(PHY 10112)

M.Sc. DEGREE EXAMINATION,
NOVEMBER/DECEMBER 2015

First Semester

Physics

Paper I — MATHEMATICAL PHYSICS

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

1. (a) Obtain the series solution of Legendre's function.

(b) Using generation function show that $H_{n-1}^{(x)} + H_{n+1}^{(x)} = \frac{2n}{x} H_n(x)$.

Or

(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.

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.

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

(d) State and explain residue theorem.

5. (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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First Semester

Physics

Paper II — CLASSICAL MECHANICS

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer FIVE questions, choosing ONE question from each Unit.

All questions carry equal marks.

(5 × 14 = 70)

1. (a) State and prove the conservation theorems of linear momentum and angular moment for a system of particles.

(b) Obtain D' Alembert's principle and explain its significance.

Or

(c) Using generalised co-ordinates obtain Lagrange's equation of motion.

(d) Draw At wood's machine and obtain its equation of motion its Lagrangian formulation.

2. (a) What is canonical momentum and a cyclic co-ordinate. Explain the significance of cyclic co-ordinate.

(b) Explain the meaning of Hamilton function H and derive Hamilton's equations.

Or

(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 method to obtain the solution of harmonic oscillator problem.

Or

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

(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

(c) Obtain Euler's equations of motion for a rigid body.

(d) Discuss the principle and applications of a gyroscope.

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M.Sc. DEGREE EXAMINATION,
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First Semester

Physics

Paper III — QUANTUM MECHANICS — I

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

All questions carry equal marks.

1. (a) Give the physical significance of the wave function.

(b) Obtain the equation of continuity and discuss its significance.

Or

(c) State and prove Ehrenfest theorem.

(d) Write about stationary states.

2. (a) Explain victors in n-dimensional space and discuss their properties.

(b) Discuss with examples linear operators and their properties.

Or

(c) Describe the properties of Hermitian operators and unitary operators.

(d) Explain how the change of basis set is obtained.

3. (a) Write angular momentum operators in Cartesian co-ordinates. Obtain the commutation relations of L_x, L_y , L_z and L^2.

(b) Explain what are L_+, L_- operators. Obtain their commutation relations with L_x, L_y and L_z.

Or

(c) Write the Schrodinger's wave equation for a rigid rotator and obtain its solutions.

(d) For hydrogen atom show how the radial equation is obtained. Discuss its solutions.

4. (a) Give an account of time independent perturbation applied to non-degenerate case to the first order.

(b) Explain how the ground state of He-atom is obtained using time independent perturbation.

Or

(c) What is variational principle? Explain how their is applied to obtain the ground state energy of a system.

(d) Briefly explain the WKB method.

5. (a) Explain first order time dependent perturbation theory. Explain what is meant by Harmonic Perturbation.

(b) Discuss transition into closely spaced levels.

Or

(c) Write about Einstein's transition probabilities.

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

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First Semester

Physics

Paper IV — ELECTRONICS (GENERAL)

(Regulation 2012)

Time : Three hours Maximum : 70 marks

Answer FIVE questions, choosing ONE question from each Unit.

All questions carry equal marks.

(5 × 14 = 70)

1. (a) Explain the working of differential amplifier and its characteristics.

(b) What is CMRR? Explain the constant current bias level translator.

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. (a) Explain how op-amp and as a summing, scaling and arranging amplifiers.

(b) Describe the working of Weinbridge oscillator with a neat circuit diagram.

Or

(c) Distinguish between fixed and adjustable voltage regulators and explain the working of switching regulator.

(d) List the characteristics of practical and ideal op-amp.

3. (a) Explain modulation and demodulation of AM waves and discuss DSBSC modulation.

(b) Discuss the generation and coherent detection of DSBCC waves.

Or

(c) What is SSB modulation? Explain the generation of SSB waves.

(d) Describe the working of FDM with a neat circuit diagram.

4. (a) With a neat circuit diagram, explain the working of DE Multiplexer.

(b) Draw the circuit diagram of JK Master slake Flip-Flop and explain its working.

Or

(c) Draw the functional diagram of shift register and explain its working.

(d) Distinguish between synchronous and asynchronous counters and explain the operation of cascade counter.

5. (a) Explain the addressing modes of 8085 microprocessor with examples.

(b) Write an assembly language program to perform multiplication of two 8-bit numbers.

Or

(c) Draw the architectural diagram of 8051 micro controller and explain each part in it.

(d) Discuss the memory organisation of 8051 microcontroller.