D–1490	Sub. Code
	34511

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2019.

First Semester

Physics

CLASSICAL MECHANICS

(CBCS 2018-19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What are degrees of freedom?

2. Define principle of virtual work.

3. What are ignorable co – ordinates?

4. What is twin paradox in the theory of relativity?

5. Show that [F,G] = -[G,F].

6. What are Cyclic coordinates?

7. Write a note on normal coordinates of small oscillations.

8. What are the Eigen values of small oscillations?

9. What is δ - variation?

10. What are principal axes and principal moments of inertia of a rigid body?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) State and prove D'Alembert's principle.

Or

(b) Obtain the equation of motion of a simple pendulum by using Lagrange method.

12. (a) Derive Hamilton's equations of motion.

Or

(b) Derive Hamilton's Jacobi equation for a conservative system.

13. (a) Discuss stable, unstable and neutral equilibrium.

Or

(b) Derive secular equation for a system of small oscillations.

14. (a) Derive the three principal moments of inertia of a rigid body.

Or

(b) Derive an expression for the rotational Kinetic Energy of a rigid body.

15. (a) What is frame of reference? Show that a frame of reference having a uniform rectilinear motion relative to an inertial frame is also inertial.

Or

(b) The spectral line of $\lambda = 5000\ \text{Å}$ in the light coming from a distant star is observed at $5200\ \text{Å}$. Find the recessional velocity of the star.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE of the following.

16. Derive Lagrange's equations from D'Alembert's principle.

17. Derive the Routhian equation of motion for a system with cyclic coordinates.

18. Derive the principle of least action for a conservative system.

19. State and prove Kepler's laws of planetary motion.

20. Derive the Lagrangian equations of motion for small oscillations of a linear triatomic molecule.

D–1491

Sub. Code
34512

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2019.

First Semester

Mathematical Physics — Physics

MATHEMATICAL PHYSICS — I

(CBCS 2018-19 Academic Year Onwards)

Time : Three hours　　　　　　Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Find the constant p for which $A \times B = C$ where

   $A = \vec{i} + 2\vec{k}$
   $B = \vec{i} + p\vec{j} - \vec{k}$
   $C = -2\vec{i} + 3\vec{j} + \vec{k}$

2. Express the following quantity in cylinderical co-ordinates $\nabla \cdot A$.

3. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$.

4. State and prove the symmetry property of beta function, $\beta(m,n) = \beta(n,m)$.

5. Using Rodrigue's formula for Legendre polynomials, prove that, $\int_{-1}^{+1} P_0(x) = 2$.

6. Show that $H_{2n}(0) = (-1)^n \frac{(2n)!}{n!}$.

7. Prove that $L_0(x) = 1$.

8. Write the infinite Fourier sine transform.

9. Find the Laplace transform of t^n, $n > -1$.

10. Find the Laplace transform of the function $F(t) = \frac{e^{at} - 1}{a}$.

SECTION B — (5 × 5 = 25 marks)

Answer ALL the questions.

11. (a) If $A = 5t^2\vec{i} + t\vec{j} - t^2\vec{k}$,

$B = \sin t\,\vec{i} - \cos t\,\vec{j}$, find

$\frac{d}{dt}(A \times B)$.

Or

(b) Given $A = \begin{bmatrix} 1 & -1 & 1 \\ -3 & 2 & -1 \\ -2 & 1 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 1 & 2 & 6 \end{bmatrix}$ Compute AB and BA and hence show that $AB \neq BA$.

12. (a) Prove that $\beta(m,n) = \frac{\Gamma m \, \Gamma n}{\Gamma (m+n)}$.

Or

(b) Prove that $nP_n = (2n-1)x\,P_{(n-1)} - (n-1)\,P_{(n-1)}$.

13. (a) Prove that $2x\,H_n(x) = 2n\,H_{n-1}(x) + H_{n+1}(x)$.

Or

(b) Derive the Rodrigue's formula for Laguerre polynomials

$$L_n(x) = \frac{e^x}{n!}\frac{d^n}{dx^n}(x^n\,e^{-x}) \;\; n\text{, is an integer.}$$

14. (a) State and prove the Parsevals theorem in Fourier transform.

Or

(b) Find the Fourier transform of $e^{-|t|}$.

15. (a) Find the Laplace transforms of functions

(i) $e^{at}\cos wt$

(ii) $e^{at}\sin wt$.

Or

(b) State and prove the extension theorem of the Laplace transform of the derivative of a function.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Define Gauss Divergence theorem. Discuss and prove that the Gauss divergence theorem.

17. For what values of μ in the equations

$$x+y+z=1$$
$$x+2y+4z=\mu$$
$$x+4y+10z=\mu^2$$

have a solution and solve them completely in each case.

