

B.A./B.Sc.-Ist Year (Ist Semester)

MATHEMATICS

SESSION - 2020-21, 2021-22, 2022-23

Paper I: Calculus-I

Maximum Marks: 50 Marks

Pass Percentage: 35%

Maximum Time : 3 Hrs

Private/Distance Education Students

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 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

**Differential Calculus:**  $\epsilon - \delta$  definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities. Differentiability, Derivative of nth order, Leibnitz theorem, Asymptotes. Test for concavity and convexity, Points of inflexion, Tracing of Curves with  $y'$  and  $y''$  (Standard curves in Cartesian form without use of Grapher).

Section-B

**Functions of several variables:** Limits, continuity and differentiability of two variables. Partial derivatives and its Linearization, Chain rule, Partial derivative with constrained variables. Homogeneous functions, Euler theorem and its applications, Extreme values and saddle points, Lagrange multipliers, Taylor's theorem and its linear and quadratic approximation.

RECOMMENDED BOOKS :

1. Malik and Arora, Mathematical Analysis, New Academic Science, 2017
2. Thomas and Finney, Calculus and Analytic Geometry, Ninth Edition.
3. R. K. Jain and S.R.K. Iyengar: Advanced Engineering Mathematics, Narosa Publishing House.

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## PAPER-II: DIFFERENTIAL EQUATIONS

Maximum Marks: 50 Marks

Pass Percentage: 35%

Maximum Time : 3 Hrs

### 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 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 Section A and B and compulsory question of Section C.

#### Section-A

**First order differential equations :** Order and degree of a differential equation, Separable differential equations, Homogeneous differential equations, equations reducible to Homogenous differential equations , Exact differential equations, Linear differential equations and equations reducible to linear differential equations.

**Higher order differential equations :** Wronskian, Solution of Linear homogeneous and non-homogeneous differential equations of higher order with constant coefficients and with variable coefficients, Method of Variation of Parameters.

#### Section-B

**Higher order differential equations :** Differential operator method, Linear non-homogeneous differential equations with variable coefficients, Euler's Cauchy method.

**Series solution of Differential equation:** Regular point, ordinary point, Power Series method. Frobenius method, Bessel and Legendre Equations, Legendre and Bessel functions and their properties , recurrence relations, orthogonality, Rodrigue's formula.

#### RECOMMENDED BOOKS :

1. George F .Simmons ; Differential Equations with Aplication and historical Notes(Textbooks in Mathematics) CRC press
2. Rai Singhania : Ordinary and Partial Differential Equations , S.Chand & Company, New Delhi
3. Zafar Ahsan: Differential Equations and Their Applications, Prentice-Hall of India Pvt. Ltd. New Delhi-Second edition
4. H.T.H. Piaggio : An Elementry Treatise on Differential equations : Barman Press.

  
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## PAPER-III: LINEAR ALGEBRA

**Maximum Marks: 50 Marks**

**Pass Percentage: 35%**

**Maximum Time : 3 Hrs**

### 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 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 Section A and B and compulsory question of Section C.

**Objective:** This course familiarizes the students with the study of matrices which is used in solving linear equations and basic notions in linear algebra that are often used in mathematics and other sciences.

#### Section-A

Elementary operation on matrices, Inverse of a matrix using Gauss Jordan Method. Linear independence of row and column vectors, Row rank, Column rank and their equivalence. Eigen values, Eigen vectors and the characteristic equation of a matrix, Diagonalization, Cayley-Hamilton theorem and its use in finding inverse of a matrix, Consistency of a system of linear equations.

#### Section-B

Vector spaces. Examples, Linear Dependence, Linear Combinations, Bases and Dimension. Subspaces, Linear transformation, Algebra of linear transformations, Matrices as linear transformations, Matrices and change of basis, Kernel and image, Rank and Nullity theorem.



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**RECOMMENDED BOOKS :**

1. Gilbert Strang: Linear Algebra and its Applications, Cengage Learning Publishers ( Fourth Edition)
2. P.B. Bhattacharya, S.K.Jain & S.R.Nagpaul : first course in Linear Algebra, New Age International (P) Limited
3. Serge Lange: Introduction to Linear Algebra, Springer
4. Kenneth Hoffman , Kunze : Linear Algebra, PHI (Second Edition)
5. Charles W. Curtis: Linear Algebra An Introductory Approach, Springer



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B.A./ B.Sc .-Ist Year (2nd Semester)

MATHEMATICS

SESSION : 2020-21, 2021-22, 2022-23

PAPER-IV: CALCULUS-II

Maximum Marks: 50 Marks

Pass Percentage: 35%

Maximum Time : 3 Hrs

*Handwritten mark*

For Private/Distance Education Students

**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 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 Section A and B and compulsory question of Section C.

**Objective:** The objective is to introduce Vector Analysis and the Calculus of Several Variables and their applications

**Section-A**

**Integral Calculus**

Double integrals, Double integrals in Polar Form, Change of order and change of variable in double integral. Triple integrals in Rectangular co-ordinates. Triple integrals in Cylindrical and Spherical co-ordinates. Applications to evaluation of Areas, Volume, Centre of Gravity and Moments of Inertia.

**Section-B**

Vectors in the plane . Cartesian Co-ordinates and vectors in spaces, Dot and cross products. Lines and planes in space. Line integrals, vector fields , work circulations and flux, Path independence. Potential Functions and Conservative Fields, Green theorem in Plane. surface area and surface integrals. Stokes Theorem and the divergence theorem.

**RECOMMENDED BOOKS :**

1. Malik and Arora ,Mathematical Analysis, New Academic Science, 2017
2. Thomas and Finney ,Calculus and Analytic Geometry, Ninth Edition.
3. R. K. Jain and S.R.K. Iyengar:Advanced Engineering Mathematics,Narosa Publishing House.

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## PAPER-V: PARTIAL DIFFERENTIAL EQUATIONS

Maximum Marks: 50 Marks  
Maximum Time : 3 Hrs

Pass Percentage: 35%

### 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 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 Section A and B and compulsory question of Section C.

**Objective:** The objective of the course is to equip the students with the knowledge of Partial differential equations of first, second and higher orders and their applications

#### Section-A

**Partial differential equations :** Partial differential equation of first order, Lagrange's solution, Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces, Partial differential equation of first order but of any degree, Charpit's general method of solution.

**Partial differential equations of second and higher order :** Partial differential equations of the second order and their classification into hyperbolic, elliptic and parabolic types, canonical forms.

#### Section-B

Homogeneous and non-homogeneous partial differential equations with constant coefficients One dimension Wave and Heat Equation. Two dimensional Laplace equation by separation of variable method and D'Alembert's solution of wave equation.

#### RECOMMENDED BOOKS :

1. George F. Simmons : Differential Equations with Application and historical Notes (Textbooks in Mathematics) CRC press
2. Rai Singhania : Ordinary and Partial Differential Equations", S.Chand & Company, New Delhi
3. I. N. Sneddon . Elements of Partial Differential Equations, Mc Graw Hill Book Co.
4. Zafar Ahsan: Differential Equations and Their Applications, Prentice-Hall of India Pvt. Ltd. New Delhi-Second edition
5. H.T.H. Piaggio : An Elementry Treatise on Differential equations : Barman Press.

  
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**PAPER-VI : ANALYTIC GEOMETRY**

**Maximum Marks: 50 Marks**  
**Maximum Time : 3 Hrs**

**Pass Percentage: 35%**

**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 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 Section A and B and compulsory question of Section C.

**Objective:** This course introduces two and three dimensional geometry. It familiarizes the students with the study of conics, oblique axes, cone, cylinder and conicoid

**Section-A**

**General Equation of Second Degree:** conic section, centre of conic section, principal axes and eccentricity of a conic, axis, latus rectum, vertex and focus of a parabola, tracing of cones

**Polar Equation of a conic:** tracing of the conic, chord joining two points, tangents, normals, polar, director circle and asymptotes.

**Introduction of Oblique Axes:** distance between two points, equation of a line, angle between two lines, length of perpendicular, angle between the pair of lines, oblique axes from rectangular axes, invariants, equation of circle, parabola, ellipse, hyperbola

**Section-B**

**Sphere:** Section of a sphere by a plane, sphere through a given circle. Intersection of a line and sphere, tangent line, tangent plane, angle of intersection of two spheres and condition of orthogonality

**Cone:** general second degree equation of a cone, its intersection with a plane and with a line, enveloping cone, right circular cone, the cone  $ax^2 + by^2 + cz^2 = 0$

**Cylinder:** enveloping cylinder, right circular cylinder

**RECOMMENDED BOOKS :**

1. P.K. Jain and Khalil Ahmad: Text Book of Analytical Geometry. New Age International Publishers, Third Edition
2. Shanti Narayan and P.K Mittal: Analytical Solid Geometry, 17<sup>th</sup> Revised Edition, S.Chand and Co., New Delhi, 2006.
3. N.Saran and R.S. Gupta : Analytical Geometry of Three Dimensions, Pothishala Pvt. Ltd. Allahabad.

