D–5592

Sub. Code
34511

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, MAY 2022.

First Semester

Physics

CLASSICAL MECHANICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL the questions

1. Define Newton's law of motion.
2. What is virtual work?
3. Explain the principles of least action.
4. State Liouville's theorem.
5. Prove $\{q_i, q_j\}=0$
6. Define moment of inertia.
7. What is Galilean transformation?
8. What is principal moments?
9. Define small oscillation.
10. What is neutral equilibrium.

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Derive the Lagrange's equation for simple system.

Or

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

12. (a) Explain the properties of Lagrange bracket.

Or

(b) Discuss the theory on calculas of variation.

13. (a) Estimate the moment of inertia of a body about any line through the origin of coordinate frame.

Or

(b) Deduce the expression for addition of velocities.

14. (a) Describe the theory on Compound pendulum.

Or

(b) What is time dialation? Explain.

15. (a) Describe the theory on two coupled oscillators.

Or

(b) Write the secular equation and eigen value equation for small oscillation.

PART C— ($3 \times 10 = 30$ marks)

Answer any THTREE questions

16. Deduce kepler's laws of planetary motion.

17. Derive the Lagrangian equation of motion from Hamilton's principle.

18. Explain in detail about the Eulerian angles.

19. Derive the Einstein's mass-energy relation.

20. Discuss the theory on vibration of a linear triatomic molecule.

———————

D–5593

Sub. Code
34512

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2022.

First Semester

MATHEMATICAL PHYSICS – I

(CBCS – 2018-19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What is the curl of a vector point function?

2. Define the surface integral.

3. If $A = \begin{bmatrix} 1 & -2 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 \\ 0 & 1 \end{bmatrix}$, then show that $AB \neq BA$.

4. What is Hermitian Matrix?

5. Show that inverse of an orthogonal matrix is orthogonal.

6. Prove that $\lceil n = (n-1) \lceil n-1$.

7. Prove that $J_{\frac{-1}{2}}(x) = \sqrt{\left(\frac{2}{\pi x}\right)} \cos x$.

8. What is the indicial equation of Hermite function?

9. Write the Fourier sine and cosine integrals.

10. Show that $L(\sin at) = \frac{a}{s^2 + a^2}$.

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Find the curl of $\vec{v} = (xyz)\hat{i} + (3x^2y)\hat{j} + (xz^2 - y^2z)\hat{k}$ at $(2,-1,1)$.

Or

(b) State and prove Gauss's theorem.

12. (a) If $A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$, then find A^{-1}.

Or

(b) Show that any square matrix can be expressed as the sum of two matrices, one symmetric and the other anti-symmetric.

13. (a) Derive the relation between beta function and gamma function.

Or

(b) Show that $x J_n'(x) = n J_n(x) - J_{n+1}(x)$.

14. (a) Obtain the recurrence relations of Legendre's polynomial.

Or

(b) If α and β are the roots of $J_n(x) = 0$, then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x)\, dx = 0$.

15. (a) Discuss the convolution theorem of Fourier transform.

Or

(b) Find the Laplace transform of $t^2 \cos at$.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. State and prove the Stoke's theorem.

17. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.

18. Solve Bessel's differential equation and obtain its general solution.

19. Obtain the solution of Hermite differential equation.

20. Solve for $f(x)$ from the integral equation

$$\int_0^\infty f(x) \sin sx \, dx = \begin{cases} 1 \text{ for } 0 \le s < 1 \\ 2 \text{ for } 1 \le s < 2 \\ 0 \text{ for } s \ge 2. \end{cases}$$

———————

D–5594

Sub. Code
34513

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, MAY 2022.

First Semester

Physics

LINEAR AND INTEGRATED ELECTRONICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer the following

1. What is tunnel diode?
2. Explain the function of Zener diode.
3. Define DC load line.
4. What is class A transistor?
5. Draw Wien bridge circuit diagram.
6. Define phase shift.
7. Define offset voltage.
8. Define integrator.
9. Define subtractor.
10. Define low pass filter.

