

**D-2513**

**Sub. Code**

**34511**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

First Semester

CLASSICAL MECHANICS

(CBCS 2018 – 19 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. State the principle of least action.
2. Define constraints.
3. What is ignorable coordinates?
4. Express Hamilton – Jacobi equation.
5. Define Liouville's theorem.
6. Write down the expression for Euler's Equation of motion for a rigid body.
7. What is length contraction?
8. List out the postulates of special theory of relativity.
9. What is stable equilibrium?
10. Write the secular equation for small oscillations.

PART B — ( $5 \times 5 = 25$  marks)

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

11. (a) Deduce Kepler's first law of planetary motion.

Or

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

12. (a) Derive the Euler – Lagrange equation of motion using calculus of variation.

Or

- (b) Obtain the equation of motion using Poisson's bracket.

13. (a) What is time dilation? Explain.

Or

- (b) Obtain the variation of mass from moving frame with respect to the stationary frame.

14. (a) Derive an expression for angular momentum of a rigid body.

Or

- (b) Deduce Einstein's mass-energy relation.

15. (a) Discuss different types of equilibria with illustration.

Or

- (b) Write a short note on :

- (i) Normal modes  
(ii) Normal Coordinates.

PART C — ( $3 \times 10 = 30$  marks)

Answer any **THREE** questions.

16. Derive Hamilton's Canonical equation.
  17. Deduce the Lagrangian equation of motion from Hamilton's principle.
  18. Describe the theory on compound pendulum. Obtain an expression for period of oscillation.
  19. Derive Lorentz transformation equation.
  20. Explain the general theory of small oscillations.
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**D-2514**

**Sub. Code**

**34512**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

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 the questions.

1. What is surface integral?
2. Define gradient of a scalar function.
3. Let  $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ ;  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ ;  $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ . Find the vector  $\vec{a} \times (\vec{b} \times \vec{c})$ .
4. What is orthogonal matrix?
5. Find the determinant of a matrix  $A = \begin{bmatrix} 4 & 6 \\ 3 & 8 \end{bmatrix}$ .
6. Show that the matrix  $A = \begin{bmatrix} 2 & 6 \\ 1 & 3 \end{bmatrix}$  is singular or not.
7. Define beta function.
8. Prove that  $\beta_{(m+1),n} = \frac{m}{m+n} \beta_{(m,n)}$ .

9. Fourier sine integral for  $f(x) = \text{—————}$ .

10.  $L(\cos at) = \text{—————}$ .

PART B — (5 × 5 = 25 marks)

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

11. (a) Prove that  $\nabla(uv) = u\nabla v + v\nabla u$ .

Or

(b) If  $\phi = 2x^3y^2z^4$ , find  $\text{div}(\text{grad } \phi)$ .

12. (a) State and prove Gauss's divergence theorem.

Or

(b) Derive the differential form of Gauss Law.

13. (a) Find the rank of the matrix  $\begin{bmatrix} 1 & 3 & 4 & 2 \\ 2 & -1 & 3 & 2 \\ 3 & -5 & 2 & 2 \\ 6 & -3 & 8 & 6 \end{bmatrix}$  by

reducing it to normal form.

Or

(b) Obtain the eigen values of the matrix  $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & 2 & 0 \end{bmatrix}$

14. (a) Derive the relation between Gamma function and Beta function.

Or

(b) Prove that  $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)} = \sum_{n=-\infty}^{\infty} t^n J_n(x)$ .

15. (a) Find the Fourier cosine transform of  $f(x) = e^{-ax}$ .

