

(PHY10112)

M.Sc. DEGREE EXAMINATION, DECEMBER 2019.

First Semester

Physics

Paper I – MATHEMATICAL PHYSICS

(Regulation 2012)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

1. (a) Obtain the solution of Bessel's differential equation
(b) Show that $P_n(-1) = (-1)^n P_n(1)$
Or
(c) Obtain the generating function for Hermite polynomial
(d) Show that $(2n + 1 - x)L_n(x) = (n + 1)L_{n+1}(x) + nL_{n-1}(x)$
2. (a) Define Laplace transform and prove the linear and first shifting properties of Laplace transform
(b) Find the Laplace transform of 'sinkt'.
Or

- (c) Explain the evaluation of Fourier coefficients
 (d) Find the Fourier integral of the $f(x) = e^{-kt}$ when $x > 0$.

3. (a) State and prove Cauchy's integral theorem
 (b) Evaluate the integral $\int_C \frac{zdz}{(9-z^2)(z+i)}$ where C is the circle $|Z| = 2$ described in the positive sense

Or

- (c) State and explain the Residue theorem
 (d) Find the residue of $\frac{z}{(z-a)(z-b)}$ at infinity

4. (a) Define tensor and explain the covariant and contravariant tensors
 (b) If A^i and B_j are the components of contravariant and covariant tensor of rank one, the $C_j^i = A^i B_j$ are components of a mixed tensor of rank two

Or

- (c) Explain the Quotient law of tensors
 (d) Show that contraction of a tensor of rank two leads to a scalar

5. (a) Obtain the generating function for Legendre's polynomial
 (b) Briefly explain the partial fraction method for finding the Inverse Laplace transform

Or

- (c) State and explain the Taylor's theorem
 (d) Explain the addition and multiplication of tensors

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M.Sc. DEGREE EXAMINATIONS, DECEMBER 2019.

First Semester

Physics

Paper II : CLASSICAL MECHANICS

(Regulation 2012)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

All questions carry equal marks.

1. (a) Explain the mechanics of a system of particles.
- (b) Define constraints and give its classification.

Or

- (c) Derive the Lagrange's equations from Hamilton's principle.
- (d) Explain about the energy function and the conservation of energy.

2. (a) Explain the integral power law potentials and obtain the condition for closed orbits.
(b) Discuss the scattering in a central force field.

Or

- (c) Explain the cyclic coordinates and conservation theorems.
(d) Obtain the Hamilton's equations of motion from variational principle.
3. (a) Obtain canonical transformations from Legendre transformations.
(b) Show that the transformation $Q = 1/p$, $P = qp^2$ are canonical.

Or

- (c) Explain Hamilton-Jacobi method.
(d) Obtain Hamilton-Jacobi equation for Hamilton's characteristic function.
4. (a) Write a note Euler angles and infinitesimal rotations.
(b) Explain the motion of a rigid body.

Or

- (c) Explain the torque free motion of a rigid body
(d) Explain the frequencies of free vibration and normal coordinates.

5. (a) State and explain Hamilton's principle.
(b) Explain the principle of least action.

Or

- (c) Explain the action angle variables in systems of one degree of freedom.
(d) Explain the free vibrations of a linear atomic molecule.

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M.Sc DEGREE EXAMINATION, DECEMBER 2019.

First Semester

Physics

Paper III — QUANTUM MECHANICS - I

(Regulation 2012)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

1. (a) State and explain Ehrenfest theorem.
(b) Write a note on stationary states.
Or
(c) Obtain Schrodinger equation in the harmonic oscillator problem.
(d) What do you mean by change of basis? Explain.
2. (a) Obtain the angular momentum in spherical polar coordinates.
(b) Obtain the Eigen values for L^2 and L_z operators.

Or

- (c) Obtain Eigen values for L^2 and L_z operators.
- (d) Obtain the Eigen values of rigid rotator.

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

Or

- (b) Explain the Stark effect in hydrogen atom.
- (c) Explain the WKB method.

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

- (b) Obtain Fermi's Golden rule.

Or

- (c) Obtain Einstein transition probabilities using Fermi's Golden rule.
- (d) Explain the interaction of an atom with the electromagnetic radiation.

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

- (b) Obtain the Eigen functions of hydrogen atom.

