



**Scheme of Examination  
and  
Course of Study**

**FACULTY OF SCIENCE**

**B.Sc. (Pass)  
(10+2+3 Pattern)**

## General Rules

1. The course of study for the examination shall extend over a period of three years as an integrated course. There shall be an examination at the end of each year namely, "Part-I Examination at the end of first year", "Part-II Examination at the end of second year", and "Part-III Examination at the end of third year".
2. The examination shall be conducted by means of written paper and practical test wherever required.
3. The subjects for examination shall be as follows :-

### Compulsory Subjects -

1. General Hindi/General English
2. Environmental Studies
3. Elementary Computer Application

### Optional Subjects-

1. Physics
2. Chemistry
3. Mathematics
4. Botany
5. Zoology

A candidate shall be required to offer any one of the following group of the option subjects -

#### Group - I

Physics, Chemistry, Mathematics

#### Group - II

Chemistry, Zoology, Botany

## 4. Scheme of Examination-

The number of papers and the maximum marks for each paper together with the minimum marks required for a pass are shown in the scheme of examination against each subject separately. It will be necessary for a candidate to pass in theory part as well as practical part of a subject/paper, wherever prescribed, separately. Classification of successful candidates shall be as follows :

First Division	60%	} of the aggregate marks obtained in all the papers and practical at the Pt.I, Pt.II and Pt.III examination, taken together
Second Division	48%	

All the rest will be declared to have passed the examination if they obtain the minimum pass marks viz. 36% in each paper. No division shall be awarded at the Pt.I and Pt.II examination.

5. Maximum Marks in a Subject is 100 and minimum pass marks in subject 36 for theory examination.

#### Marks Distribution-

Paper - I	3 Hrs. Duration	33 Marks
Paper - II	3 Hrs. Duration	33 Marks
Paper - III	3 Hrs. Duration	34 Marks
Practical	5 Hrs. Duration	50 Marks

## SCHEME FOR B.Sc. Pass - PART I

**Total Marks: 750**

Name of the subject		Duration of Exam.	Max.Marks Th.	Min.Marks Th.
<b>Compulsory Subjects</b>				
Paper I - General Hindi/ General English		3 Hrs.	100	36
Paper II - Elementary Computers Application	Theory	3 hrs	60	22
	Practical	2 hrs	40	14
Paper III - Environmental Studies		3 Hrs.	100	36
<b>Physics</b>	Paper – I	3 Hrs.	33	} 100 36
	Paper – II	3 Hrs.	33	
	Paper – III	3 Hrs.	34	
	Practical	5 Hrs.	50	
			<b>150</b>	<b>54</b>
<b>Chemistry</b>	Paper – I	3 Hrs.	33	} 100 36
	Paper – II	3 Hrs.	33	
	Paper – III	3 Hrs.	34	
	Practical	4 Hrs.	50	
			<b>150</b>	<b>54</b>
<b>Mathematics</b>	Paper – I	3 Hrs.	50	} 150 54
	Paper – II	3 Hrs.	50	
	Paper – III	3 Hrs.	50	
			<b>150</b>	<b>54</b>
<b>Botany</b>	Paper – I	3 Hrs.	33	} 100 36
	Paper – II	3 Hrs.	33	
	Paper – III	3 Hrs.	34	
	Practical	4 Hrs.	50	
			<b>150</b>	<b>54</b>
<b>Zoology</b>	Paper – I	3 Hrs.	33	} 100 36
	Paper – II	3 Hrs.	33	
	Paper – III	3 Hrs.	34	
	Practical	4 Hrs.	50	
			<b>150</b>	<b>54</b>

\* Marks of Compulsory Subjects I, II and III will not be included in determining of the division but it will be mandatory to obtained passing marks that are 36% in each subjects.

## COMPULSARY SUBJECTS

### GENERAL HINDI

Max.Marks - 100

Duration - 3 Hours

Min. Pass Marks - 36

निर्देश - इस प्रश्न-पत्र के प्राप्तांक श्रेणी निर्धारण में सम्मिलित नहीं किये जायेंगे।

(भाग - अ)

अंक योजना :

गद्य एवं पद्य संकलन की विविध विधाएं क्रमशः

(25+25=50 अंक)

1. एक प्रश्न व्याख्याओं से संबन्धित क्रमशः (दो व्याख्याएं)

(10+10=20 अंक)

2. दो परिचयात्मक प्रश्न पाठ्यपुस्तकों से

(15+15=30 अंक)

(भाग - ब)

व्याकरण खण्ड

1. शब्द शुद्धि

2. वर्तनी शुद्धि

- 5 अंक

3. वाक्य शुद्धि

- 5 अंक

4. पारिभाषिक शब्दावली

- 5 अंक

(अंग्रेजी शब्दों के हिन्दी समानार्थक शब्द)

5. संक्षेपण

- 5 अंक

6. पल्लवन

- 5 अंक

7. वाक्यांश के लिए सार्थक शब्द

- 5 अंक

8. प्रारूप

- 5 अंक

(प्रार्थना-पत्र, निविदा, परिपत्र, अधिसूचना, ज्ञापन, विज्ञापन)

9. शब्द युग्म, अर्थ भेद

- 5 अंक

10. निबन्ध

- 5 अंक

पाठ्य पुस्तकें

1. गद्य प्रभा : सम्पादक - डॉ. नवलकिशोर, पंचशील प्रकाशन, फिल्म कॉलोनी, चौड़ा रास्ता, जयपुर मूल्य रु. 15.00

2. कविता के आधुनिक सोपान : सम्पादक - डॉ. जीवनसिंह, डॉ. भागीरथ भार्गव, किरण पब्लिकेशन, पुरानी मण्डी, अजमेर मूल्य रु. 5.50

3. नूतन हिन्दी व्याकरण एवं रचना, लेखक - डॉ. रामेश्वरलाल, चिराग पब्लिकेशन उदयपुर मूल्य रु. 25.00

## GENERAL ENGLISH

Max.Marks-100

Duration - 3Hrs

Min.Marks-36

**OBJECTIVES :** This is essentially a language based course. It aims at making students read English prose with a view to enlarging their comprehension of the language and encouraging them to develop reading habits. It also aims at giving them basic skills in grammar, widening their vocabulary and teaching them to write simple and correct English.

