PGS-251001
Autonomous Examination-DEC-2025
SEMESTER-I
M.Sc. (Physics)
Paper – I (Mathematical Physics)

Time : 3 Hours M.M. : 70

Note: Attempt all questions. Scheme of questions and marks are indicated against the questions.

Section-A

01. Objective type questions Attempt any 12 questions out of 10 given below.
(1 x 10 = 10)

(i) The residue of the function $f(z) = \frac{z^2}{z^2+4}$ at z = 2i is

(a) $e^{i\pi/2}$ (b) $e^{i\pi}$

(c) $e^{3i\pi/2}$ (d) $e^{-i\pi/2}$

(ii) The value of $\oint_c \frac{dz}{z-3}$ if c is the circle $|z-2| = 5$ is

(a) π i (b) 2π i

(b) 0 (d) 2π

(iii) The analytic function f(z) whose real part is $\frac{x}{x^2+y^2}$ will be

(a) $|z|$ (b) z

(c) sinz (d) $\frac{1}{z}$

(iv) The value of $\int_{-1}^{+1} [P_4(x)]^2 dx$ is equal to

(a) 1 (b) $\frac{2}{9}$

(c) $\frac{2}{7}$ (d) $\frac{4}{9}$

(v) The number of non-vanishing terms in the fourier series of sinx in the internal $(-\pi, \pi)$

(a) one (b) two

(c) three (d) infinity

(vi) The laplace transform of e^{at} is……

(vii) If the standard deviation of the poisson distribution is $\sqrt{2}$, the probability for r = 2 ……...

(viii) The product of eigen values of matrix is A equal to …….. of A.

(ix) The generating function for Legendre polynomial is……....

(x) Kronecker delta $\left(S_\mu^V\right)$ is ……..... tensor.

(xi) Every subgroup of cyclic group is not cyclic. (True/False)

(xii) The tensor of first order is called vector. (True/False)

Section-B

02. Very Short answer type questions (word limit – 70-100 words) Attempt any Three questions out of Five given below.
(03 x 03= 09)

(i) Define unitary matrix with example.

(ii) Differentiate between the symmetric and antisymmetric tensor.

(iii) Find the Laplace transform of L ($\sin^2 t$).

(iv) Prove that Pn(1) = 1.

(v) Define group and subgroup with example.

Section-C

03. Short answer type questions (word limit – 200-250 words) Attempt any Three questions out of Five given below.
(06 x 03= 18)

(i) Find the value of $\int_c \frac{Z^2+1}{Z^2-1}$ dz, if c is a circle of unit radius with center at z=1.

(ii) For Legendre polynomial, prove that $nP_n(x)=xP^1_n(x) - P^1_{n-1}(x)$

(iii) Find the finite Fourier sine transform of the function
$f(x) = x^2$; $0<x<4$.

(iv) Show that any tensor of rank 2 can be expressed as a sum of a symmetric and antisymmetric tensor, both of rank 2.

(v) Explain reducible and irreducible represnetations and mention their main features.

Section-D

04. Long answer type questions (word limit – 500.600 words) Attempt any three questions out of five given below.

(11 x 03 = 33)

(i) Find the eigen value and eign vector of following matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.

(ii) Prove that for Legendre polynominal $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2-1)^n$.

(iii) Find the fourier series of function as f(x) = (sin x) for $-\pi < x < \pi$.

(iv) Explain what do you mean by poisson's distribution. Calculate mean and standard deviation of poisson's distribution.

(v) Define contravariant, covariant and mixed tensors. If A_r^{Pq} and B_r^{Pq} are tensors. Prove that sum and difference are also tensors.

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PGS-251002
Autonomous Examination Dec-2025
SEMESTER-I
M.Sc. (Physics)
Paper – II (Classical Mechanics)

Time : 3 Hours M.M. : 70

Note: Attempt all questions. Scheme of questions and marks are indicated against the questions.

