



*S.S.R Uploading & Inauguration  
Hon'ble Vice Chancellor, V.K.S.U*

## **VEER KUNWAR SINGH UNIVERSITY, Ara**

### **content**

**B. SC. PART- II**

### **GENERAL, SUBSIDIARY AND HONOURS**

<b><u>SERIAL No.</u></b>	<b><u>Subject</u></b>
<b>1.</b>	<b>Physics : Honours &amp; Sub.</b>
<b>2.</b>	<b>Chemistry : Honours &amp; Sub.</b>
<b>3.</b>	<b>Math : Honours &amp; Sub.</b>
<b>4.</b>	<b>Botany</b>
<b>5.</b>	<b>Zoology</b>
<b>6.</b>	<b>Hindi Rachna</b>
<b>7.</b>	<b>Hindi Rachna Ahindi Bhasiyun</b>

## 8. Urdu Composition

### B.Sc : PART – II (ii) Earth's Inductor

4. Wavelength by Newton's rings.
5. Refractive index by spectrometer.
6. Wavelength of monochromatic light using Biprism.
7. Characteristics of a semi-conductor Diode.
8. Specific rotation by polarimeter .
9. Figure of merit of a suspended Coil galvanometer.
10. Measure of monochromatic light by plane transmission grating using Spectrometer.
11. Measurement of monochromatic light using optical bench.
12. Resolving power of telescope.
13. Callibration of ammeter and voltmeter by potentiometer.
14. Compare the capacities of capacitors by De Saute's Bridge.
15. B.C. Constant by decrement method.
16. Measurement of low and high resistance.
17. Figure of merit of ballistic galvanometer.
18. Design and study of single stage R.C. coupled amplifier.

### PHYSICS:

#### (GENERAL/SUBSIDIARY)

The course shall consist of one Theory paper of 75 Marks. The pass marks will be 23 and the examination will be 3' hours duration. There will be One Practical paper of 25 marks. The pass marks will be 10 and the examination will be of 3 hours duration.

The following will be the detailed Courses.

#### Paper – II

#### THEORY

Time- 3 Hours

Full

Marks : 75

10 questions to be set, 5 to be answered. Question number one will be objective (15 Questions) and it will be Compulsory. 2 question will be set from' Group-A from Group-B and 3 from Group-C Atleast one question from each group is to be answered. All question will be of equal marks.

#### Group-A

#### ELECTROSTATICS AND MAGNETISM:

#### 2(1+1)Question

Boundary Condition at the surface of separation of two dielectrics, Electric doublets, Dipole moments, Dielectric polarization. Electrical images, Problems involving conducting plane and thin conducting, spherical shell only.

Magnetic shell, Langevin's and Weiss theory of dia, Para and fields, Magnetic circuits and electromagnets.

#### Group-B

#### CURRENT ELECTRICITY, MODERN PHYSICS:

4

#### Questions

Thermodynamical treatment of see bac, Peltier and Thomos effect and their application's. Moving coil a periodic and ballistic galvanometer, Growth and decay of current in electric Circuit, Oscillatory discharge of condenser, A.C. and A.C. Circuits–Use of Vectors and Complex Quantities in A.C. Circuits .Theory (LR, CR and LCR circuits). De Sauty's bridge. Anderson's bridge, Carey Foster's bridge.

Measurement of charge by Milikan's method and specific charge of an electron by Thomson's method, Natural radio-activity, Rutherford-Soddy's Theory of radio-active decay, Geiger Mullar Counter, Discovery of Neutron. Isotopes, Artificial, radio activity, Elementary ideas about nucleus and its structure, Nuclear fission Reactors, Aston's mass spectrograph, Photoelectric emission, Eansetin's photo electric equation, Photo-conductive and photo-voliaic cell, Compton effect. Cathode ray, Oscilloscope and its uses in amplitude, frequency and phase measurement, Solid state rectifier. One stage R-C amplifier Principal of amplitude modulation and demodulation. Radio receiver through block diagram.

#### Group-C

3 Questions

Fermat's principle, Newton's ring, Michelson's Interferrometer', Fresnel's diffraction at straight edge .Fraunhoffer's diffraction, single slit double slit. Plane transmission grating. Resolving power of Telescope and microscope. Polarization, Production of plane, Circularly and elliptically-polarized lights. Nicol's prism, Quarter wave plate, half shade polarimeter, Babinet's Compensator. Bohr's theory of Hydrogen spectra, Principal of Laser action, Ruby Laser. Maxwell's equation, Equation of plane, electromagnetic. waves and its solution.

#### PRACTICAL PAPER

Time: Hrs

Full Marks: 25

The course shall include the following experiments-

1. Magnifying power of Telescope
2. Angle of Dip by Circle.
3. Wave length by Newton's rings.
4. Refractive index by spectrometer.
5. Wave length by plane transmission grating.
6. Measurement of low resistance.
7. Measurement of high resistance.

8. Figure of merit of moving coil galvanometer.
9. Measure angle of prism by spectrometer. wot
10. Angle of dip by earth inductor.
11. Resolving power of telescope.
12. Magnifying power of microscope.
13. Callibration of ammeter and volt-meter by potentiometer.
14. Study the characteristics of given semiconductor diode.
15. Compare the capacities of capacitors by De Sauty's Bridge.

**Paper- III (A)**  
**CHEMISTRY(HONS)**

**Full Marks: 50**

There will be TEN questions each of ten (10) marks including Question No. 1 (one) will be of objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

**GROUP-A**

**1. SOLID STATE:**

Lattice energy, its calculations and application, crystal structure of NaCl, KCl, ZnS and diamond, Radius ratio rule and co-ordination numbers. Properties of solids: Magnetic properties, Electrical properties and Dielectric properties, Idea of liquid crystals.

