D–3205

Sub. Code
34511

DISTANCE EDUCATION

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

First Semester

CLASSICAL MECHANICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What are ignorable coordinates?

2. Write down the Kepler's laws of planetary motion.

3. Write down the principal of virtual work.

4. Define phase space.

5. Show that $[X, Y] = -[Y,X]$

6. Write a note on moment of inertia of a body.

7. What is time dilation?

8. State the general theory of relativity.

9. Draw the relation between potential energy and equilibrium.

10. What are normal coordinates?

PART 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 equation for a conservative system.

13. (a) Derive the relation between Lagrange and Poisson brackets.

Or

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

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) Differentiate stable, unstable and neutral equilibrium.

Or

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

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

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–3206

Sub. Code
34512

DISTANCE EDUCATION

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

First Semester

MATHEMATICAL PHYSICS – I

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define curl of a vector function. Is it a scalar or vector?

2. Write a note on Gauss's law and Poisson's equation.

3. Show that the cylindrical polar coordinate system is orthogonal.

4. What do you mean by rank of matrix?

5. Show that Eigen values of Hermitian matrices are real and orthogonal to each other.

6. Find the value of $\beta(1,2)$.

7. Show that $H_n(-x)=(-1)^n H_n(x)$.

8. Prove that $J_{1/2}(x)=\sqrt{\frac{2}{\pi x}}\sin x$.

9. What do you mean by Fourier transform of the derivative of a function?

10. Find the Laplace transform of $f(t)=\sinh(at)$.

PART B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Show that $\vec{F}=\left(2xy+z^3\right)\hat{i}+x^2\hat{j}+3xz^2\hat{k}$ is a conservative force.

Or

(b) Express the following quantities in cylindrical coordinates.

(i) $\nabla.A$

(ii) $\nabla\times A$

(iii) $\nabla^2\phi$

12. (a) Solve by Cramer's rule the system of equations

$X+2y+3z=10$

$2x-3y+z=1$

$3x+y-2z=9$

Or

(b) Evaluation of Gamma functions $\Gamma n=\int_0^\infty e^{-x}x^{n-1}dx$.

13. (a) Prove that the Recurrence formula $xJ_n'(x)=nJ_n'-xJ_{n+1}(x)$.

Or

(b) Derive the generating functions of Hermite polynomials.

14. (a) Obtain the Rodrigue's formula for Legendre's polynomials.

Or

(b) Show that $\int_{-1}^{+1} Pn(x)Pm(x)dx=\frac{2}{2n+1}\delta m$.

15. (a) State and prove convolution theorem of Fourier transform.

Or

(b) Find the Laplace transform of

(i) $\sin^2 t$ and (ii) $\cos^2 t$

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. State and prove Stoke's theorem in vector analysis.

17. Find the characteristic equation of the matrix.

$A=\begin{bmatrix}1 & 2 & 3\\ 2 & -1 & 1\\ 3 & 1 & 1\end{bmatrix}$ and verify the Cayley Hamilton theorem.

18. Show that $\int_{-1}^{+1} xPn(x)Pn-1(x)dx=\frac{2n}{4n^2 1}$

19. Prove the followings:

(a) $\int_0^{\infty} e^{-\lambda y} y^{n-1} dy=\frac{\Gamma n}{\lambda^n}$

(b) $\Gamma n=\int_0^1 \left\{\log e\frac{1^{n-1}}{y}\right\}dy$

(c) $\Gamma n=\frac{1}{n}\int_0^{\infty} e^{-y1/n} dy$

(d) $\Gamma 1/2=\sqrt{\pi}$.

20. (a) Find the cosine transform of $x^n e^{-ax}$

(b) Find the inverse Fourier transform of $e^{-\lambda n}$.

(c) Find the Laplace transform of sin and cos at.

D–3207

Sub. Code
34513

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, DECEMBER 2019.

First Semester

Physics

LINEAR AND INTEGRATED ELECTRONICS

(CBCS 2018–19 Academic Year onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Describe the difference between majority and minority carriers.

2. Write the differences between Zener breakdown and Avalanche breakdown.

3. What are the advantages of LED lights?

4. What is the need for transistor biasing?

5. What is a Class C amplifier?

6. What is DC operating point analysis?

7. Which is better FET or *MOSFET why*?

8. What is difference between damped and free oscillation?

9. Why it is necessary to null the offset voltage before using the op amp?

10. What is a voltage follower?

PART B — (5 × 5 = 25 marks)

Answer ALL questions

11. (a) Explain in detail how zener diode is used as a voltage regulator.

Or

(b) How will you determine the input and output characteristics of CC connection experimentally?

12. (a) With a neat circuit, describe the working of class A power amplifier also discuss its advantages and disadvantages.

