(PHY10112)

M.Sc. DEGREE EXAMINATION,
OCTOBER/NOVEMBER 2018.

First Semester

Physics

Paper I — MATHEMATICAL PHYSICS

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Show that $\left(1-2xz+z^2\right)^{\frac{-1}{2}}$ is the generating function of Legendre's polynomial.

(b) Prove that $P_n(-x)=(-1)^n P_n(x)$.

Or

(c) Obtain the series solution of Hermite differential equation.

(d) Prove that recurrence relation of Laguerre polynomial.

$(n+1)\, L_{n-1}^{(x)} = (2n+1-x)\, L_n(x) - n\, L_{n-1}^{(x)}$.

2. (a) Explain the second shifting and change of scale properties of Laplace transform.

(b) Show that $L\{\cos at\} = \frac{s}{s^2 + a^2}$ and $L\{\sin at\} = \frac{a}{s^2 + a^2}$.

Or

(c) Obtain the Laplace transform of a derivative.

(d) Using Laplace transform of derivative find the Laplace transform of 't cost t'.

3. (a) Obtain the Fourier coefficients of a Fourier series.

(b) Expand the function $f(x) = |x|$ for $-\pi \le x \le \pi$ in Fourier series

Or

(c) Define Fourier Transform and find the Fourier transform of $f(x) = \begin{cases} 1, & |x| \le a \\ 0, & |x| > a. \end{cases}$

(d) Explain Fourier Transform of delta function.

4. (a) State and explain Cauchy's integral theorem.

(b) Expand $f(z) = \ln(1+2)$ in a Taylor series about $z = 0$

Or

(c) Explain the calculus of Residues.

(d) Show that $\int_0^\infty \frac{dx}{x^4 + a^4} = \frac{\pi\sqrt{2}}{4a^3}$, $a > 0$ using contour integrals.

5. (a) Explain the transformation of coordinates.

(b) Discuss the addition and multiplication of tensors.

Or

(c) Explain quotient law of tensor.

(d) Write a note on fundamental tensors.

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(PHY10212)

M.Sc. DEGREE EXAMINATION,
OCTOBER/NOVEMBER 2018.

First Semester

Physics

Paper II — CLASSICAL MECHANICS

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Obtain the energy conservation theorem for the system of particles.

(b) State and explain D'Alembert's principle.

Or

(c) Write a short note on velocity dependent potentials and the dissipation function.

(d) Write down the simple applications of Lagrangian formulation.

2. (a) What are generalized coordinates? Explain the advantages of using them.

(b) Classify orbits and obtain the differential equation for the orbit.

Or

(c) Explain the motion of particle under inverse square force on the case of a Keplers problem.

(d) Discuss briefly the scattering in a central force field.

3. (a) State Hamilton's principle and deduce the Hamilton's equations from modified Hamilton's principle.

(b) State and explain principle of least action.

Or

(c) Prove that the transformation defined by $P = \frac{1}{2}(q^2 + p^2)$ and $\tan Q = \frac{q}{p}$ is canonical.

(d) Obtain the angular momentum Poisson bracket relations.

4. (a) Discuss Hamilton-Jacobi equation for Hamilton's characteristic function.

(b) Explain the action – angle variables in systems of one degree of freedom.

Or

(c) Define normal coordinate and obtain an expression for kinetic energy in normal coordinates.

(d) Explain the vibrations of linear triatomic molecule.

5. (a) Explain what do you understand by the independent coordinates of a rigid body.

(b) Discuss the concept of moment of inertia and inertia tensor.

Or

(c) Solve the Euler's equations of motion for a torque free motion of a rigid body.

(d) State and explain coriolis effect.

(PHY10312)

M.Sc. DEGREE EXAMINATION,
OCTOBER/NOVEMBER 2018.

First Semester

Physics

Paper III — QUANTUM MECHANICS – I

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) State the conditions of admissibility of a wave function.

(b) State and explain Ehrenfest theorem.

Or

(c) Show that the probability current density in stationary state is constant in time.

(d) Explain the transmission of a particle through a potential barrier quantum mechanically.

