

**B. A. \ B.Sc (Mathematics) III semester  
(Sessions 2021-22, 2022-23, 2023-24)**

**Paper-I: Analysis-I**

**For Regular Students**

Maximum Marks: 50 Marks

University Exam: 40

**For Distance Education Students /Private Students**

Maximum Marks: 50 Marks (No Internal Assessment)

**Maximum Time: 3 Hrs.**

Teaching Hours : 50

Internal Assessment: 10

**INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

**INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

**INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

**SECTION-A**

**Sequence:** Definition of a sequence, Bounded and Monotonic sequences, Convergent sequence, Cauchy sequences, Cauchy's Convergence Criterion, Theorems on limits of sequences. Sub-sequence, Sequential continuity.

**Infinite Series:** Definition of a series, Tests of convergence, Comparison test. Cauchy's integral Ratio test, condensation test, Raabe's test, Logarithmic test, Gauss test, Cauchy's root test, Alternating series. Leibnitz's test. Absolute convergence and conditional convergence. Weierstrass M-Test for Uniform convergence of sequence of functions and series of functions. Simple applications. Determination of Radius of convergence of power series. (All Test without proofs only applications)

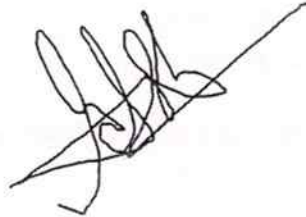
**SECTION-B**

**Improper integrals:** Definition, statements of their conditions of existence. Test of the convergence of improper integral, beta and gamma functions and their convergence. Abel's and Dirichlet's tests.

**BOOKS RECOMMENDED:**

1. Tom.M. Apostol: *Mathematical Analysis*, Second Edition, Addison-Wesley Publishing Company, 1974.
2. W. Rudin: *Principles of Mathematical Analysis*, third edition. McGraw Hill, 2013.
3. S.C Malik, S. Arora: *Mathematical Analysis*, New Age International Publishers, 1992.

Chandhal





## **PAPER-II: Linear Programming**

### **For Regular Students**

Maximum Marks: 50 Marks

University Exam: 40

**Maximum Time: 3 Hrs.**

Teaching Hours : 50

Internal Assessment: 10

### **For Distance Education Students /Private Students**

Maximum Marks: 50 Marks (No Internal Assessment)

#### **INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

#### **INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

#### **INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

### **SECTION-A**

**Linear Programming:** Formation of LPP, Graphical Method. Theory of the Simplex Method, Standard form of LPP, Feasible solution to basic feasible solution, Improving BFS, Optimality Condition, Unbounded solution, Alternative optimal solution, Correspondence between BFS and extreme points. Simplex Method, Simplex Algorithm, Simplex Tableau. Simplex Method Case of Degeneracy, Big-M Method, Infeasible solution, Alternate solution, Solution of LPP for unrestricted variable.

### **SECTION-A**

**Transportation Problem:** Formation of TP, Concepts of solution, feasible solution, Finding Initial Basic Feasible Solution by North West Corner Method, Matrix Minima Method, Vogel's Approximation Method. Optimal Solution by MODI method, Unbalanced and maximization type of TP.

**Assignment Problem:** Maximization, Minimization, Unbalances, With restriction Assignment problems, Algorithm, Hungarian method.

### **BOOKS RECOMMENDED:**

### Paper-III: MECHANICS

#### For Regular Students

Maximum Marks: 50 Marks

University Exam: 40

#### For Distance Education Students /Private Students

Maximum Marks: 50 Marks (No Internal Assessment)

Maximum Time: 3 Hrs.

Teaching Hours : 50

Internal Assessment: 10

#### INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

#### INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

#### INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

#### SECTION-A

**Statics:** Basic notation, Newton Laws of motion, system of two forces, parallelogram law of forces, resultant of two collinear forces, resolution of forces, moment of a force, couple, theorem on moments of a couple, coplanar forces, resultant of three coplanar concurrent forces, theorem of resolved parts, resultant of two forces acting on a rigid body. Varignon's theorem, generalized theorem of moments.

Equilibrium of two concurrent forces, equilibrium condition for any number of coplanar concurrent forces, Lami's theorem.  $\lambda - \mu$  theorem, theorems of moments, resultant of a force and a couple. Equilibrium conditions for coplanar non-concurrent forces.

#### SECTION-B

Motion of a particle with constant acceleration, acceleration of falling bodies, motion under gravity, motion of a body projected vertically upward, motion of a two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane. Variable acceleration, Simple harmonic motion, Projectile.

#### BOOKS RECOMMENDED:

1. S.L. Loney: *The Elements of Statics and Dynamics*, 5<sup>th</sup> edition, Cambridge University Press, 1947.
2. John I. Synge, Byron A. Griffith: *Principles of Mechanics*, 3<sup>rd</sup> Edition, McGraw-Hill



**B. A. \ B.Sc (Mathematics) IV semester**

**PAPER-IV: Analysis-II**

**For Regular Students**

Maximum Marks: 50 Marks

University Exam: 40

**For Distance Education Students /Private Students**

Maximum Marks: 50 Marks (No Internal Assessment)

**Maximum Time: 3 Hrs.**

Teaching Hours : 50

Internal Assessment: 10

**INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

**INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

**INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

**Objective:** This course continues the study of Analysis started in Paper II (Analysis I) and will students will study Uniform Convergence, Power Series and Vector Calculus.

**SECTION-A**

**Functions of bounded Variation and Rectifiable Curves:** Properties of Monotonic Functions, Functions of Bounded Variation, Total variation, Additive property of total variation, Total Variation on  $[a, x]$  as a function of  $x$ , functions of bounded variation expressed as the difference of increasing functions, continuous functions of bounded variation, rectifiable curves and arc length. Additive and continuity Property of Arc Length, Equivalence of Paths and Change of Parameter.

**SECTION-B**

**The Riemann-Stieltjes integrals:** Definition, elementary properties, integration by parts, change of variable, reduction to Riemann integral, step functions as integrators. Reduction of

Riemann's Condition, Comparison Theorems, Integrators of bounded variation, Mean value theorems for Riemann-Stieltjes integrals, Fundamental theorem of integral calculus, Mean value theorems for Riemann Integrals.

**BOOKS RECOMMENDED:**

1. T. M. Apostol: *Mathematical Analysis*, Norosa Publishing House, New Delhi, 1985.
2. S. Kumaresan: *Topology of Metric Space*, Alpha Science International Ltd. 2005
3. S. C. Malik, Savita Arora: *Mathematical Analysis*, Wiley, 1984.

Four handwritten signatures in black ink are present below the list of recommended books. The first signature on the left is 'Chandul'. The second signature is a stylized 'Arun'. The third signature is a complex, overlapping scribble. The fourth signature on the right is 'S. C. Malik'.



## **Paper-V: Numerical Methods**

### **For Regular Students**

Maximum Marks: 50 Marks

University Exam: 40

### **For Distance Education Students /Private Students**

Maximum Marks: 50 Marks (No Internal Assessment)

**Maximum Time: 3 Hrs.**

Teaching Hours : 50

Internal Assessment: 10

### **INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

### **INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)**

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

### **INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

## **SECTION-A**

**Measures of Errors:** Relative, absolute and percentage errors. Types of errors: Inherent error, Round-off error and Truncation error.

Bisection method, Regula-Falsi method, Secant method, Fixed-point iteration, Intermediate value theorem. Iteration methods based on first degree equation: Newton-Raphson method, Birge-Vieta method, Bairstrow method.

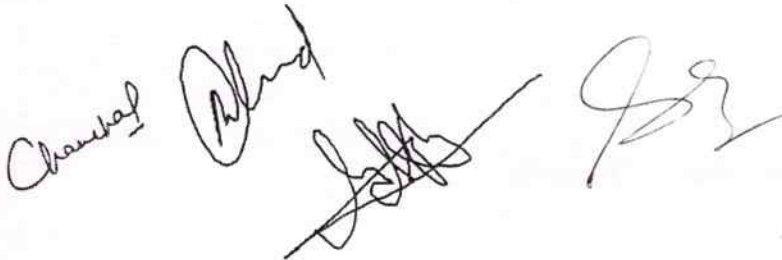
## **SECTION-B**

**Linear System of Equations:** Gauss-Elimination method, Pivot element, Pivoting strategies, Partial and complete Pivoting, Gauss Jordan and Triangularization method, Jacobi Method, Gauss Seidel Method, Eigen value problem.

**Interpolation:** Finite differences, Divided differences, Newton Gregory Forward and Backward formula, Lagrange's Formula, Newton's Formulae, Central Differences, Stirling, Bessel's and Everett's formulae, Error in linear and quadratic interpolation.

## **BOOKS RECOMMENDED:**

3. S.S. Sastry: *Introductory Methods Of Numerical Analysis*, Fifth Edition, Eastern Economy edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
4. Kendall E. Atkinson: *An Introduction to Numerical Analysis*, Wiley, 1978.