  
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## ਬੀਐੱਸ.ਸੀ. ਭਾਗ ਪਹਿਲਾ

## ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ

2020-21, 2021-22 ਅਤੇ 2022-23 ਸੈਸ਼ਨ ਲਈ

## ਸਮੇਸਟਰ ਪਹਿਲਾ

ਕੁਲ ਅੰਕ : 100

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 25 ਅੰਕ

ਬਾਹਰੀ ਪਰੀਖਿਆ: 75 ਅੰਕ

ਸਮਾਂ : 3 ਘੰਟੇ

ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 35

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 09

ਬਾਹਰੀ ਪਰੀਖਿਆ ਵਿਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 26

(ਅਧਿਆਪਨ: 6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

## ਸਿਲੇਬਸ ਤੇ ਪਾਠ ਪੁਸਤਕਾਂ:

ਭਾਗ-ੳ: ਕਥਾ ਰੰਗ (ਸੰਪਾ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ)

20 ਅੰਕ

ਭਾਗ-ਅ: (1) ਨਿਬੰਧ-ਰਚਨਾ : ਵਿਗਿਆਨ, ਤਕਨਾਲੋਜੀ, ਮਾਤ ਭਾਸ਼ਾ ਅਤੇ ਵਿਗਿਆਨ, ਸਮਕਾਲੀ ਵਿੱਦਿਆ-ਪ੍ਰਬੰਧ, ਮਾਤ ਭਾਸ਼ਾ ਤੇ ਗਿਆਨ ਪ੍ਰਸਾਰ, ਮਾਤ ਭਾਸ਼ਾ ਵਿਚ ਵਿਗਿਆਨ ਦੀ ਪੜ੍ਹਾਈ, ਮਾਤ ਭਾਸ਼ਾ ਤੇ ਵਿਗਿਆਨ ਦਾ ਅਧਿਆਪਨ ਅਤੇ ਵਾਤਾਵਰਣ ਆਦਿ ਵਿਸ਼ਿਆਂ ਨਾਲ ਸਬੰਧਤ ਨਿਬੰਧ ਰਚਨਾ।

10 ਅੰਕ

ਅ(2) ਗਿਆਨ-ਵਿਗਿਆਨ ਤੇ ਪੰਜਾਬੀ ਭਾਸ਼ਾ:

(i) ਗਿਆਨ-ਵਿਗਿਆਨ ਅਤੇ ਭਾਸ਼ਾ: ਪੰਜਾਬੀ ਵਿਚ ਵਿਗਿਆਨ ਦੀ ਪੜ੍ਹਾਈ, ਅਧਿਐਨ ਅਤੇ ਖੋਜ ਦੀਆਂ ਸਮੱਸਿਆਵਾਂ, ਵਿਗਿਆਨਕ ਤੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਦਾ ਹੋਰ ਭਾਸ਼ਾਵਾਂ ਵਿਚੋਂ ਸ਼ਬਦ-ਉਧਾਰ ਅਤੇ ਸ਼ਬਦਜੋੜ ਅਤੇ ਉਚਾਰਣ-ਨਿਰਧਾਰਣ ਦੇ ਮਸਲੇ। ਪਾਠਕ੍ਰਮ ਵਿੱਚ ਦਰਜ ਤਕਨੀਕੀ/ਸੰਕਲਪਵਾਚੀ ਸ਼ਬਦਾਵਲੀ ਦਾ ਆਲੋਚਨਾਤਮਕ ਅਧਿਐਨ

05 ਅੰਕ

(ii) ਕੁਦਰਤੀ ਵਿਗਿਆਨਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ (ਲਗਭਗ 100 ਸ਼ਬਦ): ਅਨੁਵਾਦ ਅਤੇ ਵਾਕਾਂ ਵਿਚ ਵਰਤੋਂ।

10 ਅੰਕ

ਭਾਗ-ੲ: ਭਾਗ-ੳ ਦੀ ਪੁਸਤਕ ਕਥਾ ਰੰਗ ਅਤੇ ਭਾਗ-ਅ (2) ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਪ੍ਰਸ਼ਨ।

15x2=30 ਅੰਕ

## ਅੰਕ-ਵੰਡ ਅਤੇ ਪੇਪਰ ਸੈੱਟਰ ਲਈ ਹਦਾਇਤਾਂ:

1. ਪਾਠਕ੍ਰਮ ਦੇ ਦੋ ਭਾਗ ਲ਼ ਅਤੇ ਅ ਹੋਣਗੇ ਪਰੰਤੂ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਤਿੰਨ ਭਾਗਾਂ ਲ਼ ਅ ਅਤੇ ਲ ਵਿੱਚ ਵੰਡਿਆ ਜਾਵੇਗਾ।

2. ਭਾਗ ਲ਼ ਵਿੱਚੋਂ (i) ਕਿਸੇ ਕਹਾਣੀ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ ਅਤੇ ਕਹਾਣੀ ਬਾਰੇ ਪਾਠਕ ਦੇ ਪ੍ਰਭਾਵ (ਤਿੰਨ ਵਿੱਚੋਂ ਇੱਕ)

10 ਅੰਕ

(ii) ਪਾਤਰਾਂ ਸੰਬੰਧੀ ਜਾਣਕਾਰੀ (ਚਾਰ ਵਿੱਚੋਂ ਦੋ)

2 x 5 = 10 ਅੰਕ

4. ਭਾਗ ਅ-(1) ਦਰਸਾਏ ਗਏ ਵਿਸ਼ਿਆਂ ਵਿੱਚੋਂ ਕਿਸੇ ਇੱਕ 'ਤੇ ਨਿਬੰਧ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (ਤਿੰਨ ਵਿੱਚੋਂ ਇੱਕ)

10 ਅੰਕ

ਅ-(2) ਗਿਆਨ-ਵਿਗਿਆਨ ਅਤੇ ਮਾਤ-ਭਾਸ਼ਾ ਵਾਲੇ ਭਾਗ (i) ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਅਤੇ ਵਿਦਿਆਰਥੀ ਦੋਵਾਂ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਉੱਤਰ ਲੇਖੇਗਾ।

05 ਅੰਕ

ਅ- (2) ਦੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਉਪਭਾਗ (ii) ਵਿੱਚੋਂ ਵਿਗਿਆਨਕ ਸ਼ਬਦਾਵਲੀ ਵਿਚੋਂ ਅੰਗਰੇਜ਼ੀ ਦੇ 15 ਸ਼ਬਦ ਦਿੱਤੇ ਜਾਣਗੇ।

ਇਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ 10 ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਦੇਵੇਗਾ ਅਤੇ ਉਨ੍ਹਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤੇਗਾ।

10 ਅੰਕ

5. ਭਾਗ-ੲ: ਪਾਠਕ੍ਰਮ ਦੇ ਭਾਗ ਲ਼: ਕਥਾ ਰੰਗ ਅਤੇ ਭਾਗ ਅ (2) ਵਿੱਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 15 (ਭਾਗ ਲ਼ ਵਿੱਚੋਂ 10 ਅਤੇ ਭਾਗ ਅ-2

ਵਿੱਚੋਂ 5 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿਚ ਪਾਠਕ੍ਰਮ ਵਿਚ ਦਰਜ ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦਾਂ ਦੇ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਦੀ ਉਚਿੱਤਤਾ, ਉਨ੍ਹਾਂ ਦੇ ਸੰਭਵ ਬਦਲ, ਸ਼ਬਦਜੋੜਾਂ ਬਾਰੇ ਸਵਾਲ ਪੁੱਛੇ ਜਾ ਸਕਦੇ ਹਨ। ਵਿਦਿਆਰਥੀ ਨੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਸੰਖੇਪ ਉੱਤਰ ਦੇਣੇ