Or

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

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. State and prove Stoke's theorem.
17. Derive the grad, div and curl for cylindrical coordinate system.
18. Reduce the following matrix into diagonal matrix  
$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$
19. Solve the Hermite differential equation and deduce its final solution.
20. Find inverse Laplace transform of  
$$\left\{ \frac{6}{2S-3} - \frac{3+4S}{9S^2-16} + \frac{8-6S}{16S^2+9} \right\}.$$
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**D-2515**

**Sub. Code**

**34513**

**DISTANCE EDUCATION**

**M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.**

**First Semester**

**LINEAR AND INTEGRATED ELECTRONICS**

**(CBCS 2018 – 2019 Academic Year Onwards)**

**Time : Three hours**

**Maximum : 75 marks**

**PART A — (10 × 2 = 20 marks)**

**Answer ALL the questions.**

1. What are the properties of semiconductors?
2. Draw the V-I characteristics of PN diode.
3. List out the different types of biasing.
4. Define an Amplifier.
5. What is meant by biasing a transistor?
6. Classify the different sinusoidal oscillators.
7. What is slew rate? State slew rate equation.
8. Give the ideal characteristics of op-amp and give its equivalent circuit.
9. What is an active filter?
10. Draw the neat circuit configuration of CE.

PART B — (5 × 5 = 25 marks)

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

11. (a) What are the forward bias and reverse bias characteristics of semiconductor diodes?

Or

- (b) What is LED? Write its advantages and uses.

12. (a) Derive the expressions for the Q point in voltage divider bias.

Or

- (b) Write note on distortions in amplifiers.

13. (a) Explain the construction and working of Hartley oscillator.

Or

- (b) What are the parameters that will influence the frequency response of FET amplifiers? Explain.

14. (a) Explain the Input resistance of OP-AMP internal circuit.

Or

- (b) Explain the working of OP-AMP as inverting amplifier.

15. (a) Compare PN diode and Zener Diode.

Or

- (b) Explain the working of differential amplifier and derive the expression for CMRR.

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. Explain briefly, with the help of circuit diagram how V-I characteristics of a p-n junction diode are obtained in (a) Forward bias, and (b) Reverse bias. Draw the shapes of curves obtained.
  17. Explain in detail, different biasing methods for a transistor circuit with neat circuit diagram and obtain respective stability factors.
  18. Derive the input impedance, output impedance, voltage gain and current gain of common source MOSFET amplifier.
  19. Explain the working of OP-AMP as non-inverting amplifier summer with neat circuit diagram.
  20. Draw the transistor circuit in CB configuration. Sketch the output characteristics. Indicate 'active', 'saturation' and 'cutoff region'. Brief explain the nature of those curves.
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**D-2516**

**Sub. Code**

**34521**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Second Semester

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. Write down the limitations of a wave function.
2. Calculate the nuclear binding energy using uncertainty relation.
3. Differentiate bound state and free states.
4. How do you represent a state vector and its conjugate in Dirac's notation?
5. Define eigen functions and eigen values.
6. What is the principle of perturbation theory?
7. Under what situation WKB method is applicable?
8. Define Stokes and Anti-Stokes lines in Raman scattering.
9. Distinguish spontaneous and stimulated emission.
10. Mention the selection rules of absorption in scattering.

PART B — ( $5 \times 5 = 25$  marks)

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

11. (a) Derive the time independent Schrodinger equation.

Or

- (b) From the equation of continuity give interpretation for current density and position probability density.

12. (a) Obtain the expression of probability of penetration of a barrier and obtain transmission coefficients.

Or

- (b) Find the eigen value and eigen function of a particle in a one-dimensional box.

13. (a) Develop first order time independent perturbation theory for degenerate case.

Or

- (b) Using variational principles, estimate the ground state energy of Helium atom.

14. (a) What are Einstein's coefficients of spontaneous and induced emission of radiation? Deduce a relationship between them.

Or

- (b) Briefly discuss the quantum theory of radiation using time dependent perturbation theory.

15. (a) Discuss WKB method for the solution of Schrodinger wave equation in a potential field and discuss its validity.

Or

- (b) Give the quantum mechanical theory of Raman scattering.