2. (a) Write about linear vector space in quantum mechanics and change of basis.

(b) Show that the eigen values of Hermitian operator an real.

Or

(c) Write a note on projection and positive operators.

(d) Explain the orthogonalization procedure.

3. (a) Obtain the commutation relations for angular momentum operator.

(b) Obtain the eigen values and eigen vectors of L^2 and L_z operators.

Or

(c) Show that $[L_z, L_+] = \hbar L_+$ and $[L^2, L_-] = 0$.

(d) Obtain the eigen values of a rigid rotator.

4. (a) Explain time-independent perturbation theory for non-degenerate system.

(b) Explain stark effect in hydrogen atom.

Or

(c) Explain variation method.

(d) Using variation method find the energy lends of the ground state of Helium atom.

5. (a) Describe the salient features of time dependent perturbation theory.

(b) Explain Fermi's golden rule for constant transition rates.

Or

(c) Explain the interaction of an atom with the electromagnetic radiation.

(d) Discuss sudden and adiabatic approximation.

(PHY10412)

M.Sc. DEGREE EXAMINATION,
OCTOBER/NOVEMBER 2018.

First Semester

Physics

Paper IV — ELECTRONICS (GENERAL)

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

All questions carry equal marks.

1. (a) Explain the principle and working of dual input differential amplifier with a neat circuit diagram.

(b) What is CMRR? Explain.

Or

(c) Draw the block diagram of typical op-amp and explain its characteristics.

(d) Explain the working of voltage follower with a neat circuit diagram.

2. (a) Explain the important terms input offset voltage, input offset current and CMRR frequency response in op-amp.

(b) Explain the concepts of feedback and frequency stability in oscillators.

Or

(c) Draw the circuit diagram of mono stable multivibrator and explain its working.

(d) Explain the working of adjustable voltage regulator using op-amp.

3. (a) Explain the generation and demodulation of AM waves.

(b) Discuss the coherent detection of DSBSC waves.

Or

(c) Define SSB modulation and explain the detection of SSB waves.

(d) Write a note on Frequency Division Multiflexing (FDM).

4. (a) Explain the working of encoder with a neat circuit diagram.

(b) Explain the working of multiplexer as a data selection.

Or

(c) Write a neat circuit diagram explain the operation of T flip-flop and D flip-flops.

(d) Explain the working of cascade counter with a neat diagram.

5. (a) Explain the addressing modes of 8085.

(b) Explain the pin configuration of 8085.

Or

(c) Write an ALP to add 8-bit numbers.

(d) Describe the architecture of 8051 micro controller.

(PHY10116)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2018

First Semester

Physics

Paper – I: MATHEMATICAL PHYSICS

(Regulation 2016)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Obtain the solution of Hermite differential equation.

(b) Show that $P_n(-1) = (-1)^n P_n(1)$.

Or

(c) Obtain the generating function for Laguerre polynomial.

(d) Show that $\frac{1}{2}xJ_{n+1}(x) + \frac{1}{2}xJ_{n-1}(x) = nJ_N(x)$.

2. (a) Explain the first and second shifting theorems of Laplace transform.

(b) Find the Laplace transform of '$e^{at}\cos bt$'.

Or

(c) Briefly explain the partial fraction method for finding the Inverse Laplace transform.

(d) Explain the convolution theorem.

3. (a) Explain the half wave expansions in Fourier series.

(b) Find the Fourier integral of the $f(x) = e^{-kt}$ when $x>0$.

Or

(c) Explain the Parseval's and Modulation theorems in Fourier Transforms.

(d) Find the Fourier sine transform of t^2 in the range $0 \le t \le \pi$.

1. (a) State and prove Cauchy's integral theorem.

(b) Evaluate the integral $\int_C \frac{zdx}{(9-z^2)(z+i)}$ where c is the circle $|z| = 2$described in the positive sense.

Or

(c) State and prove Taylor's expansion.

(d) Obtain the Laurent's series expansion of $f(z)=\frac{1}{z^2-3z+2}$ in the region $1<|z|<2$

5. (a) Explain the transformation of coordinates in tensors.