18. Show that $\int_0^{\pi/2} \sin^p\theta \cos^q\theta \, d\theta = \dfrac{\Gamma\left(\frac{p+1}{2}\right)\Gamma\left(\frac{q+1}{2}\right)}{2\,\Gamma\left(\frac{p+q+2}{2}\right)}$ Hence evaluate $\int_0^{\pi/2} \sin^P\theta \, d\theta$ $\int_0^{\pi/2} \cos^q\theta \, d\theta$.

19. Show that $\int_{-1}^{+1} P_m(x)P_n(x)\,dx = \dfrac{2}{2n+1}\delta_{mn}$ where $\delta_{mn}=0$ if $m \neq n$; $\delta_{mn}=1$ if $m=n$.

20. Write the Fourier transform of the function $f(t)$ and hence prove moment theorem, that is $g(w)=\dfrac{\perp}{\sqrt{2\pi}}\sum_{n=0}^{\infty}\dfrac{m_n}{n!}(-iw)^n$.

D–1492

Sub. Code
34513

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2019.

First Semester

Physics

LINEAR AND INTEGRATED ELECTRONICS

(CBCS-2018-19 Academic year onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What do you understand by intrinsic and extrinsic semiconductors?

2. Write a short note on breakdown voltage.

3. Write down the advantages of Schottky diode.

4. What is a transistor? Why is it so called?

5. What do you understand by class A, class B and class C power amplifiers,

6. What do you understand by stabilisation of operating point?

7. What is the difference between FET and Bipolar transistor?

8. What is an oscillator? What is its'need? Discuss the advantages of oscillators.

9. What do you mean by
   (a) output offset voltage
   (b) input offset current?

10. Define CMRR and skew rate of an operational amplifier.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions either (a) or (b).

11. (a) Draw and explain the V-I characteristics of a PN junction.

Or

   (b) Explain how zener diode maintains constant voltage across the load

12. (a) Explain the working of tunnel diode.

Or

   (b) Describe the potential divider method in detail. How stabilisation of operating point is achieved by this method.

13. (a) How will you draw d.c. load line on the output characteristics of a transistor? What is its importance?

Or

   (b) Show that maximum collector efficiency of class A transformer coupled power amplifier is 50%.

14. (a) Define the JFET parameters and establish the relationship between them.

Or

   (b) Explain the construction and working of a triac

15. (a) Discuss the operation of a summing amplifier.

Or

(b) Discuss the operation of OP-amp differentiator

PART C — (3 × 10 = 30 marks)

Answer any THREE out of FIVE questions.

16. How will you determine the input and output characteristics of CE connection experimentally?

17. Draw the V-I characteristics of an SCR. What do you infer from them?

18. With a neat diagram, explain the action of Colpitt's and Wien bridge oscillators.

19. How do you solve a differential equation with constant coefficient using analog computation?

20. What are active filters? Explain how band — pass and high-pass filter can be constructed using op-amp.

D–1493

Sub. Code
34521

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2019.

Second Semester

Physics

QUANTUM MECHANICS – I

(CBCS – 2018 – 19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. State and explain uncertainity principle.

2. What is the physical significance of eigen values?

3. Calculate the zero point energy of linear harmonic oscillator of frequency 50HZ. Assume that $h = 6.63 \times 10^{-34}$ J/sec.

4. Define bound state.

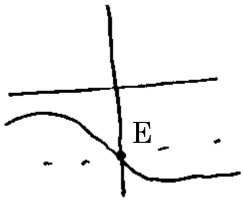
5. What are ladder operators? Explain why they are so called?

6. Define Dirac's bra and ket vectors.

7. What is meant by stark effect?

8. State Fermi Golden rule.

9. In this WKB approximation diagram, what is the point "E" called as



10. What is a rigid rotator? What is its energy eigen value?

PART B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Define the adjoint of an operator. Prove that the

(i) Position operator and

(ii) Momentum operator are self adjoint.

Or

(b) Derive turne dependent Schrodinger equation for a free particle. Also give its physical significance of the wave function.

12. (a) Discuss the problem of particle in a box.

Or

(b) Set up the Schrodinger equation for a rigid rotator and obtain the solution for the rotational energy levels.

13. (a) Obtain the equation of motion in the Schrodinger picture.

Or

(b) Discuss the first order nondegenerate stationary perturbation theory.

14. (a) Discuss WKB approximation. Explain how the solution of one dimensional Schrodinger equation can be obtained by WKB approximation.

Or

(b) What are Einstein coefficients? Get the relation between them.

15. (a) Prove that

(i) Eigen values of every Hermitian operator are real and

(ii) Eigen function belonging to different eigen values of Hermitian operator are orthogonal.

Or

(b) Explain the principle of variation perturbational theory and apply to determine the ground state energy of Helium atom.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. State and prove Ehrenfest's theorem in quantum mechanics.

17. Set up the Schrodinger equation for a Linear harmonic oscillator and solve it to find its eigen value and eigen functions.