**2. COLLOIDS:**

Definitions, classification. Lyophilic and Lyophobic colloids, Preparation of colloids; peptization, purification of colloids Dialysis, properties of colloids, Brownian Movement, Tyndall effect, electrophoresis, Origin of charge, electrokinetic potential, size determination, coagulation, Hardy Schulze rule Protection of Colloids Gold number Gel, Emulsion and Micelles.

**3. CATALYSIS:**

Definition and classification of catalyst, characteristics of catalyst, theory of catalysis, acid-base catalysis, auto-catalysis enzyme catalysis, zeolite catalysis, promoter, inhibitors, catalytic Poison.

**GROUP-B**

**THERMODYNAMICS:**

Second law of thermodynamics, Carnot theorem, Carnot Cycle. Entropy and its probability entropy change for reversible and irreversible processes and ideal gases, entropy of mixing of ideal gases, free energy and work function, criteria of chemical reactions, Gibbs-Helmholtz equation, Clausius-Clapeyron equation and its applications.

**PHASE EQUILIBRIUM:**

Phase rule, terms and derivation, one component water and Sulphur system, two component solid and liquid systems (Ag-Pb; Mg-Sn, KI-H<sub>2</sub>O, FeCl<sub>3</sub>-H<sub>2</sub>O), Eutectic mixture azeotropic mixture, congruent and incongruent compounds.

**3. DISTRIBUTION LAW:**

Nernst distribution law, Factors affecting partition coefficient, thermodynamic derivation, limitations and applications, modification in case of association dissociation and chemical change.

**GROUP-C**

**CHEMICAL KINETICS:**

Effect of temperature on reaction rate (Arrhenius equation), effect of catalyst on reaction rate, Energy of activation and its determination, Experimental measurement of order in acid catalysed hydrolysis of methyl acetate, saponification of ester and inversion of cane sugar, first order gas phase reaction (Lindemann Theory)

**CONDUCTANCE:**

Conductance of electrolytes, cell constant, specific conductance, equivalent conductance and Molar conductance, effect of dilution on various types of conductance and their measurement. Kohlrausch's law independent migration of ions and its applications, conductometric titration.

**IONIC EQUILIBRIUM:**

Ostwald's Dilution Law Determination of dissociation constant of acetic with the help of conductance measurement, Relative strength of acids and bases, salt hydrolysis Constant, degree of hydrolysis. Application of conductance measurement; solubility product, degree of ionization and ionic product of water, theory of acid base indicators.

**Paper-III(B)**  
**INORGANIC CHEMISTRY**  
**GROUP-A**

**ATOMIC STRUCTURE:**

Determination of electronic charge and e/m ratio, Bohr frequency condition, Dual nature of electrons, Uncertainty principle, idea of ground state term symbols. Excited state term symbol for d<sup>2</sup> system

**CHEMICAL BONDING:**

Explanation of valence Bond Theory, Qualitative treatment simple applications, Sidgwick-Powell theory, structure of BF<sub>3</sub>, NH<sub>3</sub>, H<sub>2</sub>O, PCl<sub>5</sub>, ClF<sub>3</sub>, SF<sub>4</sub>, SF<sub>6</sub>, IF<sub>7</sub>, CO<sub>3</sub>, NO<sub>3</sub>, SO<sub>4</sub>, I<sub>3</sub>  
Metallic bond-Idea of free electron theory and VB. T. explanation, conductors, semiconductors.

## COORDINATION CHEMISTRY:

Double salts and co-ordination compounds, I.U.P.A.C- nomenclature of Co-ordination compounds including complexes with unsaturated molecules or groups and bridging group. Werner postulates, EAN rule, Valence bond theory of Co -ordination compounds, Isomcrism, Types with examples. Shapes of d-orbitals, C.F.T. and its applications, chelates.

### GROUP-B

1. General chemistry, structure and bonding of-
  - (a) Noble gas compounds.
  - (b) Pseudo halogens and polyhhalides.
2. Transition metals and comparative chemistry of-
  - (a) Sc, Y, La (b) Ti, Zr, Hf
  - (c) Fe, Co, Ni .
3. **Chemistry of Group-IV Elements:**  
C. Si Ge: Carbides silicates and letrahalides idea of fullerenes and zeolites.

### GROUP-C

#### SPECTROSCOPY:

Elementary idea of principles and simple applications of the following R Spectroscopy, U-V and Visible spectroscopy.

#### ANALYTICAL CHEMISTRY:

Use of complexation reactions in qualitative, inorganic mixture analysis, Organic reagents in inorganic analysis, EDTA, dimethyl glyoxime, Oxine, a-nitrose b-naphthol, cupeferron, thiosalicylic acid,

Theory behind the group separation in inorganic qualitative cationic analysis.

- (a) Outline of chemistry involved in the following and allied phenomcement steel, water, fuel and industrial gases.
- (b) Idea of major chemical pollutants in environment.

## Paper-III(C) ORGANIC CHEMISTRY GROUP-A

#### ISOMERISM:

Tautomerism, Keto-enol tautomerism, Estimation of Keto and enolic content, Stersoidomerism, projection formulae elements of symmetry, geometrical and optical isomerism, E-Z and R-S modes of nomenclature.

Elementary idea of cofiguration, diastereoismerism, Asymmetry and dismmetry, walden inversion.

Electrophilic substitution in benzene nucleus, mechanism of nucleophilic substitution at saturated carbon.