Four handwritten signatures in black ink are arranged horizontally. From left to right: the first signature is 'Chandul', the second is a circular mark with a vertical line through it, the third is a complex, overlapping scribble, and the fourth is a stylized 'JR'.



## Paper-VI: Number Theory

### For Regular Students

Maximum Marks: 50 Marks

University Exam: 40

### For Distance Education Students /Private Students

Maximum Marks: 50 Marks (No Internal Assessment)

Maximum Time: 3 Hrs.

Teaching Hours : 50

Internal Assessment: 10

### INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

### INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

### INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

### SECTION-A

Divisibility, Greatest common divisor, Fundamental Theorem of arithmetic, congruence, residue classes and reduced residue classes, Euler-Fermat theorem, Wilson's theorem, Linear congruence, Chinese Remainder theorem.

### SECTION-B

An Application to cryptography, primitive roots, indices, quadratic residues, Legendre Symbol, Euler's criterion, Gauss Lemma., Quadratic reciprocity Law, Jacobi Symbol. Arithmetic functions  $\mu(n)$ ,  $d(n)$ ,  $\phi(n)$ ,  $\sigma_a(n)$ , Mobius inversion Formula.

### BOOKS RECOMMENDED:

1. David M. Burton: *Elementary Number Theory*, 3rd Edition, McGraw-Hill Higher Education, (scope as in Chapters I-II), 2007.
2. I. Niven, Herbert S. Zuckerman: *An Introduction to the Theory of Numbers*, Wiley Eastern (Scope as in Chapters 1-7), 1976.
3. G.H. Hardy, E.M. Wright: *Number Theory*, Oxford Univ. Press (Scope as in Chapter 19), 2008.

ਬੀ.ਐੱਸਸੀ. ਭਾਗ ਦੂਜਾ, ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ ਭਾਗ ਦੂਜਾ  
2021-22, 2022-23 ਅਤੇ 2023-24 ਸੈਸ਼ਨ ਲਈ  
(ਸਮੈਸਟਰ ਤੀਜਾ)

ਕੁਲ ਅੰਕ : 100

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 25 ਅੰਕ

ਬਾਹਰੀ ਪਰੀਖਿਆ: 75 ਅੰਕ

ਸਮਾਂ : 3 ਘੰਟੇ

ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 40

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 10

ਬਾਹਰੀ ਪਰੀਖਿਆ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 30

(ਅਧਿਆਪਨ: 50 ਪੀਰੀਅਡ, 6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

**ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ**

**ਭਾਗ-ੳ**

ਭਾਗ ੳ-1: ਨਾਵਲ ਕੀ ਹੁੰਦਾ ਹੈ?, ਨਾਵਲ ਦਾ ਸਰੂਪ, ਨਾਵਲ ਅਤੇ ਨਾਵਲੈੱਟ ਵਿਚ ਅੰਤਰ, ਨਾਵਲ ਅਤੇ ਕਹਾਣੀ ਵਿਚ ਅੰਤਰ

ਭਾਗ ੳ-2: ਨਾਵਲ: ਖੇਤਾਂ ਦਾ ਰੁਦਨ (ਬਲਬੀਰ ਪਰਵਾਨਾ), ਵਿਦਿਆਰਥੀ ਨੂੰ ਨਾਵਲ ਪੜ੍ਹਨ ਲਈ ਉਤਸ਼ਾਹਿਤ ਕੀਤਾ ਜਾਵੇਗਾ ਅਤੇ ਨਾਵਲ ਬਾਰੇ ਉਸ ਦੇ ਪਾਠਕੀ ਹੁੰਗਾਰੇ ਨੂੰ ਦਰਜ ਕਰਨਾ ਸਿਖਾਇਆ ਜਾਵੇਗਾ।

**ਭਾਗ-ਅ**

ਭਾਗ ਅ-1: ਪੰਜਾਬੀ ਲੋਕ-ਚਿਕਤਸਾ: ਸਰੂਪ, ਵਰਗੀਕਰਨ ਅਤੇ ਪ੍ਰਕਾਰਜ

i) ਲੋਕ-ਚਿਕਤਸਾ: ਜੜੀਆਂ ਬੂਟੀਆਂ ਆਧਾਰਿਤ ਲੋਕ-ਚਿਕਤਸਾ

ii) ਲੋਕ-ਵਿਸ਼ਵਾਸਾਂ ਆਧਾਰਿਤ ਲੋਕ-ਚਿਕਤਸਾ: ਲੋਕ-ਵਿਸ਼ਵਾਸ, ਝਾੜਾ, ਟੂਣਾ, ਹਥੇਲਾ: ਸਰੂਪ, ਵਿਵਰਣ ਅਤੇ ਮਨੋ ਵਿਗਿਆਨਕ ਆਧਾਰ

(ਨੋਟ: ਇਸ ਖੰਡ ਦੇ ਆਧਾਰ 'ਤੇ ਵਿਦਿਆਰਥੀ ਤੋਂ ਇੱਕ ਅਭਿਆਸ-ਪ੍ਰਸਤੁਤ ਤਿਆਰ ਕਰਵਾਈ ਜਾਵੇਗੀ। ਉਸ ਵਿਚ ਵਿਦਿਆਰਥੀ ਕੁਲ 20 ਪੰਨੇ ਵਿਚ ਉਹ ਖੇਤਰੀ ਕਾਰਜ ਦੇ ਆਧਾਰ 'ਤੇ ਤਸਵੀਰਾਂ (ਫੋਟੋਆਂ ਤੇ ਚਿੱਤਰ) ਲਗਾਵੇਗਾ। ਲੋਕ-ਚਿਕਤਸਾ ਵਿਚ ਵਰਤੀਆਂ ਜਾਂਦੀਆਂ ਜੜੀਆਂ-ਬੂਟੀਆਂ ਦੀਆਂ ਤਸਵੀਰਾਂ ਅਤੇ ਉਨ੍ਹਾਂ ਦੀ ਵਿਗਿਆਨਕ ਵਿਆਖਿਆ ਕਰੇਗਾ। ਲੋਕ-ਵਿਸ਼ਵਾਸ ਆਧਾਰਿਤ ਲੋਕ-ਚਿਕਤਸਾ ਦੀਆਂ ਤਸਵੀਰਾਂ ਦੀਆਂ ਤਸਵੀਰਾਂ ਅਤੇ ਆਪਣੇ ਅਨੁਭਵਾਂ ਅਤੇ ਵਿਚਾਰਾਂ ਨੂੰ ਦਰਜ ਕਰੇਗਾ। ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ ਵਿਚ ਅਸਾਈਨਮੈਂਟ ਦੇ ਨੰਬਰ ਇਸ ਸਕਰੈਬਬੁੱਕ ਦੇ ਆਧਾਰ 'ਤੇ ਦਿੱਤੇ ਜਾਣਗੇ।)

ਭਾਗ ਅ-2 ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿੱਪੀ ਨਾਲ ਜਾਣ-ਪਛਾਣ

ੳ) ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਇਤਿਹਾਸ ਅਤੇ ਇਲਾਕਾਈ ਵੰਨਗੀਆਂ

ਅ) ਗੁਰਮੁਖੀ ਲਿੱਪੀ ਦਾ ਇਤਿਹਾਸ, ਗਰਮੁਖੀ ਆਰਥੋਗਰਾਫੀ

ੲ) ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਉਂਤ: ਸਵਰ, ਵਿਅੰਜਨ, ਖੰਡੀ ਅਤੇ ਅਖੰਡੀ ਧੁਨੀਆਂ