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. State and prove Ehrenfest's theorem. What information is obtainable from this theorem?
  17. Discuss the linear harmonic oscillator problem and obtain expressions for energy eigen values and eigen functions one dimensionally.
  18. Solve the radial part of Hydrogen atom.
  19. Derive time dependent Schrodinger's wave equation and deduce time independent wave equation from it obtain its solution also.
  20. Solve the Schrodinger equation for a three dimensional harmonic oscillator. Are the energy levels degenerate?
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**D-2517**

**Sub. Code**

**34522**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Second Semester

MATHEMATICAL PHYSICS – II

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Define complex number. Give one example.
2. Locate the singularities of  $f(z) = \frac{1}{(z-1)(z-3)}$ .
3. What is analytic function?
4. Write the equation of vibrating membrane.
5. Mention the use of Green's function.
6. Write a note on summation convention.
7. What is the rank of tensor  $A_{\beta\sigma}^{\alpha\beta\gamma}$ ?
8. Define real index. Give one example.
9. What is abelian group?
10. Write a note on classical probability.

PART B — (5 × 5 = 25 marks)

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

11. (a) Write a note on conformal mapping.

Or

- (b) Find the pole and residue of the function

$$f(z) = \frac{z}{z-1}.$$

12. (a) State and prove Cauchy's integral theorem.

Or

- (b) Evaluate the following integral using residue

theorem  $\int_c \frac{4-3z}{z(z-1)(z-2)} dz$ , where  $c$  is the circle

$$|z| = \frac{3}{2}.$$

13. (a) Obtain the expression for two dimensional heat flow equation.

Or

- (b) Using method of separation of variables solve

$$\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u, \text{ where } u(x,0) = 6e^{-3x}.$$

14. (a) If  $A_{\sigma}^{\mu\gamma}$  and  $B_{\sigma}^{\mu\gamma}$  are tensors, prove that their sum and difference are tensors.

Or

- (b) Write a note on contra variant and covariant tensors.

15. (a) What are symmetry elements and symmetry operators?

Or

- (b) Write a note on random variable with example.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Derive the Cauchy-Riemann conditions for analytic function.
17. Using residue calculus evaluate the following integral
- $$\int_0^{2\pi} \frac{1}{5 - 4 \sin \theta} d\theta.$$
18. Find an orthonormal basis for the vector space generated by the vector (1, 1, 0, 1), (1, -2, 0, 0) and (1, 0, -1, 2) using Gram-Schmidt orthogonalisation process.
19. State and prove quotient law of tensors.
20. What is binomial distribution? Obtain its mean and variance.
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**D-2518**

**Sub. Code**

**34523**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Second Semester

ELECTROMAGNETIC THEORY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Define electrostatics and magnetostatics.
2. State the continuity equation for charge.
3. What is skin depth?
4. Define the terms reflection and refraction of electromagnetic waves.
5. What is total internal reflection?
6. Briefly explain the Lorentz formula.
7. Name two types of waveguides.
8. What is a resonant cavity?
9. Define plasma.
10. What is the pinch effect in plasma physics?

PART B — ( $5 \times 5 = 25$  marks)

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

11. (a) Derive the wave equation for the electric field in a source-free region from Maxwell's equations.

Or

- (b) State and explain the Poynting theorem, including the physical significance of each term.

12. (a) Discuss the phenomena of reflection and refraction of electromagnetic waves at the interface of non-conducting media.

Or

- (b) Describe the conditions for total internal reflection and its practical applications.

13. (a) Explain the Lorentz formula and its connection to the dielectric constant.

Or

- (b) Explain the theory of scattering of electromagnetic waves.

14. (a) Briefly describe the concept of modes in waveguides.

Or

- (b) Describe the working principle of a Klystron for microwave generation.

15. (a) Discuss the conditions for plasma existence and its natural occurrence.

Or

- (b) Explain the basic principles of magnetohydrodynamics (MHD).