PART B — ($5 \times 5 = 25$ marks)

Answer the following choosing either (a) or (b)

11. (a) Explain extrinsic semiconductor with necessary diagram.

Or

(b) Briefly explain the characteristics of reverse bias of a diode.

12. (a) Explain the functions of Schottky diode.

Or

(b) Draw the circuit diagram of CB configuration of a transistor.

13. (a) Explain zener diode as voltage regulator.

Or

(b) Define transistor biasing.

14. (a) Briefly explain base bias with collector feedback.

Or

(b) Explain the working of TRIAC.

15. (a) Explain band pass Filter with necessary diagram.

Or

(b) Define nullification with examples.

PART C— ($3 \times 10 = 30$ marks)

Answer any THREE of the following

16. What is fixed bias? Explain base bias with emitter feedback.

17. Define transformer coupled audio power amplifier.

18. Explain construction, working and I/O characteristics of FET.

19. Define and explain Colpit's oscillator.

20. Explain Hartley oscillator with necessary diagrams.

———————

D–5595

Sub. Code
34521

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, MAY 2022.

Second Semester

Physics

QUANTUM MECHANICS – I

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Explain eigen value and eigen function in a wave equation.

2. Define zero point energy.

3. Differentiate free and bound particle.

4. Express r, θ and ϕ equation of Hydrogen atom.

5. Give the total degeneracy of the Hydrogen like atom.

6. What is Stark effect?

7. Define classical turning point.

8. What is the importance of variational method?

9. Define Transition probability.

10. What are Einstein's coefficients?

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Derive schrodinger time independent wave equation.

Or

(b) State and prove Ehrenfest's theorem.

12. (a) Write short note on free particle.

Or

(b) Explain Dirac's bra and ket notation.

13. (a) Explain the validity of WKB approximation.

Or

(b) Develop the first order perturbation theory for non degenerate case.

14. (a) Discuss time dependent perturbation theory and arrive at Fermi Golden rule.

Or

(b) Write about the semi classical treatment of theory of radiation.

15. (a) Explain Rayleigh scattering as an application of time dependent perturbation theory.

Or

(b) Write notes on the selection rule of allowed transitions.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Outline the different basic postulates of quantum mechanics.

17. Explain Tunnel effect and obtain an expression for reflection and transmission coefficient.

18. Discuss the energy spectrum of three dimensional harmonic oscillator in terms of degeneracy.

19. Explain variational principle and obtain the ground state of Deuteron.

20. Describe WKB method of approximation.

D–5596

Sub. Code
34522

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2022.

Second Semester

MATHEMATICAL PHYSICS – II

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

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

Answer ALL the questions.

1. Show that $(Z_1 + Z_2)Z_3 = Z_1Z_3 + Z_2Z_3$.

2. Define mapping.

3. What are the singular points of the function $\frac{1-2z}{z(z-1)(z-2)}$?

4. What are the conditions to be considered if two vectors X and Y are said to be orthonormal?

5. Write the complementary function of the equation if the roots are real and distinct.

6. What is first order tensor?

7. What is Summation Convention?

8. Find the type and rank of the tensor A^{pqr}_{qmn}.

9. Define the rearrangement theorem.

10. Define the classical probability.

SECTION B — ($5 \times 5 = 25$ marks)

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

11. (a) Derive an expression for Cauchy's integral formula.

Or

(b) Explain the conformal mapping.

12. (a) Evaluate the residue of $\frac{z^2}{(z-1)(z-2)(z-3)}$ at $z = 1,2,3$ and infinity and show that their sum is zero.

Or

(b) Obtain the expressions for Laplace and Poisson equations.

13. (a) Discuss about the Strum Liouville equation.

Or

(b) Explain the following algebraic operations of tensors.

(i) Addition and subtraction

(ii) Equality of tensors.

14. (a) Discuss about the inner product of two tensors $A_{\sigma}^{M\gamma}$ and B_{ρ}^{λ}.

Or

(b) Describe the Crystallographic point groups.

