Sessional Examination - 2024

Class : B. Sc. **2nd** Semester

Subject : Physics (CORE)

Time : 1 Hour 20 Minutes | Full Marks : 30

Answer *any Six*: 6 x 5 = 30

1. Define electric flux. Calculate the flux passing through the area $\vec{A} = 2\hat{i} + 6\hat{j}\,m^2$ kept in an electric field $\vec{E} = 2\hat{j} + 4\hat{k}\,\frac{N}{C}$. 1+4=5

2. State and establish Gauss's law of electrostatics. 1 + 4 = 5

3. Calculate the electric field near a charged linear rod of an infinite length. 5

4. What is a differential equation? Write order and degree of the differential equation: 1+2+2=5

   i) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 8y = 0$ ii) $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2} = 5\frac{d^2y}{dx^2}$

5. Write the standard form of a linear differential equation.

   Solve the equation $\frac{dy}{dx} + 5y = 0$ 1 + 4 = 5

6 Draw the parallel LCR-circuit and find the expression for admittance of the circuit. 2 + 3 = 5

7. Find an expression of magnetic vector potential. 5

8. Using Biot- Savart law, find the magnetic field due to an infinitely long straight current carrying conductor. 5

9. Find the expression of torque of a current loop in a uniform magnetic field. 5

10. Why series LCR-circuit is called acceptor circuit? Explain the terms of resonance and quality factor. 2 + 3 = 5

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Sessional Examination - 2024

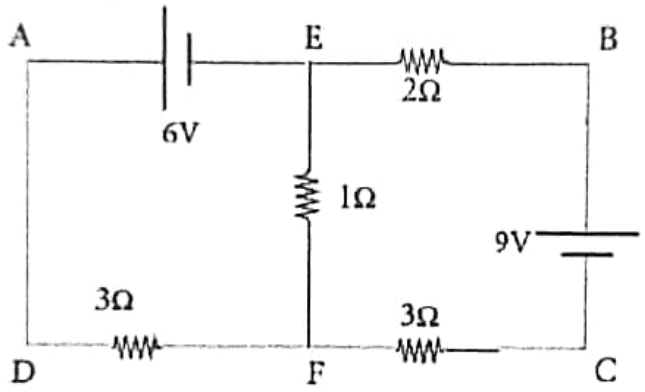
Class : B. Sc. 2nd Semester

Subject : Physics (SEC-2)

Time : 1 Hour 20 Minutes | Full Marks : 30

Answer any *Six*. | 6 x 5 = 30

1. Write short note on Resistor and Capacitor.
2. State Kirchoff's Current and Voltage laws.
3. Calculate the current that flows in the 1Ω resistor in the following circuit.



4. Explain in details the fabrication of PCB.
5. Draw and explain half wave rectifier.
6. What is digital multimeter? Write its uses.
7. Explain in details the tools used in soldering technique.
8. Write short note on:
   i) Vernier Callipers
   ii) Screw Gauge
9. Draw the circuit diagram and write the principle of regulator power supply.
10. State Ohm's law. A potential difference across 24 Ω resistor is 12 V. What is the current through the resistor?

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Sessional Examination - 2024

Class : B. Sc. **2nd** Semester

Subject : Physics (MDC-2)

(Natural and Physical Science in Everyday Life)

Time : 1 Hour 20 Minutes | Full Marks : 30

Write short note on ***any Eight***: $8 \times 5 = 40$

1. Carbohydrates
2. Proteins
3. Vitamins and Minerals
4. Pesticides
5. Green House Effect
6. Acid Rain
7. Nuclear Energy
8. Waste water treatment
9. Renewable and Non Renewable energy sources
10. Future fuel
11. Corrosion
12. Pollutants and contaminants

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Sessional Examination - 2024

Class : B. Sc. 4th Semester
Subject : Physics (Honours)
Paper : PHY-HC-4016
(Mathematical Physics-III)

Time : 1 Hour 20 Minutes | Full Marks : 30

Answer any *Six* : | 6 x 5= 30

1. What is a complex number? Write the different representations of complex number.
2. What is organd diagram? Represent $z_1 = 2 + i,\ z_2 = 2 - i$ in an organd diagram.
3. Define analytic function. Verify whether the function $f(z) = z^*$ is analytic.
4. State and establish the Cauchy-Riemann conditions.
5. Use Cauchy-Riemann conditions to verify the analyticity of the function $f(z) = z^2$.
6. Find $f'(z)$ if $f(z) = \frac{1+z}{1-z}$. Also determine whether $f(z)$ is not analytic.
7. State Taylor Series. Expand $\frac{e^z}{(z-1)^2}$ about z=1 using Laurent Series.
8. Find residue of the function $f(z) = \frac{z^2}{z^2 + a^2}$
9. Evaluate $\int_0^{2\pi} (1 + \sin\theta) d\theta$ using Residue theorem.
10. Find $\int_0^{\infty} \frac{dx}{1 \neq x^2}$