Name reaction with their mechanism; Friedel-craft reactions, Sandmeyer Reactions, Gattermann-koch reactions, Caniizzaro's reaction, Benzoin Condensation, Perkin reaction, Reimer-Tiemann reaction.

### GROUP-B

#### CARBOHYDRATES:

Nomenclature, classification, structure and configuration of glucose and fructose, Ring structure, Ruff degradation, killiani Fischer Synthesis. Osazone formation, mechanism, Epimerization and interconversion (lower to higher carbohydrate & vice-versa, Aldose to ketose & vice-versa.

#### AROMATIC COMPOUNDS:

Aromaticity and Huckel' rule, Preparation and properties of benzene, toluene, benzene sulphonic acid, nitrobenzene, aniline, diazonium salt, phenol benzaldehyde, Bennoic acid.

#### HYDROXYACIDS:

Lactic acid, citric acid, general methods of preparation and distinction between a and b hydroxy acids, stereochemistry of hydroxy acids.

### GROUP-C

Synthetic applications of the following reagents in Organic chemistry Raney Ni, LiAlH<sub>4</sub>, AlCl<sub>3</sub>, Al (OCH-CH<sub>3</sub>-CH<sub>3</sub>)<sub>3</sub> and HNO<sub>3</sub> Brief introduction of TLC, Paper and pas chromatography.

- (a) Organic polymers and resins.
- (b) Brief idea of proteins.

## DEGREE-II Paper-IV CHEMICAL PRACTICAL

Full Marks: 50

#### [A] VOLUMETRIC ANALYSIS:

Estimate the amount of NaOH and Na<sub>2</sub>CO<sub>3</sub> each in One Litre of the supplied mixture solution with the help of standard acid solution.

Estimate the amount of Na<sub>2</sub>CO<sub>3</sub> and NaHCO<sub>3</sub> each in One litre of the supplied mixture solution with the help of standard acid solution.

#### [A] REDOXTITRATION:

- (1) Preparation of N/10 KMn(), solution and its standardisation with N/10 oxalic acid solution.
- (2) Estimate the amount of Fe' in one litre of the supplied Mohr's salt solution using standard KMnO<sub>4</sub> solution.
- (3) Estimate the amount of H<sub>2</sub>SO<sub>4</sub> and H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> each in one litre of supplied mixture solution wing standard KMnO<sub>4</sub> solution.
- (4) Estimate the amount of Fe' in one litre of the supplied solution with the help of K<sub>2</sub>Cr<sub>2</sub>O<sub>2</sub> solution or estimation' of Ni<sup>2+</sup>, SO<sub>4</sub> and Ba<sup>2+</sup> in one litre of the given solution gravimetrically.

(5) Estimate the amount of copper in one litre of supplied solution with the help of standard  $\text{Na}_2\text{S}_2\text{O}_3$

2. Preparation of any one of the following-

- (a) Acetylation of salicylic acid, aniline and p-toluidine.
  - (b) Benzoylation: Preparation of benzanilide and benzoyl derivative of p-toluidine.
  - (c) Nitration: Preparation of p-nitroacetanilide, Picric acid and m-di Nitrobenzene.
  - (d) Reduction: Preparation of m-nitroaniline from meta di-nitrobenzene.
  - (e) Oxidation: Preparation of (i) Benzoic acid from benzaldehyde and (ii) anthranilic acid from anthracene.
  - (f) Esterification: Preparation of ethyl benzoate
3. Note Book and viva-voce.

### CHEMISTRY (SUBSIDIARY AND GENERAL)

#### Full Marks:75

There will be TEN questions each of fifteen(15) marks including Question No. 1(one) will be objective type and compulsory covering the entire syllabus. Three questions will be set from each group out of which FOUR to be answered selecting at least ONE from each group.

#### STATE OF MATTER:

**Gasous State:** Vander waals equation of state, units and significance of a & b, critical constants, liquefaction of gases critical constants, collision no, collision frequency. Mean free path, Law of Corresponding state.

**Solid State:** Types of crystalline solids. Laws of crystallography lattice, unit cell and their types, Bragg's equation, Lattice energy, Born-Haber cycle. Stoichiometric and non-stoichiometric defects in simple ionic solids.

#### THERMODYNAMICS:

Definition of terms: System, extensive, intensive properties first and second laws of thermodynamics, Carnot theorem and Carnot cycle.

(a) **Ionic Equilibrium:** Ostwald's dilution law, conductance measurement of dissociation constant of acetic acid, salt Hydrolysis, idea of theory of acid base indicators.

(b) **Phase Rule:** Terms, equation (no derivation required, Sulphur-system)

#### 4. CHEMICAL KINETICS:

Rate of reaction order and molecularity, expression for rate constant of 1<sup>st</sup> and 2<sup>nd</sup> order reaction, half life period and its units, effect of temp on reaction rate, Arrhenius equation.

#### GROUP-B

(a) **Atomic structure and Bonding:** de Broglie's wave equation, Heisenberg uncertainty principle, Schrodinger wave equation (no derivation), wave function, Eigen value and Eigen function. Covalent Bond: Simple treatment of V.B.T., Hybridization, van der Waals forces and Metallic bonding.

(b) **Complex Compounds:** Double and complex Salts, Werner's Postulates, I.U.P.A.C nomenclature complexes, Isomerism in complexes (only structural).

#### 2. TRANSITION METALS:

General characteristics of transition metals with reference to oxidation state, complex formation, magnetic behavior and colour of their compounds.

