K15P 0304

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (Reg./Sup./Imp.) Examination, November 2015
(2014 Admn. Onwards)
PHYSICS
PHY 1C01 : Mathematical Physics – I

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **both** questions, either (**a**) or (**b**). **Each** question carries **12** marks.

1. a) Define Hermitian matrix. Prove that Hermitian matrix remains. Hermitian under unitary similarity transformation.

   OR

   b) Derive Laplacian operator in any orthogonal curvilinear co-ordinates system.

2. a) i) Explain inner multiplication and contraction of tensors.

      ii) Apply a suitable contractions to the curvature tensor and arrive at Ricci tensor.

   OR

   b) Obtain Rodrigues's formula for Legendre polynomials. Deduce first three Legendre polynomials. **(2×12=24)**

SECTION – B

Answer **any four** (**1** mark for part '**a**', **3** marks for part '**b**', **5** marks for part '**c**') :

3. a) What is scale factors in cylindrical polar coordinates ?

   b) What are orthogonal curve linear co-ordinates ?

   c) Obtain an expression for curl in spherical polar co-ordinates.

P.T.O.

4. a) What is the importance of diagonal elements in a diagonalized matrix ?
   b) With suitable example explain what are diagonal matrices ?
   c) Explain how a matrix can be diagonalized ?

5. a) What is second order linear ODE's ?
   b) Explain Frobeniu's method.
   c) Apply Frobeniu's method to linear oscillator problem.

6. a) Give a short account of graphical representation of complex numbers.
   b) Prove that the modulus of the sum of two complex numbers does never exceed the sum of their moduli.
   c) Discuss the necessary and sufficient conditions for f(z) to be analytic.

7. a) What is the role of Euler's definite integral in the definitions of Gamma function ?
   b) Derive the recursion relation for gamma function :

      $\Gamma(n+1) = n\Gamma(n)$.

   c) Find the value of $\Gamma\left(\frac{1}{2}\right)$.

8. a) Write down Bessel differential equation.
   b) Obtain a power series solution.
   c) Show that $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)} = \sum_{n=-\infty}^{+\infty} J_n(x)\, t^n$ where $J_n(x)$ is given by the series obtained in (a).

(4×9=36)

K15P 0305

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (Reg./Sup./Imp.) Examination, November 2015

PHYSICS (2014 Admin. Onwards)

PHY 1C02 : Classical Mechanics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** questions (either **a** or **b**). **Each** question carries **12** marks.

1. a) Distinguish between differential and total cross section. Obtain the differential cross section for the scattering of two rigid spheres of the same size. Explain why the variation with angle is independent of the radius.

OR

b) What is meant by a rigid body ? Is it possible to have a perfectly rigid body ? Justify your answer. Derive the Euler's equation of motion. Explain the significance of the solutions of Euler's equation.

2. a) Derive the Hamilton's equation of motion for a body in a central force field. Prove that the angular momentum for a particle moving in a central force field is conserved.

OR

b) What is stable, unstable and neutral equilibrium ? Give examples. Show that the eigen vectors corresponding to the two distinct eigen frequencies are orthogonal. Explain the meaning of orthogonality. **(2×12=24)**

SECTION – B

Answer **any four** questions (**1** mark for Part **a**, **3** marks for Part **b** and **5** marks for Part **c**).

3. a) What are constraints ?

b) Explain the meaning of holonomic and non holonomic constraints with examples.

c) State and obtain the mathematical form of D' Alembert's principle.

P.T.O.

4. a) State Hamilton's principle.
   b) Show that the Lagrangian and Newtonian equations are equivalent.
   c) Prove Hamilton's principle from Newton's equations.

5. a) Can a canonical transformation reveal symmetry in a physical system ?
   b) How can it be used to reduce the number of independent variables ?
   c) Prove that the Poisson bracket of two constants of motion is itself a constant of motion even when the constants depend upon time explicitly.

6. a) What is the significance of Hamilton Jacobi theory ?
   b) Obtain the Hamilton Jacobi equations.
   c) Discuss the problem of one dimensional harmonic oscillator by the Hamilton Jacobi method.

7. a) What is Coriolis force ?
   b) Give some phenomena in nature that arises due to Coriolis force.
   c) Discuss the effect of Coriolis force on a freely falling particle.

8. a) What is degenerary ?
   b) Explain using an example.
   c) Investigate the small oscillations of a CO2 like molecule. **(4×9=36)**

K15P 0306

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree (Reg./Sup./Imp.) Examination, November 2015
(2014 Admn. Onwards)
PHYSICS
PHY 1C03 : Electrodynamics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** questions (either **a** or **b**). **Each** question carries **12** marks.

