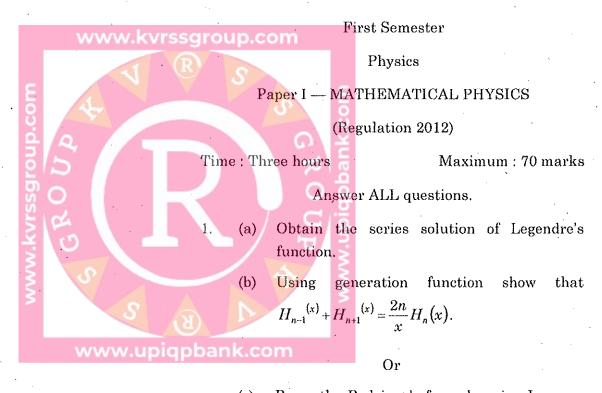
## (PHY 10112)

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- (c) Prove the Rodrigue's formula using Lagurre polynomial.
- (d) Prove the recurrence relation  $(n+1)L_{n+1}(x) = (2n+1-x)L_n(x) nL_{n-1}(x).$

- 2. (a) State and prove first and second shifting properties of Laplace transform
  - (b) Evaluate  $L^{-1}\left\{\frac{6s^2 + 22s + 18}{s^3 + 6s^2 + 11s + 6}\right\}$  using partial fraction method.

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

(b) Evaluate  $\int_C \frac{dz}{z}$  where C is a singly closed curves.

Or

- (c) State and explain the Laplace transform of a derivatives.
- (d) Find the inverse Laplace transform of  $\frac{1}{\sqrt{2s+5}}$  and  $\frac{s}{\left(s^2-k^2\right)}$ .
- 3. (a) Starting from the general Fourier Series of a periodic function f(x) in the interval (-l, l), obtain the Fourier integral.
  - (b) Explain the Half wave expansions in Fourier series.

Or

- (c) Find the Fourier Sine transform of  $e^{-ax}$  for x>0.
- (d) Explain the Fourier transform of delta function.

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(c) Find Taylor's series for the function  $z^3 - 3z^2 + 4z - 2$  about z = 2.

Or

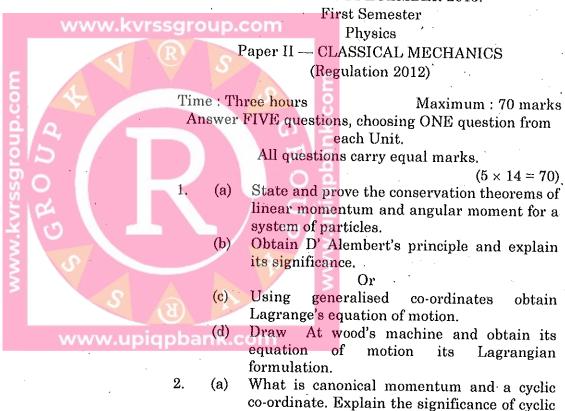
- (d) State and explain residue theorem.
- (a) Define tensor. Distinguish between contravariant and covariant tensors.
- (b) Write a note on mixed tensors.

Or

- (c) Explain the process of contraction of a tensor with one example.
- (d) Explain the quotient law of tensor.

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co-ordinate.

and derive Hamilton's equations.
Or

Explain the meaning of Hamilton function H

- (c) In the body central force problem obtain the equation of motion and prove Kepler's second law.
- (d) What are the first integrals and discuss their significance?
- 3. (a) Explain Hamilton's principle. Deuce Hamilton's equations from modified Hamilton principle.
  - (b) Show Lagrange's equations follow Hamilton's principle.

Or

- (c) What are Legendre transformations? Using Legendre transformations deduce Hamilton's equations of motion.
- (d) Explain the nature of cannocial transformations using the example of Harmonic oscillator.
- 4. (a) Obtain Hamilton Jacobi equation and deduce Hamilton's principal function.
  - (b) Apply Hamilton-Jacobi meth<mark>od</mark> to obtain the solution of harmonic oscillator problem.

Or

(c) Obtain the solutions of a coupled oscillator. Discuss its normal modes and normal coordinates.

- (d) Explain the nature of different vibrational frequencies present in a linear triatomic molecule.
- 5. (a) Discuss the independent co-ordinates of rigid body. Explain what are Euler angles. Describe what are infinitesimal rotations.
  - (b) Explain what is inertia tensor. Discuss the significance of principal moments of inertia tensor.