Or

- (c) Briefly explain the variation method.
- (d) Write a note on sudden and adiabatic approximation.

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M.Sc. DEGREE EXAMINATIONS, DECEMBER 2019.

First Semester

Physics

Paper IV — ELECTRONICS (GENERAL)

(Regulation 2012)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

1. (a) Explain the circuit configuration and working of dual input differential amplifier using OP-amp

(b) Write a note on CMRR

Or

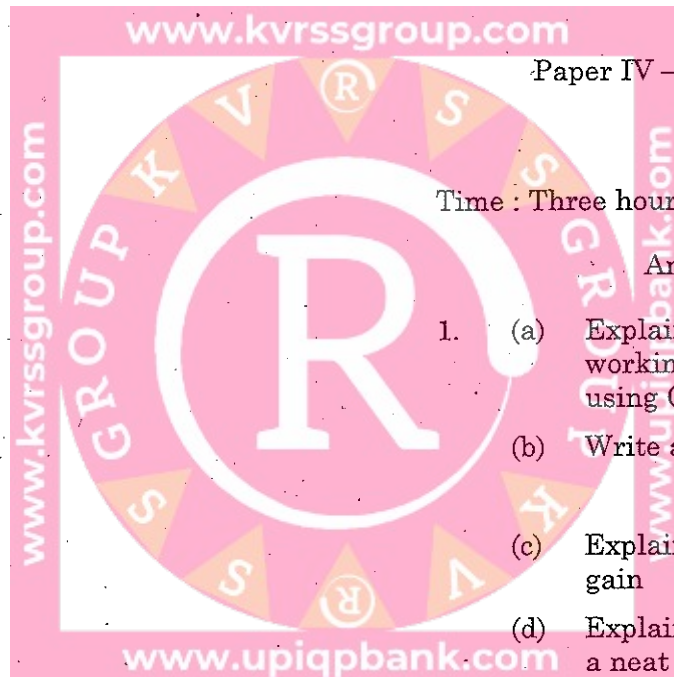
(c) Explain the effect of feedback on closed loop gain

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

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

(b) Explain the working of LC tunable oscillator

Or



- (c) Write a note on oscillator principles and its types
- (d) Explain the working of Monostable multivibrator with a neat diagram

3. (a) Define amplitude modulation and explain the generation of AM waves
- (b) Explain the coherent detection of DSBSC waves

Or

- (c) Explain the working of encoder with a neat circuit diagram
- (d) Distinguish between Multiplexer and De Multiplexer
4. (a) Describe the architecture of 8085
- (b) Explain about the addressing modes in 8085

Or

- (c) Explain the architecture of 8051 microcontroller
- (d) Write an assembly language program for counting and indexing

5. (a) Draw the inverting amplifier in open loop configuration and explain its working
- (b) Explain the working of adjustable voltage regulator with circuit diagram

Or

- (c) Write a note on asynchronous and synchronous counters
- (d) Explain the instruction set of 8085

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M.Sc. DEGREE EXAMINATION, DECEMBER 2019.

First Semester

Physics

Paper I – MATHEMATICAL PHYSICS

(Regulation 2016)

Time : Three hours

Maximum : 70 marks

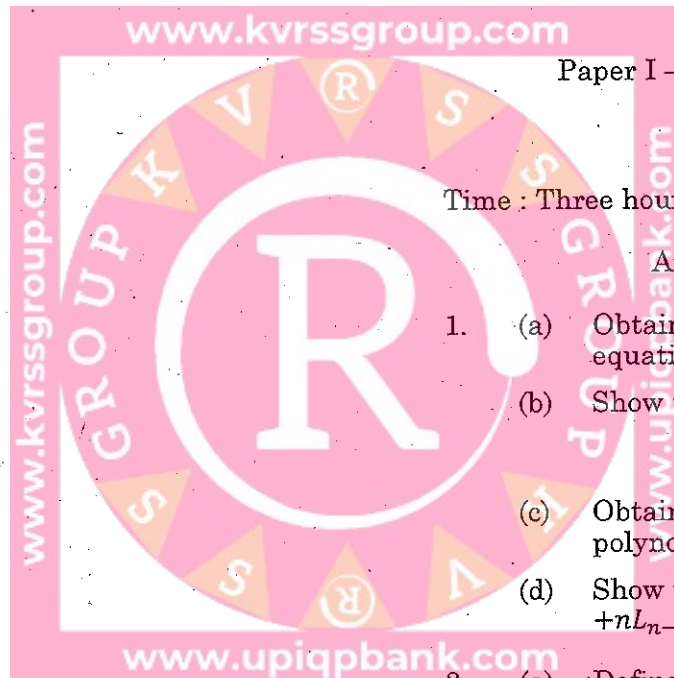
Answer ALL questions.