3. CHEMISTRY OF GROUP-IV ELEMENTS: C, Si, Fullerenes and Zeolites, Major chemical pollutants in environment.

4. Chemistry of following elements and their compounds,

(a) Fe, Co, Ni (b) Cr (c) Mn

#### GROUP-C

**STRUCTURE AND MECHANISM:** Different types of Isomerism, E-Z- nomenclature, Electronic substitution in benzene nucleus and mechanism of nucleophilic substitution at saturated carbon ( $\text{S}_\text{N}1$  &  $\text{S}_\text{N}2$ )

**NATURAL PRODUCTS: Carbohydrates:** Nomenclature, classification, open chain structure of glucose and fructose, elementary idea of glycosides.

(a) Structure of Benzene, preparation and properties of benzene diazonium chloride and benzaldehyde. Lactic Acid and Citric Acid. Brief idea of polymers, resins, proteins, sulphur drugs and antibiotics.

### CHEMISTRY PRACTICAL (SUBSIDIARY AND GENERAL)

Time: 5 hrs.

Full Mark: 25

#### VOLUMETRIC ANALYSIS:

Estimate the amount of NaOH and  $\text{Na}_2\text{CO}_3$  each in one litre of the supplied mixture solution with the help of standard acid solution.

Estimate the amount of  $\text{Na}_3\text{CO}_3$  and  $\text{NaHCO}_3$  each in one litre of the supplied mixture solution with the help of standard acid solution.

Preparation of N/10  $\text{KMnO}_4$  solution and its standardization with N/1 oxalic acid solution.

Estimate the amount of  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{C}_2\text{O}_4$  each in one litre of supplied mixture solution using standard  $\text{KMnO}_4$  solution.

#### ORGANIC PREPARATION:

8 Marks

- (a) Acetylation of aniline and p-toluidines,
- (b) Nitration of nitrobenzene.
- (c) Oxidation of benzaldehyde.



(d) Hydrolysis of esters like ethyl benzoate and methyl salicylate. Records of class work and viva-voce.

**Mathematics**  
**(General and Subsidiary Course)**

Stress should be given an development of ideas and theory development rather than solving problems. Problems should short and intelligent. There will be sixteen question to be set and eight to be answered selecting at least one from each group, One question will be objective/short answer will be compulsory, This question will be of sixteen marks and the rest questions are each of twelve marks.

**Paper-II**

**Time: 3 Hours**

**Full**

**Marks: 100**

**Group-A** : Mechanics

(a) Statics

(b) Dynamics : 2+2 Ques.

**2. Group-B**

(a) Differential Calculus

(b) : 3+2 Ques.

**3. Group-C** : Differential Equations : 2 Ques.

**4. Group-D** : Vector : 2 Ques.

**5. Group-E** : Real Analysis and infinite Series : 2 Ques.

**Group-A**

**MECHANICS:**

**Statics:** Resultant of a system Coplaner forces into a single force and couple, Virtual work in two dimension, Stable Equilibrium, Catenary.

**Dynamic:** Simple Harmonic Motion, Simple pendulum Elastic string and spring, Hooke's law (one question). Component of velocity and acceleration in a plane, tangential and normal velocities and acceleration, radial and transverse velocities and acceleration, projectile, Kepler's Laws of planetary motion (one question).

**Group-B**

**DIFFERENTIAL AND INTEGRAL CALCULUS:**

**Differential Calculus:** Successive differentiation, Leibnitz theorem, tangent and normal Curvature, Asymptotes. partial differentiation. Euler's theorem Exact differential, Indeterminate forms.

**Integral Calculus:** Integration of rational and irrational functions, Notion of Integrals as Sum, Evaluation of definite Integrals. Length of curves, areas of curves. Volume and Surface area.

**Group-C**

**DIFFERENTIAL EQUATIONS:**

Formation and solution of differential Equation. Differential Equation of 1<sup>st</sup> order and 1<sup>st</sup> degree, separation of variables. Exact differentials, linear differential equation of 2<sup>nd</sup> order with constant coefficient, Complementary functions and particular integral.

**Group-D**

**VECTOR:**

Product of three and four vectors, Differentiation of Vector point functions, differentiation of product of vectors, Grad Divergence and curl of a vector function, Moment of Localized Vectors about a point. Scalar Moment of vector about a directed line, work done by a force.

**Group-D**

**REAL ANALYSIS AND INFINITE SERIES:**

**Real Analysis Series:** Dedekind's theory of real analysis sequence and its convergence" Cauchy's sequence its general principle of convergence, monotonic sequence, Taylors and McLaren's Series of elementary function. **Infinite Series:** Convergence of an infinite series, Comparison test, Rabbe's test. Ratio test, Leibnitz test. Absolute Convergence and rearrangement of series.

**B.A/B.Sc. Part-II**

**MATHEMATICS (HONS)**

There will be twelve questions to be set and Six to be answered in each paper selecting at least one from each group. One question will be objective: answer type and will be compulsory. This question will be of twenty marks and the rest questions are of each of sixteen marks in both the papers.

**Paper-III**

**Time: 3 Hours**

**Full**

**Marks: 100**

**Group-A:** Real Analysis : 4Ques.

**Group-B:** Infinite Series : 3Ques.

**Group-C:** Abstract Algebra : 4Ques.

**Group-A**

**REAL ANALYSIS:**

Dedekind's Theory of real numbers, algebraic and order properties of real no. archmedian properties of real number, sequence and its convergence, Cauchy" sequence, Cauchy's general principle of convergence, monotonic sequence, cantor's construction of real nos. Continuity and differentiability of a function of single variables, Properties of continuous and dis-continuous functions, Rollers theorem. Mean value theorems Taylor's and Macurins series of elementary functions.

