frac{v^2}{c^2}}$. 5
6. State D'Alembert's principle. Find the expression for it. 1+4 = 5
7. Find the Lagrange's equation for a simple pendulum. 5
8. Derive Hamilton's canonical equation of motion. 5
9. Find the Hamilton's equation for the motion of a 1-D linear
harmonic oscillation.
10. Write the principle of virtual work. Write the physical significance
of H. Lagrangian of a system is give by
$$L = \frac{1}{2} \dot{x}^2 - \frac{1}{2} \omega^2 x^2 - \alpha x^3 + \beta x \dot{x}^2$$
 (α, β are constant).
Deduce its Hamiltonian. 1 + 2 + 2 = 5