Or

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

13. (a) Define FEE parameters μ, g_m and r_d. Obtain relations between them.

Or

(b) Explain the construction and working of a TRIAC.

14. (a) Draw the *V-I* characteristics of an SCR. What do you infer from them?

Or

(b) What is a photo detector? Explain the construction and working of a photo detector.

15. (a) Derive an expression for the voltage gain of a non-inverting amplifier.

Or

(b) Discuss the operation of an OP-amp integrator.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions

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

17. With a neat circuit diagram, explain the working of transformer-coupled transistor amplifier.

18. With a neat diagram, explain the action of Hartley oscillators. What are the advantages of Hartley oscillator?

19. Explain with a suitable example how the second order differential equation is solved by Op-Amp.

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

———————

D– 3208

Sub. Code
34521

DISTANCE EDUCATION

M.Sc DEGREE EXAMINATION, DECEMBER 2019.

Second Semester

Physics

QUANTUM MECHANICS-I

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions

1. In the Hamiltonian of one dimensional Hamnonic oscillator equation $H = \frac{P^2}{2m} + \frac{1}{2}kx^2 + \frac{1}{2}\alpha\ x^3$ which is the term representing the perturbation?

2. Distinguish between constant perturbation and harmonic perturbation.

3. Show that there is no stark effect in the ground state of an atom.

4. Write the Fermi Golden rule.

5. Prove that the result of the variation method always gives an upper limit for the ground state energy of the system.

6. State the limitation of WKB approximation

7. What is meant by zero point energy?

8. What are Bra and Ket vectors?

9. Show that momentum operator is self adjoint.

10. What are raising and lower operators? Why they are called so?

PART B — (5 × 5 = 25 marks)

Answer ALL questions

11. (a) State and prove Ehrenfest's theorem.

Or

(b) Explain the uncertanties in the process of measurement. Give an account of the interpretation of the wave particle dualism.

12. (a) Develop the time independent schrodinger wave equation and solve the same for a free particle. Explain the physical significance of wave function.

Or

(b) Write the schrodinger equation for a linear harmonic oscillator and obtain the energy eigen value.

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

Or

(b) Develop the stationary perturbation theory for degenerate case.

14. (a) Deduce Bohr sommerfield quantization rule as an application of WKB method to a potential well

Or

(b) State the fundamental postulates of quantum mechanics. Obtain the commutation relations of position momentum variables.

15. (a) What are Einstein coefficients? Get the relation between them. Also calculate the probability per unit time for spontaneous emission.

Or

(b) Prove the relation $\int \psi^* H \psi \, dT \geq E_0$ Where E_0 is the upper bound of the ground state energy.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Show that the probability current density J together with probability density $\rho = \psi^* \psi$ satisfies the equation of continuity.

17. Using the first order perturbation theory, discuss fully the effect of electric field on the energy levels of the hydrogen atom.

18. Solve the radial part of Schrodinger equation for Hydrogen atom and obtain its energy eigen value

19. Using time dependent perturbation theory, Obtain an expression for the transition probability per unit time and hence derive Fermi's Golden rule.

20. Discuss

(a) Schrodinger and

(b) Heisenberg pictures for discribing the dynamic behaviour of a system.

———————

D–3209

Sub. Code
34522

DISTANCE EDUCATION

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

Second Semester

MATHEMATICAL PHYSICS – II

(CBCS – 2018-19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State Cauchy residue theorem.

2. Solve one dimensional heat flow equation.

3. Express Laurent series of an analytic function f(z) about the centre $z = z_0$.

4. State Quotient law.

5. Define covariant and contra variant tensors.

6. Prove that $A_{\mu\nu}B^{\mu}C^{\nu}$ is an invariant if B^{μ} and C^{ν} are contravariant vectors and $A_{\mu\nu}$ is a covariant tensor.

7. Show that the groups of order 4 may or may not be a cyclic group.

8. What do you mean by probability?

9. What do you mean by normal distribution?

10. Criticize the following statement : The mean of a Poisson's distribution is 5, while standard deviation is 4.

PART B — (5 × 5 = 25 marks)

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

11. (a) Prove that the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ satisfies Laplace's equation and determine the corresponding regular function u+iv.

Or

(b) Test whether the following are analytic in the finite plane

(i) $\frac{1}{z}$ and

(ii) log z

12. (a) State and prove the following algebraic operations of tensors

(i) Addition and

(ii) Equality of Tensors.

Or

(b) Write a note on Gram-Schmidt orthogonalization.

13. (a) Show that $g_{\mu w}$ is a covariant tensor of the second order.

Or

(b) Find the class of rotation group D3 of the equilateral triangle and construct its character table.

14. (a) Explain reducible and irreducible representations and mention their main features.