**Group-B**

**INFINITE SERIES:**

Infinite series and their convergence, Comparison test Rabbe's test, Cauchy. Condensation test. Integral test, Leibniz test, Gauss, Best, Kummer's test, De Morgan's and Bertrand's test, Logarithmic ratio test, Absolute Convergence and rearrangement of series, Pringrecrsin's theoretns, Cauchy's multiplication of series and its convergence.

**Group-C**

**ABSTRACT ALGEBRA:**

Binary operation, notion of a group, abelian and non-abelian groups with examples, Different ways of defining a group and their equivalence, Concept of a subgroup and cyclic groups, inter section of Subgroups. Cyclic subgroups.

Group of residue classes, permutation group, Cayley's theorem, Homomorphism and isomorphism of groups, Kernel of a group, Homomorphism and isomorphism theorems for groups, factor group," fundamental theorem. Concept of a ring, Integral domain and field with examples, Divisor of Zero, a finite domain as a field.

Ring of residue classes, ring of matrices, sub rings, ideals ring, homomorphism quotient rings, fundamental theorem of homomorphism of rings.

#### Paper-IV

Time: 3 Hours

Full

Marks: 100

Group-A: Diff. Equations : 3 Ques.

Group-B: Vector Calculus : 2 Ques.

Group-C: Statics (Via Vector) : 3 Ques.

Group-D: Dynamics : 3 Ques.

#### Group-A

##### DIFF. EQUATION:

Formation and solution of differential equation, Diff equation of 1<sup>st</sup> order and 1<sup>st</sup> degree. Separation of variables, Homogeneous equations. Exact Differential Equations of 1<sup>st</sup> order but not of the first degree, orthogonal trajectory, singular solution, Linear differential Equations of 2<sup>nd</sup> order with constant co-efficient, Complementary functions and particular integrals. Application of differential equations.

#### Group-B

##### VECTOR CALCULUS:

Product of three and four vectors. Differentiation of a vector point function. Differentiation of product of vectors, gradient, Divergence and curl of a vector. Functions and its deductions, Moment of a localized vector, about a point, scalar moment of a vector about a directed line, integral of a vector functions.

Scalar triple product and its geometrical interpretation. Vector triple product, scalar and vector products of four vectors, Work done by a force, moment of a force about a point and angular differentiation of vector point function, Differentiation of product of vectors, Gradient of a scalar field. Divergence and curl of vector functions.

#### Group-C

##### STATICS (VIA-VECTOR):

Reduction of a force system to a force and 2 couple, Equation of the resultant. General conditions of equilibrium of a system of forces acting in one plane upon a rigid body. Centroid. Principle of Virtual work for any system of forces in one plane and its converse, omission of the force. The Common Centenary and stability of equilibrium.

#### Group-D

##### DYNAMIC:

Simple Harmonic Motion, Simple Pendulum  
.. Elastic Springs and springs, Hooke's law, Component of Velocities and acceleration. Cartesian radial and transverse velocities and acceleration, tangential and normal velocities and acceleration. Motion of a particle under Central force, differential equation of Central Orbit in polar and pedal forms, Newton Laws of gravitation and planetary orbit, Kepler's Laws of planetary motion.

#### BOOKS RECOMMENDED:

- 1.Elementary Differential Equation-W.E. Boyce & R.C. DiPrima, Wiley's Publication.
- 2.Advance Calculus-Folland, Pearson Education.
- 3.Advance Calculus-Kaplan, Pearson Education.
- 4.The Theory of Differential Equation-Kelly & Peterson.

#### Botany Honours

There will be two theoretical and one practical paper in second year B.Sc. Part-II examination carrying 75 marks in each theory paper and 50 marks in practical paper.

#### Paper-III

##### PLANT PHYSIOLOGY AND ECOLOGY

Time: 3 Hours

Full

Marks: 75

The paper will consist of ten questions, out of which Question No. 1 will be objective type and compulsory covering the entire syllabus. Out of remaining 9 questions five questions shall be from Group-A and four from Group-B. Four questions have to be answered besides Question No. 1 selecting at least two questions from each group.

#### Group-A:

##### PLANT PHYSIOLOGY

**Physiology of Plant Cell:** Colloidal system, imbibition, diffusion, osmosis and plasmolysis. **Plant-water relationships:** Water potential and chemical potential, transpiration and its significance, factors affecting transpiration, mechanism of stomatal movement. **Mineral nutrition:** Criteria of essentiality of elements, macro and role of micronutrients, essential elements, mineral deficiency and plant disorders, nutrient uptake and transport mechanism,

**Photosynthesis:** Historical background and its significance, structure of photosynthetic apparatus, photosynthetic pigments, accessory pigments reaction centre complexes, photochemical reactions, photosynthetic electron transport, photophosphorylation, the calvin cycle-C<sub>3</sub> cycle

**Respiration:** Glycolysis, TCA cycle and its regulation, electron transport system, pentose phosphate pathway, cyanide-resistant respiration.

**Transport of organic substances:** Mechanism of translocation in the phloem.

**Nitrogen metabolism:** Biological nitrogen fixation, reduction of N<sub>2</sub> into ammonia, nif-genes, regulation of nitrate reductase and nitrogenase, nitrate and Ammonium assimilation.

**Growth and development:** General aspect of definitions, Phases of growth, kinetic of growth, physiology of dormancy and seed germination, concept of photoperiodism.

**Physiology of flowering:** Florigen concept of phytohormones and their role, vernalization, senescence and fruit ripening, physiological role and mechanism of action of phytohormones-Auxins, Cytokinins, Gibberellins, Abscisic acid and Ethylene, phytomorphogenesis, phytochrome, their Role and mechanism of action. Signal transduction-basic concept, plant movement-tropic and nastic. Biological clock

### Group-B ECOLOGY

**Introduction:** Ecological factors (Biotic and abiotic) ecological amplitude, triggering factors-soil, water and atmosphere.