1. (a) Obtain the solution of Legendre's differential equation
(b) Show that $P_n(-1) = (-1)^n P_n(1)$

Or

- (c) Obtain the generating function for Hermite polynomial
(d) Show that $(2n + 1 - x)L_n(x) = (n + 1)L_{n+1}(x) + nL_{n-1}(x)$
2. (a) Define Laplace transform and prove the linear and first shifting properties of Laplace transform
(b) Find the Laplace transform of 'sinkt'

Or



- (c) Briefly explain the partial fraction method for finding the Inverse Laplace transform.
- (d) Obtain the Laplace transform of a derivative
3. (a) Explain the evaluation of Fourier coefficients.
- (b) Find the Fourier integral of the $f(x) = e^{-kt}$ when $x > 0$.

Or

- (c) Obtain the Fourier sine transform of a derivative.
- (d) Find the Fourier transform of t^2 in the range $0 \leq t \leq \pi$.
4. (a) State and prove Cauchy's integral theorem.
- (b) Evaluate the integral $\int_C \frac{zdz}{(9-z^2)(z+i)}$ where C is the circle $|Z| = 2$ described in the positive sense

Or

- (c) State and explain the Residue theorem
- (d) Find the residue of $\frac{z}{(z-a)(z-b)}$ at infinity

5. (a) Define tensor and explain the covariant and contravariant tensors.
- (b) If A^i and B_j are the components of contravariant and covariant tensor of rank one, the $C_j^i = A^i B_j$ are components of a mixed tensor of rank two.

Or

- (c) Explain the Quotient law of tensors
- (d) Show that contraction of a tensor of rank two leads to a scalar.

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M.Sc. DEGREE EXAMINATION, DECEMBER 2019.

First Semester

Physics

Paper II – CLASSICAL MECHANICS

(Regulation 2016)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

1. (a) Explain the conservation theorem for linear momentum and angular momentum
(b) Define constraints and give its classification

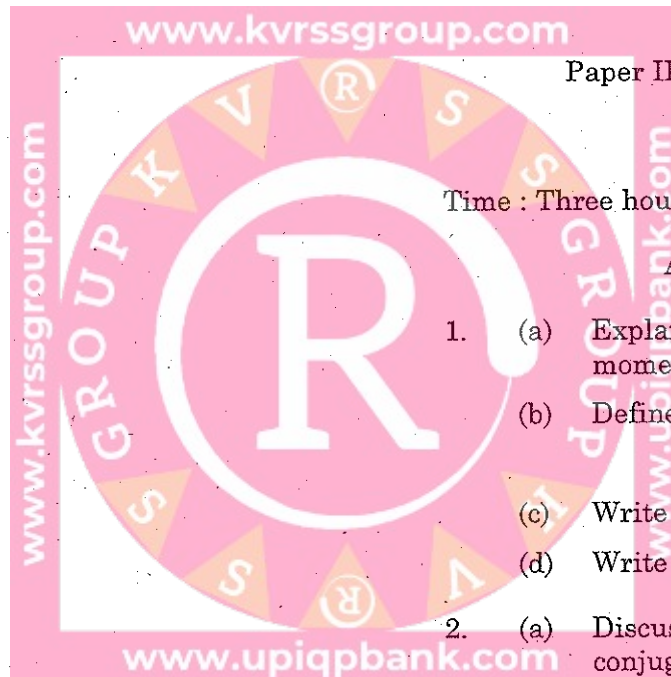
Or

- (c) Write a note on velocity dependent potentials
(d) Write a note on Lagrangian formulation

2. (a) Discuss how the generalized momentum conjugate to a cyclic co-ordinate is conserved

- (b) Explain the physical significance of Hamilton's equations

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) Obtain Hamilton's equations from modified Hamilton principle
- (b) State and explain the principle of least action

