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Reg. No. : .....

D 2128 **Q.P. Code : [D 07 PPH 01]**

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, MAY 2014.

First Year

Physics

CLASSICAL MECHANICS AND MATHEMATICAL PHYSICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) How are Poisson and Langrage brackets related? Derive the equation of motion in Poisson Bracket Notation.

   (b) Explain about Kepler problem in action angle variables.

2. (a) Describe about generalized coordinates for rigid body motion and Euler's angle.

   (b) Explain moments and products of inertia. Derive moment of inertia of a rigid body.

7. (a) Explain about Dirichlet's theorem. Find the finite Fourier sine and cosine transform of $\partial^2 u/\partial x^2$ where u is a function of x and t for $0<x<1, t>0$.

(b) Explain Schmidt orthogonalization process.

8. (a) Derive the solution for Harmonic oscillator problem using Hamilton-Jacobi method.

(b) Obtain the Fourier series for $f(x)=1+x+x^2$ in $(-\pi,\pi)$. Deduce that $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+....\infty=\frac{\pi^2}{6}$.

Reg. No. : .....

D 2129 Q.P. Code : [D 07 PPH 02]

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, MAY 2014.

First Year

Physics

QUANTUM MECHANICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) Derive the equation of motion in Schrödinger picture and Dirac picture.

   (b) Explain one dimensional linear harmonic oscillator in matrix mechanics.

2. (a) Describe time independent perturbation theory for non-degenerate case.

   (b) Derive the Fermi-Golden rule from time-dependent perturbation theory.

3. (a) Find out the expression for J^2 and J_z using matrix representation.

   (b) Write about Klein Gordon equation.

4. (a) What is hybridization? Explain Sp^1 and Sp^2 hybridization.

(b) Explain the scattering by Coulomb and Yukawa potential.

5. (a) Describe about spontaneous and induced emission of radiation from semi classical theory. Derive the expression for Einstein's coefficients.

(b) Write a note on quantization of electromagnetic field energy and momentum.

6. (a) Explain in detail about the concept of orbital angular momentum, spin angular momentum and total angular momentum.

(b) Derive Dirac relativistic equation for a free particle.

7. (a) Explain doublet separation in the spectra with Na as an example.

(b) Give a brief explanation about field quantization of the non-relativistic Schrodinger equation.

8. (a) Derive Hartree - Fock equation

(b) Explain Heitler - London theory of H_2 molecules.

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D 2130 Q.P. Code : [D 07 PPH 03]

(For the candidates admitted from 2007 onwards)

M.Sc. DEGREE EXAMINATION, MAY 2014.

First Year

Physics

ELECTROMAGNETIC THEORY AND OPTICAL PHYSICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) State Gauss's theorem. Show that the potential difference between two points distant r_1 and r_2 from an infinitely long line charge of linear charge density λ is given by

$$\nabla\Phi = \frac{1}{4\pi\varepsilon_0} 2\lambda \log_e {}^{r1}/_{r2}.$$

(b) Explain Biot–Savart law and give general proof of Ampere's circuital law.

2. (a) Derive Maxwell's equations in free space.

(b) Deduce Brewster's law on the basis of electromagnetic theory and explain how it can be verified experimentally.

3. (a) Outline the concept of scattering by a free electron.

(b) Explain the theory of partial coherence.

4. (a) Discuss magneto optic effect in detail.

(b) Describe about the propagation of light in an optical fibre.

5. (a) Explain the atomic basis for laser action.

(b) Describe the construction and working of He – Ne laser.

6. (a) Derive Clausius Mossotti relation for non-polar molecules.

(b) Establish the relation between electric field strength E, polarization P and electric induction D.

7. (a) Distinguish between Lorentz gauge & Coulomb gauge.

(b) Explain about the measurement of stellar diameter.

8. (a) Write about propagation of light in crystals and double refraction.

(b) Explain about Q-switching and mode locking.

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Reg. No. : .....

D 2131 Q.P. Code : [D 07 PPH 04]

(For the candidates admitted during 2007 onwards)

M.Sc. DEGREE EXAMINATION, MAY 2014.

First Year

Physics

NUCLEAR PHYSICS AND SPECTROSCOPY

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) Discuss the salient features of $\beta-$ ray spectrum and Pauli's hypothesis.

   (b) Describe the construction, working and theory of a Bainbridge – Jordan mass spectrograph.

2. (a) Give experimental evidences in support of magic numbers and shell structure of nucleons in nuclei.

   (b) Write a note on "Nuclear Isomerism".

3. (a) Derive Breit Wigner dispersion formula.

   (b) Write a note on Gell – Mann – Okuba mass formula for Baryons. Describe the CP violation in neutral Kaons (K°) decay.

4. (a) Differentiate Normal Zeeman effect and anomalous Zeeman effect.

   (b) Outline the theory of Paschen — Back effect and hyperfine structure of spectral lines with example.

5. (a) Describe the basic principle of FTIR spectroscopy.

   (b) Explain classical and quantum theory of Raman effect.

6. (a) Explain the principle and working of high resolution NMR spectrometer.

   (b) Outline the fundamental requirements for Nuclear Quadrapole resonance to occur.

7. (a) Explain the parameters of Mossbauer Effect for chemical applications.

   (b) Describe about Geiger – Nuttal law and the condition for spontaneous fission.

8. (a) Explain symmetry and conversion laws of Baryons. Give the possible values of isospin I and its Z — component I_3 for the system of particles

   (i) $\pi^+ + P$

   (ii) $\pi^- + P$

   (b) Write a note on liquid drop model.