**ਭਾਗ-ੲ**

ਭਾਗ ੲ ਅਤੇ ਅ ਦੇ ਵਿਆਕਰਣ ਵਾਲੇ ਭਾਗ ਵਿਚੋਂ ਸੰਖੇਪ ਉਤਰਾਂ ਵਾਲੇ ਪ੍ਰਸ਼ਨ।



ਅੰਕ-ਵੰਡ ਤੇ ਪੇਪਰ ਸੈਂਟਰ ਲਈ ਹਦਾਇਤਾਂ

1. ਪਾਠਕ੍ਰਮ ਦੇ ਦੋ ਭਾਗ ਓ ਅਤੇ ਅ ਹਨ ਪਰ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਤਿੰਨ ਭਾਗ ਓ, ਅ ਅਤੇ ਏ ਹੋਣਗੇ।
2. ਭਾਗ ਓ-1) ਵਿਚੋਂ 2 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਉੱਤਰ ਦੇਵੇਗਾ। ਇਹ ਪ੍ਰਸ਼ਨ ਦਿੱਤੇ ਗਏ ਗਲਪ ਰੂਪਾਂ ਦੇ ਸਰੂਪ, ਤੱਤਾਂ ਬਾਰੇ ਜਾਂ ਇਨ੍ਹਾਂ ਵਿਚਕਾਰ ਸਮਾਨਤਾਵਾਂ ਜਾਂ ਅੰਤਰਾਂ ਬਾਰੇ ਹੋਣਗੇ। 10 ਅੰਕ
3. ਭਾਗ ਓ-2 ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਇੱਕ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ। ਨਾਵਲ ਬਾਰੇ ਪਾਠਕੀ ਹੁੰਗਾਰਾ, ਨਾਵਲ ਬਾਰੇ ਵਿਦਿਆਰਥੀ ਦੇ ਪ੍ਰਭਾਵ, ਨਾਵਲ ਦੇ ਮੰਤਵ ਅਤੇ ਜੀਵਨ ਨੂੰ ਸਮਝਣ ਵਿਚ ਨਾਵਲ ਦੇ ਮਹੱਤਵ ਬਾਰੇ ਪ੍ਰਸ਼ਨ ਪੁੱਛਿਆ ਜਾ ਸਕਦਾ ਹੈ। ਇਸ ਭਾਗ ਵਿਚ ਪਾਤਰਾਂ ਬਾਰੇ ਵੀ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾ ਸਕਦੇ ਹਨ। ਨਾਵਲ ਦੇ ਵਿਸ਼ੇ-ਵਸਤੂ, ਵਿਚਾਰਧਾਰਾ, ਸਮਕਾਲੀ ਜੀਵਨ ਵਿਚ ਨਾਵਲ ਦੇ ਵਿਸ਼ੇ ਦੇ ਮਹੱਤਵ, ਪਾਤਰਾਂ ਦੀ ਘਾਤਤ, ਮਨਪਸੰਦ ਪਾਤਰ, ਪਾਤਰਾਂ ਦੇ ਸੁਭਾਅ ਦਾ ਵਿਸ਼ਲੇਸ਼ਣ ਕਰਨ ਲਈ ਕਿਹਾ ਜਾ ਸਕਦਾ ਹੈ। ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਬਨਾਉਣ ਲੱਗਿਆਂ ਧਿਆਨ ਰੱਖਿਆ ਜਾਵੇ ਕਿ ਵਿਦਿਆਰਥੀ ਦੇ ਆਪਣੇ ਵਿਚਾਰਾਂ ਦੇ ਪ੍ਰਗਟਾਵੇ ਨੂੰ ਉਤਸ਼ਾਹਿਤ ਕੀਤਾ ਜਾਵੇ। 15 ਅੰਕ
4. ਭਾਗ ਅ-1 ਵਿਚ ਦਰਜ ਪੱਤਰਕਾਰੀ ਰੂਪਾਂ ਦੀ ਪਰਿਭਾਸ਼ਾ, ਸਰੂਪ, ਪ੍ਰਕਾਰਜ ਅਤੇ ਮਹੱਤਵ ਦੇ ਨਾਲ ਨਾਲ ਇਨ੍ਹਾਂ ਰੂਪਾਂ ਦੇ ਆਪਸੀ ਨਿਖੇੜੇ ਬਾਰੇ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾ ਸਕਦੇ ਹਨ। ਇਸ ਭਾਗ ਵਿਚੋਂ ਕੁਲ 2 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ। 10 ਅੰਕ
5. ਭਾਗ ਅ-2 ਵਿਚੋਂ ਵੀ 2 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ। 10 ਅੰਕ
6. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਭਾਗ ਏ ਵਿਚ ਪਾਠਕ੍ਰਮ ਦੇ ਭਾਗ ਓ ਅਤੇ ਅ ਦੇ ਸਾਰੇ ਭਾਗਾਂ ਵਿਚੋਂ 15 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਵਿਦਿਆਰਥੀ ਨੇ ਇਨ੍ਹਾਂ ਸਾਰੇ ਪ੍ਰਸ਼ਨਾਂ ਦਾ ਉੱਤਰ 4-6 ਸਤਰਾਂ ਵਿਚ ਦੇਣਾ ਹੋਵੇਗਾ। 15x2=30 ਅੰਕ

#### ਸਹਾਇਕ ਪਾਠ ਸਮੱਗਰੀ

1. ਰਾਜਿੰਦਰਪਾਲ ਸਿੰਘ ਬਰਾੜ, ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ, ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਸਾਹਿਤ ਰੂਪਾਕਾਰ: ਸਿਧਾਂਤ ਅਤੇ ਰੂਪਾਂਤਰਣ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2011
2. ਸਾਹਿਤ ਕੋਸ਼, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 1989
3. ਡਾ. ਪਰਮਿੰਦਰ ਸਿੰਘ ਤੇ ਕਿਰਪਾਲ ਸਿੰਘ ਕਸੇਲ, ਸਾਹਿਤ ਦੇ ਰੂਪ, ਲਹੌਰ ਬੁੱਕ ਸ਼ਾਪ, 1977
4. ਡਾ. ਟੀ. ਆਰ. ਵਿਨੋਦ, ਨਾਵਲ ਆਲੋਚਨਾ ਸ਼ਬਦਾਵਲੀ ਕੋਸ਼, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 1999
5. ਗਿ. ਲਾਲ ਸਿੰਘ ਤੇ ਹਰਕੀਰਤ ਸਿੰਘ, ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ, ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀਵਰਸਿਟੀ ਟੈਕਸਟਬੁੱਕ ਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ
6. ਗੁਰਮੀਤ ਸਿੰਘ, ਲੋਕਧਾਰਾ ਦੇ ਕੁਝ ਪੱਖ, ਦ ਪੰਜਾਬੀ ਰਾਈਟਰਜ਼ ਕੋਆਪਰੇਟਿਵ, ਲੁਧਿਆਣਾ



ਬੀ.ਐਸ.ਸੀ. ਭਾਗ ਦੂਜਾ, ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ  
2021-22, 2022-23 ਅਤੇ 2023-24 ਸੈਸ਼ਨ ਲਈ  
(ਸਮੈਸਟਰ ਚੌਥਾ)

ਕੁਲ ਅੰਕ : 100

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 25 ਅੰਕ

ਬਾਹਰੀ ਪਰੀਖਿਆ: 75 ਅੰਕ

ਸਮਾਂ : 3 ਘੰਟੇ

ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 40

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 10

ਬਾਹਰੀ ਪਰੀਖਿਆ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 30

(ਅਧਿਆਪਨ: 50 ਪੀਰੀਅਡ, 6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

**ਪਾਠਕ੍ਰਮ ਦੀ ਰੂਪ-ਰੇਖਾ ਅਤੇ ਅੰਕ ਵੰਡ**

ਭਾਗ-ੳ

ਵਿਗਿਆਨਕ ਵਾਰਤਕ ਦੀ ਕਿਤਾਬ: ਉੱਪ ਪਤਾਲ, ਗੁਰਮੁਖ ਸਿੰਘ ਬੇਦੀ, ਪੰਜਾਬੀ ਸਾਹਿਤ ਅਕਾਡਮੀ, ਲੁਧਿਆਣਾ

ਭਾਗ-ਅ

ਅ-1: ਕੰਪਿਊਟਰ ਸਿਖਲਾਈ:

ੳ) ਗੁਰਮੁਖੀ ਫ਼ੋਂਟ: ਆਰੰਭ ਅਤੇ ਵਿਕਾਸ

ਅ) ਫ਼ੋਂਟ ਬਦਲੀ (ਕਨਵਰਟਰ): ਮੁੱਢਲੀ ਜਾਣਕਾਰੀ

ੲ) ਯੂਨੀਕੋਡ ਪ੍ਰਣਾਲੀ ਨਾਲ ਜਾਣ-ਪਛਾਣ

(ਇਸ ਹਿੱਸੇ ਲਈ ਵਿਦਿਆਰਥੀ ਅਭਿਆਸ-ਪੁਸਤਕ ਤਿਆਰ ਕਰੇਗਾ, ਇਹ ਅਭਿਆਸ ਪੁਸਤਕ ਸੈਫਟ ਰੂਪ ਵਿਚ ਹੋਵੇਗੀ।

ਅਧਿਆਪਕ ਉਸ ਦੇ ਸੈਫਟ ਰੂਪ ਦਾ ਮੁਲਾਂਕਣ ਕਰੇਗਾ ਪਰ ਵਿਦਿਆਰਥੀ ਰਿਕਾਰਡ ਹਿਤ ਇਸ ਦਾ ਪ੍ਰਿੰਟ ਕਢਵਾ ਕੇ

ਅਧਿਆਪਕ ਨੂੰ ਜਮ੍ਹਾਂ ਕਰਵਾਏਗਾ। ਉਹ ਆਪਣੇ ਮੁੱਖ ਵਿਸ਼ੇ ਨਾਲ ਸੰਬੰਧਿਤ 20 ਤੋਂ 25 ਪੰਨੇ (ਰਾਵੀ ਯੂਨੀਕੋਡ ਫ਼ੋਂਟ ਮਾਪ