1. a) Explain the concept of the method of images. Apply the image theory to determine the total induced charge in the case of a point charge placed above a grounded conducting plane.

OR

b) Explain the concept of radiation reaction. Derive the Abraham-Lorentz formula.

2. a) Derive the Laplace's equation in cylindrical coordinates. Give the general procedure for solving Laplace's equation.

OR

b) Explain the concept of electric dipole radiation. Treating electric dipole to be equivalent to an accelerated charge calculate (1) The dipole moment amplitude in terms of charge q and acceleration 'a' of the accelerated charge. (2) The instantaneous rate of radiation from the charge. **(2×12=24)**

SECTION – B

Answer **any four** questions. **1** mark for Part **a**, **3** marks for Part **b**, **5** marks for Part **c**.

3. a) What is Poynting's theorem ?

b) Derive Poynting's vector.

c) Show how Poynting's theorem can be interpreted for the microscopic fields $(\overline{E}, \overline{B})$ as a statement of conservation of energy of the combined system of particles and fields.

P.T.O.

4. a) What is Polarization ?
   b) Obtain the condition for the linear polarization.
   c) What is skin depth ? Derive an expression for the skin depth.

5. a) What is meant by boundary-value problems ?
   b) Obtain Fresnel coefficients for normal incidence reflections.
   c) Prove that all the incident energy is either reflected or transmitted at the boundary of two non conducting media.

6. a) What is total internal reflection ?
   b) Explain Brewster's angle and critical angle.
   c) Derive the Hagen-Rubens relation using the concept of reflection from a conducting plane.

7. a) What is a retarded potential ?
   b) Explain the significance of Lienard Wiechert potentials.
   c) Obtain the scalar Lienard-Wiechert potential.

8. a) What is a wave guide ?
   b) Explain the difference between TE & TM modes.
   c) A rectangular hollow metal wave guide is designed to propagate a 9375 MHz signal in the TE_{10} mode. Calculate the breadth of wave guide 'a' if the guide wavelength is equal to the cutoff wavelength. Calculate the cutoff frequency of the next higher order mode if b = a/2.

(4×9=36)

K15P 0307

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (Reg./Sup./Imp.) Examination, November 2015
(2014 Admn. Onwards)
PHYSICS
PHY1C04 : Electronics

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **both** questions (Either **a** or **b**). **Each** question carries **12** marks .

1. a) Draw the basic differential amplifier circuit using transistors and explain. Derive expressions for the AC voltage gain in the single ended and double ended configuration.

OR

b) Distinguish between combinational and sequential logic circuits. Draw the circuit diagram of a master slave JK flip flop and explain its working using a truth table. How is it different from edge triggering ?

2. a) Describe with circuit the working of a) Integrator b) Differentiator. Sketch their output wave forms and give one application each. Design a differentiator that will differentiate an input signal of fmax = 100 HZ.

OR

b) Distinguish between asynchronous counters and synchronous counters. Design a mod-6 asynchronous counters using TFFs. Explain the effects of propagation delay in Ripple counters.

(2×12=24)

3. a) What is slew rate of an 0 pamp ?

b) Obtain the slew rate equation.

c) Explain the causes and significance of slew rate in applications. How does slew rate differ from transient response ?

P.T.O.

4. a) What is a zero crossing detector ?

   b) Describe the working of Schmitt trigger.

   c) Explain the difference between inverting and differential summing amplifiers.

5. a) What is multiplexing ?

   b) Name the types of multiplexing. How can a multiplexer be used to realize a logic function ?

   c) What is a de multiplexer ? Why is a multiplexer called a data selector and a de multiplexer called a distributor ?

6. a) What is a flip flop ? Give its applications.

   b) Distinguish between synchronous and asynchronous latches.

   c) Convert a J-K flip flop into a D-flip flop.

7. a) What is DIA conversion ?

   b) The logic levels used in an 8-bit R-2R ladder DAC are 0=0V and 1=5V. What is the binary input when the analog output is 4V ?

   c) With the help of neat diagram explain the working of R-2R ladder network type DAC. What is the advantage of R-2R ladder DAC over the weighted resistor type DAC ?

8. a) Distinguish between RAM and ROM.

   b) What is an EPROM ? Give its advantages.

   c) Draw the functional block of 8085 micro processor and explain the blocks.

(4×9=36)