**Ecological adaptation:** Ecological groups of plants : Hydrophytes, Xerophytes, Halophytes. **Community:** Definition, composition, development of community and its structure. Method of study of communities, Succession such as hydrosere, lithosere.

**Ecosystem:** Concept, component and organization, energy flow, ecological efficiencies, cycling of C, N and P, characterization and structure of ecosystem, biotic and abiotic components, their inter-relationships, the trophic organization, auto trophy, heterotrophy, parasitism and detritus, food chain, food web and ecological pyramid.

**Flow of Energy and materials:** Flow of energy and materials within ecosystem, models of energy flow, ecosystem productivity, biogeochemical cycles, major types of ecosystem.

**Phytogeography:** General principles, vegetation in India.

**Soil:** Types of soil in India water holding capacity, soil conservation & reclamation

### Paper-IV DEVELOPMENT OF PLANTS AND THEIR UTILIZATIONS

**Time: 3 Hours**

**Full**

**Marks: 75**

Ten questions has to be set. Out of which Question No. 1 will be objective type and compulsory the entire syllabus. Out of remaining 9 questions. There will be five questions from Group-A and four from Group-B Four questions has to be answered besides Question No.1 selecting at least two questions from each group.

#### Group-A: DEVELOPMENT OF PLANTS

**Organization of the higher plant body:** The shoot and the root system, variations in habit and longevity environmental influences.

**Meristems and development:** Theories of shoot and root apical meristems lateral meristems and their functions, Range of form and structure of root, stem and leaf, their tissues and functions, mechanical tissues, organization of tissues in relation to environment. **Secondary growth in**

**Plants:** Vascular cambium, secondary xylem (basic structure of wood), secondary Phloem and Periderm, Anomalous secondary growth (Boerhaavia, Mirabilis, Achyranthes, Nyctanthes, Dracaena).

**Embryology and Developmental Processes:** Microsporogenesis and development of male gametophyte, megasporogenesis and development of female gametophyte, endosperm (morphological nature) and embryogeny. An outline of experimental embryology-anther and embryo culture.

#### Group-B:

#### PLANT RESOURCE UTILIZATION

**Plant biodiversity:** Concept, status utilization in India.

Origin of crop Plants and historical perspective of economic Botany and Ethnobotany.

**Domestically of Plants:** Primary and secondary centres of biodiversity. New introduction.

General account of Seeds **producing** oils- mustard, groundnut, soyabean and coconut, Pulses-Chickpea (Bengal Urad Gram), red gram (Arhar), gram, pea, masoor and mung, cereals-rice, wheat, maize, sorghum, bajara, Sugar yielding-sugarcane, fibre yielding cotton, jute, coir, Vegetables-potato, brinjal, Timber and firewood-any ten species of your locality, Medicinal plant species at least 10 species of your locality Rubber yielding plants, essential oil yielding plants.

**Ornamental Plants:** Familiarity with seasonal and perennials species grown your locality. Recycling of wastes and biogas resources.

#### PRACTICAL PAPER

#### Based on paper-III & IV

**Time: 4 Hours**

**Full Marks: 50**

**Experiment based** on (i) Osmosis, Diffusion, Transpiration, photosynthesis, Respiration (ii) Separation of chloroplast pigments by either paper chromatography or solvent method

**OR**

To extract enzymes and to study their activity-amylase lipase, acid phosphatase, catalase and peroxidase.

**OR**

Bioassay of plant hormones-auxin, ethylene, G.A., ABA and cytokinin. **12**  
Determination of the minimum size of the quadrat by species area curve method.

**OR**

To study ecological adaptations in plants

**OR**

To study Selected soil properties such (any One) as texture, pH, carbonate, nitrate, base deficiency and reductivity.

Internal anatomy of Primary and secondary structure of angiospermic plants-normal and abnormal characters.

**OR**

Embryo dissection (e.g. Tridax procumbens) **12**  
To comment Upon spots (1-6) based on developments of plants and plant resource utilizations.

**06**

Class records  
Viva-voce

**06**  
**06**



**BOTANY**  
**SUBSIDIARY COURSE**

There shall be one theoretical paper carrying 75 marks and one Practical paper carrying 25 marks in B.Sc. Subsidiary-II examinations as mentioned below

**PAPER-II**

**BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS;  
UTILIZATION OF PLANTS;  
PLANT-PHYSIOLOGY AND ENVIRONMENTAL-BIOLOGY**

**Time: 3 Hours**

**Full**

**Marks: 75**

Ten questions has to be set. Question No. 1 will be objective type and compulsory coveting the entire syllabus, Remaining 9 questions have to be set from three groups (A,B,C) in which four questions are to be answered besides Question No.- 1 selecting at least from each group.

**Group-A**

**BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS**

**Gymnosperm:** Origin, evolution and classification. Biodiversity; Geological 'time scale; fossilization and fossils.

**Morphology of Vegetative and reproductive parts:** Anatomy of root, stem and leaf; Reproducing and life cycle of Pinus, Cycas and Gnetum; their economic value.

**Angiosperms:** Origin and evolution, characteristic features of primitive angiosperms; Important rules of plant nomenclature (Binomial nomenclature)

**Salient features of system proposed by Bentham and Hooker:** Hulchinsan

**Diversity in members of the families:** Ranunculaceae, Rutaceae, Apiaceae, Apocyanaceae, Asclepiadaceae, Lamiaceae, Chenopodiaceae Euphorbiaceae and Poaceae

**Group-B**

**UTILIZATION OF PLANTS**

**Food crops:** Rice, Wheat, Maize, Potato, Sugarcane.

**Vegetable oils:** Mustard Coconut, Groundnut.

**Pulses:** Gram, Arhar, Mung, Masoor.

Forest Wealth of Bihar with reference to timber yielding plants.