12, ਸਤਰਾਂ ਵਿਚ ਵਿੱਥ 1.5, ਡਿਫ਼ਾਲਟ ਪੇਜ ਸੈਟਿੰਗ) ਲਿਖੇਗਾ, ਜਿਸ ਵਿਚ ਘੱਟ ਤੋਂ ਘੱਟ 10 ਲਿਖਤਾਂ ਜ਼ਰੂਰ ਹੋਣ।

ਅ-2 ਵਿਆਕਰਣ:

ੳ) ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ: ਨਾਂਵ, ਪੜਨਾਂਵ, ਕਿਰਿਆ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸੰਬੰਧਕ, ਯੋਜਕ

ਅ) ਵਿਆਕਰਣਕ ਵਰਗ: ਲਿੰਗ, ਵਚਨ, ਕਾਲ, ਕਾਰਕ, ਪੁਰਖ, ਵਾਚ, ਪੱਖ (ਇਨ੍ਹਾਂ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਹਵਾਲੇ ਨਾਲ ਇਨ੍ਹਾਂ ਦੀ ਸਮਝ)

ੲ) ਗੁਰਬਾਣੀ ਵਿਆਕਰਣ ਨਾਲ ਜਾਣ-ਪਛਾਣ (ਭੂਮਿਕਾ (ਪੰਨਾ ੳ ਤੋਂ ੲ ਤਕ) ਸ਼ਬਦਾਰਥ ਸ੍ਰੀ ਗੁਰੂ ਗ੍ਰੰਥ

ਸਾਹਿਬ ਜੀ, ਪੇਥੀ ਪਹਿਲੀ, (ਪ੍ਰਕਾਸ਼ਕ ਸ਼੍ਰੋਮਣੀ ਗੁਰਦੁਆਰਾ ਪ੍ਰਬੰਧਕ ਕਮੇਟੀ, ਸ੍ਰੀ ਅੰਮ੍ਰਿਤਸਰ) ਦੇ ਪ੍ਰਸੰਗ

ਵਿਚ)

ਭਾਗ-ੲ

ਭਾਗ ੳ ਅਤੇ ਅ ਵਿਚੋਂ ਸੰਖੇਪ ਉਤਰਾਂ ਵਾਲੇ ਪ੍ਰਸ਼ਨ।

ਅੰਕ-ਵੰਡ ਅਤੇ ਪੇਪਰ ਸੈੱਟਰਾਂ ਲਈ ਹਦਾਇਤਾਂ

1. ਭਾਗ ਓ ਵਿਚੋਂ ਕਿਸੇ ਲੇਖ ਦਾ ਵਿਸ਼ਾ ਵਸਤੂ/ਸਾਰ/ ਵਿਗਿਆਨਕ ਸੋਝੀ/ ਲੇਖ ਦਾ ਸੁਨੇਹਾ ਅਤੇ ਲੇਖ ਵਿਚਲੀ ਵਿਗਿਆਨਕ ਸੋਝੀ ਦਾ ਜੀਵਨ ਵਿਚ ਮਹੱਤਵ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ) 15 ਅੰਕ
2. ਭਾਗ ਓ ਵਿਚੋਂ ਹੀ 4 ਪ੍ਰਸ਼ਨ ਦੇ ਕੇ ਉਨ੍ਹਾਂ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ  $2 \times 5 = 10$  ਅੰਕ
3. ਭਾਗ ਅ-1 ਦੇ ਕੰਪਿਊਟਰ ਸਿਖਲਾਈ ਵਾਲੇ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਉੱਤਰ ਲਿਖੇਗਾ। 10 ਅੰਕ
4. ਭਾਗ ਅ-2 ਵਿਚਲੇ ਵਿਆਕਰਣ ਨਾਲ ਸੰਬੰਧਿਤ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ 4 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ 2 ਦਾ ਉੱਤਰ ਲਿਖੇਗਾ।  $2 \times 5 = 10$  ਅੰਕ
5. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਭਾਗ ਏ ਵਿਚ 15 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਸਾਰਿਆਂ ਦੇ ਵਿਦਿਆਰਥੀ ਨੇ ਸੰਖੇਪ ਉੱਤਰ ਲਿਖਣੇ ਹੋਣਗੇ। ਇਹ ਪ੍ਰਸ਼ਨ ਪਾਠਕ੍ਰਮ ਦੇ ਭਾਗ ਓ, ਅ-1 ਅਤੇ ਅ-2 ਵਿਚ ਦਰਜ ਵਿਸ਼ਿਆਂ ਦੇ ਆਧਾਰ 'ਤੇ ਹੋਣਗੇ  $15 \times 2 = 30$  ਅੰਕ

#### ਸਹਾਇਕ ਪਾਠ-ਸਮੱਗਰੀ

1. ਡਾ. ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ ਅਤੇ ਹੋਰ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਣ ਭਾਗ-1, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ ਜਲੰਧਰ, 1991, ਪੰਨਾ 67-73
2. ਡਾ. ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ ਅਤੇ ਹੋਰ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਣ ਭਾਗ-1।, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ ਜਲੰਧਰ, 1992
3. ਗਿ. ਲਾਲ ਸਿੰਘ ਤੇ ਹਰਕੀਰਤ ਸਿੰਘ, ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ, ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀ. ਟੈਸਕਟ ਬੁੱਕ ਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ
4. ਸੀ. ਪੀ. ਕੰਬੋਜ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਕੰਪਿਊਟਰੀਕਰਨ, ਗਰੇਸੀਅਸ ਬੁੱਕਸ, ਪਟਿਆਲਾ
5. ਸੀ. ਪੀ. ਕੰਬੋਜ, ਕੰਪਿਊਟਰ ਵਿਗਿਆਨ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ



**B.Sc.-II (Chemistry) Semester III & IV**  
**2021-22**

**SEMESTER III**

Paper	Title	Max. Marks	Sem. Paper	Int. Asstt.	Pass Percentage
I	INORGANIC CHEMISTRY	35	26	09	35%
II	ORGANIC CHEMISTRY	35	26	09	35%
III	PHYSICAL CHEMISTRY	35	26	09	35%
I	PRACTICAL CHEMISTRY-I	45	16 (Pass Marks)		35%

**SEMESTER IV**

Paper	Title	Max. Marks	Sem. Paper	Int. Asstt.	Pass Percentage
I	INORGANIC CHEMISTRY	35	26	09	35%
II	ORGANIC CHEMISTRY	35	26	09	35%
III	PHYSICAL CHEMISTRY	35	26	09	35%
I	PRACTICAL CHEMISTRY-II	45	16 (Pass Marks)		35%

**B.Sc.-II (Chemistry) 2021-22, 2022-23 & 2023-24**

**CHEMISTRY**  
**SEM-III**

**PAPER-I**  
**INORGANIC CHEMISTRY**

Max Marks : 35  
Semester Paper : 26  
Internal Assessment: 9  
Pass Marks : 35%

30 hours  
Time allowed - 3 hrs  
3 period/week

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 4 marks each. Section C will consist of 5 short answer questions that will cover the entire syllabus and will be of 2 marks each. Use of scientific non-programmable calculator is allowed.

**INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions selecting two questions from each of A & B Sections and Section C 9th question being compulsory.

**SECTION-A**

**I. Chemistry of Elements of First Transition Series**

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. (10 Hrs.)

Professor & Head  
Deptt. of Chemistry  
Punjab University, Patiala









## II. Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds. (5 Hrs.)

### SECTION-B

## III. Chemistry of Elements of Second and Third Transition Series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states. Magnetic behaviour, spectral properties & stereochemistry (10 Hrs.)

## IV. Chemistry of Actinides Elements

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides. (5 Hrs.)

### CHEMISTRY SEM-III

#### PAPER II : ORGANIC CHEMISTRY

Max Marks : 35

Semester Paper : 26

Internal Assessment: 9

Pass Marks : 35%

30 hours

Time allowed - 3 hrs

3 period/week

#### INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 4 marks each. Section C will consist of 5 short answer questions that will cover the entire syllabus and will be of 2 marks each. Use of scientific non-programmable calculator is allowed.

#### INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of A & B Sections and Section C 9th question being compulsory.

#### Section - A

##### I. Alcohols

Classification and nomenclature.

Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols.

Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with  $[Pb(OAc)_4]$  and  $HIO_4$  and Pinacol-Pinacolone rearrangement.

Trihydric alcohol-nomenclature, methods of formation and chemical reactions of

glycerol.

(7 Hrs.)

## II.- Phenols

Nomenclature, structure and bonding. Preparation of Phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation Mechanisms of Fries rearrangement. Gatterman synthesis, Hauben. Hostch reaction. Lederer-Mianasse reaction and Reimer-Tiemann reaction.

(8 Hrs.)

## Section - B

## III. Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3- dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties and Mechanism of nucleophilic addition to carbonyl group with particular emphasis of Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (Meerwein Ponderoff Vorley) reaction, Clemmensen, Wolff-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reductions. Halogenation of enolizable ketones.