15. (a) Find the class of rotation group D_3 of the equilateral triangle and construct its character table.

Or

(b) Write a short note on random variables with examples.

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

Answer any THREE questions.

16. What is Cauchy's residue theorem? Solve the following integral using Cauchy residue theorem $\int_C \frac{2z^2 + z}{z^2 - 1} dz$, where C is the circle $|z - 1| = 1$.

17. Obtain the expression for Laurent series.

18. Find the Orthonormal basis for the vector space generated by the vectors $(1,1,0,1), (1,-2,0,0)$ and $(1,0,-1,2)$ using Gram-Schmidt Orthogonalization process.

19. Suppose, it is not known, whether a quantity 'X' is a tensor or not, if an inner product of 'X' with an arbitrary tensor is itself a tensor, then prove that 'X' is also a tensor.

20. Discuss about binomial distribution and find its mean variance and standard deviation.

———————

D–5597

Sub. Code
34523

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2022.

Second Semester

ELECTROMAGNETIC THEORY

(CBCS 2018 – 2019 Academic year onwards)

Time : Three hours Maximum : 75 marks

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

Answer ALL questions.

1. Define wave equation.

2. State poynting theorem.

3. State Fresnel's equation.

4. Define skin depth.

5. Define polarization.

6. Explain the Lorentz equation.

7. State the generation of microwaves.

8. What is scattering parameter?

9. What are the applications of magnetron?

10. State the pinch effect.

SECTION B — (5 × 5 = 25 marks)

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

11. (a) Briefly explain the conversation of energy and momentum.

Or

(b) Discuss the theory of propagation of electromagnetic waves in non-conducting medium.

12. (a) Derive Brewster's law and degree of polarization.

Or

(b) Derive the Clasusius-Mossotti relation.

13. (a) Derive an expression for the Lorentz transformation formula.

Or

(b) Discuss the theory of polarization of scattering light.

14. (a) Briefly explain the resonant cavities in microwaves.

Or

(b) Derive the Liecard-Wiechert potential for a uniformly moving point charge.

15. (a) Discuss the motion of charged particles in simultaneous homogeneous electric and magnetic fields.

Or

(b) Describe the conditions for occurrence of plasma.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Explain the propagation of electromagnetic waves in isotropic and anisotropic non-conducting medium.

17. Describe the reflection and transformation co-efficients at the interface between two dielectric media.

18. Explain the coherence and incoherence of scattering light.

19. Discuss the motion of charged particles in uniform constant electric field and homogeneous magnetic field.

20. Derive the magneto hydrodynamics equations.

———————

D–5598

Sub. Code
34531

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, MAY 2022.

Third Semester

Physics

MOLECULAR SPECTROSCOPY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What is directed bonds?
2. State stark effect.
3. What is meant by hybridization?
4. Define Franck –Condon principle.
5. State mutual exclusion principle.
6. What is hyper Raman effect?
7. Explain coherent anti-stokes Raman scattering.
8. Define chemical shift.
9. Write any two applications of ESR.
10. Explain the principle of NQR.

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Explain the valence bond theory to explain the hydrogen molecule problem.

Or

(b) Give a brief account on Quadrupole hyperfine interaction.

12. (a) Discuss the Raman spectrum of symmetric top molecules.

Or

(b) How do you determine the structure of the molecule using IR spectrometer?

13. (a) Describe the effect of an harmonicity in the case of diatomic vibrating rotator.

Or

(b) What is dissociation energy? Arrive an expression for the maximum number of vibrational levels below the dissociation limit.

14. (a) State the principle and explain the action of photo acoustic raman scattering.

Or

(b) Explain the theory of rotational and vibrational spectra of diatomic molecule.

15. (a) Obtain the Block equation.

Or

(b) State the principle of ESR and describe in detail its applications.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Calculate the rotational energy of a diatomic molecule and discuss its spectra.