18. Obtain the equation of motion in Heisenberg picture.

19. Using the first order perturbation theory, discuss fully the effect of an electric field on the energy levels of the Hydrogen atom.

20. Obtain an expression for transition probability per unit time for first order trasction under constant perturbation.

D–1494

Sub. Code
34522

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2019.

Second Semester

Mathematical Physics

MATHEMATICAL PHYSICS — II

(CBCS 2018 – 2019 Academic year onwards)

Time : Three hours   Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Write the Cauchy's – Riemann equations in polar form.

2. Evaluate $\int_0^{\pi i} Z \cos Z^2 \, dz$.

3. Write the heat flow equation.

4. If A^m and B_v are the components of a contravaniant and covariant tensors of rank one, show that $C_v^{\mu} = A^{\mu} B_v$ are the components of a mixed tensor of rank two.

5. What is the geodesic?

6. What is abelian group?

7. Discuss and Criticise the following:

   $P(A) = 2/3$, $P(B) = 1/4$ and $P(C) = 1/6$ for the probabilities of three mutedly exclusive events A, B and C.

8. The probability of horse A winning the race is $\frac{1}{5}$ and the probability of horse B winning the race is $\frac{1}{6}$. What is the probability that one of horses wins?

9. What is theoretical distribution?

10. Bring out the fallacy, if any, in the following statement: "The mean of binomial distribution is 5 and its standard deviation is 3.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Which of the following are analytic functions of complex variable $Z = x + iy$ (i) $|Z|$ and (ii) $\sin z$.

Or

(b) Define cotravariant and covariant tensors.

12. (a) State and prove the addition and subraction of tensors.

Or

(b) Show that

(i) $[\mu v, \sigma] + [\sigma v, \mu] = \frac{\partial g_{r\mu}}{\partial x^{v}}$

(ii) $\left\{ \begin{matrix} \mu \\ \mu v \end{matrix} \right\} = \frac{\partial}{\partial x^{v}} \log \sqrt{g}$.

13. (a) Prove that two right cosets (or left cosets) of a sub group in a given group are either equal or else have no elements in common.

Or

(b) What is meant by isomorphic and homorphic groups?

14. (a) Find the classes of D_3.

Or

(b) State and prove the additive law of probability.

15. (a) Three groups of children contain 3 girls and 1 boy, 2 girls and 2 boys, 1 girl and 3 boys. One child is selected at random from each group show that the chance that the three selected consists of 1 girl and 2 boys is 13/22.

Or

(b) Define Poisson's distribution. Discuss its importance in physics.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. State and prove that the Cauchy's integral formula.

17. Determine the steady state temperature distribution of a thin rectangular plate bounded by lines $x = 0$, $x = l$, $y=0$, $y=b$ assuming that the edges $x=0$, $x=1$, $y=0$ are maintained at zero temperature and edges $y=b$ is maintained at steady state temperature $f(x)$.

18. (a) Prove that the group of order two is always cyclic.

    (b) Prove that the group of order three is always cyclic.

19. State and prove that the schur's Lemma.

20. State and prove that the orthogonality theorem.

D–1495

Sub. Code
34523

DISTANCE EDUCATION

M.Sc. (Phyiscs) DEGREE EXAMINATION, MAY 2019.

Second Semester

ELECTROMAGNETIC THEORY

(CBCS 2018-19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Write down the relation of Gauss's law in differential form.

2. Give the relation of Neumann formula.

3. Write down the major four Maxwell's equations.

4. What is electric dipole radiation?

5. What is a wave equation?

6. State Poynting Theorem.

7. Give the boundary conditions for Reflection and Transmission.

8. What are retarded potentials?

9. What is Polarization?

10. Specify domains of hydro magnetics and plasma physics.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Deduce Laplace and Poisson equations.

Or

(b) Discuss Ampere's law in magnetized materials.

12. (a) Explain about the boundary condition for magneto statics.

Or

(b) Discuss the propagation of electromagnetic waves in conductors and get the modified wave equations.

13. (a) Derive the expression for skin depth.

Or

(b) Explain about three fundamental laws of geometrical optics and describe about the reflection and transmission at oblique incidence.

14. (a) Give a brief note on Magnetron.

Or

(b) Explain Newton's third law in electrodynamics.

15. (a) Explain how to calculate the point charges of Lienard-Wiechard potentials.

Or

(b) Deduce Brewster's law on the basis of electromagnetic theory.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the phenomenon of total internal reflection media on the basis of Maxwell's equations.

17. Discuss the propagation of high frequency electromagnetic waves in plasma.

18. Derive the expression for the total power radiated by a point charge and hence Larmour formula.

19. Explain the theory of scattering of e.m. waves.

20. What are wave guides? Discuss the propagation of electromagnetic waves along a rectangular wave guide in TE mode.