ਹੋਣਗੇ। ਹਰ ਪ੍ਰਸ਼ਨ ਦੇ 2 ਅੰਕ ਹੋਣਗੇ।

15x2=30 ਅੰਕ

## ਸਹਾਇਕ ਪਾਠ ਸਮੱਗਰੀ

1। ਵਿਗਿਆਨਕ ਸ਼ਬਦਾਵਲੀ ਕੋਸ਼, ਭਾਸ਼ਾ ਵਿਭਾਗ, ਪੰਜਾਬ, ਪਟਿਆਲਾ

ਵਿਗਿਆਨ ਨਾਲ ਸੰਬੰਧਿਤ ਤਕਨੀਕੀ/ਸੰਕਲਪੀ ਸ਼ਬਦਾਵਲੀ

1. Abnormal behavior of oxygen: ਅਓਕਸੀਜਨ ਦਾ ਅਸਾਧਾਰਣ ਵਿਵਹਾਰ
2. Absorption: ਸੋਖਣ
3. Actinoid contraction: ਐਕਟੀਨਾਇਡ ਸੁੰਗੜਨ
4. Activation energy: ਉਤੇਜਨ ਊਰਜਾ
5. Adventitious roots: ਰੇਸ਼ੇਦਾਰ ਜੜ੍ਹਾਂ
6. Alkynes: ਐਲਕਾਈਨ, ਖਾਰ
7. Alpha particles: ਐਲਫ਼ਾ ਕਣ
8. Amorphous solids: ਅਕ੍ਰਿਸਟਲੀ ਠੋਸ
9. Anther: ਪਰਾਗਕੋਸ਼
10. Antibiotics: ਜੀਵਾਣੂ
11. Antielectron: ਪ੍ਰਤਿ ਇਲੈਕਟ੍ਰਾਨ
12. Apomixes: ਅਸੰਗਪ੍ਰਜਣਨ
13. Applied Physics: ਅਨੁਪ੍ਰਯੁਕਤ ਭੌਤਿਕੀ, ਵਿਹਾਰਕ ਭੌਤਿਕੀ
14. Archegonium: ਆਰਕੀਸਪੋਰੀਅਮ
15. Asexual reproduction: ਅਲਿੰਗੀ ਪ੍ਰਜਣਨ
16. Astronomical scale: ਖਗੋਲੀ ਪੱਧਰ
17. Atomic: ਪ੍ਰਮਾਣਵੀ
18. Autogamy: ਸਵੈਪਰਾਗਣ
19. Automation: ਸਵੈਚਾਲਨ
20. Average rate: ਔਸਤ ਵੇਗ
21. Binary solution: ਦੋ ਅੰਗੀ ਘੋਲ
22. Catalyst/Catalysis: ਉਤਪ੍ਰੇਰਕ/ਉਤਪ੍ਰੇਰਣ
23. Cell differentiation: ਸੈੱਲ ਵਿਭੇਦਨ
24. Cell division: ਸੈੱਲ ਵਿਭਾਜਨ
25. Cervix: ਗਰਭ ਮਾਰਗ
26. Chemical kinetics: ਰਸਾਇਣਕ ਬਲਗਤਿਕ
27. Circular orbits: ਚੱਕਰਾਕਾਰ ਆਰਬਿਟ
28. Classical Physics: ਕਲਾਸੀਕੀ ਭੌਤਿਕੀ
29. Coleorhiza: ਜੜ੍ਹ ਅੰਕੁਰ ਕਵਚ
30. Concentration of solutions: ਘੋਲਾਂ ਦੀ ਸੰਘਣਤਾ
31. Coordination compounds: ਉਪਸਹਿਸੰਯੋਜਨ ਯੋਗਿਕ
32. Coordination isomerism: ਉਪਸਹਿਸੰਯੋਜਨ ਸਮਅੰਗਕਤਾ
33. Coordination polyhedron: ਉਪਸਹਿਸੰਯੋਜਨ ਬਹੁਫਲਕ
34. Coordination theory: ਉਪਸਹਿਸੰਯੋਜਨ ਯੋਗਿਕਾਂ ਦਾ ਸਿਧਾਂਤ
35. Cyclic structure: ਚੱਕਰੀ ਸੰਰਚਨਾ
36. Depressants: ਅਵਮਨਕ
37. Dialysis: ਝਿੱਲੀ ਨਿਖੇੜਨ
38. Dioecious: ਬਿਖਮ ਲਿੰਗੀ
39. Distillation: ਕਸ਼ੀਦਣ
40. Double fertilization: ਦੋਹਰਾ ਨਿਸ਼ੇਚਨ
41. Electric circuit: ਬਿਜਲਈ ਸਰਕਟ
42. Electro Chemistry: ਬਿਜਲੀ ਰਸਾਇਣ
43. Electrodynamics: ਇਲੈਕਟ੍ਰੋਡਾਇਨਾਮਿਕਸ
44. Electromagnetic radiations: ਬਿਜਲ ਚੁੰਬਕੀ ਵਿਕਿਰਨਾ
45. Electromagnetism: ਬਿਜਲ ਚੁੰਬਕਤਾ
46. Elements: ਤੱਤ
47. Elliptical orbits: ਅੰਡਾਕਾਰ ਆਰਬਿਟ
48. Embryo sac: ਭਰੂਣ ਕੋਸ਼
49. Embryogenesis: ਭਰੂਣ ਨਿਰਮਾਣ
50. Embryonic development: ਭਰੂਣ ਵਿਕਾਸ
51. Endosperm: ਭਰੂਣਪੇਸ਼
52. Entropy: ਐਨਟਰਾਪੀ
53. Enzyme catalyst: ਐਨਜ਼ਾਈਮ ਉਤਪ੍ਰੇਰਕ
54. Epicotyl: ਬੀਜ ਪੱਤਰ ਪਰਤ

*ਸ਼ਕ*

55. Exothermic: ਤਾਪ ਨਿਕਾਸੀ
56. External fertilization: ਬਹਾਰੀ ਨਿਸ਼ੇਚਨ
57. External genitalia: ਬਹਾਰੀ ਜਣਨ ਅੰਗ
58. Fallopian tubes: ਅੰਡਵਹਿਣੀਆਂ
59. Ferromagnetism: ਧਾਤ ਚੁੰਬਕਤਾ
60. Fertilization: ਨਿਸ਼ੇਚਨ
61. Filament: ਫਿਲਾਮੈਂਟ
62. Fission: ਵਿਖੰਡਨ
63. Force: ਬਲ
64. Fossil fuel: ਪਥਰਾਟ ਬਾਲਣ
65. Galaxy: ਆਕਾਸ਼ ਗੰਗਾ
66. Gamete transfer: ਯੁਗਮਕ ਸਥਾਨਾਂਤਨਣ
67. Gametes: ਯੁਗਮਕ
68. Gametogenesis: ਯੁਗਮਕ ਬਣਨਾ
69. Geitonogamy: ਸਜਾਤੀ ਪਰਾਗਣ
70. Glans penis: ਸਿਸ਼ਨ ਮੁੰਡ
71. Gravitation: ਗੁਰੂਤਾਕਰਸ਼ਨ
72. Half-life: ਅਰਧ ਆਯੂ
73. Haploid: ਗੁਣਸੂਤਰੀ ਸੈੱਲ
74. Heat engine: ਤਾਪ ਇੰਜਣ
75. Heliocentric Theory: ਸੂਰਜ ਕੇਂਦਰੀ ਸਿਧਾਂਤ
76. Homogamete or isogamete: ਸਮਯੁਗਮਕੀ
77. Hydrogen Bond: ਹਾਈਡ੍ਰੋਜਨ ਬੰਧੇਜ
78. Hymen: ਯੋਨੀ ਪਰਦਾ
79. Hyperacidity: ਅਤੀਤੇਜਾਬੀਪਨ
80. Ideal solutions: ਆਦਰਸ਼ ਘੋਲ
81. Implantation: ਅੰਤਰ ਰੋਪਣ
82. Impurity defects: ਅਸ਼ੁੱਧਤਾ ਦੋਸ਼
83. Inner transition elements: ਅੰਦਰੂਨੀ ਅੰਤਰਕਾਲੀ ਤੱਤ
84. Insemination: ਵੀਰਜ ਸੰਚਾਰ
85. Instability constant: ਅਸਥਿਰਤਾ ਸਥਾਈ ਅੰਕ
86. Interaction: ਅੰਤਰਕਿਰਿਆ
87. Intermolecular forces: ਅੰਤਰ ਅਣਵੀ ਬਲ
88. Intermolecular: ਅੰਤਰਅਣਵੀ
89. Internal energy: ਆੰਤਰਿਕ ਊਰਜਾ
90. Internal fertilization: ਅੰਦਰੂਨੀ ਨਿਸ਼ੇਚਨ
91. Interstitial compounds: ਅੰਤਰ ਵਿੱਥੀ ਯੋਗਿਕ
92. Ionic conductance: ਆਇਨਨ ਚਾਲਕਤਾ
93. Ionic isomerism: ਆਇਨਨ ਸਮਅੰਗਕਤਾ
94. Ionization enthalpy: ਆਇਨਨ ਐਨਥੈਲਪੀ
95. Ionosphere: ਆਈਨੋਸਫੀਅਰ
96. Isomerism: ਸਮਅੰਗਕਤਾ
97. Kinetic energy: ਗਤਿਜ ਊਰਜਾ
98. Kinetic theory: ਅਣਗਤੀ ਸਿਧਾਂਤ
99. Kingdom fungi: ਉੱਲੀ ਜਗਤ
100. Magnitudes: ਪਰਿਮਾਣ

*Handwritten signature*

ਬੀਐਸ.ਸੀ. ਭਾਗ ਪਹਿਲਾ

(ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ)

2020—21, 2021-22 ਅਤੇ 2022—23 ਸੈਸ਼ਨ ਲਈ

ਸਮੇਸਟਰ ਦੂਜਾ

ਕੁਲ ਅੰਕ : 100

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 25 ਅੰਕ

ਬਾਹਰੀ ਪਰੀਖਿਆ: 75 ਅੰਕ

ਸਮਾਂ : 3 ਘੰਟੇ

ਸਿਲੇਬਸ ਤੇ ਪਾਠ ਪੁਸਤਕਾਂ:

ਵਿਸ਼ੇ ਵਿੱਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 35

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ ਵਿੱਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 09

ਬਾਹਰੀ ਪਰੀਖਿਆ ਵਿੱਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 26

(ਅਧਿਆਪਨ: 6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

ਭਾਗ- ਓ: ਵਾਰਤਕ ਵਿਵੇਕ (ਸੰਪਾ. ਡਾ. ਰਾਜਿੰਦਰ ਪਾਲ ਸਿੰਘ ਬਰਾੜ, ਡਾ. ਜਗਤਾਰ ਸਿੰਘ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ