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. Derive the wave equations for both scalar and vector potentials from Maxwell's equations in a general medium. Discuss their importance in understanding electromagnetic waves.
  17. Explain the phenomenon of dispersion of electromagnetic waves. Discuss in detail normal and anomalous dispersion, providing physical explanations and relevant graphs.
  18. Explain the principle and operation of a rectangular waveguide. Discuss the concept of TE and TM modes, and derive the cutoff frequency for a particular mode.
  19. Discuss the motion of a charged particle in (a) a homogeneous magnetic field and (b) simultaneous homogeneous electric and magnetic fields. Explain the resulting trajectories.
  20. Describe the working principle, construction, and applications of (a) a Klystron and (b) a Magnetron in detail.
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**D-2519**

**Sub. Code**

**34531**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Third Semester

Physics

MOLECULAR SPECTROSCOPY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. What is directed bonds?
2. What are asymmetric top molecules?
3. Write two difference between Raman and FTIR spectra.
4. State mutual exclusion principle.
5. What is predissociation?
6. Define Inverse Raman effect.
7. Write a block equation.
8. What is the principle of nuclear quadrupole resonance?
9. Define dipole-dipole interaction.
10. What is spin lattice interaction?

SECTION B — ( $5 \times 5 = 25$  marks)

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

11. (a) Write a note on SP, SP<sup>2</sup> and SP<sup>3</sup> hybridization.

Or

- (b) What is the isotopic substitution of the molecule using Raman Spectroscopy?

12. (a) Define Stark effect and state its importance in Microwave Spectroscopy.

Or

- (b) Calculate the rotational energy of a diatomic molecule and discuss its spectra.

13. (a) Write a detail note on intensity distribution CO molecule.

Or

- (b) What is hyper Raman effect? Give the classical treatments of hyper Raman effect.

14. (a) Give a detailed account on principle, instrumentation and applications of multi photon spectroscopy with neat diagram.

Or

- (b) Give some of the characteristic properties of the stimulated emissions.

15. (a) State the principle of NQR and describe its applications.

Or

- (b) Describe in detail the spin-spin coupling in NMR spectrum.

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

Answer any THREE questions.

16. Explain the formation of hydrogen molecule based on Heitler-London theory along with explanation of the potential energy curve.
  17. Describe in detail how the information about molecular structure is obtained from Raman Spectroscopy.
  18. What is Portrait Parabola? Explain.
  19. Describe the principle and action of photo acoustic scattering.
  20. Give an expression for the determination of crystal symmetry and molecular structure in Mossbauer spectroscopy.
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**D-2520**

**Sub. Code**

**34532**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Third Semester

QUANTUM MECHANICS — II

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Calculate the value of  $(\sigma_x + \sigma_y + \sigma_z)^2$ .
2. What is the effect of interchanging two identical particles on observable quantities?
3. List the properties of bosons.
4. Distinguish symmetric and antisymmetric wave functions.
5. What was the modification made by Fock in Hartree's method?
6. Express Dirac's Hamiltonian.
7. Define Hamiltonian density of a field.
8. Why do we require quantum theory?
9. Define differential and total scattering cross section.
10. Express the probability density of relativistic mechanisms.

PART B — ( $5 \times 5 = 25$  marks)

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

11. (a) Show that  $L^2$  commutes with all the three components of angular momentum operators.

Or

- (b) Obtain the eigen vectors for  $S_x$ ,  $S_y$  and  $S_z$  for spin  $V_2$  system.

12. (a) Write short notes on doublet intensity of alkali spectrum.

Or

- (b) Derive relativistic Klein Gordon equation.

13. (a) Obtain the Lagrangian equations for the classical fields.

Or

- (b) Explain how the concept of spin angular momentum has evolved automatically from Dirac's Hamiltonian.

14. (a) Derive the continuity equation for the relativistic Schrodinger equation.

Or

- (b) Describe the quantisation of Dirac's field.

15. (a) Define creation, annihilation and number operators. Show that the eigen values of number operators are restricted to 0 and 1.

Or

- (b) Discuss Born approximation to obtain the scattering amplitude. Give the validity regimes of Born approximation.