Or

(b) Show that three cube roots of unity form an abelien finite group under multiplication.

15. (a) Explain what do you mean by a binomial distribution. Find its mean and standard deviation.

Or

(b) Write a note on symmetry operation in crystal and crystallographic point group.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Derive the Cauchy-Riemann necessary and sufficient conditions for a function to be analytic.

17. (a) Apply calculus of residues to prove that

$$\int_0^{2\pi} \frac{d\theta}{a+b\cos\theta} = \frac{2\pi}{\sqrt{a^2-b^2}} \; a > b > 0 \text{ and}$$

(b) Prove by contour integration that $\int_0^{\infty} \frac{\sin mx}{x} dx = \frac{\pi}{2}$.

18. Show $\frac{\partial A_\mu}{\partial x_\mu}$ is not a tensor even though A_μ is a covariant tensor of rank one, but the addition of suitable quality to $\frac{\partial A_\mu}{\partial x_\mu}$ causes the result to be a tensor.

19. State and prove great orthogonality theorem.

20. (a) Fit Poisson's distribution to the set of observations.

Deaths	0	1	2	3	4
Frequency	122	60	15	2	1

and calculate theoretical frequency.

(b) A perfect cubic die is thrown a large number of times in sets of 8. The occurrence of a 5 or 6 is called success. In what promotion of the sets would you expect 3 success?

D–3210	Sub. Code
	34523

DISTANCE EDUCATION

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

Second Semester

ELECTROMAGNETIC THEORY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Find out the intrinsic impedance of the space when EM waves are propagated in free space.

2. State Poynting's theorem of electrodynamics.

3. State a few applications of magneto statics.

4. Write Brewster law of polarisation of light

5. How do normal and anomalous dispersion differ?

6. Explain Lorentz condition.

7. What is meant by elasticand inelastic scattering?

8. What are the applications of reflex klystron?

9. How is plasma created?

10. What is Alfven wave in plasma?

PART B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) What is vector and scalar potential. Derive wave equations in terms of scalar and vector potentials.

Or

(b) Derive the integral form of Maxwell's equations.

12. (a) Discuss the theory of propagation of electromagnetic waves in isotropic dielectrics medium.

Or

(b) Explain the propagation of plane electromagnetic waves in conducting medium.

13. (a) Derive Fresnel's equation for non-conducting media when E vector is parallel to the plane of incidence.

Or

(b) Discuss the phenomenon of total Internal Reflection and prove that the net energy flow through the surface into second medium is zero.

14. (a) What is dispersion? Discuss it in the case of gaseous medium having both real and complex refractive index.

Or

(b) Obtain Thomson scattering cross section in the case of scattering of electromagnetic waves by a free electron

15. (a) Discuss the motion of charged particles in uniform constant electric field.

Or

(b) Derive magneto hydrodynamics equations.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the boundary conditions on field vectors D, E, B and H in detail

17. Obtain the local field in a dielectric field and hence deduce Claussius Mossotti relation

18. What are TE, TM and TEM modes? Discuss TE wave propagation in a rectangular wave-guide.

19. Why pi-mode operation is preferred in cylindrical type magnetron? Give its working principle with neat sketches.

20. What is retarded potential? Derive Lienard – Wiechert potentials for a moving point charge.

———————

D–3211

Sub. Code
34531

DISTANCE EDUCATION

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

Third Semester

MOLECULAR SPECTROSCOPY

(CBCS 2018–19 Academic year Onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. What are bonding and antibonding orbitals?

2. Give the importance of stark effect studies in microwave spectroscopy.

3. Why are pure rotational spectra studied only in the gaseous states of atoms and molecules

4. What are the differences between Raman spectra and infrared spectra?

5. How would you account for predissociation in certain molecules?

6. What is inverse Raman effect?

7. Distinguish between resonant and non–resonant two–photon absorption processes.

8. Explain chemical shift with examples.

9. Explain the principle of ESR.

10. Write a brief note on Mossbouer sources.

PART B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Explain the effect of isotopic substitution on the rotational spectra of molecules.

Or

(b) Describe the study of quadrupole hyperfine interaction in microwave spectra.

12. (a) Give the theory of rotation–vibration spectra of diatomic molecules.

Or

(b) Give the information on molecular constitution from infrared studies.

13. (a) Describe Franck–Condon principle in emission and absorption.

Or

(b) What is hyper–Raman effect? Explain the experimental techniques for hyper–Raman effect.

14. (a) With a schematic diagram explain the experimental arrangement for CARS.

Or

(b) Explain briefly, the Doppler-Free two -photon absorption process.

15. (a) Outline the applications of ESR spectroscopy and NQR spcetroscopy.