Important yielding plants of your region.

**Beverages:** Tea and Coffee.

Rubber.

**Group-C**

**PLANT PHYSIOLOGY AND ENVIRONMENTAL BIOLOGY**

**Transpiration:** Role of major and minor elements.

**Enzymes:** Nature, types and Properties.

**Photosynthesis:** Photophosphorylation, Calvin Cycle.

**Respirations:** Glycolysis, Krebs' Cycle. Nitrogen fixation.

**Plant and environment:** Water, soil, atmosphere, light, temperature and biota. Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes)', temperature (vernalization), light (photoperiodism) and salinity.

**Plant community and ecosystems:** succession-Hydrosere and Xerosere.

**Pollutions:** Soil, water and Air.

**PRACTICAL PAPER BASED ON  
PAPER-II**

**Time: 3 Hours**

**Full**

**Marks: 25**

Morphological and anatomical study of Gynmosperm-Pinus, Cycas and their temporary side preparation and identification **05**

Description and identification of plants out of families included in the syllabus **05**

3. To comment upon plant physiological experiments set up amongst-

(a) T/A ratio.

(b) **Ganong's potometer:** Ratio of transpiration/Farmer's photometer.

rate of transpiration.

(c) O<sub>2</sub> evolved during Photosynthesis.

(d) Moll's experiment

(e) Anaerobic respiration.

4. Anatomical ecological adaptation in Hydrophytes, Xerophytes, Mesophytes, Parasites and Epiphytes.

**OR** Comment upon spots (I-V)of utilization of plants as described in syllabus **05**

5. Class records.

**03**

6. Viva

Voce.

**02**

**BOTANY GENERAL**

There shall be one theoretical paper carrying 75 marks and one practical paper carrying 25 marks.

**Paper-II**

**BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATIC AND STRUCTURE,  
DEVELOPMENT AND  
REPRODUCTION FLOWERING PLANTS**

**Time: 3 Hours**

**Full**

**Marks: 75**

Ten question has to be set Question No. 1 will be objective type and compulsory covering the syllabus. Remaining 9 questions have to be set from thee group (A, B) an which four questions are

to be answered besides Question No. 1, selecting at least to from each group.

**Group-A**

**BIODIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS**

**Gymnosperms:** Origin evolution and classification, Biodiversity. Geological time scale, fossilization and fossils.

**Morphology of vegetative and reproductive parts:** Anatomy of root, stem and leaf. Reproduction and life cycles of Pinus, Cycas and Ephedra, their economic values.

**Angiosperms, Origin and evolution:** Characteristic features of primitive angiosperms, Important rules of plant nomenclature (Binomial nomenclature) Salient features of systems proposed by Bentham and Hooker Hutchinson.

**Diversity of members of the families:** Ranunculaceae, Rutaceae, Apiaceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Cyperaceae and Poaceae.

**Group-B**

**STRUCTURE, DEVELOPMENT AND REPRODUCTIVE IN FLOWERING PLANT**

The basic body plan of a flowering plant- Modular type of growth.

Shoot system: Meristems; Initiation, activity and functions of cambium Anomalous Secondary growth in Boerhaavia, Achyranthes and Dracaena, Root-stem transition and Periderm.

**Embryological development:** Development of anther, pollen grains, Embryo sac, fertilization, endosperm and embryo, Brief idea of experimental embryology.

Signification of Seed.

**Vegetative reproduction:** vegetative Propagation, grafting economic aspects.

**PRACTICAL PAPER BASED ON**

**Paper-II**

**(GENERAL)**

**Time: 3 Hours**

**Full Marks: 25**

Morphological and structural details of Gymnasperms included in the syllabus and their temporary slide preparation.

Description of Angiospermic plants belonging to the families, described in the syllabus at theory paper and (their identification upto family level).

Study of primary and secondary (both normal and abnormal) structures of roots and stems of angiospermic plants.

Study the structure of anther and pollen grains or ovule and embryo sac development.

**OR**

Simple experiments to show vegetative propagation-Leaf cuttings in Bryophyllum, stem cutting in rose/sugarcane.

To identify and comment upon forms(I-V)

Practical records

Viva-Voce

**Zoology**

**SUBSIDIARY/GENERAL COURSE**

**Time: 3 Hours**

**Full Marks: 75**

Five Questions are to be from each group, Students shall have to answer five question attempt at least two from any group.

**GROUP-A**

**CHORDATA:**

Bionomics, General Characters and Classification (up to orders only) of living chordata of the following groups; Protochordata, Cyclostomata, Pisces, Amphibia. Reptilia, Aves and Mammalia.

Study of the following types-

(i) Urochordata-Herdmania (including reterogressive metamorphosis).

(ii) Cephalochordata-Amphioxus,

(iii) Fishes-Scoliodon-Type study: difference with that of a Bony fish.

(iv) Reptilia-Biting & feeding mechanism of Snakes.

(v) Aves-Columba, Flight adaptations, elementary ideas of bird migration & Sanctuaries of India

(vi) Mammals-Characters, Distribution and affinities of Prototheria & Metatheria.

Comparative study of the following in Vertebrates: Integument, Heart Aortic Arches and Brain.

**GROUP-B**

**EMBRYOLOGY:**

Types of Vertebrate eggs and their early cleavage.

Development of Amphioxus (Up to the formation of Coelom) and chick up to 3 germ layers.

Placenta in Mammals: their development, type and functions.