10+10 + 20 ਅੰਕ

ਭਾਗ ਅ-1 ਪ੍ਰੈੱਸ ਰਿਪੋਰਟ: ਵਿਗਿਆਨ ਦੇ ਖੇਤਰ ਨਾਲ ਸੰਬੰਧਿਤ ਕਿਸੇ ਆਯੋਜਨ, ਵਿਗਿਆਨ-ਮੇਲੇ, ਇਕੱਤਰਤਾ ਜਾਂ ਸੈਮੀਨਾਰ ਕਾਨਫਰੰਸ ਦੀ ਪ੍ਰੈੱਸ ਰਿਪੋਰਟ/ ਲਿਖਣ ਦੀ ਸਿਖਲਾਈ

10 ਅੰਕ

ਅ-2 (i) ਵਿਗਿਆਨ ਨਾਲ ਸੰਬੰਧਿਤ ਕਿਸੇ ਅੰਗਰੇਜ਼ੀ ਪੈਰ੍ਹੇ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

05 ਅੰਕ

(ii) ਕੁਦਰਤੀ ਵਿਗਿਆਨਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ (100 ਸ਼ਬਦ): ਅਨੁਵਾਦ ਅਤੇ ਵਾਕਾਂ ਵਿਚ ਵਰਤੋਂ

10 ਅੰਕ

ਭਾਗ-ਏ ਉਪਰੋਕਤ ਸਿਲੇਬਸ ਦੇ ਭਾਗ ਓ ਅਤੇ ਭਾਗ ਅ-2 (ii) 'ਤੇ ਅਧਾਰਤ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਪ੍ਰਸ਼ਨ।

30 ਅੰਕ

ਅੰਕ-ਵੰਡ ਅਤੇ ਪੇਪਰ ਸੈਂਟਰ ਲਈ ਹਦਾਇਤਾਂ:

1. ਪਾਠਕ੍ਰਮ ਦੇ ਦੋ ਭਾਗ ਓ ਅਤੇ ਅ ਹੋਣਗੇ ਪਰੰਤੂ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਤਿੰਨ ਭਾਗਾਂ ਓ ਅ ਅਤੇ ਏ ਵਿੱਚ ਵੰਡਿਆ ਜਾਵੇਗਾ।

2. ਭਾਗ ਓ ਵਿੱਚੋਂ:

(i) ਕਿਸੇ ਇਕ ਨਿਬੰਧ ਦਾ ਵਿਸ਼ਾ/ਸਾਰ/ ਮੁੱਖ ਵਿਚਾਰਾਂ/ ਪਾਠਕ ਦੇ ਪ੍ਰਭਾਵਾਂ ਬਾਰੇ ਪ੍ਰਸ਼ਨ।

ਤਿੰਨ ਵਿੱਚੋਂ ਇੱਕ) 10 ਅੰਕ

(ii) ਨਿਬੰਧਾਂ ਵਿਚਲੇ ਵਿਚਾਰਾਂ ਸਬੰਧੀ ਸੰਖੇਪ ਪ੍ਰਸ਼ਨ। (ਚਾਰ ਵਿੱਚੋਂ ਦੋ)  $2 \times 5 = 10$  ਅੰਕ

4. ਭਾਗ ਅ-1 ਵਿਗਿਆਨ ਦੇ ਖੇਤਰ ਨਾਲ ਸੰਬੰਧਿਤ ਕਿਸੇ ਆਯੋਜਨ, ਵਿਗਿਆਨ-ਮੇਲੇ, ਇਕੱਤਰਤਾ ਜਾਂ ਸੈਮੀਨਾਰ ਆਦਿ ਦੇ ਆਯੋਜਨਾਂ ਵਿੱਚੋਂ ਦੋ ਵਿਸ਼ੇ ਦੇ ਕੇ ਕਿਸੇ ਵਿਸ਼ੇ 'ਤੇ ਪ੍ਰੈੱਸ ਰਿਪੋਰਟ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (ਦੋ ਵਿੱਚੋਂ ਇੱਕ)

10 ਅੰਕ

5. ਅ-2 ਦੇ ਉਪਭਾਗ (i) ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਅਤੇ ਵਿਦਿਆਰਥੀ ਨੇ ਦੋਵਾਂ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਹੋਵੇਗਾ।

05 ਅੰਕ

6. ਅ-2 ਦੇ ਉਪਭਾਗ (ii) ਵਿੱਚ 15 ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦਾਂ ਦੇ ਕੇ 10 ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਅਤੇ ਵਾਕਾਂ ਵਿਚ ਵਰਤੋਂ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ।

10 ਅੰਕ

5. ਭਾਗ-ਏ ਵਿਚ ਪਾਠ ਪੁਸਤਕ ਵਾਰਤਕ ਵਿਵੇਕ ਅਤੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿੱਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 15 (ਪਾਠ ਪੁਸਤਕ ਵਾਰਤਕ ਵਿਵੇਕ ਵਿੱਚੋਂ 10 ਅਤੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿੱਚੋਂ 5 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ

ਭਾਗ ਵਿਚ ਪਾਠਕ੍ਰਮ ਵਿਚ ਦਰਜ ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦਾਂ ਦੇ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਦੀ ਉਚਿੱਤਤਾ, ਉਨ੍ਹਾਂ ਦੇ ਸੰਭਵ ਬਦਲ, ਸ਼ਬਦਜੋੜਾਂ ਬਾਰੇ ਸਵਾਲ ਪੁੱਛੇ ਜਾ ਸਕਦੇ ਹਨ। ਵਿਦਿਆਰਥੀ ਨੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਸੰਖੇਪ ਉੱਤਰ ਦੇਣੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ 2 ਅੰਕ ਹੋਣਗੇ।  $15 \times 2 = 30$  ਅੰਕ

ਸਹਾਇਕ ਪਾਠ ਸਮੱਗਰੀ

2। ਵਿਗਿਆਨਕ ਸ਼ਬਦਾਵਲੀ ਕੋਸ਼, ਭਾਸ਼ਾ ਵਿਭਾਗ, ਪੰਜਾਬ, ਪਟਿਆਲਾ

ਕੁਦਰਤੀ ਵਿਗਿਆਨਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਮੁੱਢਲੀ ਸ਼ਬਦਾਵਲੀ

1. Mammary glands: ਦੁੱਧ ਗ੍ਰੰਥੀਆਂ
2. Mass: ਪੁੰਜ
3. Maxwell's equations: ਮੈਕਸਵੈੱਲ ਸਮੀਕਰਨ
4. Mechanics: ਮਕੈਨਿਕਸ
5. Mega-sporangium: ਗੁਰੂਬੀਜਾਣੂਕੋਸ਼
6. Menstrual cycle: ਮਾਸਿਕ ਚੱਕਰ
7. Metallic solids: ਧਾਤਵੀ ਠੋਸ
8. Metallurgy: ਧਾਤਕਰਮਕੀ
9. Microscope: ਖੁਰਦਬੀਨ
10. Microscopic and Macroscopic: ਸੂਖਮ ਅਤੇ ਸਬੂਲ
11. Microsporangium: ਲਘੂਬੀਜਾਣੂਕੋਸ਼
12. Minerals: ਖਣਿਜ
13. Mitosis: ਸਮਸੂਤਰੀ ਵਿਭਾਜਨ
14. Molecular Asymmetry: ਅਣਵੀ ਅਸਮਮਿਤਾ
15. Molecular orbit theory: ਅਣਵੀ ਆਰਬਿਟਲ ਸਿਧਾਂਤ
16. Molecular solids: ਅਣਵੀ ਠੋਸ
17. Molecular: ਅਣਵਿਕ
18. Multiple fission: ਬਹੁਖੰਡਨ
19. Natural Sciences: ਕੁਦਰਤੀ ਵਿਗਿਆਨ
20. Newtonian mechanics: ਨਿਊਟਨ ਦਾ ਯੰਤਰਕੀ ਸਿਧਾਂਤ
21. Non polar molecular solids: ਅਧੁਰਵੀ ਅਣਵੀ ਠੋਸ
22. Non-ideal solutions: ਅਣ-ਆਦਰਸ਼ਕ ਘੋਲ
23. Nuclear Model: ਨਾਭਿਕੀ ਮਾਡਲ
24. Octahedra: ਅੱਠਫਲਕੀ ਵਿੱਖਾਂ
25. Oestrus cycle: ਮਦ ਚੱਕਰ
26. Optics: ਪ੍ਰਕਾਸ਼ਕੀ
27. Osmotic pressure: ਪਰਾਸਰਣ ਦਾਬ
28. Ostwald process: ਓਸਟਵਾਲਡ ਪ੍ਰਕਿਰਿਆ
29. Outbreeding devices: ਬਾਹਰੀ ਪ੍ਰਜਣਨ ਢੰਗ
30. Ovaries: ਅੰਡਕੋਸ਼
31. Ovary: ਅੰਡਕੋਸ਼
32. Oviparous: ਅੰਡੇ ਦੇਣ ਵਾਲੇ ਜੀਵ
33. Ovulation: ਅੰਡ-ਉਤਸਰਜਨ
34. Ovule: ਅੰਡਾਣੂ
35. Oxidation number: ਔਕਸੀਕਰਣ ਸੰਖਿਆ
36. Oxidation state: ਔਕਸੀਕਰਣ ਅਵਸਥਾ
37. Ozone: ਓਜ਼ੋਨ
38. Para magnetism: ਅਨੁਚੁੰਬਕਤਾ
39. Parthenogenesis: ਨਿਸ਼ੇਚਨ ਰਹਿਤ
40. Penetrating ray: ਪਰਵੇਸ਼ਕੀ ਕਿਰਨ
41. Photoelectric effect: ਪ੍ਰਕਾਸ਼ ਬਿਜਲ ਪ੍ਰਭਾਵ
42. Photoelectric effect: ਫੋਟੋਇਲੈਕਟ੍ਰਿਕ ਪ੍ਰਭਾਵ
43. Physical quantities: ਭੌਤਿਕ ਰਾਸ਼ੀਆਂ
44. Physics: ਭੌਤਿਕੀ
45. Pollen grain: ਪਰਾਗਣ
46. Pollen-pistil interaction: ਪਰਾਗ-ਇਸਤਰੀਕੇਸਰ ਅੰਤਰ-ਕਿਰਿਆ
47. Pollination: ਪਰਾਗਣ
48. Poly-embryony: ਬਹੁਭਰੂਰਣਤਾ
49. Positron: ਪਾਜ਼ੀਟਰਾਨ
50. Pre fertilization: ਨਿਸ਼ੇਚਨ ਪੂਰਵ
51. Pregnancy: ਗਰਭ ਧਾਰਨ
52. Primary valence: ਪ੍ਰਾਇਮਰੀ ਸੰਯੋਜਕਤਾ