Section-A

01. Objective type questions Attempt any 12 questions out of 10 given below.
(1 x 10 = 10)

(i) The Lagragian of a system is a function of ……..
(ii) The angular momentum of a rigid body is ……. Quantity.
(iii) There are …….. types of central forces.
(iv) D' Alembert's principle is based on ……. Work done by the system of particles.
(v) For the conservative system, the potential Energy is a function of …….
(vi) The relation between the singular momentum and the moment of inertia of rigid body is
(a) $J = IW^2$ (b) $J = 1/2\ IW^2$
(c) $J = IW$ (d) $J = 2IW$
(vii) The total number of variables in a Lagriagan of a system is
(a) n+1 (b) 2n+1
(c) 3n+1 (d) 4n+1
(viii) The first kind of generating function (F_1) is a function of
(a) q,Q,t (b) q.P,t
(c) p,Q,t (d) p,P,t
(ix) Lagrange's bracket is invariant under
(a) Lorentz transformation (b) Contact transformation
(c) Gallilean Transformation (d) None of the above
(x) The expression for the conjugate momenta is……
(xi) The Lagrangian of a system is the sum of kinetic energy and potential energy of a system of particles. (True/False)
(xii) The Hamilton's of Jacobi equation is based on the second kind of generating function. (True/False)

Section-B

02. Very Short answer type questions (word limit – 70-100 words) Attempt any Three questions out of Five given below.
(03 x 03= 09)

(i) Write the characteristics properties of central force .
(ii) Define principle moment of inertia and principle axes.
(iii) What do you understand by Lagrange's bracket?
(iv) What is generalized momentum?
(v) What do you mean by Homogeneity of Space?

Section-C

03. Short answer type questions (word limit – 200-250 words) Attempt any Three questions out of Five given below.
(06 x 03= 18)

(i) Obtain the expression for the rotational kinetic energy of a rigid body.
(ii) State and prove the Noether's theorem.
(iii) Obtain the expression for the time period of oscillation for the one dimensional Harrmonic oscillator by applying Lagrange's equation of motion.
(iv) State and prove the conservation of energy as a consequence of Homogeneity of time.
(v) Write short notes on symmetry property.

Section-D

04. Long answer type questions (word limit – 500.600 words) Attempt any three questions out of five given below.
(11 x 03 = 33)

(i) State and prove Liouvillee's theorem.
(ii) Discuss the Routh's procedure in details.
(iii) State and prove the principle of least action.
(iv) Derive the Hamilton's canonical equation of motion by applying Hamilton's variational principle.
(v) Show that Poissan's bracket is invariant under canonical transformation.
(vi) Obtain the expression for the Hamiltonian of system in the case of Relativistic Mechanics.

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PGS-251072
Autonomous Examination DEC-2025
SEMESTER-I
M.A./M.Sc./M.Com./LLM
Paper – IV - (Research Methodology & Computer Application:Basics)

Time : 3 Hours M.M. : 70

नोट : सभी प्रश्न हल करना अनिवार्य है। प्रश्न के समक्ष अंक एवं शब्द सीमा निर्दिष्ट है।
Note: Attempt all questions. Scheme of questions and marks are indicated against the questions.

'खण्ड–अ'
Section-A

1.वस्तुनिष्ठ प्रश्न–दिये गये 12 प्रश्नों में से किन्हीं 10 प्रश्नों के उत्तर दीजिए।
Objective type questions Attempt any 10 questions out of 12 given below.
(01 x 10 = 10)

(i) निम्न में से कौन सा शोध का अंग नहीं है-
(अ) परिकल्पना निर्माण (ब) तथ्यों का संकलन
(स) परिकल्पना का परीक्षण (द) साहित्यिक चोरी

Which of the following is not a part of research?
(a) Hypothesis generation (b) Data collection
(c) Hypothesis testing (d) Plagiarism