**BIOCHEMISTRY, PHYSIOLOGY AND ENDOCRINOLOGY:**

Structure and classification of Protein. Carbohydrate & fats.

Physiology of Digestion, Excretion and Respiration in mammals.

Histophysiology of the following Endocrine glands in Mammals Islets of Langerhans, Testes, Ovary, Thyroid, Adrenal & Pituitary.

**SUBSIDIARY/GENERAL ZOOLOGY**

**PRACTICAL**

**Paper-IIB**

**Time: 3 Hours**

**Full Marks: 25**

**Dissection:**

**Scoliodon:** Afferent and Efferent Bronchial arteries. Cranial nerves (V, VII, IX & X) Internal ear, eye muscles & their nerves supply. Urogenital system.

**Columba:** Flight muscles, Arterial and Venous system.

**Mounting:**

Permanent/temporary stained preparation of the following-  
Scales of fishes, Armpulla of Lorenzini, pecten and filopume feather of birds

**Spotting:** Museum specimen – – 1 No. **06**

Bones – 3 Nos.

(Limb, Girdle, Skull, Vertebrae of Vertebrates)

**Slides:** 2 Nos (Endocrinology & Embryology) **2×2=04**

Identification of permanent slides of the various development stage of Frog and Chick.  
Identification and comments upon the histological structure of various Endocrine glands of Vertebrates.

Practical

Records

**04**  
**04**

Viva-Voce

**B.Sc. Honours (Part-II)**  
**Zoology**  
**Paper-III A (Theory)**

**Time: 3 Hours**

**Marks: 75**

**Full**

In all ten questions are to be set of which number 1 and 2 consists of objective (1×15 marks) and short answer (3×5) questions respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

**CHORDATA:**

Origin and Evolution of Chordates.

Bionomics, General character and classification of the living chordates (up to orders) of the following groups: Urochordates, Cephalochordate, Cyclostomata, Pisces, Amphibia, Reptilia, Aves and Mammalia.

Study of the following types-

**Urochordata:** General organization and life cycle of Herdmania and Salpa.

**Cephalochordata:** Amphioxus

**Cyclostomata:** Petromyzon.

**Fishes:** Labeo or any bony fishes, scoliodon.

Distribution: General organization and affinities of dipnoi.

**Amphibia:** Origin and evolution of Amphibia (ii) Neoteny.

Reptilia: Any Lizard

Biting and feeding Mechanisms in snakes.

**Aves:**

(i) Columba

(ii) Origin of birds

Flight Adaptations Mammals

(i) Characters, distribution and affinities of Prototheria and Metatheria

(ii) General organization of Primates.

**COMPARATIVE VERTEBRATE ANATOMY AND EMBRYOLOGY**

**Time: 3 Hours**

**Marks: 75**

**Full**

In all ten question are to be set out of which number 1 and 2 consists of objective (1×15 marks) and short answer (3×5) question respectively and both shall span over the whole syllabus in the paper. Students would be required to answer five questions out of which question number 1 and 2 shall be compulsory.

**COMARATIVE ANATOMY:**

Study of following organ system in major Vertebrate groups.

(i) **Integument: Its derivatives and function.**

(ii) Gastrointestinal tract.

(iii) Respiratory System.

Hear, Aortic arches. Brain. Evolution and fate of kidney, urogenital ducts, gonads.

**EMBRYOOGY**

**Fertilization:** Types of Vertebrate eggs early cleavage.

Development of Amphioxus (upto 3 germinal of coelom)

Development of chick (upto 3 germinal layers). Development and function of extra-embryonic

membranes in chick. Placenta in mammals-its development, types and function. Organogenesis of Heart, Brain and Eye in Chick embryo.

**B.Sc. Honours (HONOURS)**

**PRACTICAL**

**Paper-III & IVB**

**Time: 3 Hours**

**Marks: 25**

**Full**

**Dissection:**

**10**

**Scoliodon and any Bony fish:** Afferent and efferent bronchial vessels, cranial nerves (V, VII, IX, X) Eye muscles and their nerve supply, internal ear, accessory respiratory organs.

Frogs-Cranial nerves (V, VII, IX, X)

Lizard-Arterial and Venous system.

Pigeon-Arterial and Venous system, air sacs, flight muscles (with the origin and insertion of tendons).

Mammals-Neck nerves, Urino-gential organs.

**Mounting:**

**05**

Velum and Oral hood of Amphioxus, Ampulla of Lorenzini, respiratory membrane of air breathing structures, seals of fishes. Pecten and feathers, Mounting of chick embryo (24 and 48)

Permanent stained preparation of paraffin sections provided.

**05**  
**2×10=20**

**Spelting.**

(i) Museum specimen – 2 Nos

(ii) Slides-Histology & Embrology – 4 Nos

Bones

Limbs – 1 Nos

Girdles – 1 Nos

Skull – 1 Nos

Vertebrae of-  
Frog, Varanus, Fowl & Rabbit 1 No.  
Record and Field Work  
Viva-Voce

05  
06

**URDU COMPSDITION**  
**(Arts, Science & Commerce)**

**Time: 1.30 Hours**

**Full**

**Marks: 50**

**Distribution of Marks:**

Objective (10 questions)

1×10=10

Critical Questions

1×20=20

Essay

1×20=20

The paper will consist of 3 questions with alternative one objective of 10 marks. One critical questions from prescribed text and one letter/application/reporting of 20 marks.

**Books Prescribed:**

Adbiya: Published by Aiwan-e-Adab Patna Poetry:

Jab Karbala Mein

Meer Anis

Shaheen

Eqbal

O Ishque

Akhtar Shirani

Bharat Mata