53. Pseudo solutions: ਆਭਾਸੀ ਠੋਸ
54. Pyro metallurgy: ਤਾਪ ਧਾਤਕਰਮ
55. Qualitative: ਗੁਣਤਾਮਕ
56. Quantitative: ਮਾਤਰਾਤਮਕ
57. Quantum Mechanics: ਕੁਆਂਟਮ ਭੌਤਿਕੀ
58. Reduction: ਨਿਊਨੀਕਰਨ
59. Reproduction: ਪ੍ਰਜਣਨ
60. Reverse osmosis: ਉਲਟ-ਕ੍ਰਮ ਪਰਾਸਰਣ
61. Rigid and deformable bodies: ਦ੍ਰਿੜ ਤੇ ਵਿਚੁਪਣਸ਼ੀਲ ਪਿੰਡ
62. Rocket propulsion: ਰਾਕੇਟ ਨੇਦਨ
63. Scientific Method: ਵਿਗਿਆਨਕ ਵਿਧੀ
64. Scrotum: ਪਤਾਲੂ ਥੈਲੀ
65. Semiconductors: ਅਰਧਚਾਲਕ
66. Seminiferous tubules: ਸੁਕਰਾਣੂਜਣਨ ਨਾਲੀਆਂ
67. Semipermeable membrane: ਅਰਧ ਪਾਰਗਮਨ ਝਿੱਲੀ
68. Semisynthetic polymers: ਅਰਧ ਸੰਸਲਿਸ਼ਤ ਬਹੁਲਕ
69. Sexual reproduction: ਲਿੰਗੀ ਪ੍ਰਜਣਨ
70. Shape selective catalysts: ਆਕਾਰਚੋਣਾਤਮਕ ਉਤਪ੍ਰੇਰਕ
71. Solid state: ਠੋਸ ਅਵਸਥਾ
72. Solubility: ਘੁਲਣਸ਼ੀਲਤਾ
73. Sound waves: ਧੁਨੀ ਤਰੰਗਾਂ
74. Spermatogenesis: ਸੁਕਰਾਣੂਜਣਨ
75. Sporulation: ਬੀਜਾਣੂਜਣਨ
76. Statistical mechanics: ਅੰਕਤਾ ਯੰਤਰਕੀ
77. Stimulated emission: ਉਦੀਪਤ ਉਤਸਰਜਨ
78. Super cooled liquids: ਅਤਿਸ਼ੀਤਿਤ ਦ੍ਰਵ
79. Superconductivity: ਅਤੀਚਾਲਕਤਾ
80. Syngamy: ਯੁਗਮਕ ਸੁਮੇਲ
81. Telescope: ਦੂਰਬੀਨ
82. Temperature: ਤਾਪਮਾਨ
83. Terrestrial: ਧਰਤ-ਸੰਬੰਧੀ
84. Testes: ਪਤਾਲੂ
85. Thalamus: ਪੁਸ਼ਪਆਸਨ ਜਾਂ ਪੁਸ਼ਪਦਲ
86. Theory of relativity: ਸਾਪੇਖਕਤਾ ਦਾ ਸਿਧਾਂਤ
87. Thermodynamics: ਥਰਮੋਡਾਇਨਾਮਿਕਸ
88. Transfer of heat: ਤਾਪ ਸਥਾਨਾਂਤਰਨ
89. Ultrafiltration: ਅਤਿਸੂਖਮ ਫਿਲਟਰੀਕਰਨ
90. Unification: ਏਕੀਕਰਨ
91. Unit cell: ਯੂਨਿਟ ਸੈੱਲ
92. Uterus: ਗਰਭਕੋਸ਼
93. Vagina: ਯੋਨੀ
94. Vapor pressure: ਵਾਸ਼ਪ ਦਾਬ
95. Viviparous: ਬੱਚੇ ਦੇਣ ਵਾਲੇ ਜੀਵ
96. Water hyacinth: ਜਲਕੁੰਡੀ
97. White phosphorous: ਸਫੇਦ ਫਾਸਫੋਰਸ
98. Womb: ਬੱਚੇਦਾਨੀ
99. Zoospores: ਅਲਿੰਗੀ ਚਲ ਬਿਜਾਣੂ
100. Zygote: ਗੁਗਮਜ

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## B.Sc. (Physics) Part-I ( Ist and Second Semester)

### SCHEME

#### SESSION 2020-21, 2021-22, 2022-23

Code	Title of Paper	No of Lectures	Max Marks			Examination Time (Hours)
			Total	Ext.	Int.	
<b>SEMESTER -I</b>						
Paper A	Mechanics-I	40	40	30	10	03 HRS.
Paper B	Vibrations and Waves-I	40	40	30	10	03 HRS.
Paper C	Electricity and Magnetism-I	40	40	30	10	03 HRS.
	Practicals	80	30	22	08	03 HRS.
<b>SEMESTER -II</b>						
Paper A	Mechanics-II	40	40	30	10	03 HRS.
Paper B	Vibrations and Waves-II	40	40	30	10	03 HRS.
Paper C	Electricity and Magnetism-II	40	40	30	10	03 HRS.
	Practicals	80	30	22	08	03 HRS.

#### **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 non programmable 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 non programmable 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 question to be attempted.

## Semester -I

### PAPER A: 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 examination, 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 carry 05 marks. Section C will carry 10 marks of 2 marks each.

#### 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 is to attempt any five questions).
- 2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION A

Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle, Various forces in Nature (brief introduction), Centre of mass, Equivalent one body problem, Central forces, Equation of motion under central force, Equation of orbit in inverse square, Force field and turning points, Kepler laws and their derivations.

#### SECTION B

Relationship of conservation laws and symmetries of space and time. Inertial frame of reference. Galilean transformation and invariance, Non-inertial frames of reference, Coriolis force and its applications. Variation of acceleration due to gravity with latitude. Foucault pendulum (qualitative). Elastic collision in Laboratory and C.M.system, velocities, angles and energies, Cross section of elastic scattering . Rutherford scattering (qualitative).

#### Text Books:

1. Mechanics : Berkeley Physics Course, vol. I by C.Kittel, W.D.Knight and M.A.Ruderman, Mc Graw-Hill Publication
2. Mechanics : H.S.Hans and S.P.Puri, Tata McGraw Hill, New Delhi

## Semester –I

### PAPER B: VIBRATIONS AND WAVES-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 examination, 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 carry 05 marks. Section C will carry 10 marks of 2 marks each.

#### 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 is to attempt any five questions).
- 2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

### SECTION A

Simple harmonic motion, energy of a Simple Harmonic Oscillation (SHO). Compound pendulum, Electrical oscillations. Transverse vibrations of a mass on a string, composition of two perpendicular SHM of same period and of period ratio 1 : 2. Anharmonic oscillations. Decay of free vibrations due to damping. Differential equation of motion, types of damping. Determination of damping co-efficient-logarithmic decrement, relaxation time and Q-Factor. Electromagnetic damping (Electrical oscillator).

### SECTION B

Differential equation for forced mechanical and electrical oscillators. Transient and steady state oscillation. Displacement and velocity variation with driving force frequency, variation of phase with frequency resonance, Power supplied to an oscillator and its variation with frequency, Q value of a forced oscillator and band width. Q-value as an amplification factor of low frequency response.

#### Text Books:

1. Physics of Vibrations and Waves by H.J.Pain, Wiley & Sons, New Delhi
2. Fundamentals of Vibrations and Waves by S.P.Puri, Tata McGraw Hill, New Delhi.
3. Waves and Oscillations, by E.Crawford, Berkeley Physics Course, McGraw-Hill Publications.

