ADIKAVI NANNAYA UNIVERSITY
I SEMESTER

M.Sc. PHYSICS
(Effective from 2016-2017 admitted batch)
P101 : CLASSICAL MECHANICS.
MODEL QUESTION PAPER

Time: 3 Hrs. **Max.Marks:75.**

SECTION –A.

Answer ALL Questions. **4 x 15 = 60.**

1. a) State D'Alembert's principle and derive Lagrange's equation of motion using it. 10
b) Write the equation of constraint and the Lagrangian for a particle moving on the surface of a sphere under gravity. 5

OR

c) Obtain Lagrange's equation of motion from Hamilton's principle for conservative systems. 10
d) For a conservative system when constraints are independent of time show explicitly that total energy is conserved. 5

2. a) What is the first integral of motion? Show that the orbit of a planet moving around the sun under the inverse square law of force is a conic 10 .
b) What are generalized co-ordinates? When is a co-ordinate cyclic? What is its physical significance ? 5

OR

c)Obtain Rutherford's formula for the scattering of a charged particle from scattering center. 10
d) Explain rainbow Scattering. 5

3.a) Define moment of inertia tensor. Derive Euler's equations of rotational motion of a rigid body. 10
b) What are Euler angles ? Show them in a diagram. 5

OR

c)Using Hamilton – Jacobi technique solve the problem of one dimensional harmonic oscillator. 10
d) Show that the solutions are time integrals of the Lagrangian. 5

4. a) What are the normal co-ordinates for a system of linear symmetrical tri-atomic molecule. 10
b) Obtain an expression for the normal frequencies of oscillations.5

OR

c)Derive Hamilton's equations of motion using Legendre transformations.Give the Physical significance of the Hamiltonian. 10
d) Express canonical equations of motion in Poisson bracket form. 5

PART - B.

Answer any FIVE Questions. 5 x 5 = 25.

2. A block of mass ‘m’ sits on a horizontal frictionless table. It is attached by a massless string to another block of mass M. The string passes over a frictionless pully. Use Lagrange’s equation to solve the motion of the system.

3. Construct the Hamiltonian and hence obtain the equation of motion of a simple pendulum.

7. Prove the Jacobian Identity. What is its significance ?

8. Define Action angle variable. Determine the frequency of periodic motion using Action-angle variable.

9. Explain central forces. In the central force motion show that a real velocity is constant.

10. Obtain conservation theorem for total angular momentum of a system of particles.

11. Using variational principle show that the shortest distance between two points is a straight line.

12. Show that the Poisson bracket is invariant under canonical transformation.

ADIKAVI NANNAYA UNIVERSITY

II SEMETER

M.Sc PHYSICS

(Effective from 2016-17 Admitted Batch)

P102: ATOMIC AND MOLECULAR PHYSICS

MODEL QUESTION PAPER

Time: 3 Hrs Max.Marks:75

SECTION-A

Answer ALL Questions 4×15=60

1. a) With the help of schematic diagram, describe the Stern-Gerlach experiment and evidence for the Spin of an electron. 10
   b) Establish the relation between magnetic dipole moment and angular momentum of an orbiting electron. 5

   (OR)

   c) Explain the quantum numbers associated with an electron of an atom. 10
   d) Explain the fine structure of chief spectral series of sodium. 5

2. a) Explain the spectral features of helium. Compare the higher energy levels of helium with Hydrogen. 10
   b) Explain Hund's rule based on residual columbic interaction. 5

   (OR)

   c) Explain the concept of indistinguisible particles and state Pauli's exclusion principle. 10
   d)What is L-S coupling? Deduce the various interaction energy terms for L-S coupling. 5

3. a) Give Quantum mechanical treatment of Zeeman effect. 10
   b) Calculate the Zeeman splitting of the terms $2p_{3/2}$ and $5F_1$ in terms of applied magnetic field. 5

   (OR)

   c) What is Paschen-Back effect? 5
   d) Explain the weak field and strong field stark effects in Hydrogen. 10

4.a) Explain the bonding and anti bonding orbital's from linear combination of atomic orbital's . 10
   b) Explain the Bond order for N_2. 5

   (OR)

   c) State Frank-Condon principle. 5
   d) Describe the principle features of vibrating rotator. 10

PARTB

Answer

any FIVE of the following.

5×3=15

5. Show the fine structure of H_α line of Hydrogen.
6. What is Lande's interval rule?
7. What is Normal and Anomalous Zeeman effect?
8. What are penetrating and non-penetrating orbits?
9. Draw the Paschen-Back pattern for 2P-2S transition of sodium.
10. Show that separation between consecutive rotational lines of pure rotational spectrum of Molecule is constant.
11. Explain briefly the rotational spectrum of a molecule.
12. Draw the quadratic stark pattern for 2P-2S transition of sodium.