An Introduction to  $\alpha$ ,  $\beta$  unsaturated aldehydes and ketones, Michael addition.

(15 Hrs.)

## CHEMISTRY SEM-III

### PAPER III : PHYSICAL CHEMISTRY

Max Marks : 35  
Semester Paper : 26  
Internal Assessment: 9  
Pass Marks : 35%

30 hours  
Time allowed - 3 hrs  
3 period/week

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 4 marks each. Section C will consist of 5 short answer questions that will cover the entire syllabus and will be of 2 marks each. Use of scientific non-programmable calculator is allowed.

### INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of A & B Sections and Section C 9th question being compulsory.



## Section - A

### I. Thermodynamics-I

Definition of thermodynamics terms: system, surroundings. Types of systems, intensive and extensive properties. State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermochemistry.

First Law of Thermodynamics : statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of  $w$ ,  $q$ ,  $dU$  &  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

(10 Hrs.)

### II. Thermodynamics-II- (Part-a)

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

(5 Hrs.)

## SECTION-B

### III. Thermodynamics-II- (Part-b)

Concept of entropy as a state function, entropy as a function of  $V$  &  $T$ , entropy as a function of  $P$  &  $T$ , entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

(5 Hrs.)

### IV. Thermodynamics-III

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function ( $G$ ) and Helmholtz function ( $A$ ) as thermodynamic quantities.  $A$  &  $G$  as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of  $G$  and  $A$  with  $P$ ,  $V$  and  $T$ .

(5 Hrs.)

### V. Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action. Le Chatelier's principle.

Reaction isotherm and reaction isochore-Claapeyron equation and Clausius-Clapeyron equation.

(5 Hrs.)

  
Professor & Head,  
Deptt. of Chemistry  
Punjab University, Patiala



**B.Sc.-II**  
**PRACTICALS CHEMISTRY-I**  
**Sem.-III**

Max. Marks: 45  
Time: 4 Hrs.  
Pass Percentage: 35%

6 Periods/week

**\*Volumetric Analysis and TLC**  
**Volumetric Analysis**

- (a) Determination of acetic acid in commercial vinegar using NaOH, Alkalinity of water sample.
- (b) Determination of alkaline content of antacid.
- (c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- (d) Estimation of hardness of water by EDT A.
- (e) Estimation of ferrous and ferric by dichromate method.
- (f) Estimation of copper using sodium thiosulphate.

**Organic Chemistry**

**Laboratory Techniques**

Thin Layer Chromatography

Determination of  $R_f$  values of different components.

- (a) Separation of green leaf pigments (spinach leaves may be used)
- (b) Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzophenone and cyclohexanone using toluene and light petroleum mixture (40 : 60).
- (c) Separation of a mixture of dyes.

**PRACTICALS**

**INSTRUCTIONS FOR EXAMINERS AND CANDIDATES**

The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from volumetric Analysis and TLC. Distribution of marks will be as under (Books may be consulted):

(1)	Volumetry analysis	=	20 marks
			{Initial write up 7 marks
			(Volumetry; equation:1,
			Indicator:1, end point:1 and general
			calculations:4)
			Performance and results 13 marks
			(initial burette reading:2, final
			reading:2, end point:2 calculations
			and result:7)}
(2)	TLC	=	10 marks (Performance and result)
(3)	Viva-Voce	=	10 marks
(4)	Note Books	=	5 marks
	<b>Total</b>	=	<b>45 marks</b>

**CHEMISTRY**  
**SEM-IV**

**PAPER I : INORGANIC CHEMISTRY**

**Max Marks : 35**  
**Semester Paper : 26**  
**Internal Assessment: 9**  
**• Pass Marks : 35%**

**30 hours**  
**Time allowed - 3 hrs**  
**3 period/week**

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 4 marks each. Section C will consist of 5 short answer questions that will cover the entire syllabus and will be of 2 marks each. Use of scientific non-programmable calculator is allowed.

**INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions selecting two questions from each of A & B Sections and Section C 9th question being compulsory.

**Section - A**

**I. Coordination Compounds**

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. (10 Hrs.)

**II. Oxidation and Reduction**

Use of redox potential data-analysis of redox cycle, redox stability of water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements. (5 Hrs.)

**Section - B**

**III. Acids and Bases**

Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases. (7Hrs.)

**IV. Non-aqueous Solvents**

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$  (8 Hrs.)

  
**Professor & Head;**  
**Dept. of Chemistry**  
**Punjabi University, Patiala**



**CHEMISTRY  
SEM-IV**

**PAPER II : ORGANIC CHEMISTRY**

**Max Marks : 35  
Semester Paper : 26  
Internal Assessment: 9  
Pass Marks : 35%**

**30 hours  
Time allowed - 3 hrs  
3 period/week**

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 4 marks each. Section C will consist of 5 short answer questions that will cover the entire syllabus and will be of 2 marks each. Use of scientific non-programmable calculator is allowed.

**INSTRUCTIONS FOR THE CANDIDATES**

Candidates are required to attempt five questions selecting two questions from each of A & B Sections and Section C 9th question being compulsory.

**Section - A**

**I. Carboxylic Acids**

Nomenclature, structure and bonding. physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation.

Methods of formation and chemical reactions of Halo acids and Hydroxyacids. Maleic acid, tartaric acid and citric acid. (Structural Formula only).

Methods of formation and chemical reaction of unsaturated monocarboxylic acids. Dicarboxylic acids, methods of formation and effect of heat and dehydrating agents. (10 Hrs.)

**II. Carboxylic Acid Derivatives**

Structure and nomenclature of acid chlorides, esters. amides and acid anhydrides. Relative stability and reactivity of acyl derivatives.

Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterification and hydrolysis (acidic and Basic). (5 Hrs.)

**SECTION-B**

**III. Ethers and Epoxides**

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions-cleavage and autooxidation, Ziesel's Method.

Synthesis of epoxides, acid and base catalysed ring opening of epoxide, orientation of ring opening reactions of Grignard and organolithium reagents with epoxide. (3 Hrs.)



#### IV. Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates. (3 Hrs.)

#### V. Organic Compounds of Nitrogen

##### a) Nitro Compounds

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media, Picric acid. (4 Hrs.)

##### b) Amines

Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting the basicity of amines. Amine salts as phase-transfer catalyst and preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hoffmann bromamide reaction. (5 Hrs.)

### CHEMISTRY SEM-IV

#### PAPER III : PHYSICAL CHEMISTRY

Max Marks : 35  
Semester Paper : 26  
Internal Assessment: 9  
Pass Marks : 35%

30 hours  
Time allowed - 3 hrs  
3 period/week

#### INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 4 marks each. Section C will consist of 5 short answer questions that will cover the entire syllabus and will be of 2 marks each. Use of scientific non-programmable calculator is allowed.

#### INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of A & B Sections and Section C 9th question being compulsory.

#### Section - A

##### I. Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems.

Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag systems, desilverisation of lead.

Solid Solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H<sub>2</sub>O), (FeCl<sub>3</sub>-H<sub>2</sub>O) systems. Freezing mixtures,

acetone-dry ice.

Partially miscible liquids: Lower and upper consolute temperature, Effect of impurity on consolute temperature. Immiscible liquids, steam distillation.

Nernst distribution law, thermodynamic derivation & applications. (10 Hrs.)

## II. Electrochemistry-I (a)

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution.

Migration of ions and Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elemental treatment only). (5 Hrs.)

## SECTION-B

## III. Electrochemistry-I (b)

Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of  $K_a$  of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations. (5 Hrs.)

## IV. Electrochemistry-II

Types of reversible electrodes--gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode. potential, sign conventions, electrochemical series and its significance.

Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction ( $G$ ,  $H$  and  $K$ ), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations.

Definition of pH and pK., determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers--mechanism of buffer action, Henderson-Hassel equation, Hydrolysis of salts, Corrosion-types, theories and methods of combating it. (10 Hrs.)

## B.Sc.-II PRACTICALS CHEMISTRY-II Sem.-IV

Max. Marks: 45

6 Periods/week

Time: 4 Hrs.

Pass marks: 35%

## Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in



simple organic compounds.

### Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine  $\Delta H$  of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride.