## Semester-I

### PAPER C: ELECTRICITY AND MAGNETISM-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 examination, 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 carry 05 marks. Section C will carry 10 marks of 2 marks each.

#### 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 is to attempt any five questions).
- 2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION A

Basic ideas of Vector Calculus, Gradient, Divergence, curl and their physical significance, Laplacian in rectangular. Coulomb's Law for point charges and continuous distribution of charges. Electric field due to dipole line charge and sheet of charge. Electric flux. Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's's theorem.

#### SECTION B

Work and potential difference. Potential difference as line integral of electric field. Electric potential due to a point charge, a group or point charges, dipole and quadruple moments, long uniformly charged wire, charged disc. Stoke's theorem and its application in Electrostatic field,  $\text{curl } E=0$ . Electric field as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments. Poisson and Laplace's Equation and their solutions in Cartesian and concept of electrical images. Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet.

#### Text Books:

1. Fundamentals of Electricity and Magnetism by Author F.Kipp.
2. Electricity and Magnetism. Berkeley Physics Course. Vol. II by E.M Purcell, McGraw-Hill, 1965.
3. Introduction to classical Electrodynamics by David Griffith.
4. EM waves and Radiating systems by Edward C. Jordan and K.G Balmain.

## B.Sc. (Physics)

### 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 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 06 experiments out of which an examinee will mark 04 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 where needed.

### Semester- I

(75 Hours)

1. Analysis of experimental data by :
  - i) Fitting of given data to a straight line.
  - ii) Calculation of probable error.
2. To establish relationship between torque and angular acceleration using fly wheel and hence to find inertia of flywheel.
3. To determine the Young's Modulus by bending of beam.
4. To study one-dimensional collision using two hanging spheres of different materials.
5. Determination of Poisson's ratio for rubber.
6. Study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations) using objects of various geometrical shapes but of same mass.
7. To set up CRO for Sine and Square wave and to find their frequency and amplitude.
8. Study the dependence of solenoidal field on number of turns and current.
9. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
10. To determine the value of air capacitance by de-Sauty method and to find the permittivity of air and also to determine the dielectric constant of medium.
11. To study the efficiency of an electric kettle/heater element with varying input voltages.
12. To study the working of energy meter.

### Text and Reference Books:

1. B.Sc. Practical Physics, By C.L.Arora, S.Chand & Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P.Khandelwal

## Semester –II

### PAPER A: 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 examination, 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 carry 05 marks. Section C will carry 10 marks of 2 marks each.

#### 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 is to attempt any five questions).
- 2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION A

Rigid body motion: Rotational motion, principal moments and axes. Euler's equations; precession and elementary gyroscope. Galilean transformation and Invariance, Non-Inertial frames, concept of stationary universal frame of reference and ether. Michelson-Morley experiment and its result.

#### SECTION B

Postulates of special theory of relativity. Lorentz transformations, Observer and viewer in relativity. Relativity of simultaneity. Length, Time, Velocities, Relativistic Doppler effect. Variation of mass with velocity, mass-energy equivalence, rest mass in an inelastic collision, Relativistic momentum and energy, their transformation, concepts of Minkowski space, four vector formulation.

#### Text Books:

1. Mechanics : Berkeley Physics Course, vol. I by C.Kittel, W.D.Knight and M.A.Ruderman, Mc Graw-Hill Publication
2. Mechanics : H.S.Hans and S.P.Puri, Tata Mc Graw Hill Publication, New Delhi

## Semester -II

### PAPER B: VIBRATIONS AND WAVES-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 examination, 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 carry 05 marks. Section C will carry 10 marks of 2 marks each.

#### 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 is to attempt any five questions).
- 2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION A

Stiffness coupled oscillators. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators, Types of waves, Wave equation (transverse) and its solution, The string as a forced oscillator, Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy, Reflection and Transmission Energy, Reflection and transmission of string, wave and group velocity. Standing waves on a string of fixed length. Energy of vibrating energy string,wave and group velocity.

#### SECTION B

Physical interpretation of Maxwell's equations. Electromagnetic waves and wave equation in a medium having finite permeability and permittivity but with conductivity  $\sigma=0$ . Pointing vector. Impedance of a dielectric to EM waves, EM waves in a conducting medium and skin depth. EM waves velocity in a conductor an anomalous dispersion. Response of a conducting medium of EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal incidence. Reflection of EM waves from the surface of a conductor at normal incidence.

#### Text Books:

1. Fundamentals of Vibrations and Waves by S.P.Puri, Tata McGraw Hill, New Delhi.
2. Physics of Vibrations and Waves by H.J.Pain, Wiley & Sons, New Delhi
3. Waves and Oscillations, by E.Crawford, Berkeley Physics Course, McGraw-Hill Publications, New Delhi.
4. EM Waves and Radiating Systems by Edward C.Jordan and K.G.Balmain, Prentice Hall of India, New Delhi.

## Semester-II

### PAPER C: ELECTRICITY AND MAGNETISM-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 examination, 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 carry 05 marks. Section C will carry 10 marks of 2 marks each.

#### 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 is to attempt any five questions).
- 2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

#### SECTION A

Current and current density, equation of continuity. Microscopic form of Ohm's Law. ( $J = \sigma E$ ) and conductivity. Failure of Ohm's Law. Invariance of charge.  $E$  in different frames of reference. Field of a point charge moving with constant velocity. Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of  $M$  and  $H$  and their relation to free and bound currents. Permeability and susceptibilities and their inter-relationship. Orbital motion of electrons and diamagnetism. Electron spin and paramagnetism. Ferromagnetism. Domain theory of Ferromagnetism. Hysteresis Loss. Magnetisation curve. Ferrites..

#### SECTION B

Lorentz's force. Definition of  $B$ . Biot Savart's Law and its applications to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its application. Divergence and curl of  $B$ . Hall effect expression and co-efficient. Vector potential, Definition and derivation of current density-definition its use in calculation or change in magnetic field at a current sheet. Transformation equation of  $E$  and  $B$  from one frame to another. Faraday's Law of EM induction. Displacement current. Maxwell's equations. Mutual inductance and reciprocity theorem. Self inductance  $L$  for solenoid. Coupling of Electrical circuits. Analysis of LCR series and parallel resonant circuits.  $Q$ -factor. Power consumed power factor..

#### Text Books:

1. Fundamentals of Electricity and Magnetism by Author F.Kipp.
2. Electricity and Magnetism. Berkeley Physics Course. Vol. II by E.M Purcell, McGraw-Hill, 1965.
3. Introduction to classical Electrodynamics by David Griffith.
4. EM waves and Radiating systems by Edward C. Jordan and K.G Balmain.

## **B.Sc. (Physics)**

### **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 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 where needed.

### **Practical Semester II**

**(75 hours)**

1. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine
  - i) Radius of gyration of bar pendulum about an axis through its Centre of Gravity and perpendicular to its length.
  - ii) Value of Centre of Gravity,  $g$ .
2. Determination of  $g$  by Kater's pendulum.
3. Determination of modulus of rigidity of material of a wire using Maxwell's needle.
4. Measurement for logarithmic decrement, co-efficient of damping, relaxation time and quality factor of a damped simple pendulum.
5. To determine the frequency of AC mains using a sonometer and an electro magnet.
6. To determine the low resistance using Carey Foster Bridge.
7. Determination of unknown capacitance by flashing and quenching of neon lamp.
8. Study the phase relationships between voltage and current using impedance triangle.
9. To study the resonance in series and parallel LCR circuits for different resistances and calculate Q-value.
10. To determine the given inductance by Anderson's bridge.
11. Verify laws of electromagnetic induction.
12. To study the induced emf as function of velocity.

### **Text and Reference Books:**

1. B.Sc. Practical Physics, By C.L.Arora, S.Chand & Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P.Khandelwal

**B.SC. (PHYSICS) PART-I (Ist & IInd SEMESTER  
SESSION 2020-21, 2021-22, 2022-23**

**PAPER A : Mechanics -I**

**PAPER A : Mechanics-II**

- 1 Dr. Manjitinder Kaur,  
Department of Physics, Govt. Mohindra College, Patiala.  
Mobile No: 94179-76418
- 2 Dr. Makhan Singh,  
Department of Physics, Govt. Rajindra College, Bathinda.  
Mobile No : 98154-92001
- 3 Dr. Gurdeep Singh Sekhon  
Department Of Physics, Govt. College, Mohali.  
Mobile No : 98882-89101
- 4 Dr. Harvinder Singh ,  
Department of Physics, Govt. Ripudman College, Nabha.  
Mobile No 95017-58600
- 5 Surinder Singla  
Department of Physics,  
Govt. Ranbir College, Sangrur, Cell No. 9417383906
- 6 Dr. Baljit Singh,  
Department of Physics, Khalsa College, Bela.  
Mobile No 98149-26827

**PAPER B : VIBRATIONS AND WAVES-I**

**PAPER B : VIBRATIONS AND WAVES-II**

- 1 Dr. Manju Midha,  
Department of Physics, Govt. Mahindra College, Patiala.  
Mobile No 98723-75737
- 2 Dr. Harvinder Singh,  
Department of Physics, Govt. Ripudaman College, Nabha.  
Mobile No 950175-8600
- 3 Professor Harjinder Singh Mann,  
Department of Physics, Govt. Rajindra College, Bathinda.  
Mobile No : 98157-29166
- 4 Dr. Meera Rani,  
Department of Physics, Govt. College, Ropar.  
Mobile No : 94175-90982
- 5 Dr. Gurdeep Singh Sekhon  
Department of Physics, Govt. College Mohali.  
Mobile No: 98882-89101
- 6 Professor Jatinder Singh Gill,  
Department of Physics, Govt. College, Ropar  
Mobile No 81460-22995.

