Internal Questions Session 2023-2024

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 1st Semester
Full Marks: 10 Time: 30 Minutes
PHY-M-T-1: Mathematical Physics-I:

1. Define the limit of a function. [2]
Or, State the divergence theorem. [2]
2. What is the condition for a matrix to be orthogonal?[2]
3. Find the derivative of the function f(x) = sin (x^2 + 1) using the chain rule.[3]
4. Find the gradient of the scalar field φ (x, y, z) = x^2y + yz^2 [3]
Or, Find the eigenvalues and eigenvectors of the matrix A = [[1, 2], [2, 1]]. [3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 1st Semester
Full Marks: 10 Time:30 Minutes
PHY-SEC-T-1: Electrical Circuits & Networks

1. Explain Ohm's Law and its significance in electrical circuits.[2]
2. Differentiate between AC and DC electricity.[2]
Or, what is the purpose of a fuse in an electrical circuit?[2]
3. Describe the working principle of a transformer and its applications.[3]
Or, Explain the concept of power factor and its importance in AC circuits.[3]
4. Discuss the different types of electrical motors and their applications.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 1st Semester
Full Marks: 10 Times: 30 Minutes
PHY-MI-T-1: Mathematical Physics-I:

1. What is the difference between continuity and differentiability of a function?[2]
2. What is the physical interpretation of the curl of a vector field?[2]
Or, Define the transpose of a matrix.[2]
3. Evaluate the integral $\int (x^3 + 2x)\,dx$. [3]
Or, Calculate the divergence of the vector field F (x, y, z) = (x^2, y^2, z^2).[3]
4. Determine whether the matrix B = [[1/√2, -1/√2], [1/√2, 1/√2]] is orthogonal.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 3rd Semester
Full Marks: 10 Time:30 Minutes
PHY-H-CC-T-05: Mathematical Physics-II,

1. Define Dirichlet conditions and explain their significance in Fourier series. [2]
2. State Rodrigues' formula for Legendre polynomials. [2]
Or, what is the difference between systematic and random errors?[2]
3. Derive the expression for the coefficients of a Fourier series.[3]
4. Discuss the properties of Bessel functions of the first kind.[3]
Or, Solve the wave equation using the method of separation of variables.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 3rd Semester
Full Marks: 10 Times: 30 Minutes
Question Paper: PHY-H-CC-T-06: THERMAL PHYSICS

1. State the Zeroth Law of Thermodynamics and its significance. [2]
2. Define entropy and explain its physical meaning.[2]
Or, what is the Joule-Thomson effect?[2]
3. Derive the relation between Cp and Cv for an ideal gas.[3]
4. Explain the Carnot cycle and its efficiency.[3]
Or, Discuss the Maxwell-Boltzmann distribution of molecular velocities in an ideal gas.[3]

DUMKAL COLLEGE
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Internal Assessment, 3rd Semester
Full Marks: 10 Times: 30 Minutes
Question Paper: PHY-H-CC-T-07: ANALOG SYSTEMS AND APPLICATIONS

Instructions: Answer all questions.
1. Explain the difference between drift and diffusion currents in a semiconductor. [2]
2. What is the significance of the Q-point in a transistor circuit?[2]
Or, Define slew rate and its importance in op-amp applications.[2]
3. Derive the expression for the barrier potential and barrier width of a PN junction diode.[3]
4. Explain the working principle and characteristics of a common emitter (CE) transistor configuration.[3]
Or, Discuss the concept of virtual ground and its application in inverting and non-inverting op-amp circuits.[3]

DUMKAL COLLEGE
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Internal Assessment, 3rd Semester
Full Marks: 10 Times: 30 Minutes
Question Paper: PHY-H-SEC-T-01: BASIC INSTRUMENTATION SKILLS

Instructions: Answer all questions.