### SCHEME OF EXAMINATION AND COURSE OF STUDY :-

#### 1. Comprehension and vocabulary

- a. Question based on content from the prescribed text 10 Marks
- b. Question based on a passage from the prescribed text 20 Marks  
to test the candidate's comprehension and vocabulary
- c. Question based on an unseen passage to test the 10 Marks  
candidate's comprehension and vocabulary  
(There will be a text of essays and short stories between 100 and 150 words length. The text to be prescribed will be notified later)

#### 2. Composition

- a. Letter/Application writing 10 Marks
- b. Paragraph writing/précis writing 10 Marks
- c. Report Writing 10 Marks

#### 3. Translation

- a. This exercise will require candidates to render into 10 Marks  
English ten simple sentences in Hindi. At least 15  
sentences will be set.

#### 4. Grammar and Usage

- a. Elements of a sentence 2 Marks
- b. Transformation of Sentences including Active and 2 Marks  
Passive Voice
- c. Models 2 Marks
- d. Tense Usage 2 Marks
- e. Determiners 2 Marks
- f. Common English Errors 2 Marks
- g. Phrasal Verbs 4 Marks
- h. Idioms 4 Marks

#### Phrasal Verbs

- Break : Break away, break down, break off, break up.
- Bring : Bring about, bring in, bring up, bring down
- Come : Come by, come across, come upon
- Carry : Carry out, carry on, carry off, carry over
- Call : Call on, Call off, Call at
- Get : Get along, Get away with, Get by, Get through, Get over
- Give : Give up, Give away with, Give in.

Hard : Hard up, hard of hearing, hard nut to crack, hard to please  
 Look : Look after, Look into, Look forward to, And Look Up To.  
 Put : Put out, Put off, Put up, Put up with.  
 Run : Run after, Run down, Run over, Run out of.  
 Take : Take after, Take up, Take to.

**Idioms :**

To be born with a silver spoon in one's mouth, To be at daggers drawn. To be at sea, To be in the dark, To be in hot water, To be on the run, To be out of the woods, To be under someone's thumb, To break the ice, To break fresh ground, To make a mountain out of a molehill, To put a spoke in someone's wheel, To put two and two together, To turn a deaf ear, To turn a new leaf, To turn the tables (On someone), to blow one's own trumpet, To burn the candle at both ends, To curry favour, To cut one's coat according to one's cloth To fill in troubled waters, To hit the nail on the head, To kill two birds without stone, To know where the shoe pinches, To let the cat out of the banch. Something in the bud. To smell a rat, To wash one's hands of something.

**The following prose places are prescribed for study :-**

1. R.K.Narayan : Toasted English
2. E.V.Lucas : Of Silver Paper
3. Mahatma Gandhi : To Students
4. Goh Sin Tub : The shoes of my Sensei
5. B. Desai : Between the Mosque and the Temple
6. Uma Rao : A Special Child

**Recommended Books :**

1. A.K.Thomson and M.V.Martinet : A Practical English Gramar (Oxford Paperback)
2. S.Pit Confer : Intermediate English Practice Book (O.L.)
3. Bhaskaram and Horsburgh : Strengthen Your English (O.U.P. 1973)
4. F.T.Wood : A Remedial English Grammar for Foreign Students (Macmillan 1965)
5. T.L.H.Smith-Pearse : The English Errors of Indian Students OUP



**Computer Networking:** Type of networks. LAN,MAN and WAN concept of topology, Bridges and Routers. Gate ways, Modems, ISDN and Leased lines. Teleconferencing and videoconferencing.

**Internet :** Concepts, email services, world wide web, web browsers, search engines, simple programs in HTML, type of HTML documents, document structure element, type and character formatting, tables frames and forms.

**E-commerce :** Concept of E-commerce, benefits and growth of E-commerce, security considerations and hazards of virus and other security risks. Antivirus software, electronic payment system.

**LABORATORY :** The laboratory exercise will be designed to help in the understanding of concepts of computer and the utilization in the areas outlined in the theory syllabus. The emphasis should be on practical usage rather than on theoretical concepts only. In addition, MS-Office package has to be practiced in the lab.

**Note :** Passing in theory and practical examination separately shall be necessary by securing at least 36 percent marks each. Maximum marks for theory will be 60 and Maximum Marks for practical paper will be 40. Minimum marks for theory and practical shall be 22 and 14 respectively.

The practical examination scheme should be as follows-

- |                                   |         |
|-----------------------------------|---------|
| a. Record/Sessionals              | 6 Marks |
| b. Viva - voce                    | 6 Marks |
| c. Practical Exercise (DOS)       | 7 Marks |
| d. Practical Exercise (Window 98) | 7 Marks |
| e. Practical Exercise (MS Word)   | 7 Marks |
| f. Practical Exercise (MS Excel)  | 7 Marks |

Duration for practical examination shall be of 2 Hours and more than 2 batches of 30 students each should be examined in a day by single examiner.

## **ENVIRONMENTAL STUDIES**

**Max. Marks: 100**

**Duration : 3 hrs.**

**Min. Marks. : 36**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit. 40% weightage will be given to problems and numerical.

### **UNIT I : Introduction and Natural Resources.**

1. Definition, Scope and Importance.
2. Renewal and Non- Renewable Resources
  - a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams their effects on forests and tribal people.
  - b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.
  - c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
  - d) Food resources: World food problems, Changes caused by agriculture and overgrazing, effect of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
  - e) Energy resources - Growing energy needs Renewable and Non-renewable energy sources, use of alternate energy sources.
  - f) Land resources: Land as resource, land degradation, man induced land slides, soil erosion and desertification.
3. Role of and Individual in Conservation of Natural Resources.
4. Need for Public awareness.

### **UNIT II : Eco-systems**

1. Concept of an ecosystem.
2. Structure and function of an ecosystem.
3. Producers, Consumers and decomposers.
4. Energy flow in ecosystem.
5. Ecological Succession.
6. Food Chain, Food webs and ecological pyramids.
7. Introduction, types, characteristic features, structure and function of the following ecosystem a). Forest ecosystem.  
b). Grassland ecosystem.  
c). Desert ecosystem.