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. Construct the CG coefficient for the addition of two spin  $1/2$  systems.
  17. Describe the salient features of spectrum of alkali atoms. Discuss about its doublet separation.
  18. Solve the relativistic Schrodinger equation for the Hydrogen atom.
  19. Obtain Dirac matrices. Prove that Dirac matrices  $\vec{\alpha}$  and  $\vec{\beta}$  must be even dimensional. List down their properties.
  20. What is a self consistent field and explain the Hartree method of approximation.
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**D-2521**

**Sub. Code**

**34533**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Third Semester

MICROPROCESSOR AND ELECTRONIC  
INSTRUMENTATION

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. What is the segment registers in 8086?
2. Name the five flags in 8085.
3. Mention any two features of 8051 microcontroller.
4. What is a stack? Where is it located in memory?
5. List any two features of 8257.
6. What is the difference between memory and I/O interfacing?
7. Define comparator.
8. State one advantage of capacitive displacement transducers.
9. Mention the role of I/O ports in interfacing.
10. Define Special Function Register (SFR).

PART B — (5 × 5 = 25 marks)

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

11. (a) Describe the function of general-purpose registers.

Or

- (b) List and explain different types of instructions in 8085.

12. (a) Describe the general-purpose and special function registers in 8051.

Or

- (b) Compare and explain arithmetic vs logical instructions in 8051 with examples.

13. (a) What are the major signals used in 8257 and their functions?

Or

- (b) Describe any one data transfer scheme with example.

14. (a) Write a short note on comparator and its applications.

Or

- (b) Explain the principle of operation of an LVDT.

15. (a) Compare different types of temperature transducers based on accuracy and range.

Or

- (b) Describe the process of analog-to-digital conversion using 8085.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Draw the pin diagram of 8086 and explain the function of each pin in detail.
  17. Explain in detail the hardware features of 8051 microcontroller.
  18. Write a detailed note on the architecture and working of a basic I/O interface system.
  19. Explain the classification of transducers in detail with suitable examples.
  20. Describe in detail the different modes of operation of 8255 with diagrams and examples.
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**D-2522**

**Sub. Code**

**34541**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Fourth Semester

CONDENSED MATTER PHYSICS

(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 Unit Cell.
2. What is translational symmetry in a crystal lattice? Give an example.
3. What is simple cubic lattice and mention the number of atoms per unit cell?
4. What are acoustic and optical phonons?
5. What does Fermi energy represent in the free electron model of a solid?
6. Define polarization in a dielectric material.
7. What is piezoelectric effect? Give one example of piezoelectric material.

8. What is meant by magnetic hysteresis in ferro-magnetic materials?
9. What is coercivity and how does it differ in soft and hard magnetic materials?
10. Give the main postulates of BCS theory in super conductivity.

PART B — (5 × 5 = 25 marks)

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

11. (a) Classify crystalline solids based on bonding and give example for each type.

Or

- (b) Describe the HCP crystal structure with its key properties with neat diagram.

12. (a) What are lattice vibration? Explain their effects on properties of solids.

Or

- (b) Explain the free electron gas model in three dimension. Derive the expression for density of states.

13. (a) Using band theory, explain the difference between intrinsic and extrinsic super conductors.

Or

- (b) State and derive Clausius-Mosotti relation and give the significance of relation in context of dielectrics.

14. (a) What are ferromagnetic domains? Discuss their behaviour during magnetization and demagnetization.

Or

- (b) Differentiate between ferromagnetism and anti-ferro magnetism with suitable diagrams.
15. (a) Describe hysteresis loss in magnetic materials. How is it related to the area of the B-H loop?

Or

- (b) Describe Langevin's theory of paramagnetism.