- 7 Professor Harpal Kaur,  
Department of Physics, Govt. Mohindra College, Patiala  
Mobile No : 977791-73989
- 8 Dr. Makhan Singh  
Department of Physics, Govt. Rajindera College, Bathinda  
Mobile No. 98154-92001
- 9 Dr. Manjitinder Kaur,  
Department of Physics, Govt. Mohindra College, Patiala  
Mobile No 94179-76418

**Paper C Electricity and Magnetism-I**  
**Paper C Electricity and Magnetism-II**

- 1 Dr. Makhan Singh  
Department of Physics, Govt. Rajindera College, Bathinda  
Mobile No. 98154-92001
- 2 Professor Ravinder Singh,  
Department of Physics, Govt. Mohindra College, Patiala.  
Mobile No : 94170-96353
- 3 Surinder Singla  
Department of Physics,  
Govt. Ranbir College, Sangrur,  
Cell No. 9417383906
- 4 Professor Jatinder Singh Gill,  
Department of Physics, Govt. College, Ropar.  
Mobile No : 8146022995
- 5 Dr. Meera Rani,  
Department of Physics, Govt. College, Ropar  
Mobile No : 9417590982
6. Dr. Lovleen  
Department of Physics, Govt. College for Women, Patiala.  
Mobile No : 98147- 15350

## PRACTICALS

1. Mrs. Manjitinder Kaur,  
Department of Physics, Govt. Mahindra College, Patiala. Mobile: 98153 16929
2. Dr. Makhan Singh,  
Department of Physics, Govt. Rajindra College, Bathinda. Mobile: 98154 92001
3. Dr. Gurdeep Singh Sekhon  
Department of Physics, Govt. College, Mohali. Mobile: 988828 89101
4. Dr. Harvinder Singh ,  
Department of Physics, Govt. Ripudman College, Nabha. Mobile: 950175-8600
5. Mr. B.S. Stayal,  
Department of Physics, Govt. College Ropar. Mobile: 94170 22131
6. Dr. Gurpreet Singh  
Department of Physics, DAV College Bathinda.
7. Dr. Baljit Singh  
Department of Physics, Khalsa College Bela. Mobile No: 98149-26827
8. Mrs. Harpal Kaur,  
Department of Physics, Govt. Mohindra College, Patiala Mobile: 977791-73989
9. Mr. Inderjit Singh  
Department of Physics, Govt. College, Ropar Mobile: 98767-85054
10. Mr. Harjinder Singh Mann,  
Department of Physics, Govt. Rajindra College, Bathinda. Mobile: 98157-29166
11. Mr. Ravinder Singh,  
Department of Physics, Govt. Mohindra College, Patiala. Mobile: 94170-96353
12. Dr. Loveleen,  
Department of Physics, Govt. College for Women, Patiala. Mobile: 98147 15350
13. Dr. Jagdish Singh,  
Department of Physics, Guru Teg Bahadur College, Anandpur Sahib
14. Mrs. Anoop Kaur  
Department of Physics, Govt. College, Faridkot.
15. Mr. Jatinder Singh Gill,  
Department of Physics, Govt. College, Ropar. Mobile No: 81460 22995
16. Dr. Manjit Singh Saini,  
Department of Physics, Govt. Mohindra College, Patiala. Mobile No: 94179 76418
17. Dr. Meera Rani,  
Department of Physics, Govt. College, Ropar Mobile No: 94175 90982
18. Mr. Joginder Singh Batra,  
Department of Physics, Govt. College, Mohali. Mobile No: 98158-46609
19. Dr. M.P. Singh,  
Guru Kashi College, Talwandi Sabo, Mobile No : 94170-67792
20. Dr. Jaspal Singh,  
Department of Physics, Punjabi University Girls College, Mansa  
Mobile No: 94780 11059

- 21 Dr. Tajinder Singh  
Department of Physics, Mata Gujri College, Fatehgarh Sahib. Mobile: 97819 86678
- 22 Surinder Singla  
Department of Physics, Govt. Ranbir College, Sangrur, Cell No. 9417383906

B.Sc. (CHEMISTR) PART – I  
(SEMESTER FIRST & SECOND)  
(SESSION – 2021-22) (CHEB3PUP)

SEMESTER - I

PAPER CODE	TITLE	MAX MARKS	SEM.PAPER	INT.ASSTT.
CHEB1101T	INORGANIC CHEMISTRY	35	26	09
CHEB1102T	ORGANIC CHEMISTR	35	26	09
CHEB1103T	PHYSICAL CHEMISTRY	35	26	09
CHEB1104L	PRACTICAL CHEMISTRY	45	16 (PASS MARKS)	

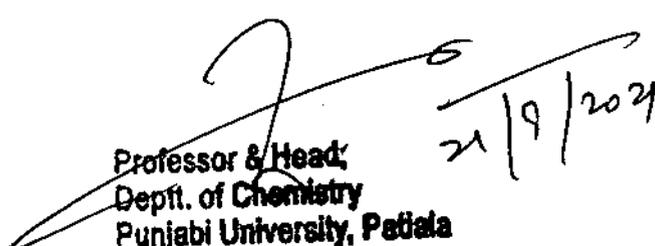
SEMESTER – II

PAPER CODE	TITLE	MAX MARKS	SEM.PAPER	INT.ASSTT.
CHEB1201T	INORGANIC CHEMISTRY	35	26	09
CHEB1202T	ORGANIC CHEMISTR	35	26	09
CHEB1203T	PHYSICAL CHEMISTRY	35	26	09
CHEB1204L	PRACTICAL CHEMISTRY	45	16 (PASS MARKS)	

Drug Abuse Problem, Management and Prevention\* 100 (MM) 70 (SP) 30(IA)

Qualifying Paper: Session 2016-17, 2017-18 and 2018-19

\*As per University Letter No. 13831/SM-6 Dated: 12.10.2016

  
Professor & Head  
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Punjabi University, Patiala

21/9/2024

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**PUNJABI UNIVERSITY, PATIALA**  
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**ORDINANCES  
AND  
OUTLETS OF TESTS,  
SYLLABUS AND COURSES OF READING  
FOR B.SC. (CHEMISTRY) PART-I  
SESSION 2020-21, 2021-22 & 2022-23**



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**B.Sc. (Chemistry) Part-I**  
**2020-21, 2021-22 & 2022-23**

**SEMESTER I**

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

**SEMESTER II**

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

**Drug Abuse Problem, Management and Prevention\***    100 (MM)    70 (SP)    30(IA)

Qualifying Paper: Session 2016-17, 2017-18 and 2018-19

\*As per University Letter No.13831/SM-6 Dated: 12.10.2016

**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 (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

**- Section - A**

**1. Atomic Structure**

7 hrs.

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of  $\Psi$  and  $\Psi^2$ , quantum numbers, radial and angular wave functions and probability distribution curve, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.

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## 2. Periodic Properties

Position of element in the periodic table effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electronic affinity and electronegativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

5 hrs.

## 3. Chemistry of Noble gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

3 hrs.

### Section - B

#### 1. Chemical Bonding - I

Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions.  $\text{BeF}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{SnCl}_2$ ,  $\text{XeF}_4$ ,  $\text{BF}_4^-$ ,  $\text{PF}_6^-$ ,  $\text{SnCl}_6^{2-}$ .

15 hrs.

#### 2. Chemical Bonding - II

Valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2$ , and  $\text{H}_2\text{O}$ . MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear ( $\text{BO}$ ,  $\text{CN}$ ,  $\text{CO}^+$ ,  $\text{NO}^+$ ,  $\text{CO}$ ,  $\text{CN}$ ), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes) percentage ionic character from dipole moment and electronegativity difference.

### SEMESTER I 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 (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

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## Section - A

### I. Structure and Bonding

5 Hrs.

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

### II. Mechanism of Organic Reactions

7 Hrs

Curved arrow notation, drawing electron movements with half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents of organic reaction. Energy considerations. Reactive intermediates-cations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereo-chemical studies).

### III. Alkanes

4 Hrs.

Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

## Section - B

### 1. Cyclo alkanes

3 Hrs.

Cycloalkanes--nomenclature, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds.

### 2. Alkenes, Cycloalkenes

6 Hrs.

Nomenclature of alkenes-methods of formation, mechanisms and dehydration of alcohols and dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ . Polymerization of alkenes. Substitution and the allylic and vinylic positions of alkenes. Industrial application of ethylene and propene.

Methods of formation, conformation and chemical reactions of Cycloalkenes.

### 3. Dienes And Alkynes

6 Hrs.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions hydroboration-oxidation. metal-ammonia reductions oxidation and polymerization.