17. Describe in detailed the rotational Raman spectra.

18. Discuss the principle and demonstration of coherent Anti-stroke's raman scattering.

19. Give a detailed account on principle instrumentation and applications of multi photon spectroscopy with neat diagram.

20. State the principle of mossbauer spectroscopy. How the molecular structure can be identified with the help of above technique.

———————

D–5599

Sub. Code
34532

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, MAY 2022.

Third Semester

Physics

QUANTUM MECHANICS – II

(CBCS 2018 – 19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What are CG coefficients?

2. Define the commutator of two operators.

3. What do you mean by central field approximation?

4. What are the disadvantages of Hartree's self consistent method?

5. Define particle exchange operator.

6. Distinguish between symmetric and anti-symmetric wave functions.

7. Differentiate relativistic and non relativistic field.

8. What is the relativistic equation used for treating spin ½ particles?

9. Define second quantisation.

10. Express the probability densities of relativistic mechanics.

PART B — (5 × 5 = 25 marks)

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

11. (a) Write down the components of angular momentum in terms of quantum mechanical equivalents. List some of the commutation rules of angular momentum operators.

Or

(b) Discuss the matrix representation of angular momentum and derive its 3×3 matrix.

12. (a) Obtain the eigen values of L^2 and L_z.

Or

(b) Write short notes on doublet separation in alkali atoms.

13. (a) Derive Klein Gordon relativistic equation and obtain its solution.

Or

(b) For a system of fermions, define the number operator N_k and show that its eigen values are 0 and 1

14. (a) Explain how to quantize a Klein Gordon equation and justify how particles accompany its antiparticles.

Or

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

15. (a) Write down the Salient Features of optical theorem.

Or

(b) Show that $(\alpha.A)(\alpha.B) = (A.B) + i\sigma'(A \times B)$ where A and B commute with α and $\sigma' = \begin{pmatrix} \sigma & 0 \\ 0 & \sigma \end{pmatrix}$.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions

16. Discuss the construction procedure for the CG coefficient matrix. Obtain CG coefficients for $j_1 = j_2 = \frac{1}{2}$.

17. Solve the Klein Gordon equation for plane waves and discuss its results in detail using Hydrogen like atom.

18. Explain how will you quantize a particle under electromagnetic field.

19. Explain Born Approximation. Apply the method to calculate the scattering cross section from a screened coulomle potential.

20. Discuss the Hartree Fock's method of central field approximation.

D–5600

Sub. Code
34533

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2022.

Third Semester

MICROPROCESSOR AND ELECTRONIC INSTRUMENTATION

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What do you meant by status flag?

2. What are the functions of accumulator?

3. Give the difference between microprocessor and micro controller.

4. What are loops?

5. Write a note on interfacing devices.

6. Give any four types of instructions of 8051.

7. Explain stepper motor.

8. Define comparator.

9. Write down the classifications of transducers.

10. Define piezoelectric effect.

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Discuss the timing diagram of memory read function of 8085.

Or

(b) Draw the architecture of 8086.

12. (a) Write a brief note on pseudo instructions.

Or

(b) Discuss the memory organization of 8051.

13. (a) Explain the I/O ports functioning.

Or

(b) Write a note on programmable DMA controller.

14. (a) With a neat diagram explain the construction and working of stepper motor.

Or

(b) Explain shortly on sample and hold circuits.

15. (a) Briefly discuss about potentiometer.

Or

(b) Describe the working principle of photo conductive cell with a neat diagram.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. With the architecture of 8085 explain its operation.

17. Write in brief about

    (a) Minimum mode operation of 8086

    (b) Maximum mode operation of 8086.

18. What is addressing modes? Explain in detail about register direct and indirect addressing modes.

19. Explain the A/D successive approximation method.

20. Discuss the following

    (a) Resistive strain gauges

    (b) Capacitive displacement transducers.

———————

D–5601	Sub. Code
	34541

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, MAY 2022.