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. Classify the seven crystal systems based on their axial length and inter-axial angles. Provide one example for each.
17. Describe the Face-Centered Cubic (FCC) crystal structure in detail. Derive expressions for the atomic packing factor, coordination number and number of atoms per unit cell.
18. Define the Lorentz field. Derive an expression for the local field acting on a dipole in a uniformly polarized dielectric medium.
19. Explain Weiss molecular field theory of ferro-magnetism. Derive the expression for magnetic susceptibility above the Curie temperature.
20. Describe the Josephson effect in super conductors. Differentiate between the DC and AC Josephson effects.

**D-2523**

**Sub. Code**

**34542**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Fourth Semester

NUCLEAR AND PARTICLE PHYSICS

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. State nuclear isomerism.
2. Define electric quadrupole moment.
3. What is Schmidt lines.
4. How do you normalize the deuteron wave function?
5. What is nuclear fission?
6. What is meant by thermal neutrons?
7. Explain cylindrical nuclear reactor.
8. What is baryons?
9. Define Gee-Mann-Nishijima formula.
10. State Strangeness.

PART B — ( $5 \times 5 = 25$  marks)

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

11. (a) How is helicity of neutrino measured? Explain.

Or

- (b) Describe in detail magnetic moments of the shell model.

12. (a) Give an account on parity violation in  $\beta$ -decay.

Or

- (b) Explain the important features of shell model.

13. (a) Describe in short : Simple theory of deuteron.

Or

- (b) How the mass of  $\pi$ -meson is determined from Meson theory of nuclear forces.

14. (a) Discuss the theory on the interaction of neutron with matter.

Or

- (b) Write a short note on controlled thermo nuclear reactions.

15. (a) State and explain CPT theorem.

Or

- (b) What are the fundamental forces in nature? Explain.

PART C — ( $3 \times 10 = 30$  marks)

Answer any **THREE** questions.

16. Discuss the Gomow's theory of  $\alpha$ -decay.
  17. Give the theory of liquid-drop model of a nucleus and discuss it.
  18. Describe the theory of compound nucleus formation and also its decay.
  19. Derive an expression for the critical size of a nuclear reactor.
  20. Write an essay about the fundamental interactions.
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**D-2524**

**Sub. Code**

**34543**

DISTANCE EDUCATION

M.Sc. (Physics) DEGREE EXAMINATION, MAY 2026.

Fourth Semester

MATERIALS SCIENCE

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Define viscoelastic behaviour of materials.
2. What is the difference between thermoplastic and thermosetting polymer?
3. Give two applications of polymers in the medical field
4. What is the working range of a Pirani gauge?
5. Write one difference between diffusion and turbomolecular pump.
6. What is lattice misfit? Write its formula.
7. What is Q-switching in lasers?
8. Define composite material with one example.
9. What composite is used in wind turbine blades?
10. What is piezoresistive effect?

PART B — (5 × 5 = 25 marks)

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

11. (a) Define tensile strength and toughness. How are they represented on a stress-strain curve?

Or

- (b) Define polymers and give two examples of natural and synthetic polymers.

12. (a) Give the properties and applications of stainless steel.

Or

- (b) Explain the role of a rotary vane pump in creating vacuum.

13. (a) Explain the principle and working of liquid phase epitaxy (LPE).

Or

- (b) Differentiate between Q-switching and mode-locking.

14. (a) What are photorefractive materials? Mention two applications.

Or

- (b) Write short notes on carbon-carbon composites.

15. (a) Explain the electronic applications of composites with examples.

Or

- (b) Differentiate between piezoelectric MEMS and Piezoresistive MEMS.

PART C — ( $3 \times 10 = 30$  marks)

Answer any THREE questions.

16. What do you mean by toughness and hardness? Explain with examples how they influence material selection in mechanical and civil engineering applications.
  17. Explain epitaxy of compound semiconductors (GaAs, InP, CdTe) using different epitaxial techniques.
  18. Give a detailed explanation on second harmonic generators.
  19. Explain in detail polymer matrix composites and its applications.
  20. Discuss Pseudoelasticity and shape memory effect with stress-strain curve.
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