### INSTRUCTIONS FOR EXAMINERS AND CANDIDATES

The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from Qualitative Organic Analysis and Physical Chemistry Experiments. Distribution of marks will be as under (Books may be consulted):

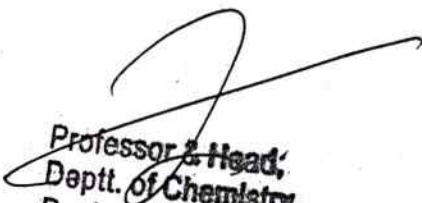
(1)	Organic Qualitative Analysis	=	15 marks (Detection of elements identification and confirmation of functional group by 2 confirmatory tests.)
(2)	Physical Chemistry Experiment	=	15 marks {Initial Write up 5 marks (Theory/principle:1, Procedure:2, General Calculations:2) Performance and result: 10 marks (Full credit up to 10% error)}
(3)	Viva-Voce	=	10 marks
(4)	Note Books	=	5 marks
	<b>Total</b>	=	<b>45 marks</b>


### BOOKS SUGGESTED (THEORY COURSES)

1. *Basic Inorganic Chemistry*. F.A. Cotten. G. Wilkinson and P.L. Gaus. Wiley.
2. *Concise Inorganic Chemistry*. 1.D. Lee. ELBS.
3. *Concepts of Models of Inorganic Chemistry*. B. Doaglas. D. McDaniel and 1. Alexander, John Wiley.
4. *Inorganic Chemistry*. D.E. Shriver, P. W. Aikins and C.H. Langford. <Oxford.
5. *Inorganic Chemistry*. W. W. Porterfield Addison. Wesley.
6. *Inorganic Chemistry*. A.G. Sharpe, ELBS.
7. *Inorganic Chemistry*. G.L. Miessler and O.A. Tarr, Prentice Hall.
8. *Organic Chemistry*. Morrison and Boyd, Prentice Hall.
9. *Organic Chemistry*. L.G. Wade Jr. Prentice Hall.
10. *Fundamentals of Organic Chemistry*. Solomons, John Wiley.
11. *Organic Chemistry*. Vol. I, II & III. S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
12. *Organic Chemistry*. F.A. Aarey, McGraw Hill India.
13. *Introduction to Organic Chemistry*. Stretwieser, Heathcock and Kosover, Machmilan.
14. *Physical Chemistry*. G.M. Barrow, International Student Edition. McGraw Hill.
15. *Basic Programming with Application*. V.K. Jain, I'ata McGraw Hill.
16. *Computers and Common. Sense*. B. Ryal and Shely, Prentice Hall.



17. *University General Chemistry*. C.N.B. Rao. Macmillan.  
18. *Physical Chemistry*. R.A. Alberty, Wiley Eastern Ltd.  
19. *The Elements of Physical Chemistry*, P.w. Aikins, Oxford.  
20. *Physical Chemistry Through Problems*. S.K. Dogra and S. Dogra. Wiley Eastern Ltd.

  
Professor & Head,  
Deptt. of Chemistry  
Punjab University, Patiala





## **SCHEME**

### **B.Sc. (Physics) Part-II (IIIrd and IVth Semester)**

#### **SESSION 2021-22, 2022-23, 2023-24**

Code	Title of Paper	No of Lectures	Max Marks		Examination Time (Hours)	
SEMESTER -I			Total	Ext.	Int.	
Paper- I	Statistical Physics and Thermodynamics-I	40	40	30	10	03
Paper- II	Optics	40	40	30	10	03
Paper - III	Quantum Mechanics-I	40	40	30	10	03
Paper - IV	Physics Practical Lab	80	30	22	08	03
SEMESTER -II						
Paper- I	Statistical Physics and Thermodynamics-II	40	40	30	10	03
Paper - II	Lasers	40	40	30	10	03
Paper - III	Quantum Mechanics-II	40	40	30	10	03
Paper - IV	Physics Practical Lab	80	30	22	08	03

#### **General Instructions**

- 1) There will be three papers of theory and one laboratory (practical) course.
- 2) The number of lectures per week will be three for each theory paper.
- 3) The number of lectures per week will be six for practicals.
- 4) The examination time for each theory will be 3 hours.
- 5) The examination time for practical will also be 3 hours.
- 6) The use of nonprogrammable calculator will be allowed in the examination centre but this will not be provided by the University/College.
- 7) Each theory paper will consist of three sections A, B and C. Section C is compulsory
- 8) Use of scientific nonprogrammable calculator is allowed in practicals also.

#### **SECTION A**

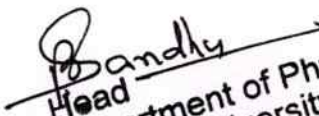
There will be four questions. Each question will carry five marks. Two questions are to be attempted

#### **SECTION B**

There will be four questions. Each question will carry five marks. Two questions are to be attempted.

#### **SECTION C**

There will be seven questions of short answer type covering the whole syllabi. Each question will carry two marks. Any five questions are to be attempted.

  
Head  
Department of Physics  
Punjabi University  
Patiala-147002

## SEMESTER - III

### PAPER-I: STATISTICAL PHYSICS AND THERMODYNAMICS-I

Maximum Marks:	External	30
	Internal	10
	Total	40

Time Allowed: 3 Hours  
Total Teaching hours: 40  
Pass Marks: 35 %

Out of 40 Marks, internal assessment (based on two mid-semester tests/internal examinations, written assignment/project work etc. and attendance) carries 10 marks, and the final examination at the end of the semester carries 30 marks.

#### Instruction for the Paper Setter

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from respective sections of the syllabus. Section C will have 07 short answer type questions (Candidate is to attempt any five questions), which will cover the entire syllabus uniformly. Each question of sections A and B carries 05 marks. Section C will carry 10 marks and each question is of 2 marks.

#### Instruction for the candidates

- 1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and consist of seven questions (Candidate has to attempt any five questions).
- 2) Use of nonprogrammable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION - A

Basic ideas of statistical physics, Scope of statistical physics, Basic ideas about probability, distribution of four distinguishable particles in two compartment of equal size. Concept of macro states, microstates, thermodynamic probability, Effects of constraints on the system, Distribution of  $n$  particles in two compartments, Deviation from the state of maximum probability, equilibrium state of dynamic system, Distribution of distinguishable  $n$  particles in  $k$  compartments of unequal sizes.

#### SECTION - B

Phase space and its division into elementary cells, Three kinds of statistics. The basic approach in the three statistics, Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of Maxwell Boltzman law of distribution of molecular speeds, Need for quantum statistics-Bose-Einstein (B.E.) statistics, Derivation of Planck's law of radiation, Deduction of Wien's displacement law and Stefan's law from Planck's law, Fermi-Dirac (F.D.) statistics, Comparison of M.B., B.E. and F.D. statistics.

#### Text Books:

1. Statistical Physics and Thermodynamics, V.S. Bhatia (Sohan Lal Nagin Chand, Jalandhar)
2. Statistical Physics and Thermodynamics, A.K. Sikri (Pardeep Publication, Jalandhar)
3. A Treatise on Heat, M.N. Saha & B.N. Srivastava, (The Indian Press Pvt. Ltd., Allahabad) 1965.

#### Reference Books

1. Statistical Mechanics: An Introductory Text, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
2. Statistical Physics, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
3. Statistical Mechanics, B.B. Laud (Macmillan India Ltd), 1981.

  
Head  
Department of Physics  
Punjabi University  
Patiala-147002



## PAPER-II: OPTICS

Maximum Marks:	External	30
	Internal	10
	Total	40

Time Allowed: 3 Hours  
Total Teaching hours: 40  
Pass Marks: 35%

Out of 40 Marks, internal assessment (based on two mid-semester tests/internal examinations, written assignment/project work etc. and attendance) carries 10 marks, and the final examination at the end of the semester carries 30 marks.

### Instruction for the Paper Setter

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from respective sections of the syllabus. Section C will have 07 short answer type questions (Candidate is to attempt any five questions), which will cover the entire syllabus uniformly. Each question of sections A and B carries 05 marks. Section C will carry 10 marks and each question is of 2 marks.

### Instruction for the candidates

- 1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and consist of seven questions (Candidate has to attempt any five questions).
- 2) Use of nonprogrammable calculator is allowed in the examination centre but this will not be provided by the University/College.

### SECTION - A

**Interference:** Concept of coherence, Spatial and temporal coherence. Coherence time, Coherence length, Area of coherence, Conditions for observing interference fringes, Interference by wave front division and amplitude division, Michelson's interferometer—working, Principle and nature of fringes, Interference in thin films, Role of interference in anti-reflection and high reflection dielectric coatings. Multiple beam interference, Fabry-Perot interferometer, Nature of fringes, Newton Rings.

### SECTION - B

**Diffraction:** Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at rectangular and circular apertures, Effects of diffraction in optical imaging, resolving power of telescope. The diffraction grating, its use as a spectroscopic element and its resolving power.

**Polarization:** Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Sheet polarizer, Retardation plates, Production and analysis of polarized light (quarter and half wave plates).

#### Text Books:

1. Fundamentals of Optics, F.A. Jenkins and Harvery E. White (McGraw Hill) 4th edition, 2001.
2. Optics, Ajoy Ghatak (McMillan India) 2nd edition, 7th reprint 1997.
3. Introduction to Atomic Spectra, H.E. White (McGraw Hill Book Co.)