(ii) शोध-नैतिकता में शामिल है-
(अ) ईमानदारी और सत्यनिष्ठा (ब) पारदर्शिता
(स) निष्पक्षता (द) उपरोक्त सभी

Research ethics includes -
(a) Honesty and Integrity (b) Transparency
(c) Impartiality (d) All of the above

(iii) किसी विशिष्ट उद्देश्य के लिए शोधकर्ता द्वारा एकत्र की गई मूल जानकारी कहलाती है-
(अ) प्राथमिक स्रोत (ब) द्वितीयक स्रोत
(स) दोनो अ और ब (द) इनमें से कोई नहीं

Original information collected directly by the researcher for a unique purpose-
(a) Primary data (b) Secondary data
(c) Both 'a' & 'b' (d) None of these

(iv) कंप्यूटर का बाहरी ढांचा कहलाता है-
(अ) सॉफ्टवेयर (ब) हार्डवेयर
(स) प्रिंटर (द) इनमें से कोई नहीं

The outer structure of a computer is called-
(a) Software (b) Hardware
(c) Printer (d) None of these

(v) प्रतिचयन का प्रकार है-
(अ) संभाव्यता प्रतिचयन (ब) गैर-संभाव्यता प्रतिचयन
(स) दोनों (द) इनमें से कोई नहीं

The type of sampling is-
(a) Probability sampling (b) Non-probability sampling
(c) Both (d) None of these

(vi) निम्न में से कौन सा इनपुट उपकरण नहीं है-
(a) माउस (b) प्रिंटर
(c) कीबोर्ड (d) स्कैनर

Which of the following is not an input device
(a) Mouse (b) Printer
(c) Keyboard (d) Scanner

(vii) एम. एस.पॉवर प्वाइंट एक .....सॉफ्टवेयर है|
M.S. Power point is a ……..software

(viii) शोध प्रश्न को हल करने के लिए डेटा इकट्ठा करने और उसका विश्लेषण करने के तरीके को .....कहते हैं |
The method of collecting and analyzing data to answer a research question is called .....

(ix) किसी बड़े समूह से शोध हेतु चुने गये प्रतिनिधि .....कहलाते हैं |
Representatives selected from a large group for research are called.....

(x) शोध उद्देश्य की पूर्ति हेतु शोध में नैतिकता अत्यंत आवश्यक है| (सत्य/असत्य)
Research Ethics is essential to achieve the research objective. (True/False)

(xi) साहित्य-समीक्षा शोध का अंग नहीं है | (सत्य/असत्य)
Literature review is not a part of research. (True/False)

(xii) गूगल,बिंग,याहू आदि प्रमुख सर्च इंजन हैं| (सत्य/असत्य)
Google, Bing, Yahoo etc. are the major search engines. (True/False)

'खण्ड–ब'
Section-B

2.अति लघुत्तरीय प्रश्न (शब्द सीमा 70–100 शब्द) दिये गये पॉच प्रश्नों में से किन्हीं तीन प्रश्नों के उत्तर दीजिए।

Very Short answer type questions (word limit – 70-100 words) Attempt any Three questions out of Five given below. **(3 x 3 = 09)**

(i) शोध के उद्देश्य को स्पष्ट कीजिये |
Explain the purpose of the research.

(ii) साहित्यिक चोरी से क्या अभिप्राय है?
What is meant by plagiarism?

(iii) सैम्पल साइज किसे कहते हैं ?
What is sample size?

(iv) ऑपरेटिंग सिस्टम क्या है ?
What is an operating system?

(v) शोध-अन्तराल क्या है?
What is Research-Gap?

'खण्ड–स'
Section-C

3.लघु उत्तरीय प्रश्न (शब्द सीमा 200–250 शब्द) दिये गये पॉच प्रश्नों में से किन्हीं तीन प्रश्नों के उत्तर दीजिए।

Short answer type questions (word limit – 200-250 words) Attempt any Three questions out of Five given below. **(6 x 3 = 18)**

(i) शोध की परिभाषा लिखिए एवं शोध के विभिन्न चरणों पर प्रकाश डालिए |
Write the definition of research and highlight the various stages of research..