### **UNIT III: Biodiversity, Its Conservation**

1. Introduction - Definition: genetic, species and ecosystem diversity.

2. Biographical classification of India.
3. Value of Biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values.
4. Biodiversity at global, National & local levels.
5. India as mega-diversity Nation.
6. Hot-Spots of Bio-diversity.
7. Threats to Bio-diversity: Habitat loss, poaching of wild life, man wild life conflicts.
8. Endangered and endemic species of India.
9. Conservation of Bio-diversity: In-situ and Ex-situ conservation of Bio-diversity.

#### **Unit- IV Environmental Pollution**

Definition - Causes, effects and control measures of

- a) Air Pollution.
- b) Water Pollution.
- c) Soil Pollution.
- d) Marine Pollution.
- e) Noise Pollution.
- f) Thermal Pollution.
- g) Nuclear Hazards.
1. Solid Waste Management: Causes, effects and control measures of Urban and Industrial wastes.
2. Role of an Individual in preventions of pollution.
3. Disaster Management: Floods, earthquake, Cyclone and Land slides.

#### **UNIT - V: Social Issues and the Environment**

1. From Unsustainable to Sustainable development
2. Urban Problems related to energy.
3. Water conservation, rain water harvesting, watershed management.
4. Resettlement and rehabilitation of people; its problems and concern: case studies.
5. Environmental ethics: Issues and possible solutions.
6. Climate change, global warming, acid rain, ozone layer depletion.
7. Population Growth, variation among nation.
8. Population explosion - Family Welfare programme.
9. Environment and human health.
10. Human Right.
11. Value Education.
12. HIV/AIDS.
13. Women and Child Welfare.
14. Role of Information Technology in Environment and Human health

**PHYSICS**  
**PAPER - I**  
**MECHANICS**

**Max. Marks: 33**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit. 40% weightage will be given to problems and numerical.

**UNIT - I**

Physical Laws and Frames of Reference:

- (a) Translation of displacement, velocity and acceleration between different frames of reference involving translation and rotation.
- (b) Uniform relative motion, Inertial frames of reference examples, Galilean transformations and invariance Newton's laws.

**UNIT - II**

- a) Relativity - Postulates of special theory of relativity, Lorentz transformations, transformation of velocity and acceleration time dilation and length contraction.
- b) Relative Rotational Motion : Transformation of velocity and acceleration between rotating frames, pseudo forces, coriolis forces, motion relative to earth, Foucault's pendulum.

**UNIT - III**

- a) Conservation Laws : Conservative forces, Potential energy, Potential energy in gravitational and electrostatic field. Rectilinear motion under conservative forces. Discussion of potential energy curves and motion of a particle. Centre of Mass.
- b) Two particles system. Motion of centre of mass and reduced mass. conservation of linear momentum. Collision of two particles in one and two dimensions (elastic and inelastic). Slowing down of neutrons in a moderator. Motion of a system with varying mass. Angular momentum conservation and charged particle scattering by a nucleus as an example.

**UNIT - IV**

- a) Rigid Body Dynamic : Equation of motion of a rotating body. Inertial coefficients. Moment of Inertia of a disc, cylinder and sphere. Case of  $J$  no parallel to  $W$ . Kinetic energy of rotation and idea of principal axes. Precessional motion of spinning top.
- b) Motion under Central Forces : Motion under central forces. Gravitational interaction, inertia and gravitational mass, general solution under gravitational interaction. Rutherford scattering. Discussion of trajectories, Cases of elliptical and circular orbits, Keplers Laws.

**UNIT - V**

Elastic properties of Matter : Elasticity, Youngs Modulus, Bulk modulus, Modulus of rigidity, Poisson's ratio and their relations.

Bending of a beam. Torsion of a cylinder, Experimental determination of elastic constants.

## PAPER - II

### ELECTROMAGNETISM

**Max. Marks: 33**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit. 40% weightage will be given to problems and numerical.

#### UNIT - I

- a) Vector Fields : Partial derivative. Gradient of a scalar function. Line integral of vector field. Potential difference and potential function. Potential energy of a system. Application : energy required to build a uniformly charged sphere. Classical radius of electron, potential and field due to short dipole, torque and force on a dipole in a Z external field.
- b) Divergence of a vector field. Divergence in the Cartesian coordinates, Concept of solid angle. Gauss divergence theorem, Gauss law in differential form, Gauss law from inverse square law, physical meaning of divergence of a vector, The Laplacian operator. Poisson's and Laplace equations.

#### UNIT - II

The Field of Moving Charge - Magnetic force, Measurement of charge in motion variance of charge. Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Force on a moving charge, Interaction between a moving charge and other moving charges.

#### UNIT - III

The Magnetic Field - the definition of magnetic field, properties of the magnetic field. Ampere's circuital law with application. Ampere's Law in the differential form. Vector potential. Poisson's equation for vector potential. Field of any current carrying wire and deduction of Bio-Savart law.

#### UNIT - IV

Magnetic Fields in Matter - Electric current due to orbiting electron, Bohr magneton. Orbital gyro magnetic ratio Electron spin and magnetic moment. Magnetic susceptibility, magnetic field caused by magnetized matter. Magnetization current. Free current and the field H.

#### UNIT - V

- a) Electric Field in Matter - The moment of a charge distribution. Atomic and molecular dipoles. Atomic polarizability. Permanent dipole moment, dielectrics. The Capacitor filled with a dielectric. The potential and field due to a polarized sphere. Dielectric sphere placed in a uniform field. The field of charge in dielectric medium and Gauss's law. The connection between electric susceptibility and atomic polarizability. Polarization in changing field. The bound charge (polarization) current. Transient behaviour of an R-C circuit.
- b) Electromagnetic Induction and Maxwell's Equations- Faraday's law in differential form. Mutual inductance, Self inductance Transient

behaviour of an L-R circuit, the displacement current, Maxwell's equations in differential and integral forms.