(b) If A^i and B_j are the components of a contravariant and covariant tensor of rank one, the $C^ij = A^iB_j$ are components of a mixed tensor of rank two.

Or

(c) Write a note on fundamental tensors.

(d) Show that contraction of a tensor of rank leads to a scalar.

(PHY10216)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2018.

First Semester

Physics

PAPER – II: CLASSICAL MECHANICS

(Regulation 2016)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Explain the mechanics of a system of particles.

(b) State and explain D' Alembert's principle.

Or

(c) Define constraints and discuss its classifications.

(d) Write a note on Lagrangian formulation.

2. (a) Define Hamilton's function H and discuss the conservation of energy.

(b) Classify the orbits and obtain the differential equation for the orbit.

Or

(c) Explain the integral power law potentials and obtain the condition for closed orbits.

(d) Discuss the scattering in a central force field.

3. (a) State and explain Hamilton's principle.

(b) Obtain the Lagrange's equations from variational principle.

Or

(c) Obtain canonical transformations from Legendre transformations.

(d) Show that the transformations $Q = 1/p, P = qp^2$ are canonical.

4. (a) Obtain the Hamilton-Jacobi equation from Hamilton's principal function.

(b) Write a note on action angle variables.

Or

(c) Explain the two coupled oscillations.

(d) Discuss the vibrations of linear triatomic molecule.

5. (a) Define inertia tensor and explain the principal moments of inertia.

(b) Explain the infinitesimal rotations.

Or

(c) Explain the motion of a rigid body.

(d) Explain the torque free motion of rigid body.

(PHY10316)

M.Sc. DEGREE EXAMINATION,
NOVEMBER- 2018.

First Semester

Physics

Paper – III: QUANTUM MECHANICS-I

(Regulation 2016)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Explain the inadequacy of classical mechanics

(b) State and explain Ehrenfest theorem

Or

(c) Write a note on stationary states

(d) Obtain Schrodinger equation in the harmonic oscillator problem

2. (a) Discuss the linear vector spaces in quantum mechanics.

(b) What do you mean by change of basis? Explain

Or

(c) Write a note on unitary and positive operators

(d) Explain about the orthogonalization procedure

3. (a) Obtain the commutation relations for angular momentum operator

(b) Obtain the angular momentum in spherical polar coordinate

Or

(c) Obtain Eigen values for L^2 and L_z operators

(d) Obtain the Eigen values of rigid rotator

4. (a) Discuss the time-independent perturbation theory for degenerate systems

(b) Write short note on WKB method and its applications.

Or

(c) Discuss variation method

(d) Using the variation method obtain the ground state of Helium atom.

5. (a) Briefly explain the time dependent perturbation theory.

(b) Obtain Fermi's Golden rule

Or

(c) Explain the interaction of an atom with the electromagnetic radiation

(d) Write a note on sudden and adiabatic approximation.

(PHY10416)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2018.

First Semester

Physics

Paper – IV : ELECTRONICS

(Regulation 2016)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Explain the circuit configuration and working of differential amplifier using Op–amp.

(b) Write a note on CMRR.

Or

(c) Explain the Op–amp with negative and voltage series feedback.

(d) Explain the effect of feedback on input resistance and output resistances.

2. (a) Explain how op–amp can work as an summing and scaling amplifier.

(b) Explain the working of LC tunable oscillator.

Or

(c) Obtain the frequency stability criteria in oscillators.

(d) With a neat circuit diagram explain the operation of Wein bridge oscillator.

3. (a) Explain the demodulation of AM waves.

(b) Define DSBSC modulation and explain the generation of DSBSC waves.

Or

(c) Explain the detection of SSB waves.

(d) Write a note on vestigial side band modulation.

4. (a) With a circuit diagram explain the working a multiplexer.

(b) Explain how De Multiplexer works as a data distributor with a block diagram.

Or

(c) Explain the working of R–S and JK flip–flops.

(d) Write a note on asynchronous and synchronous counters.

5. (a) Describe the architecture of 8085.

(b) Explain the instruction set of 8085.

Or

(c) Write an ALP to find the highest number in a series.

(d) Write a note on stack and subroutine.

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