(ii) साहित्य-समीक्षा से क्या अभिप्राय है? शोध हेतु साहित्य-समीक्षा के महत्व पर प्रकाश डालिए |
What is meant by a literature review? Explain the importance of a literature review for research

(iii) कंप्यूटर की संरचना का परिचय प्रस्तुत कीजिये|
Give an introduction to the structure of a computer.

(iv) मात्रात्मक एवं गुणात्मक शोध को उदाहरण सहित पारिभाषित कीजिये|
Define quantitative and qualitative research with examples..

(v) शोध-पत्र प्रकाशन हेतु किन बातों का ध्यान रखा जाना आवश्यक है|
What are the things that need to be kept in mind for publishing a research paper?

'खण्ड–द'
Section-D

4.दीर्घोत्तरीय प्रश्न (शब्द सीमा 500–600 शब्द) दिये गये पाँच प्रश्नों में से किन्हीं तीन प्रश्नों के उत्तर दीजिए।

Long answer type questions (word limit – 500-600 words) Attempt any three questions out of five given below. **(11 x03 = 33)**

(i) शोध की विभिन्न पद्धतियों पर प्रकाश डालिए|
Highlight various methods of research.

(ii) शोध-नैतिकता क्या है? शोध-नैतिकता के वैशिष्ट्य पर प्रकाश डालिए|
What is research ethics? Highlight the salient features of research ethics.

(iii) शोध-प्रारूप किसे कहते हैं? शोध प्रारूप के विभिन्न अंगों पर प्रकाश डालिए|
What is a research design? Explain the various components of a research design.

(iv) 'शोध कार्य में कंप्यूटर की भूमिका' विषय पर निबंध लिखिए |
Write an essay on the topic 'Role of computer in research work'.

(v) शोध के विभिन्न उपकरणों और उनके महत्व पर विस्तृत टिप्पणी कीजिये|
Comment in detail on various tools of research and their importance.

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PGS-251004
Autonomous Examination DEC-2025
SEMESTER-I
M.Sc. (Physics)
Paper – V (High Energy Physics-I)

Time : 3 Hours M.M. : 70

Note: Attempt all questions. Scheme of questions and marks are indicated against the questions.

Section-A

01. Objective type questions Attempt any 10 questions out of 12 given below.
(1 x 10 = 10)

(i) How many States are possible in the Quarks -
(a) 2 (b) 3
(c) 4 (d) 5

(ii) Mesons can be produced in the reaction through the -
(a) Weak interaction (b) Strong Interaction
(c) Electromagnetic Interaction (d) None of the above

(iii) The spin of Messon's family is -
(a) 1/2 (b) Integral
(c) Half integer (d) None of the above

(iv) How many types of symmetries -
(a) 4 (b) 3
(c) 2 (d) 6

(v) The Lepton quantum number for the Lepton particles is-
(a) 0 (b) 1
(c) -1 (d) 2

(vi) There are …….. types of conservation laws in the particle physics.
(vii) Hadrons can be categorized into …….. main types.
(viii) The Relation between multiplicity of family and isospin is…….
(ix) The positron particle is discoverd by……..
(x) ……. proposed a scalar field responsible for giving mass to particles.
(xi) Baryon gave Combination of four quarks. **(True/False)**
(xii) Hyber charge is conserved for weak interaction. **(True/False)**

Section-B

02. Very Short answer type questions (word limit – 70-100 words) Attempt any Three questions out of Five given below.
(03 x 03= 09)

(i) Define elementary particles with examples.
(ii) What is particle accelerator?
(iii) What do you mean by Quarks?
(iv) What do you understand by weak interacions.
(v) What is lepton particles?