**PAPER - III**  
**OSCILLATIONS AND WAVES**

**Max. Marks: 34**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit. 40% weightage will be given to problems and numerical.

**UNIT - I**

**Oscillations** - Oscillations in an arbitrary potential well, Simple harmonic motion, examples-mass on a spring, torsional oscillator, LC circuit, energy of the oscillator, Damping of oscillator, viscous and solid friction damping. Power dissipation.

**UNIT - II**

Driven harmonic oscillator with viscous damping. Frequency response, phase relations. Quality factor, Resonance. Introduction of  $j$  operator concept in Electrical oscillations, series and parallel LCR circuit. Electro-mechanical system-Ballistic Galvanometer Effect of damping. Anharmonic oscillator, simple pendulum as an example.

**UNIT - III**

**Coupled Oscillators** - Equation of motion of two coupled S.H Oscillators. Normal modes, motion in mixed modes. Transient behaviour. Effect of coupling in mechanical systems. Electrically coupled circuits, frequency response. Reflected impedance. Effect of coupling and resistive load.

**UNIT - IV**

Dynamics of a number of oscillators with near-neighbour interactions. Equation of motion for one dimensional monoatomic and diatomic lattices, acoustic and optical modes, dispersion relations. Concept of group and phase velocities. Electrical transmission line, propagation velocity, losses, characteristic impedance, standing waves, effect of termination.

**UNIT - V**

**Wave motion** - Elastic waves in a solid rod. Pressure waves in a gas column. Transverse waves in a string, waves in three dimensions, spherical waves. Energy and momentum of EM wave in dispersive media (normal case) Spectrum of electromagnetic radiations.

## **PRACTICAL**

**Max. Marks: 50**

**Duration o Exam : 5 hrs.**

**Min. Pass Marks : 18**

Total number of experiments to be performed by the student during the session should be sixteen, selecting any eight from each section.

In examination two experiments are to be performed taking at least one from each section.

### **Section A**

1. To study the variation of power transfer to different loads by a D.C. source and to verify maximum power transfer theorem.
2. To study the variation of charge and current in a RC Circuit different time constant (using a DC source)
3. To study the behaviour of an RC circuit with varying resistance and capacitance using AC mains as a power source and also to determine the impedance and phase relations.
4. To study in the rise and decay of current in an LR circuit with a source of constant emf.
5. To study the voltage and current behaviour of an LR circuit an AC power source. Also determine power factor, impedance and phase relations.
6. To study resonance in a series/parallel LCR circuit and determine Q factor of the circuit.
7. To study electromagnetic induction and verify Faraday's law.
8. To study the characteristic of a semiconductor junction diode and determine forward and reverse resistances.
9. To study the magnetic field along the axis of a current carrying circular coil. Plot the necessary graph and hence find the radius of the circular coil.
10. To determine the specific resistance of a material and determine difference between two small resistance using Carey Foster's bridge.
11. To Convert Galvanometer into an Ammeter.
12. To Convert Galvanometer into a voltmeter

### **Section B**

1. To study the random decay and determine the decay constant using the statistical board.
2. Using compound pendulum study the variation of time period with amplitude in large angle oscillations.
3. Using compound pendulum study the damping.
4. To study the excitation of normal modes and measure frequency splitting using two coupled oscillator.
5. To study the frequency of energy transfer as a function of coupling strength using coupled oscillators.
6. (a) To study the viscous fluid damping of a compound pendulum and determining damping coefficient and Q of the oscillator.

- (b) To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficient with the assistance of the conducting lamina.
7. To find  $J$  by Callender and Barne's Method.
  8. To determine Young's modulus by bending of beam.
  9. To determine  $Y$ ,  $\sigma$  and  $\eta$  by Searle's method.
  10. To measure Curie temperature of Monel alloy.
  11. To determine modulus of rigidity of a wire using Maxwell's needle.
  12. Study of normal modes of a coupled pendulum system. Study of oscillations in mixed modes and find the period of energy exchange between the two oscillators.
  13. To study variation of surface tension with temperature using Jaeggor's method.
  14. To study the Specific-rotation of sugar solution by polarimeter.

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

**Max. Marks: 33**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit.

**UNIT - I**

**Covalent Bond** - Valence bond theory and its limitation, directional and shapes of simple inorganic molecules and ions. 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 and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

**UNIT - II**

**Ionic Solids**- Ionic structures, radius ratio effect 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 polarizability of ions, Fajan's Rule. Metallic bond-free electron, valence bond and band theories.

**UNIT - III**

**s-Block Elements** - Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

**UNIT - IV**

**Periodicity of p-Block Elements** - Periodicity in properties of p-block elements with special elements with special reference to atomic and ionic radii, ionization energy, electron affinity, electronegativity, catenation (including diagonal relationship)

**Some important compounds of p-Block elements** - Hydrides of Boron-diborane and higher boranes, borazine, borazoles, fullerenes, carbides, fluoro-carbons, silicates, (structure, principle) tetrasulphur, tetranitride, basic properties of halogens, interhalogens and polyhalides.

**UNIT - V**

**Chemistry of Nobel Gases** - Chemical properties of the noble gases, chemistry of Xenon, structure and bonding in Xenon compounds.

**Weak Interactions** - Hydrogen bonding, van der Waals forces and their application.

**PAPER - II**  
**ORGANIC CHEMISTRY**

**Max. Marks: 33**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit.

**UNIT - I**

**Mechanism of Organic Reactions** - Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents - electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates - Carbocations, 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 effects, kinetic and stereochemical studies).

**UNIT - II**

**Stereochemistry of Organic Compounds** - 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 system 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.

**UNIT - III**

**Alkanes, cycloalkanes and Alkenes** - IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. 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 chemical reaction of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes - nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring : banana bonds. Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. 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 at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

#### UNIT - IV

**Cycloalkanes, Dienes and Alkynes** - Methods of formation, conformation and chemical reactions of cycloalkanes.

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

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

**Arenes and Aromaticity** - Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene : molecular formula and Kekule structure. Stability and carbon-carbon bond length of benzene, resonance structure, MO picture.