#### Reference Book:

1. Optics, Born and Wolf (Pergamom Press), 3rd edition, 1965.

Head  
Department of Physics  
Punjabi University  
Patiala-147002

### PAPER-III: QUANTUM MECHANICS-I

Maximum Marks:	External	30
	Internal	10
	Total	40

Time Allowed: 3 Hours  
Total Teaching hours: 40  
Pass Marks: 35%

Out of 40 Marks, internal assessment (based on two mid-semester tests/internal examinations, written assignment/project work etc. and attendance) carries 10 marks, and the final examination at the end of the semester carries 30 marks.

#### Instruction for the Paper Setter

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from respective sections of the syllabus. Section C will have 07 short answer type questions (Candidate is to attempt any five questions), which will cover the entire syllabus uniformly. Each question of sections A and B carries 05 marks. Section C will carry 10 marks and each question is of 2 marks.

#### Instruction for the candidates

- 1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and consist of seven questions (Candidate has to attempt any five questions).
- 2) Use of nonprogrammable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION - A

**Formalism of Wave Mechanics:** Brief introduction to need and development of quantum mechanics, Wave-particle duality, de-Broglie hypothesis, Complimentarity and uncertainty principle, Gaussian wave-packet, Schrodinger equation for a free particle, operator correspondence and equation for a particle subject to forces. Normalization and probability  
Interpretation of wave function, Super position principle, Expectation value, probability current and conservation of probability, Admissibility conditions on the wave function. Ehrenfest theorem, Fundamental postulates of wave mechanics, Eigen functions and eigen values. Operator formalism, Orthogonal systems, Expansion in eigen functions, Hermitian operators. Simultaneous eigen functions. Equation of motion.

#### SECTION - B

**Problems in one and three dimensions:** Time dependent Schrodinger equation. Application to stationary states for one dimension, Potential step, Potential barrier, Rectangular potential well, Degeneracy, Orthogonality, Linear harmonic oscillator, Schrodinger equation for spherically symmetric potential, Spherical harmonics. Hydrogen atom energy levels and eigen functions. Degeneracy, Angular momentum.

#### Text Books:

1. Quantum Mechanics by V.K. Thankappan.
2. A Text Book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, (Tata McGraw Hill Pub. Co. Delhi), 2002.
3. Quantum Mechanics, J.L. Powell and B. Crasemann (Narosa Pub. House, N. Delhi) 1997.

Head  
Department of Physics  
Punjabi University  
Patiala-147002



## PAPER- IV: PHYSICS PRACTICAL LAB

### General Guidelines for Physics Practical Examination

Maximum Marks:	External	22
	Internal	08
	Total	30

1. The student will be asked to perform one experiment out of the experiments mentioned in the syllabus.
2. The distribution of marks is as follows:
  - (i) One full experiment requiring the student to take some data, analyse it and draw conclusions-(candidates are expected to state their results with limits of error. (10)
  - (ii) Brief theory (04)
  - (iii) Viva-Voce (04)
  - (iv) Record (Practical File) (04)
3. There will be one session of 03 hours duration. The paper will consist of 08 experiments out of which an examinee will mark 06 experiments and one of these is to be allotted by the external examiner.
4. Number of candidates in a group for practical examination should not exceed 12.
5. In a single group, no experiment is allotted to more than three students in any group.
6. The student should determine Standard Deviations and probable error in the calculations wherever needed.

### LIST OF EXPERIMENTS

1. Adiabatic expansion of a gas
2. Thermal expansion of crystal using interference fringes
3. Probability distribution using coloured dice coins.
4. To determine the refractive index of liquid using spectrometer
5. To determine the Cauchy's constants
6. To study the refractive index of doubly refracting prism
7. To determine the wave length of a given light using bi-prism
8. To determine the resolving power of a telescope
9. To determine the principal points of a lens system
10. Study the photoelectric effect and determine the value of Planck's constant
11. To study the gas discharge spectrum of hydrogen
12. To determine the angle of wedge using interference method

### Text and Reference Books:

1. A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal.
2. B.Sc. Practical Physics, C.L. Arora.

  
Head  
Department of Physics  
Punjab University  
Patiala-147002



## SEMESTER-IV

### PAPER-I: STATISTICAL PHYSICS AND THERMODYNAMICS-II

Maximum Marks : External 30  
Internal 10  
Total 40

Time Allowed: 3 Hours  
Total Teaching hours: 40  
Pass Marks: 35%

Out of 40 Marks, internal assessment (based on two mid-semester tests/internal examinations, written assignment/project work etc. and attendance) carries 10 marks, and the final examination at the end of the semester carries 30 marks.

#### Instruction for the Paper Setter

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from respective sections of the syllabus. Section C will have 07 short answer type questions (Candidate is to attempt any five questions), which will cover the entire syllabus uniformly. Each question of sections A and B carries 05 marks. Section C will carry 10 marks and each question is of 2 marks.

#### Instruction for the candidates

- 1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and consist of seven questions (Candidate has to attempt any five questions).
- 2) Use of nonprogrammable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION-A

Statistical definition of entropy, Change of entropy of a system, Additive nature of entropy, Law of increase of entropy, Reversible and irreversible process and their examples. Work done in a reversible process. Examples of increase of entropy in natural processes, Entropy and disorder, Brief review of terms and laws of thermodynamics, Carnot's cycle, Entropy changes in Carnot cycle. Applications of thermodynamics to thermoelectric effect. Change of entropy along a reversible path in a P.V. diagram, Entropy of a perfect gas, Equation of state of an ideal gas from simple statistical consideration, Heat death of the universe.

#### SECTION-B

Derivation of Maxwell's thermo dynamical relations, Cooling produced by adiabatic stretching, Adiabatic compression, Change of internal energy with volume, specific heat at constant pressure and constant volume, Expression for  $C_p - C_v$ , Change of state and Clayperon equation, Thermo dynamical treatment of Joule-Thomson effect, Use of Joule-Thomson effect, liquefaction of helium, Production of very low temperature by adiabatic demagnetization.

#### Text Books:

1. Statistical Physics and Thermodynamics, V.S. Bhatia (Sohan Lal Nagin Chand, Jalandhar)
2. Statistical Physics and Thermodynamics, A.K. Sikri (Pardeep Publication, Jalandhar)
3. A Treatise on Heat, M.N. Saha & B.N. Srivastava, (The Indian Press Pvt. Ltd., Allahabad) 1965.

#### Reference Books:

1. Statistical Mechanics: An Introductory Text, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
2. Statistical Physics, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
3. Statistical Mechanics, B.B. Laud (Macmillan India Ltd), 1981.

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Department of Physics  
Punjabi University  
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## PAPER-II: LASERS

Maximum Marks:	External	30
	Internal	10
	Total	40

Time Allowed: 3 Hours  
Total Teaching hours: 40  
Pass Marks: 35%

Out of 40 Marks, internal assessment (based on two mid-semester tests/internal examinations, written assignment/project work etc. and attendance) carries 10 marks, and the final examination at the end of the semester carries 30 marks.

### Instruction for the Paper Setter

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from respective sections of the syllabus. Section C will have 07 short answer type questions (Candidate is to attempt any five questions), which will cover the entire syllabus uniformly. Each question of sections A and B carries 05 marks. Section C will carry 10 marks and each question is of 2 marks.

### Instruction for the candidates

- 1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and consist of seven questions (Candidate has to attempt any five questions).
- 2) Use of nonprogrammable calculator is allowed in the examination centre but this will not be provided by the University/College.

### SECTION-A

**Laser Fundamentals** : Derivation of Einstein's relations. Concept of stimulated emission and population inversion. Broadening of spectral lines, natural, collision and Doppler broadening. Line width, Line profile, Absorption and amplification of a parallel beam of light passing through a medium. Threshold condition, Introduction of three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes.

### SECTION-B


**Laser Systems** : types of lasers, Ruby and Nd: YAG lasers, He-Ne and CO<sub>2</sub> lasers-construction, mode of creating population inversion and output characteristics. Semiconductor lasers, Dye lasers, Q-switching, Mode locking, Applications of lasers—a general outline. Basics of holography.

### Text Books:

1. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi, 1996.
2. Lasers and Non-linear Optics, B.B. Laud (New Age Pub.), 2002.

### Reference Book:

1. Lasers, Svelto (Plenum Press), 3rd Ed., New York.

  
Head  
Department of Physics  
Punjabi University  
Patiala-147002



## PAPER-III: QUANTUM MECHANICS-II

Maximum Marks: External 30  
Internal 10  
Total 40

Time Allowed: 3 Hours  
Total Teaching hours: 40  
Pass Marks: 35%

Out of 40 Marks, internal assessment (based on two mid-semester tests/internal examinations, written assignment/project work etc. and attendance) carries 10 marks, and the final examination at the end of the semester carries 30 marks.

### Instruction for the Paper Setter

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from respective sections of the syllabus. Section C will have 07 short answer type questions (Candidate is to attempt any five questions), which will cover the entire syllabus uniformly. Each question of sections A and B carries 05 marks. Section C will carry 10 marks and each question is of 2 marks.