Fourth Semester

Physics

CONDENSED MATTER PHYSICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer the following

1. Define crystal lattice.
2. Define crystalline structure.
3. Define miller indices.
4. Define phonons.
5. What is polarization?
6. Define reciprocal lattice.
7. What is type II semiconductor?
8. What are called domains?
9. Define coherence length.
10. Write down the London's equation.

PART B — ($5 \times 5 = 25$ marks)

Answer the following choosing either (a) or (b)

11. (a) Briefly explain the symmetry elements of crystal.

Or

(b) Derive Claussius Mosotti relation.

12. (a) State the properties of Lorentz Field and explain.

Or

(b) Briefly explain band theory of solids.

13. (a) List out the properties of ferro crystals.

Or

(b) List out the properties of pyro crystals.

14. (a) Explain the classification of magnetic materials.

Or

(b) Briefly explain ferromagnetic domains.

15. (a) Define isotopic effect.

Or

(b) Define cooper theory and BCS theory.

PART C— ($3 \times 10 = 30$ marks)

Answer any THREE of the following

16. Define BCC structure of a Crystal with an example.

17. Derive the equation for Hall effect.

18. Derive and explain Kronig-penny model.

19. State and prove Langevin's theory of paramagnetism.

20. State and explain Neel's theory.

———————

D–5602

Sub. Code
34542

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2022.

Fourth Semester

NUCLEAR AND PARTICLE PHYSICS

(CBCS – 2018-19 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Explain – Gamma decay.
2. What is Neutrinos?
3. Write a note on Magic numbers.
4. What are tensor forces?
5. Define Phase shift.
6. What is scattering cross section?
7. What is Nuclear Force?
8. Define Parity.
9. What is Leptons?
10. Define Gell-mann-Nishijma formula.

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) What do you understand by the term nuclear isomerism of Gamma rays? Explain in detail.

Or

(b) Obtain an expression for the magnetic moment of a nucleus.

12. (a) Give an account on the single particle model of the nucleus.

Or

(b) How is helicity of neutrino measured? Explain in detail.

13. (a) Obtain an expression for the scattering cross section for low energy n-p scattering.

Or

(b) How is deutron wave function normalized?

14. (a) What are thermal neutrons? Explain.

Or

(b) Discuss in detail note on controlled thermo nuclear reactions.

15. (a) Write a short note on :

(i) Baryons

(ii) Quarks.

Or

(b) Give the theory of eight fold way SU(3) symmetry.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Discuss the Gamow's theory of α-decay.

17. Give the theory of liquid-drop model of a nucleus and discuss it.

18. Describe the Yukawa's meson theory of nuclear forces.

19. Explain neutron cycle in a nuclear reactor. Derive four factor formula.

20. Write an essay about the fundamental interactions.

———————

D–5603

Sub. Code
34543

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2022.

Fourth Semester

MATERIALS SCIENCE

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. What is meant by viscoelastic behaviour?

2. Give some properties of polimers.

3. Write down the principle of piranai gauge.

4. Define vapour phase epitaxy.

5. Explain Q switching and mode locking.

6. Define Pockels effect.

7. Give two examples of semiconductor lasers.

8. How metal matrix composites are made?

9. What are smart materials?

10. List out some material characteristics of nitinol.

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Write a brief notes on elastic, inelastic and viscoeleastic behaviour of materials.

Or

(b) Explain about addition and condensation polymerization.

12. (a) Elaborate the theory of diffusion molecular pumps.

Or

(b) How thin films are coated by thermal evaporation method?

13. (a) Write short notes on electro-optic modulators.

Or

(b) Explain the population inversion in four level laser systems with an example.

14. (a) Give short notes on polymer matrix composites.

Or

(b) List out some of the electronic applications of composite materials.

15. (a) Elaborate the working principle of shape-memory alloys.

Or

(b) Write short note on fabrication Piezo-electric MEMS materials.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Explain in detailed notes on corrosion resistive materials.

17. Write in detail about lattice misfits and imperfections.

18. Give a detailed explanation on second harmonic generators.

19. Explain the principle and working of Ruby Lasers.

20. Describe in detail about MEMS and it's advantageous.

———————