Or

- (c) Obtain canonical transformations from Legendre transformations
 - (d) Show that the transformations $Q = \frac{1}{p}, P = qp^2$ are canonical
4. (a) Explain Hamilton-Jacobi method
- (b) Obtain Hamilton-Jacobi equation for Hamilton's characteristic function

Or

- (c) Explain the two coupled oscillations
- (d) Discuss the vibrations of linear triatomic molecule

5. (a) Write a note Euler angles
- (b) Obtain an expression for kinetic energy of a rigid body

Or

- (c) Explain the motion of a rigid body
- (d) Explain the torque free motion of a rigid body

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M.Sc. DEGREE EXAMINATION, DECEMBER 2019.

First Semester

Physics

Paper III – QUANTUM MECHANICS – I

(Regulation 2016)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

All questions carry equal marks.

1. (a) Discuss the necessity of quantum mechanics.
(b) Obtain continuity equation.

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) Explain the properties of Hermitian and projection operators.

- (d) Write a note on orthogonalization procedure.

3. (a) Obtain the angular momentum in spherical polar coordinates.

- (b) Obtain the Eigen values for L_+ and L_- operators.

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.

Or

- (b) Explain the stark effect in hydrogen atom.

- (c) Explain the WKB method.

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

- (b) Obtain Fermi's Golden rule.

Or

- (c) Obtain Einstein transition probabilities using Fermi's Golden rule.

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

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M.Sc. DEGREE EXAMINATIONS, DECEMBER 2019.

First Semester

Physics

Paper IV — ELECTRONICS

(Regulation 2016)

Time : Three hours

Maximum : 70 marks

Answer ALL questions.

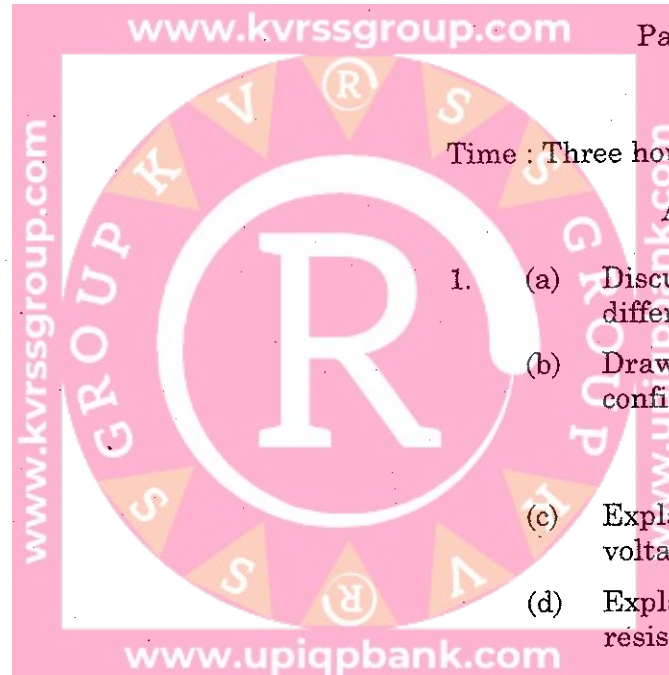
1. (a) Discuss the operation of dual input differential amplifier.
(b) Draw the inverting amplifier in open loop configuration and explain its working.

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) Write a note on CMRR frequency response.
(b) Explain the working of adjustable voltage regulator with circuit diagram.

Or



- (c) Obtain the frequency stability criteria in oscillators.
- (d) With a neat circuit diagram explain the operation of phase shift oscillator.

3. (a) Explain the demodulation of AM waves.
- (b) Define DSBSC modulation and explain the generation of DSBSC waves.

Or

- (c) Write a note on SSB modulation.
 - (d) Explain about Frequency division multiplexing.
4. (a) With a circuit diagram explain the working of multiplexer.
- (b) Explain how De Multiplexer works as a data distributor with a block diagram.

Or

- (c) Explain the working of JK master slave flip-flop and D flip-flop.
- (d) Explain the working of cascade counter with neat circuit diagram.

5. (a) Write a note on 8085 CPU.
- (b) Explain the BUS timings and generating control signals in 8085.

Or

- (c) Write an ALP to find the highest number in a series.
- (d) Write a note on stack and subroutine.