Or

(b) Explain how Mossbauer spectrum is useful in understanding crystal symmetry and electronic structure of molecules.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Outline the Heitler–Landon theory for hydrogen molecule. What are singlet and triplet states of hydrogen.

17. Explain how the structure of molecules can be determined using IR and Raman spectroscopy.

18. Discuss the rotational since structure of electronic–vibration transitions. What is Fortrat diagram?

19. Explain the following:

(a) Stimulated Raman Scattering

(b) Photo acoustic Raman Scattering

20. Explain briefly the interaction between spin and magnetic field. Derive the Bloch equations.

———————

D–3212

Sub. Code
34532

DISTANCE EDUCATION

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

Third Semester

QUANTUM MECHANICS - II

(CBCS 2018-19 Academic year onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions

1. Show that $\sigma_x\sigma_y+\sigma_y\sigma_z=0$ Where σ_x,σ_y and σ_z are pauli's spin matices.

2. Define symmetric and antisymmetric wave functions

3. State optical theorem.

4. What are the Limitations of Born approximation?

5. State the drawbacks of klein Gordon equation.

6. What is the effect of potential on the partial wave?

7. Define

   (a) differential and

   (b) Total scattering crors – section.

8. What is the order of Dirac relativistic equation?

9. Distinguish classical and quantum fields.

10. What are clebscb – Gordon coefficients?

PART B — (5 × 5 = 25 marks)

Answer ALL questions

11. (a) For the pauli's spin matrices prove that

(i) $\lfloor \sigma_x, \sigma_y \rfloor = 2i\sigma_z$ and

(ii) $\sigma_x^2 = \sigma_y^2 = \sigma_z^2 = 1$

Or

(b) Show that (i) $[J^2, J_Z]$ = 0 (ii) and $[J_z, J_\pm]$ = $\hbar J_\pm$ where $J_\pm = \mathrm{J}_x \pm iJ_y$.

12. (a) Evaluate the Clebsch Gordon Coefficients for $j_1 = \frac{1}{2}$ and $j_2 = \frac{1}{2}$.

Or

(b) Derive an equation for central field and find its solution.

13. (a) Explain Hartee' s self consistent field theory.

Or

(b) Show that for a system of identical particles the symmetry of the wave function does not change in time.

14. (a) Derive klein Gordon equation for a free particle and fund its solution.

Or

(b) Discuss the klein Gordon field.

15. (a) Derive an expression for scattering amplitude using born approximation.

Or

(b) Show that Dirac particle constrains to spin ½.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Calculate the differential scattering cross section for a screened coulomb potential $V(r) = -\frac{ze^2}{r} e^{-xr}$ where $\chi = 1/a.$

17. Explain in detail quantization of electromagnetic field.

18. Obtain the eigen values of J^2 and J_z.

19. Derive Klein Gordon equation for a particle moving in a electromagnetic field and apply it to hydrogen atom problem.

20. Show that $\frac{d\sigma}{d\Pi} = |f(\theta,\varphi)|^2$

———————

D–3213	Sub. Code
	34533

DISTANCE EDUCATION

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

Third Semester

MICROPROCESSOR AND ELECTRONIC INSTRUMENTATION

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Write down the status flags of the 8085 microprocessor.

2. What are the segment registers used in 8086 microprocessor?

3. Briefly explain any four instructions in arithmetic group.

4. Briefly explain the priority of interrupts used in microprocessor 8085.

5. Write a short notes on

   (a) PSW

   (b) PCON in microcontroller 8051.

6. Differentiate synchronous and asynchronous data transfer.

7. Give the necessity of DMA type data transfer.

8. What do you mean by handshake signals?

9. What do you mean by sample and hold technique?

10. What is called piezoelectric effect?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Explain the addressing modes of microprocessor 8085.

Or

(b) What do you mean by minimum and maximum mode operation of microprocessor 8086 and explain the pins involving in minimum mode of operation.

12. (a) Write an assembly language programme for the decimal addition of the two 8-bit numbers.

Or

(b) Explain the data transfer group instructions in 8085 microprocessor.

13. (a) Write down the arithmetic and logical group instructions in 8051 microcontroller.

Or

(b) Explain the architecture of 8255 PPI.

14. (a) Explain the pin configuration of 8257 DMA.

Or

(b) What do you mean by transducer? Explain its classification.

15. (a) Give the construction and working of unbonded strain gauges.

Or

(b) How will you measure the force using piezoelectric transducer?

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Explain the architecture of microprocessor 8086.

17. Give the flow chart and write an assembly language programme for traffic control system.

18. Draw the architecture of 8051 microcontroller and explain its features in detail.

19. Write an assembly language programme to measure and control the temperature of a system with necessary diagrams.

20. Explain with neat diagram the working principle of LVDT. Give its applications.

———————