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

#### UNIT - V

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

**Alkyl and Aryl Halides** - Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides,  $\text{S}_{\text{N}}2$  and  $\text{S}_{\text{N}}1$  reactions with energy profile diagrams.

Polyhalogen compounds : chloroform, carbon tetrachloride.

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.

Synthesis and uses of DDT and BHC.

**PAPER - III**  
**PHYSICAL CHEMISTRY**

**Max. Marks: 34**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit.

**UNIT - I**

**Mathematical Concepts and Computers -**

- A. Mathematical Concepts** - Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like  $k_x$ ,  $e^x$ ,  $x^n$ ,  $\sin x$ ,  $\log x$ ; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials, probability.
- B. Computers** - General introduction to computers, different components of a computer, hardware and software, input-output devices; binary numbers and arithmetic; introduction to computer language. Programming, operating systems.

**UNIT - II**

**Gaseous States** - Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equations of state.

**Critical Phenomena** - PV isotherms of real gases, continuity 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 number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect)

**UNIT - III**

**Liquid State** - 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 cholesteric phases. Thermography and seven segment cell.

**Solid State** - Definition of space lattice, unit cell.

Laws of crystallography - (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl and CsCl (Laue's method and powder method)

#### UNIT - IV

**Colloidal State** - 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. Emulsifier. Liquids in solids (gels) : classification, preparation and properties, inhibition, general applications of colloids.

#### UNIT - V

**Chemical Kinetics**- 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 - differential method, method of integration, method of half life period and isolation method.

Radioactive decay as a first order phenomenon.

Experimental methods of chemical kinetics: conductometric, optical methods, polarimetry and spectrophotometer. 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 and thermodynamic aspects.

## PRACTICAL

Max. Marks: 50

Duration : 5 hrs.

Min. Pass Marks. : 18

### Inorganic Chemistry

15

Semi micro Analysis - Separation and identification of 3 cations and 3 anions in given inorganic mixture.

### Organic Chemistry

#### 1. Laboratory Techniques.

3

- (a) Determination of melting point of Naphthalene, Benzoic acid, Urea etc. or
- (b) Determination of boiling point of Ethanol, Cyclohexane etc. or
- (c) A Mixed melting point determination of Urea-Cinnamic acid mixture etc. or
- (d) Crystallization of Phthalic acid from hot water (using fluted filter paper and stemless funnel), Acetanilide from boiling water, Naphthalene from ethanol, Benzoic acid from water, etc.

#### 2. Qualitative Analysis

10

Detections of extra elements (N,S and Halogens) functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

### PHYSICAL CHEMISTRY

12

(One of the following experiments should be given in the examination)

#### *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. To compare the strength of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction of decomposition of iodide by H<sub>2</sub>O<sub>2</sub>

#### *Distribution Law*

1. To study the distribution of iodine between water and CCl<sub>4</sub>
2. To study the distribution of benzoic acid between benzene and water.

#### *Viscosity, Surface Tension*

1. To determine the percentage composition of a given mixture (noninteracting systems) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the viscosity of these solutions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl- ketone).

Viva-voce

5

Record

5

**MATHEMATICS**  
**PAPER - I**  
**ALGEBRA AND TRIGONOMETRY**

**Max. Marks: 50**

**Duration : 3 hrs.**

**Scheme** - Paper will be divided into five units. Each unit will consist of two questions. Students are required to attempt five questions selecting at least one question from each unit. All questions carry equal marks.

**UNIT I**

Relations between the roots and coefficient of general polynomial equations in one variable. Transformation of equations. Descartes' rule of signs. Solution of cubic equations (Cardan method). Biquadratic equations.

**UNIT II**

Mappings, Equivalence relations and partitions. Congruence module. Definition of a group with examples and simple properties. Subgroups. Generation of groups. Cyclic group. Coset decomposition. Lagrange's theorem and its consequences. Fermat's and Euler's theorems.

**UNIT III**

Homomorphism and isomorphism. Normal subgroups. Quotient groups. The fundamental theorem of homomorphism. Permutation groups. Even and odd permutations. The alternating groups  $A_n$ . Cayley's theorem. Introduction to rings, subrings, integral domains and fields. Characteristic of a ring.

**UNIT IV**

Symmetric, Skew symmetric. Hermitian and skew Hermitian matrices. Elementary operations on matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.

**UNIT V**

**Trigonometry**

De Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions. Logarithm of a complex quantity. Expansion of trigonometrical functions. Gregory's series. Summation of series.

**References**

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi 1975
2. K.B.dutta, Matrix and Linear algebra, Prentice Hall in India Pvt. Ltd., New Delhi, 2000
3. P.B.Bhattacharya, S.K. Jain and S.R. Nagpaul, First Course in Linear Algebra, Wiley Eastern, New Delhi, 1983

4. P.B.Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2<sup>nd</sup> Edition), Cambridge University Press, Indian Edition, 1997
5. S.K.Jain, A.Gunawardena and P.B. Bhattacharya, basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001
6. H.S.Hall and S.R. Knight, Higher Algebra, H.M. Publications, 1994
7. Chandrika Prasad, Text-Book on Algebra and Theory of Equations, Pothishala Private Ltd. Allahabad.
8. S.L.Loney, Plane Trigonometry Part II, Macmillan and Company, London.
9. R.S.Verma and K.S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.

## PAPER - II

### CALCULUS

**Max. Marks: 50**

**Duration : 3 hrs.**

**Scheme** - Paper will be divided into five units. Each unit will consist of two questions. Students are required to attempt five questions selecting at least one question from each unit. All questions carry equal marks.

#### UNIT I

##### **Differential Calculus**

$\epsilon$ - $\delta$  definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities. Leibniz theorem. Maclaurin and Taylor series expansions. Asymptotes. Curvature. Multiple points. Tracing of curves in Cartesian and polar coordinates.

#### UNIT II

##### **Integral Calculus**

Integration of irrational algebraic functions and transcendental functions. Reduction formulae. Definite integrals.

#### UNIT III

Quadrature. Rectification. Volumes and surfaces of solids of revolution. Differentiation under the sign of integration.