1. Define accuracy, precision, sensitivity, and resolution in the context of measurement.[2]
2. Explain the advantages of an electronic voltmeter over a conventional multimeter.[2]
Or, what are the key differences between analog and digital multimeters?[2]
3. Describe the working principle of a cathode ray oscilloscope (CRO) and its main components.[3]
4. Explain the concept of loading effects in measurement and how they can be minimized.[3]
Or, Discuss the working principle of an RLC bridge and its applications.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 3rd Semester General Elective
Full Marks: 10 Times: 30 Minutes
Question Paper: PHY-H-GE-T-01: MECHANICS

1. Define scalar and vector quantities with examples.[2]
2. State Newton's second law of motion and explain its significance.[2]
Or, what is the difference between mass and weight?[2]
3. Derive the equation of motion for a simple harmonic oscillator.[3]
4. Explain the concept of conservation of angular momentum with an example.[3]
Or, Discuss the postulates of special relativity and their implications.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 3rd Semester Program
Full Marks: 10 Times: 30 Minutes
PHY-G-CC-T-03: Thermal Physics and Statistical Mechanics.

1. What is the difference between reversible and irreversible processes?[2]
2. Explain the concept of entropy and its significance in thermodynamics.[2]
Or, State the equipartition theorem and its limitations.[2]
3. Derive the relationship between the coefficient of volume expansion and the coefficient of isothermal compressibility.[3]
4. Explain the concept of blackbody radiation and Planck's law of radiation.[3]
Or, Compare and contrast the Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 3rd Semester Program
Full Marks: 10 Times: 30 Minutes
PHY-G-SEC-T-01: Renewable Energy and Energy Harvesting.

1. What is the significance of non-conventional energy sources?[2]
2. How does a solar cell work?[2]
Or, what are the different types of Ocean Energy?
3. Discuss the advantages and disadvantages of solar energy as a renewable energy source.[3]
4. Explain the working principle of a wind turbine and its power generation capacity.[3]
Or, Describe the concept of piezoelectric effect and its applications in energy harvesting.

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 5th Semester
Full Marks: 10 Times: 30 Minutes
Quantum Mechanics and Applications and the course code is PHY-H-CC-T-11.

1. What is the significance of the commutator of position and momentum operators in quantum mechanics?[2]
2. Explain the concept of wave-particle duality and its implications in quantum mechanics. [2]
Or, what are the key differences between the Schrödinger equation for a free particle and a particle in a potential well?
3. Describe the Stern-Gerlach experiment and its significance in understanding the concept of electron spin. [3]
4. Explain the concept of quantization of energy levels in a quantum harmonic oscillator. How does this differ from classical mechanics?[3]
Or, Discuss the role of the Pauli Exclusion Principle in determining the electronic configuration of atoms and the periodic table.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 5th Semester
Full Marks: 10 Time:30 Minutes
PHY-H-CC-T-12: Solid State Physics

1. What are the Miller indices and how are they used to describe crystal planes?[2]
2. Explain the difference between acoustical and optical phonons.[2]
Or, what is the significance of the Curie temperature in ferromagnetic materials?[2]
3. Describe the Bragg's law of X-ray diffraction and its application in determining the crystal structure of materials.[3]

Or, Explain the concept of band theory of solids and its implications for electrical conductivity.[3]

4. Describe the Meissner effect and its significance in understanding the phenomenon of superconductivity.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 5th Semester
Full Marks: 10 Time:30 Minutes
PHY-H-DSE-T-01: Classical Dynamics.

1. What is the significance of Hamilton's principle in classical mechanics? [2]

Or, Explain the concept of canonical transformations and their role in solving dynamical problems. [2]

2. What are the postulates of special relativity and how do they lead to the Lorentz transformations?[2]

3. Derive the Euler-Lagrange equations of motion from Hamilton's principle.[3]

Or, Discuss the concept of four-vectors and their transformation properties under Lorentz transformations.[3]

4. Explain the concept of retarded potentials and their use in calculating the electric and magnetic fields of a moving charge.[3]

DUMKAL COLLEGE
Department of Physics
Internal Assessment, 5th Semester
Full Marks: 10 Time: 30 Minutes
PHY-H-DSE-T-02: Nuclear and Particle Physics.

1. What are the main features of the binding energy per nucleon curve?[2]

2. Explain the concept of nuclear magic numbers and their significance.[2]

Or, what are the different types of radioactive decay?

3. Describe the liquid drop model of the nucleus and explain how it accounts for the binding energy of nuclei.[3]

4. Discuss the role of conservation laws in nuclear reactions.[3]

Or, Explain the concept of quarks and how they are related to the composition of hadrons. [3]