### Instruction for the candidates

- 1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and consist of seven questions (Candidate has to attempt any five questions).
- 2) Use of nonprogrammable calculator is allowed in the examination centre but this will not be provided by the University/College.

### SECTION-A

**One Electron Atomic Spectra:** Excitation of atom with radiation. Transition probability, Spontaneous transition, Selection rules and life time, Spectrum of hydrogen atom. Frank Hertz Experiment, Line structure, Normal Zeeman effect, Electron spin, Stern Gerlach experiment, Spin orbit coupling (electron magnetic moment, total angular momentum), Hyperfine structure, Examples of one electron systems, Anomalous Zeeman effect, Lande-g factor (sodium D-lines).

### SECTION-B

**Many Electron System Spectra:** Exchange symmetry of wave functions, exclusion principle, Shells, Sub shells in atoms, atomic spectra (Helium), L.S. coupling, Selection rules, Regularities in atomic spectra, Interaction energy, X-ray spectra, Mosley law, Absorption spectra, Auger effect. Molecular bonding, Molecular spectra, Selection rules, Symmetric structures, Rotational, vibrational electronic level and spectra of molecules, Raman spectra.

### Text Books:

1. Concepts of Modern Physics, Arthur Beiser (McGraw Hill Pub. Co., Delhi, 9th ed.), 1995.
2. Elements of Modern Physics, S.H. Patil (McGraw Hill), 1998.

### Reference Books:

1. Quantum Mechanics, E. Merzbacher (John Wiley, 2nd ed.)
2. Fundamental of Molecular Spectroscopy, C.N. Banwell (Tata McGraw Hill Pub. Co., Delhi), 2001.
3. Atomic Spectra, H.G. Kuhn (Longmans), 2nd ed., 1969.
4. Introduction to Quantum Mechanics, L. Pauling and E.B. Wilson (Tata McGraw Hill Pub. Co., Delhi), 2002.
5. Quantum Mechanics, W. Greiner (Springer Verlag), 1994.

  
Head  
Department of Physics  
Punjabi University  
Patiala-147002



## PAPER-IV: PHYSICS PRACTICAL LAB

### General Guidelines for Physics Practical Examination

Maximum Marks:	External	22
	Internal	08
	Total	30

1. The student will be asked to perform one experiment out of the experiments mentioned in the syllabus.
2. The distribution of marks is as follows:
  - (i) One full experiment requiring the student to take some data, analyse it and draw conclusions-(candidates are expected to state their results with limits of error. (10)
  - (ii) Brief theory (04)
  - (iii) Viva-Voce (04)
  - (iv) Record (Practical File) (04)
3. There will be one session of 03 hours duration. The paper will consist of 08 experiments out of which an examinee will mark 06 experiments and one of these is to be allotted by the external examiner.
4. Number of candidates in a group for practical examination should not exceed 12.
5. In a single group no experiment be allotted to more than three students in any group.
6. The student should determine Standard Deviations and probable error in the calculations whereas needed.

### LIST OF EXPERIMENTS

1. Thermal conduction in poor conductor (variation with geometry) by Lee's method
2. Thermo e.m.f. calibration comparison
3. Total radiation law, temperature dependence of radiation
4. Study of rotation of plane of polarization with a polarimeter.
5. Set up Newton's rings to determine wave length of sodium light
6. To determine the wave length and dispersive power using plane diffraction grating (Use Hg source)
7. To determine the resolving power of a grating
8. To measure an inaccessible height using sextant
9. To determine the divergence and wave length of a given laser source.
10. To study the absorption spectra of iodine vapours
11. To determine the ionization potential of mercury
12. Study of variation of light intensity using photovoltaic cell/inverse square law

### Text and Reference Books:

1. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal.
2. B.Sc. Practical Physics, C.L. Arora.

  
Head  
Department of Physics  
Punjabi University  
Patiala-147002

**B.Sc. Part-II (ENGLISH)**  
**SEMESTER -III**  
**(For Sessions 2021-2022, 2022-2023 & 2023-2024)**

Teaching Hours : Theory : 3 Hours., Tutorials : 2 Hours.  
Time Allowed : 3 Hours.

Maximum Marks : 75  
Pass Marks : 35%

**COURSE CONTENT**

The course content of this paper shall comprise of the following books:

1. *Perspectives: Selections from Modern English Prose and Fiction*, edited by S.A. Vasudevan and M. Sathya Babu, Published by Orient Longman.
2. *Composition and Writing Skills*, Published by Orient Blackswan, 2016.

The following Chapters are to be studied:

Basic Vocabulary (List C), Summary Writing, Letter Writing and E-mails.

**TESTING**

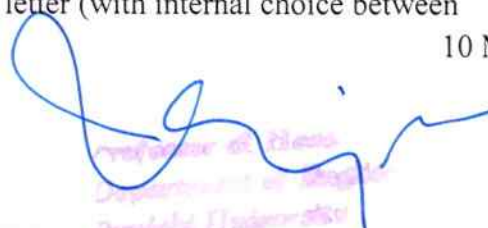
The paper shall have two sections. Section-A shall comprise testing from *Perspectives* while Section-B from *Composition and Writing Skills*.

**SECTION - A: PERSPECTIVES**

- Q.1 (Based on the section titled "Prose", comprising chapters I to VI)
- (a) One essay-type question with internal alternative. The answer should not exceed 350-400 words. 10 Marks
  - (b) Five short-answer questions to be attempted out of seven. Each answer should be written in 30 to 40 words. 5×2=10 Marks
- Q.2 (Based on the section titled "Fiction", comprising chapter VII to IX)
- (a) One essay-type question with internal alternative on character/theme and incident/episode. The answer should not exceed 350-400 words. 10 Marks
  - (b) There will be one short-answer question from each of the three stories. The candidate shall be required to attempt any two. Each answer should be written in 30 to 40 words. 2×2½=5 Marks
- Q.3 (Based on the section titled "Biographies", comprising chapter X to XII)
- (a) One essay-type question with internal alternative. The answer should not exceed 350-400 words. 10 Marks
  - (b) There will be one short-answer question from each chapter. The candidate shall be required to attempt any two. Each answer should be written in 30 to 40 words. 2×2½=5 Marks

**SECTION - B: COMPOSITION AND WRITING SKILLS**

- Q.4 (a) The candidate shall be asked to write a letter (with internal choice between personal and official letters). 10 Marks

  
Professor of English  
Department of English  
Pondicherry University  
KOTLA



(b) The candidate shall make five sentences from the given eight words (from List C of *Composition and Writing Skills*). Make a separate sentence for each word. Each sentence carries 1 mark. 5×1=5 Marks

(c) The candidate shall be asked to write a summary of a given passage in one third of the total number of words in the passage. 05 Marks

(d) The students shall be asked to write an e-mail (on the basis of given details with internal choice). 05 Marks

  
Principal of School  
Department of English  
Central Board of Secondary Education  
New Delhi

**B.Sc. Part-II (ENGLISH)**  
**SEMESTER -IV**  
**(For Sessions 2021-2022, 2022-2023 & 2023-2024)**

Teaching Hours : Theory : 3 Hours., Tutorials : 2 Hours.  
Time Allowed : 3 Hours.

Maximum Marks : 75  
Pass Marks : 35%

**COURSE CONTENT**

1. *Six One-Act Plays*, edited by Maurice Stanford, Published by Orient Longman.
2. *Composition and Writing Skills*, Published by Orient Blackswan, 2016.

The following chapters are to be studied:

Essay Writing, Job Application Letters and Curricula Vitae, Report Writing, Effective Writing.

**TESTING**


The paper shall have two sections. Section-A shall comprise testing from *Perspectives* while Section-B from *Composition and Writing Skills*.

**SECTION – A : SIX ONE-ACT PLAYS**

- Q. 1 (a) One essay type question on character, incident/episode or theme with internal alternative. The answer should be in about 450-500 words. 15 Marks
- (b) Five short-answer questions to be attempted out of seven. Each answer should be written in 50 to 60 words. 5×3=15 Marks

**SECTION – B: COMPOSITION AND WRITING SKILLS**

- Q. 2 An essay of 450-500 words on a topical or relevant subject (one topic shall be attempted out of five given topics). 10 Marks
- Q. 3 The candidate shall be asked to write a job application letter (on the basis of given details with internal choice). 10 Marks
- Q. 4 The candidate shall be asked to write a report (on the basis of given details with internal choice). 10 Marks
- Q. 5 The candidate shall be asked to prepare a C.V. (on the basis of given details with internal choice). 10 Marks
- Q. 6 The candidate shall be asked to correct a given passage of five lines on the basis of clarity, structure of argument and use of proper grammar and punctuation. 05 Marks

  
V. K. J. Kulkarni  
Professor of English  
Tatyasaheb Kore  
M. J. Somaiya Institute of  
Technology  
Mumbai