Section-C

03. Short answer type questions (word limit – 200-250 words) Attempt any Three questions out of Five given below.
(06 x 03= 18)

(i) Explain three quark, states of Baryon.
(ii) Write short notes on Feynman integrals.
(iii) Write the properties of fundamental forces.
(iv) Explain briefly electro weak unification with examples.
(v) Differentiate among electromagnetic, weak and strong interactions on the basis of their characteristic properties.

Section-D

04. Long answer type questions (word limit – 500.600 words) Attempt any three questions out of five given below.
(11 x 03 = 33)

(i) Derive the Dirac equation.
(ii) Discuss the Feynman rules for quantum electrodynamics with examples.
(iii) Classify the elementary particles on the basis of their spin and masses.
(iv) Describe the symmetries and conservation laws in details.
(v) Describe the charged and Neutral weak interactions with examples.

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PGS-251003
Autonomous Examination DEC-2025
SEMESTER-I
M.Sc.-PHYSICS
PAPER –III (QUANTUM MECHANICES-I)

Time : 3 Hours **M.M. : 70**

Note: Attempt all questions. Scheme of questions and marks are indicated against the questions.

Section A

01. Objective Type Questions attempt any 10 question out of 12 given below **(1x10=10)**

(i) The operator corresponding to a measurable physical quantity in Quantum Mechanics is called:
(a) Linear operator (b) Hermitian operator
(c) Unitary operator (d) Non Hermitian operator

(ii) The expectation value of a physical observable is always:
(a) Imaginary (b) Real
(c) Complex (d) Zero

(iii) The function that describes a quantum state of a particle is called:
(a) Action function (b) Wave function
(c) Probability function (d) Force function

(iv) The Ladder Operators (L+ and L -) are mainly used to solve the:
(a) Step potential (b) Particle in a box
(c) Simple harmonic oscillator (d) Free particle

(v) Dirac notation $|\psi\rangle$ represents a state in:
(a) Real space (b) Classical space
(c) Hilbert space (d) Phase space

(vi) Pauli spin matrices are used to describe:
(a) Linear momentum (b) Orbital angular momentum
(c) Spin angular momentum (d) Potential energy

(vii) The wave function must be single-valued and continuous. (True / False)

(viii) In the Heisenberg picture, operators remain constant and states evolve with time. (True/False)

(ix) WKB approximation is mainly used for solving quantum problems with slowly varying potentials. (True/False)

(x) The Schrödinger equation together with boundary conditions gives the _____ and eigen functions of a system.

(xi) The addition of two angular momenta is handled using _____ coefficients.

(xii) The symmetry or antisymmetric of a wave function for identical particles is governed by the _____ principle.

Section B

02. Very short answer type question (word limit -700-100 words) Attempts any three questions out of Five given below **(3x3 =09)**

(i) What do you mean by Stationary States ?
(ii) What is the Hilbert Spare ?
(iii) Write the WKB quantization rule.
(iv) Define the Symmetric and anti Symmetric wave functions with examples.
(v) Define central force with examples.

Section-C

03. Short answer type questions (word limit -200 -250 words) Attempt any three questions out of Five given below **(3x6=18)**

(i) Write the Physical Significance of wave function and also necessary Conditions an it.
(ii) Explain the commutation relations for Ladder Operators.
(iii) Distinguish between the Schrödinger, Heisenberg and interaction pictures.
(iv) Write Short notes on WKB approximation method.
(v) Explain the method of addition of two angular momenta.

Section-D

04 Long answer type question (word limit -500-600 word .Attempt any three questions out of five given below

(3x11=33)

(i) Establish the commutation relations between the angular momentum Operators.

(ii) Calculate the ground State Energy of anharmonic oscillator by applying the time independent Perturbation theory.

(iii) Discuss the problem of particle in a periodic potential with the help of Schrödinger wave Equation.

(iv) Discuss the Hermition Operators for dynamical Variables in details.

(v) Describe the time evolution of operators in details.

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