Sessional Examination - 2024

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*: 6 x 5 = 30

1. What do you mean by photoelectric effect? Derive Einstein's photoelectric equation. 1 + 4 = 5
2. Explain Davisson-Germer experiment. 5
3. How did de Broglie relate wave nature with particle nature? What do you mean by matter wave? 3 + 2 = 5
4. Explain wave packets. 5
5. Explain Blackbody Radiation in light of Quantum Theory. 5
6. State the law of Radioactivity and derive it mathematically. 1 + 4 = 5
7. Deduce the semi-empirical mass formula. 5
8. Write the similarities between liquid drops and a nucleus. 5
9. What is mass defect and binding energy? Why electron is not taken as a consequent of a nucleus. 2 + 3=5
10. Write the two properties of nuclear forces. Shaw that nuclear density is independent of the mass number. 2 + 3 = 5

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Sessional Examination - 2024

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. Explain slew rate and Virtual groun.
3. Explain an Integrator amplifier by using an OPAMP.
4. Explain differential amplifier by using an OPAMP.
5. Draw the circuit diagram and explain Hartley oscillators.
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?

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Sessional Examination - 2024

Class : B. Sc. 4th Semester

Subject : Physics (Generic)

Paper : PHY-HG-4016

(Waves and optics)

Time : 1 Hour 20 Minutes | Full Marks : 30

Answer any six : 5 x 6 = 30

1. Show that fringes in Young's double slit experiment are equally spaced.
2. What are the methods for producing coherent sources? Write the difference between fringes produced by Biprism and Lloyd's mirror? 2 + 3 = 5
3. Using Stoke's treatment show that the reflection coefficient for rarer to denser medium and the same for denser to rarer medium are numerically equal but of opposite sign.
4. What is diffraction? Write the difference between Fresnel and Fraunhofer's diffraction. 1 + 4 = 5
5. What are plane, circularly and elliptically polarized light? 1 + 2 + 2 = 5
6. State Huygen's Principle. State wavefront and write their properties. 2 + 1 + 2 = 5
7. State and explain superposition principle. 2 + 3 = 5
8. Derive the resultant wave equation due to superposition between two SHMs of same frequency.
9. Establish Fourier series.
10. Define group velocity and phase velocity. Derive the relation between them. 1 + 1 + 3 = 5

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Sessional Examination - 2024

Class : B. Sc. 6th Semester

Subject : Physics (Honours)

Paper : PHY-HC-6016

(Electromagnetic Theory)

Time : 1 Hour 20 Minutes | Full Marks : 30

Answer any *Six* : $6 \times 5 = 30$

1. Give short answer : $1 \times 5 = 5$
   a) Write a difference between conduction current and displacement current.
   b) What do you mean by isotropic medium?
   c) Write the expression for vector potential.
   d) What is a plane wave?
   e) Write the relation between μ_0 , ε_0 and c.
2. Write the physical significance of displacement current. What does the equation $\vec{k}.\vec{E} = 0$ signify in electromagnetic wave propagation?
3. State the Maxwell's equations and write their physical significance.
4. Establish the Poynting theorem.
5. Establish the electromagnetic wave equation in free space.
6. Using Fresnel's relation, discuss the phenomenon of total internal reflection for electric vector polarized perpendicular to the plane of incidence.
7. What is skin depth ? Derive its expression for a conducting medium.
8. Calculate the Poynting vector from a 100W lamp at a distance 1m from it.
9. Show that in electromagnetic wave the electrostatic energy density is equal to the magnetic energy density.
10. Find the expression for the velocity of electromagnetic wave in free space.

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Sessional Examination - 2024

Class : B. Sc. 6th Semester

Subject : Physics (Honours)

Paper : PHY-HC-6026

(Statistical Mechanics)

Time : 1 Hour 20 Minutes | Full Marks : 30

Answer any *Six*: 6 x 5 = 30

1. What is Phase space? Distinguish between micro state and macro state.
2. Deduce Maxwell- Boltzmann distribution law.
3. Deduce Fermi-Dirac 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 Bose derivation of Planck's law.
9. Give the compression of MB, BE and FD statistics.
10. Find thermodynamic functions of a strongly Degenerate Bose Gas.

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Sessional Examination - 2024

Class : B. Sc. 6th Semester
Subject : Physics (Honours)
Paper : PHY-HE-6046
(Astronomy and Astrophysics)

Time : 1 Hour 20 Minutes | Full Marks : 30

1. Give a brief outlines on active Galaxy. 5
2. Draw Hubble's tuning fork diagram for the morphology of galaxies and also give a short introduction on it. 5
3. What do you mean by spiral, elliptical and lenticular galaxcies. 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. What do you mean by distance ladder in cosmology. 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. Write a note on dark matter. 5

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Sessional Examination - 2024

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*: 6 x 5 = 30

1. State D'Alembert's Principle and established.
2. What are generalized co-ordinates? Express velocity in terms of generalized co-ordinates.
3. Using Lagrange'sequation, find the equation of motion of a simple pendulum.
4. State the principle of virtual work. Give the physical significance of Hamiltonian (H).
5. Find the Hamilton's canonical equation of motion.
6. Using Hamiltonian's equation find the equation of one dimensional harmonic oscillator.
7. Find the Lagrange's equations of motion for two coupled oscillators.
8. Write down the Lorentz transformation equations. Show that for values of V<<C; Lorentz transformation reduces to the Galilean transformation.
9. Write the postulates of Special Theory of Relativity. Write about Twin Paradox.
10. Using Lorentz transformation equations obtain Lorentz contraction formula.

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