#### UNIT IV

##### **Ordinary Differential Equations**

Degree and order of a differential equation. Equations of first order and first degree. Homogeneous equations. Linear equations and equations reducible to the linear form. Exact differential equations. First order higher degree equations solvable for  $x, y, p$ . Clairaut's form and singular solutions.

#### UNIT V

Linear differential equations of second order. Transformation of the equations by changing-the dependent variable/the independent variable. Method of variation of parameters. Ordinary simultaneous differential equations.

##### **Reference**

1. Gabriel Klambaue, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum's Outline Series, Schaum Publishing Co. New York.
3. N. Piskunov, Differential and Integral Calculus, Pease Publishers, Moscow.
4. P.k.Jain and S.K. Kaushik, An Introduction to Real Analysis, S.Chand & co. New Delhi. 2000
5. Gorakh Prasad, Differential Calculus, Pothishala Private ltd. Allahabad.

6. Gorakh Prasad, Integral Calculus, Pothishala Private ltd. Allahabad.
7. D.A.Murray, Introductory Course in Differential Equations, Orient Longman (India) 1967
8. G.F. Simmons, Differential Equations, Tata McGraw Hill, 1972.
9. E.A.codington, An Introduction to ordinary differential Equations, Prentice Hall of India, 1961
10. H.T.H. Piagglo, Elementary Treatise on Differential Equations and their Applications, C.B.S. Publisher & Distributors, Delhi, 1985
11. W.E. Boyce and P.C. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley,1986
12. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons,1999

**PAPER - III**  
**Vector Analysis and Geometry**

**Max. Marks: 50**

**Duration : 3 hrs.**

**Scheme** - Paper will be divided into five units. Each unit will consist of two questions. Students are required to attempt five questions selecting at least one question from each unit. All questions carry equal marks.

**UNIT I**

Scalar and vector product of three vectors. Product of four vectors. Reciprocal Vectors. Vector differentiation. Gradient, divergence and curl.

**UNIT II**

Vector integration. Theorems of Gauss, Green, Stokes and problems based on these.

**UNIT III**

General equations of second degree. Tracing of conics. System of conics. Confocal conics. Polar equations of a conic.

**UNIT IV**

Sphere. Cone. Cylinder.

**UNIT V**

Central conicoids. Paraboloids. Plane Sections of conicoids. Generating lines. Confocal Conicoids. Reduction of Second degree equations.

**References**

1. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
3. N.Saran and S.N. Nigam, Introduction to Vector analysis, Pothishala Pvt. Ltd. Allahabad.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. 1999
5. Shanti Narayan, A Text Book of Vector Calculus, S.Chand & Co. New Delhi.
6. S.L.Loney, The Elements of coordinate Geometry, Macmillan and Company, London.
7. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate geometry, Pothishala Pvt. Ltd. Allahabad.
8. R.J.T.Bill, Elementary Treatise on Coordinate Geometry of three Dimensions, Macmillan India Ltd. 1994
9. P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd. 1994
10. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999
11. N. Saran and R.S. Gupta, Analytical Geometry of Three Dimensions, Pothishala Pvt. Ltd. Allahabd.

# BOTANY

## PAPER - I

### Diversity of Microbes and Thallophytic

**Max. Marks: 33**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit.

#### UNIT - I

##### Viruses and Bacteria

General account of viruses and mycoplasma, general account of cyanobacteria (Oscillatoria, Nostoc).

#### UNIT - II

##### Algae

General Characters, Classification and economic importance, important features and life history of Chlorophyceae - *Volvox*, *Oedogonium*, *Chara*.

#### UNIT - III

*Xanthophyceae* - *Vaucheria*, *Phaeophyceae*-*Ectocarpus*, *Rhodophyceae*-*Polysiphonia*.

#### UNIT - IV

##### Fungi

General Characters, Classification and economic importance, important features and life history of Mastigomycotina-Pythium, Phytophthora, zygomycotina-Mucor.

#### UNIT - V

Ascomycotina-Saccharomyces, Eurotium, Chaetomium, Peziza, basidiomycotina-Puccinia, Agaricus, Deuteromycotina-Cercospora, Colletotrichum, general account of Lichens.

##### References

1. Smith, G.M. 1971, Cryptogamic Botany, Vol. I, Algae & Fungi, Tata McGraw Hill Publishing Co. New Delhi.
2. Smith, G.M. 1971, Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes, Tata McGraw Hill Publishing Co. New Delhi.
3. Sharma, O.P.1992, Text Book of Thallophytes, McGraw Hill Publishing co.
4. Sharma, O.P. 1990, Text Book of Pteridophyta, McMillan India Ltd.
5. Sharma, P.D. 1991, The Fungi, Targi & Co. Meerut.
6. Dube, H.C. 1990, An Introduction to Fungi, Vikas Publishing House Pvt. Ltd. Delhi.
7. Puri, P. 1980, Bryophyta, Atma Ram & Sons, Delhi
8. Clifton, A. 1958, Introduction to the Bacteria, McGraw Hill &Co. New York.



## PAPER - II

### Diversity of Bryophytes, Pteridophytes and Plant Breeding

Max. Marks: 33

Duration : 3 hrs.

#### UNIT - I

##### Bryophyta

Amphibians of plant kingdom displaying alternation of generations, structure, reproduction and classification of Hepaticopsida (e.g. Marchantia, Porella).

#### UNIT - II

Anthocerotopsida (e.g. Anthoceros), Bryopsida (e.g. Sphagnum)- Structure, Reproduction and classification.

#### UNIT - III

##### Pteridophyta

The first vascular plants, important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida, Structure, reproduction in Rhynia, Lycopodium.

#### UNIT - IV

Selaginella, Equisetum, Pteris and Marsilea - Characteristics and Reproduction.

#### UNIT - V

##### Plant Breeding

Methods of plant breeding, selection (mass, pureline and clonal) introduction and acclimatization, Hybridization and hybrid vigour, inbreeding depression.