Or

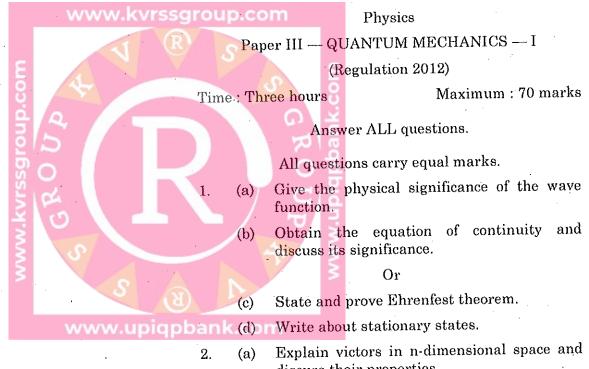
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- (c) Obtain Euler's equations of motion for a rigid body.
- (d) Discuss the principle and applications of a gyroscope.

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First Semester



- discuss their properties.
  - Discuss with examples linear operators and their properties.

- the properties of Hermitian Describe (c) operators and unitary operators.
- Explain how the change of basis set is (d) obtained.
- Write angular momentum operators in 3. (a) the Obtain co-ordinates. Cartesian commutation relations of  $L_{x,}L_{y}$  ,  $L_{z,}$  and  $L^{2}$  .
  - Explain what are  $L_{+}L_{-}$  operators. Obtain (b) their commutation relations with  $L_{\mathrm{x}}L_{\mathrm{y}}$ and  $L_z$ .

#### Or

- Write the Schrodinger's wave equation for a (c) rigid rotator and obtain its solutions.
- For hydrogen atom show how the radial (d) equation is obtained. Discuss its solutions:
- Give an account of time independent 4. perturbation applied to non-degenerate case to the first order.
  - Explain how the ground state of He-atom is (b) independent time using obtained www.upiqpbank.com perturbation.

#### Or

- What is variational principle? Explain how (c) their is applied to obtain the ground state energy of a system.
- Briefly explain the WKB method. (d)

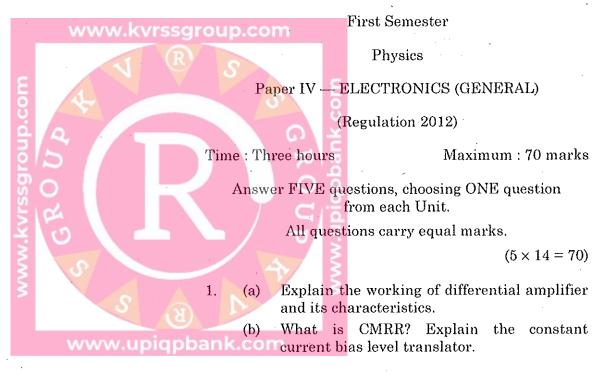
- Explain first order time dependent 5. (a) perturbation theory. Explain what is meantby Harmonic Perturbation.
  - (b) Discuss transition into closely spaced levels.

#### Or

- Einstein's transition Write about probabilities.
- Describe the interaction of an atom with electromagnetic radiation.

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Or

- (c) What is an op-amp? Explain how it can be used as an integrator and differentiation.
- (d) Explain the principle and operation of voltage follower.

- 2. Explain how op-amp and as a summing, scaling and arranging amplifiers.
  - Describe the working of Weinbridge oscillator with a neat circuit diagram.

Or

- Distinguish between fixed and adjustable voltage regulators and explain the working of switching regulator.
- List the characteristics of practical and ideal op-amp.
- Explain modulation and demodulation of 3. AM waves and discuss DSBSC modulation.
  - Discuss the generation and coherent detection of DSBCC waves.

Or

- What is SSB modulation? Explain the generation of SSB waves.
- Describe the working of FDM with a neat circuit diagram.
- With a neat circuit diagram, explain the 4 working of DE Multiplexer.
  - Draw the circuit diagram of JK Master slake Flip-Flop and explain its working.

Or

- Draw the functional diagram of shift register and explain its working.
- Distinguish between synchronous asynchronous counters and explain the operation of cascade counter.
- addressing modes of (a) Explain the 8085 microprocessor with examples.
- Write an assembly language program to perform multiplication of two 8-bit numbers.

Or

- architectural Draw the diagram (c) 8051 micro controller and explain each part in it.
- (d) Discuss the memory organisation 8051 microcontroller.

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