  
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SEMESTER I  
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 (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

**Section - A**

**1. Mathematical Concepts**

8 Hrs.

Logarithmic relations. curve sketching, linear graphs and calculation of slopes, differentiation of functions like  $kx$ ,  $e^x$ ,  $x^n$ ,  $\sin x$ ,  $\log x$ , maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions permutations and combinations. Factorials. Probability .

**2. Evaluation of Analytical Data**

6 Hrs.

Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation, confidence limits, rejection of measurements (F-test and Q-test) numerical problems related to evaluation of analytical data.

**Section - B**

**3. Liquid State**

4 Hrs.

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases.

Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and eholestric phases. Thermography and seven segment cell.

**4. Gaseous State**

8 Hrs

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision

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number, mean free path, and collision diameter. Liquifacation of gases (based on Joule-Thomson effect).

**5. Physical Properties and Molecular Structure**

4 Hrs.

Optical activity, polarization-(Clausius-Mossotti equation), orientation of dipoles in an electric field, dipole moment. Induced dipole moment, measurement of dipole moment temperature method and refractivity method. Dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetism.

**PRACTICAL CHEMISTRY - I  
SEMESTER I**

Max Marks : 45  
Passing Marks : 35%

6 Periods / week

**INSTRUCTIONS FOR THE  
PAPER SETTERS EXAMINERS/CANDIDATES**

The Practical Examinations will be held in morning (one day) and morning session will be of 3 hours duration. During this session students will perform semi micro analysis. Paper setter will enlist five different mixtures and the examiner will randomly distribute these mixtures amongst the students. Each candidate will analyse one mixture. Students are permitted to consult the books for the scheme of tests for semimicro analysis. Examiners will check the note books and will hold viva-voce.

**INORGANIC CHEMISTRY**

**Semi-micro analysis:**

Cation analysis, separation and identification of ions from Groups I, II, III, IV, V and VI. Anion analysis (2 cation and 2 anion with no interference). 30 Marks

Viva Voce

10 Marks

Copy

5 Marks

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**SEMESTER II  
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 (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

**Section - A**

**1. Ionic Solids-**

5 hrs.

Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurzite,  $\text{CaF}_2$ , and antiferite), radius ratio rule and coordination number, Limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and bond theories.

**2. s-Block Elements**

5 hrs.

Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems.

**3. p - Block Elements (Group 13)**

5 hrs.

Comparative study (including diagonal relationship) of groups 13 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13; hydrides of boron-diborane and higher boranes, borazine, borohydrides.

**Section - B**

**4. p - Block Elements (Group 14-17)**

15 hrs.

Comparative study (including diagonal relationship) of groups 14-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 14-17; fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

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SEMESTER II  
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 (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

**Section - A**

**1. Stereochemistry of Organic Compounds**

15 Hrs.

Concept of isomerism. Types of isomerism

Optical isomerism-elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism-determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives.

Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

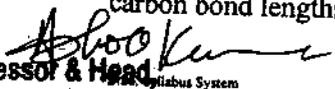
Difference between configuration and conformation.

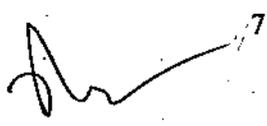
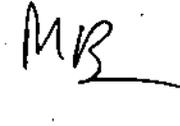
**Section - B**

**1. Arenes and Aromaticity**

7 Hrs.

Nomenclature of benzene derivatives. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

  
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**Aromaticity:** the Huckel rule, aromatic ions.

Aromatic electrophilic substitution-general pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives.

Methods of formation and chemical reaction of alkylbenzenes alkynyl benzenes.

## 2. Alkyl and aryl halides

8 Hrs.

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides,  $S_N^1$  and  $S_N^2$  reactions with energy profile diagrams.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

### SEMESTER-II 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 (Section C 9th question being compulsory) selecting two questions from each of A & B Sections.

#### Section - A

### 1. Solutions, Dilute Solutions and Colligative Properties

8 Hrs.

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficients.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination molecular weight from osmotic pressure,

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Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties.

Abnormal molar mass, degree of dissociation and association of solutes.

**2. Colloidal State**

7 Hrs.

Definition of colloids, classification of colloids

Solids in liquids (sols): properties-kinetic, optical and electrical; stability of colloids protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions) types of emulsions, preparation, Emulsifiers.

Liquids in solids (gels): Classification, preparation and properties inhibition. General applications of colloids.

**Section - B**

**3. Chemical Kinetics and catalysis**

15 Hrs.

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction- concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction-s-differential method, method of integration, method of half life period and isolation method.

Radioactive decay as a first order phenomenon.

Theories of chemical kinetics, effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis and general characteristics of catalytic reactions. Homogeneous catalysis, acid base catalysis and enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis and its mechanism.

**PRACTICAL CHEMISTRY II  
SEMESTER II**

Max Marks : 45

6 Periods / week

Passing Marks : 35%

**INSTRUCTIONS FOR THE  
PAPER SETTERS EXAMINERS/CANDIDATES**

In this session in morning students will perform physical and organic chemistry practicals. Examiner will again conduct viva-voce of students.

- 1) The examiner should preferably give different liquids solids to the candidates for the determination of boiling point/melting point and crystallization from the list of liquids/solids by the paper setter.
- 2) The paper setter will provide a list of five physical chemistry experiments. The examiner will allot one experiment randomly to each candidate. The candidate will write theory, brief procedure and

MR

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general calculations of the experiment in the first 10 minutes and thereafter perform the actual experiment.

#### DETAILS OF DISTRIBUTION OF MARKS

1) Melting point/boiling point/crystallization	10 marks
2) Physical chemistry experiment	20 marks
a) Initial write up	7 marks
b) Performance	18 marks
4) Viva-voce	10 marks
5) Note Book	5 marks

#### Laboratory Techniques

##### Determination of melting points:

Naphthalene, 80-82°. Benzoic acid, 121.5-122°  
Urea, 132.5-133°, Succinic acid, 184.5-185°.  
Cinnamic acid, 132.5-133°, Salicylic acid, 157.5-158°.  
Acetanilide, 113.5-114°, *m*-Dinitrobenzene, 90°.  
*p*-Dichlorobenzene, 52°, Aspirin, 135°.

##### Determination of boiling points

Ethanol, 78°, Cyclohexane, 81.4°. Toluene, 110.6°, Benzene, 80°.

##### Crystallization

Concept of induction of crystallization  
Phthalic acid from hot water (using fluted filter paper and seamless funnel)  
Acetanilide from boiling water  
Naphthalene from ethanol  
Benzoic acid from water

#### Physical Chemistry Experiment

20 Marks

##### Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. Viscosity & Surface Tension of pure liquids.  
To determine the viscosity and surface tension of C<sub>2</sub>H<sub>5</sub>OH and glycerin solution in water
4. Molecular weight determined by Rast method.

Viva Voce

10 Marks

Copy

5 Marks

#### BOOKS SUGGESTED (THEORY COURSES)

1. *Basic Inorganic Chemistry*. F.A. Cotton. G. Wilkinson and P.L. Gaus. Wiley.
2. *Concise Inorganic Chemistry*. J. D. Lee. ELBS.

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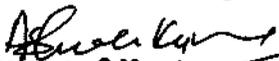
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3. *Concepts of Models of Inorganic Chemistry*. B. Doaglas. D. McDaniel and J. Alexander, John Wiley.
4. *Inorganic Chemistry*. D.E. Shriver, P. W. Aikins and C.H. Langford. <Oxford.
5. *Inorganic Chemistry*. W. W. Porterfield Addison. Wesley.
6. *Inorganic 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. Albery, 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.

#### BOOKS SUGGESTED (LABORATORY COURSES)

1. *Vogel's Qualitative Inorganic Analysis*, revised, Svehla, Orient Longman.
2. *Vogel's Textbook of Quantitative Inorganic Analysis* (revised), J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham, ELBS.
3. *Standard Methods of Chemical Analysis*, W.w. Scott the Technical Press.
4. *Experimental Inorganic Chemistry*: W.G. Palmer, Cambridge.
5. *Handbook of Preparative Inorganic Chemistry*. Vol. I & II, Brauer, Academic Press.
6. *Inorganic Synthesis*, McGraw Hill.
7. *Experimental Organic Chemistry*. Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. *Laboratory Manual in Organic Chemistry*. R.K. Bansal, Wiley Eastern.'
9. *Vogel's Textbook of Practical Organic Chemistry*. B.S. Furniss, A.I. Harnaford, V. ogers, P.w.G. Smith and A.R. Tatchell, ELBS. -.
10. *Experiments in General Chemistry*. C.N.R. Rao and U.e. Aggarwal. East- West Press.
11. *Experiments in Physical Chemistry*. R.C. Dass and B. Behra, Tata McGraw Hill.
12. *Advanced Practical Physical Chemistry*, J.B. Yadav, Goel Publishing House.
13. *Advanced Experimental Chemistry*. Vol. I: Physical, J.N. Gurtu and R. Kapoor, S. Chand & CO.
14. *Selected Experiments in Physical Chemistry*, N.G. Mukherjee, J.N. Ghose & Sons.
15. *Experiments in Physical Chemistry*. J.E. Ghosh, Bharati Bhavan.

  
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