**Note** - Teacher should cover historical aspect and the basic experiments that led to the major discoveries.

**PAPER - III**  
**Cell Biology and Genetics**

**Max. Marks: 34**

**Duration : 3 hrs.**

**UNIT - I**

**The cell envelopes :** Plasma membrane, Bilayer lipid structure functions, the cell wall, Ultrastructure of prokaryotic and eukaryotic cells.

**Structure and function of nucleus :** Ultrastructure, nuclear membrane, nucleolus.

**UNIT - II**

**Chromosome organization :** Morphology, centromere and telomere, chromosome alterations, deletions, duplications, translocations, inversions, variations in chromosome number, aneuploidy, polyploidy, sex chromosomes.

**DNA the genetic material :** DNA structure, replication, DNA protein interaction, the nucleosome model, genetic code, satellite and repetitive DNA.

**UNIT - III**

**Cell Division :** Mitosis, Meiosis

**UNIT - IV**

**Genetic Inheritance :** Mendelism, laws of segregation and independent assortment, linkage analysis, allelic and non-allelic interactions.

**Gene expression :** Structure of gene, transfer of genetic information, transcription, translation protein synthesis, tRNA, ribosomes, regulation of gene expression in prokaryotes and eukaryotes, proteins, 1D, 2D and 3D structure.

**UNIT - V**

**Genetic variations :** Mutations, spontaneous and induced, transposable genetic elements, DNA damage and repair.

**Extranuclear genome:** Presence and function of mitochondrial and plastid DNA, plasmids

**References :**

1. Alberts B., Bray D., Lewis J., Raff M., Roberts K. and Watson I.D. 1999, Molecular Biology, Garland Publishing Co., Inc. New York, USA
2. Atherly A.G., Girton J.R. and McDonald J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort worth, USA.
3. Gupta P.K. 1999, A Text-book of Cell and Molecular Biology, Rastogi Publications, Meerut, India.

4. Kleinsmith L.J. and Kish V.M. 1995, Principles of Cell and Molecular Biology, (2<sup>nd</sup> edition) Harper Collins College Publishers, new York, USA
5. Lodish H., Berk A., Zipursky S.L., Matsudaira P., Baltimore D. and Darnell J. 2000 Molecular Cell Biology, W.H. Freeman & Co., new York, USA
6. Russel P.J. 1998, Genetics. The Benjamin/ Cummings Publishing Co. Inc., USA
7. Snustad, D.P. and Simmons M.J. 2000 Principles of Genetics, John Wiley & Sons Inc. USA
8. Stent G.S. 1986, Molecular Genetics, CBS Publications.
9. Wolfe, S.L. 1993 Molecular and Cell Biology, Wadsworth Publishing Col. California, USA.

## Botany Practical

**Max. Marks: 50**

**Duration of Exam- 5 Hrs.**

**Min. Pass Marks - 18**

1. Study of the genera included under algae and fungi.
2. Study of morphology, reproductive structures and anatomy of the examples cited in theory under Bryophyta and Pteridophyta.
3. Observation of disease symptoms in hosts infected by fungi, viruses and mycoplasma. Section cutting of diseased material and identification of the pathogens as per the theory syllabus.
4. Gram staining of bacteria.
5. To study cell structure from onion leaf peels, demonstration of staining and mounting methods.
6. Comparative study of cell structure in onion cells. *Hydrilla* and *Spirogyra*. Study of cyclosis in *Tradescantia* staminal cells.
7. Study of plastids to examine pigment distribution in plants (e.g. Cassia, Lycopersicon and Capsicum).
8. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
9. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
10. Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds)
11. Preparation of karyotypes from dividing root tip cells and pollen grains.
12. Cytological examination of special types of chromosomes : bar body, lampbrush and polytene chromosomes.
13. Working out the laws of inheritance using seed mixture.
14. Working out the mode of inheritance of linked genes from test cross and/or F<sub>2</sub> data.

**MARKING SCHEME-**

**MAX. MARKS - 50**

	<b>REGULAR</b>	<b>EX. STUDENT/ COLLEGIATE</b>	<b>NON</b>
1. Make suitable stained glycerine preparation of anyone alga from the given mixture 'A' Draw its labelled diagram, assign it to its systematic position, giving reasons.	5	6	
2. Make suitable preparation of the reproductive structure of material 'B'. Draw labelled diagram. Identify giving reasons.	5	6	

3.	Make a suitable stained preparation of material 'C' (vegetative/ reproductive) Draw labelled diagram. Identify giving reasons.	6	7
4.	Make a suitable preparation of material 'D' (vegetative/ reproductive part) Draw a labelled sketch. Identify giving reasons.	6	7
5.	Make a suitable stained cytological preparation of material 'E'. Draw a labelled sketch of one of stages of nuclear divisions, Observed by you and shown to the examiner. Identify the stage giving reasons.	6	7
6.	Comment upon the spots 1-6 Identify giving reasons (3 minutes for each spot)	12	12
7.	Viva-voce	5	5
8.	Record	5	-

# ZOOLOGY

## PAPER - I

### Life and Diversity of Animals

**Max. Marks- 33**

**Duration - 3 Hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit. 40% weightage will be given to problems and numerical.

#### UNIT - I

##### Diversity of animals -

1. Zoogeographical distribution, principal zoographical regions of the world with special reference to their mammalian fauna.
2. Biodiversity of Fauna of India and world.
3. Adaptation to their modes of life and environment.
4. Conservation measures where required.
5. Continental drift.

#### UNIT - II

##### Diversity of Animals-

1. General principles of taxonomy, concepts of the five kingdom scheme.
2. Concept of Protozoa, Metazoa and Levels of organization.
3. Taxonomy and basis of classification of Non-chordata and chordata, symmetry, coelom, segmentation and embryogeny.

#### UNIT - III

Detailed Classification of non-chordata and chordata, habits & habitat, amoeba, Paramecium, Euglena, Obelia, Sycon, Fasciola, Taenia, Nereis, Hirudinaria, Palaemon, Pila, Lamelidens and Asteria, Balanoglossus, Amphioxus, Herdmania, Petromyzon, Scoliodon, Labeo, any lung fish, Ichthyophis, Salamander, Frog, Hemidactylus, Naja, Python, Crocodile, Pigeon, Great Indian Bustard, Hare, Camel Chinkara.