ADIKAVI NANNAYA UNIVERSITY
I SEMESTER
M.Sc. PHYSICS
(Effective from 2016-2017 admitted batch)
P103 :MATHEMATICAL METHODS OF PHYSICS.
MODEL QUESTION PAPER

Time: 3 Hrs. **Max.Marks:75**

SECTION –A.

Answer all Questions **15 X 4 =60**

1. a) State and prove the Taylor's theorem. 10
   b) Prove that $H_n^1(x) = 2nH_{n-1}(x)$ 5

   (OR)

   c) State and prove the necessary and sufficient condition for the function to be analytic in a region R. 10

   d) Show that 5

$$\frac{x^2 dx}{(x^2 \quad 1)^2 (x^2 \quad 2x \quad 2)} \quad 7 / 50$$

2. a) Starting from the generating function of Laguerre polynomial obtain the differential equation satisfied $L_n(x)$. 9
   b) Obtain two fundamental recurrence relations of Hermite polynomials 6

   (OR)

   c) Obtain the relation between Beta and Gamma functions 8
   d) Evaluate the value of Gamma (1/2) 7

3. a) Define Fourier series and write the conditions of its existence and also define the Fourier Transform . 7M
   b) Find the Fourier Transform of (i) Sinωt (ii) Cosωt 8M

   (OR)

   c) State and Prove Fourier Integral Theorem 15

4 a) State and Prove Initial & Finial Value theorems of the Laplace Transformation 10
   b)Evaluate the inverse Laplace transform of 5

$$\frac{7}{s^2} \quad \frac{5}{9 \quad s \; 7} \quad \frac{1}{2s^{3/2}}$$

   OR

   c) Solve $(D^4 + 2D^2 + 1)\, Y(t) = 0$ where $Y(0) = 0$, $Y^1(0) = 1$, $Y^{11}(0) = 2$ and $Y^{111}(0) = 3$ using Laplace transforms 10
   d)State and Prove Convolution Theorem 5

SECTION B

Answer Any Five Questions **5 X 5 = 25**

5.Prove orthogonal property of Laguerre polynomials

6.Given u = $3x^2y + 2x^2 - y^3 - 2y^2$ Find v such that +(z) =u +iv is analytic

7. Evaluate $\int_0 \frac{\cos aux}{x^2 \quad 1} dx$

8.Evaluate $H_o(x)$, $H_1(x)$, $H_2(x)$, $H_3(x)$ from Rodrigue's formula for Hermite polynomials.

9. Find the Fourier transform of

+ (x) = {x, x a

{0, x >a

10. Apply convolution theorem to evaluate

$$L_1\{\frac{s}{S^2 \quad a^2 \quad ^2}\}$$

11. Find the Fourier series for function defined by

f (x) = - if - <x<0

f (x) = x if 0<x<

12. State and prove Cauchy's Theorem.

ADIKAVI NANNAYA UNIVERSITY
I SEMESTER
M.Sc. PHYSICS
(Effective from 2016-2017 admitted batch)
P104 :ELECTRONIC DEVICES AND CIRCUITS
MODEL QUESTION PAPER

Time : 3 Hrs **Max. Marks:75**

SECTION - A

Answer ALL Questions **4 x 15 = 60**

1. a) Describe the working of a FET and explain its Characteristics. 10
   b) Explain briefly the small signal model of FET. 5

OR

   c) Give the construction and Characteristics of an SCR and explain its working. 10
   d) Show how an SCR can be used to control power in a circuit. 5

2. a) Describe the working of Reflex Klystron and explain its Characteristics 10
   b) Explain briefly the working of diac 5

OR

   c) Describe the working of Magnetron and explain its Characteristics 10
   d) Explain why magnetron is called as CFA 5

3 a) What are the important parameters of an operational amplifier. 5
   b) Describe the method of their measurement. 10

OR

   c) Explain the terms differential gain and DC level shifting of an op-amp 10
   d) What are the characteristics of an ideal op-amp 5

4. a) Draw the circuit diagram of a V C O and discuss its operation 10
   b) Mention some its applications 5

OR

   c)Describe with necessary theory, the working of a wein-bridge oscillator using op-amp 10
   d) How do you account for its frequency stability. 5

S E C T I O N - B
Answer any F I V E Questions 5 x 5 = 25 Marks

5. Explain the principle and working of solar cells.
6. Explain the characteristics of a varactor diode.
7. Explain the working of an Astable Multivibrator using 555.
8. Explain the principle of working of a series voltage regulator.
9. Explain what is meant by negative resistance in a tunnel diode.
10. Explain how an UJT can be used as a relaxation oscillator.
11. Explain the working of op-amp as voltage to current converter
12. Explain the working of a Schmitt trigger.