Reg. No. : .....

2501 Q.P. Code : [D 07 PPH 01]

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, JUNE 2008.

First Year

Physics

CLASSICAL MECHANICS AND MATHEMATICAL PHYSICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

All questions carry equal marks.

(5 × 20 = 100)

1. (a) Point out the Kepler's law of planetary motion and discuss the Kepler's problem in action angle variable.

(b) Derive the Equation of motion in Poisson bracket notation.

2. (a) Derive the Euler's equation of motion for a Rigid body with a fixed point and discuss torque free motion.

(b) Obtain an expression for the Moment of Inertia of a rigid body.

3. (a) Explain the properties of T, V and W.

(b) Discuss the working of parallel pendula.

4. (a) Obtain the normal modes and their frequencies of a symmetric linear triatomic molecule.

(b) Discuss the Hamilton-Jacobi method. Apply it to find the solution for the motion of linear harmonic oscillator.

5. (a) Find the solution in series of Bessel's equation.

$$\frac{d^2y}{dx^2}+\frac{1}{x}\frac{dy}{dx}+\left[1-\frac{n^2}{x^2}\right]y=0.$$

(b) Discuss the Recurrence Relations of Bessel equation.

6. (a) Use Laplace transform method, solve the differential equation.

$$\frac{d^2y}{dt^2}+4\frac{dy}{dy}-5y=5 \text{ given that } y=0, \frac{dy}{dt}=2$$

when $t=0$.

(b) Obtain Fourier series for the expansion of $f(x)=x\sin x$ in the interval $-\pi<x<\pi$.

7. (a) State and prove Cauchy Residue theorem.

(b) Apply the Calculus of Residues to evaluate $\int_{-\infty}^{\infty}\frac{dx}{x^4+a^4}$.

8. (a) Explain the Schmidt orthogonalisation procedure.

(b) Find the Fourier series for the periodic function $f(x)$ defined by

$f(x)=-\pi$ if $-\pi<x<0$

$f(x)=x$ if $0<x<\pi$.

Reg. No. : .....

2502 Q.P. Code : [D 07 PPH 02]

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, JUNE 2008.

First Year

Physics

QUANTUM MECHANICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

All questions carry equal marks.

(5 × 20 = 100)

1. (a) Explain the equation of Motion in Schrodinger Picture.

(b) Describe the Kroneig Penny Model.

2. (a) Apply the first order perturbation theory to calculate the ground state of helium atom.

(b) Discuss the W.K.B. method and give an application of this method.

3. (a) Prove that $[J^2, J_z] = 0$

$$[J_z, J_+] = \hbar J_+$$

(b) Obtain Clebesch–Gordan Coefficients for the addition of orbital and spin angular momentum.

4. (a) Derive the Relativistic wave equation for a free particle.

(b) Solve the Dirac's equation for a particle in a central field force and calculate spin orbit coupling energy.

5. (a) Explain Born's approximation and its validity.

(b) Discuss the Heitler–London Theory of Hydrogen molecule.

6. (a) Describe the Hartree self consistent Field method for Molecules.

(b) Obtain the expression for scattering Amplitude interms of Green's Function.

7. (a) Obtain Einstein's Coefficients from semi classical theory.

(b) Discuss the Quantisation of Electromagnetic Field energy and momentum.

8. (a) Obtain the energy eigen values of Linear Harmonic Oscillator.

(b) Explain the stark Effect in Hydrogen atom.

Reg. No. : .....

2503 Q.P. Code : [D 07 PPH 03]

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, JUNE 2008.

First Year

Physics

ELECTROMAGNETIC THEORY AND OPTICAL PHYSICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) What are the Polar and non-polar molecules? Derive Clausius-Mosotti Relation for the permittivity of such molecules.

(b) Show that through its definition, magnetic vector potential $\vec{A}$ is related to the electrostatic potential V through the relation $div\vec{A} + \epsilon_0 \mu_0 \frac{\partial v}{\partial t} = 0$.

2. (a) Deduce Maxwell's equation of electromagnetic field and discuss their emprical basis.

(b) What do you understand by Lorentz gauge and Coloumb's gauge? Show that coupled inhomogeneous Maxwell equations are uncoupled by a gauge transformation.

3. (a) Outline the Theory of Multilayer Films.

(b) Explain the principle, construction and working of Fabry Perot Interferometer with neat diagram.

4. (a) Explain the reflection and refraction of light at the boundary of a Absorbing Medium.

(b) Discuss the Faraday Rotation in Solids.

5. (a) Describe the construction and working of He-Ne Laser with a neat diagram.

(b) Explain the Applications of Lasers in different fields.

6. (a) Starting from Biot-Savart's law, calculate the divergence of magnentic induction vector $\bar{B}$.

(b) Explain the Langevin-Debye Formula for polar molecules.

7. (a) Describe Linear half-wave Antenna with a neat diagram.

(b) Discuss the Phenomenon of total internal reflection on the basis of electromagnetic theory.

8. (a) What is an anamalous dispersion? Give a suitable theory for its explanation and describe a suitable experimental arrangement for its study.

(b) Outline the theory of partial coherence.

Reg. No. : .....

2504 **Q.P. Code : [D 07 PPH 04]**

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, JUNE 2008.

First Year

Physics

NUCLEAR PHYSICS AND SPECTROSCOPY

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) Explain the working of Neir Mass Spectrometer with a neat diagram.

(b) Discuss the Fermi's Theory of Beta decay.

2. (a) Explain the Theories of Nuclear Composition.

(b) Explain the Absorption of Gamma Rays by matter.

3. (a) Derive the Seaborg's expression for activation energy.

(b) Explain about Schmidt lines and Nuclear Isomerism.

4. (a) Outline the theory of Nuclear Reaction.

(b) Explain the Kinematcis of stopping and Pickup Reaction.

5. (a) Obtain Gell Mann Okuba mass formula.

(b) Discuss the Quark structure of Hadrons.

6. (a) Describe the working of Microwave Spectrometer.

(b) Explain Rotation Vibration of Raman Spectra of Diatomic molecule.

7. (a) Describe the principle and working of NMR spectrometer.

(b) Discuss the experimental detection of NQR frequencies.

8. (a) Explain the Hyperfine structure of ESR spectrum.

(b) Describe the working of Mossbauer Spectrometer with a diagram.