#### UNIT - IV

##### Evolution

- 1- History of evolutionary thoughts (Lamarckism and Darwinism)
- 2- Natural Selection, genetic basis of evolution, speciation.
- 3- Variations, Isolation and adaptations

#### UNIT - V

- 1- Paleontology : fossils.
- 2- Geological divisions of the earth's crust imperfection of the geological record
- 3- Study of extinct forms, Dinosaurs, Archeopteryx.

## PAPER - II

### Cell Biology and Genetics

**Max. Marks: 33**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit.

#### UNIT - I

##### Cell Biology

1. Introduction to cell : Morphology, size, shape and characteristics of Prokaryotic, Eukaryotic, Animal cells; basic idea of virus and cell theory.
2. Cell Membrane : Characteristics of cell membrane molecules, fluidmosaic model of Singer and Nicolson, concept of unit membrane.
3. Cell membrane, transport: Passive (diffusion and osmosis facilitated mediated) and active transport.

#### UNIT - II

Cytoplasmic organelles:

- (i) Structure and biogenesis of mitochondria : electron transport chain and generation of ATP molecules.
- (ii) Structure and function of endoplasmic reticulum, ribosome (Prokaryotic and eukaryotic) and Golgi complex.
- (iii) Structure and function and function of Lysosome, microbodies and centrioles.
- (iv) Structure and functions of cilia, flagella, microvilli and cytoskeletal elements.

#### UNIT - III

##### Nuclear Organization

- (i) Structure and function of nuclear envelope, nuclear matrix and nucleolus.
- (ii) Chromosomes, Morphology, chromonema, chromomeres, telomeres, primary and secondary constrictions, chromatids, prokaryotic chromosome.
- (iii) Giant chromosome types: Polytene and lampbrush.
- (iv) chromosomal organization: Euchromatin, Heterochromatin and folded fibre model and nucleosome concept.

#### UNIT - IV

##### Nucleic Acids:

- (i) DNA structure, Polymorphism (A,B, and Z type) and replication (semi conservative mechanism), experiments of Messelson and Stahl: elementary idea about polymerases topoisomerase, single strand binding protein, replication forks (both unidirectional and bidirectional), leading and lagging strands, RNA primers and Okazaki fragments, elementary idea about DNA repairs.
- (ii) RNA structure and type (mRNA, rRNA and tRNA) and transcription (idea about polymerase, exon and introns)

2. Genetic code and Translation, triplet code. characteristics of triplet code: protein synthesis (translation)
3. Cell in Reproduction
  - (i) Interphase nucleus and cell cycle S, G-1, G-2 and M-phase
  - (ii) Mitosis : phases and process, mitosis structure and function of spindle apparatus, anaphasic movement
  - (iii) Meiosis, phase and process of meiosis, synapses and synaptonemal complex, formation and fate of chiasmata and significance of the crossing over.

#### UNIT - V

##### Genetics

1. Mendelism : brief history of genetic and mendel's work. Mendelian laws, their significance and current status, chromosomal theory of inheritance.
2. Chromosomal mutations: Classification of chromosomal mutation, translocation, inversion, deletion and duplication. Variations in chromosome numbers, haploidy, diploidy, polyploidy, aneuploidy, euploidy and polysomy.
3. Linkage and crossing over, elementary idea of chromosome mapping.
4. Genetic interaction : supplementary genes, complementary genes, duplicate genes, epistasis, inhibitory and polymorphic genes multiple gene inheritance, ABO blood group Rh Factor and their significance.
5. Cytoplasmic inheritance.

**PAPER - III**  
**Gamete & Developmental Biology**

**Max. Marks: 34**

**Duration : 3 hrs.**

**Note** - The papers divided into five independent units. One essay type and two short answer type questions will be set from each unit. The candidates are required to attempt one essay type or two short answer type questions from each unit.

**UNIT - I**

**Developmental Biology - Scope and Early events**

1. Historical review and types and scope of embryology
2. Gametogenesis
  - (i) Formation of egg and sperm
  - (ii) Vitellogenesis

**UNIT - II**

1. Fertilization : Activation of ovum, essence of activation : changes in the organization of the egg cytoplasm.
2. Parthenogenesis
3. **Developmental Biology - Pattern and Processes**
  1. Cleavage : Definition, planes and patterns among non-chordate and chordates significance of cleavage : balstulation and morulation.

**UNIT - III**

1. Fate maps, morphogenetic cell movements, significance of gastrulation
2. Embryonic induction : primary organizer, differentiation competence, Regeneration.

**UNIT - IV**

1. Development of chick up to 96 hours
2. Embryonic adaptation :
  - (i) Extra-embryonic membranes in chick their development and functions
  - (ii) Placentation in Mammals : Definition, types, classification on the basis of morphology and histology : functions of placenta.

**UNIT - V**

**Dimensions in Developmental Biology**

1. Various types of stem cells and their applications
2. Cloning of animals
  - a. Nuclear Transfer Technique b. Embryo Transfer Technique
3. Teratology - (elementary idea)
4. Brief account of biology of aging

# Practical

Max. Marks: 50

Duration : 5 hrs.

Min. Pass Marks - 18

## I. Microscopic Technique

1. Organization and working of optical microscopes : dissecting and compound microscope.
2. General methods of microscopical permanent preparations : narcotization; fixing and preservation; washing; staining; destaining; dehydration; clearing and mounting; general idea of composition, preparation and use of:
  - a. Fixative : Formaline, Bouin's fluid
  - b. Stain : Borax carmine, aceto-carmine, aceto-orcein, haematoxyline-eosin.
  - c. Common reagents : Normal saline, Ringer's solution, acid water, acid alcohol and Mayer's albumin.
3. Collection and Culture Method:
  - a. Collection of animals from their natural habitat during field trips e.g. Paramecium, Euglena, Planaria, Earthworm, Daphnia, Cyclops, etc.
  - b. Cultural of Paramecium in the laboratory and study of its structure, life processes and behaviour in the living state.
4. Microscopic slides and Specimens

**Protozoa** : Euglena, Trypanosoma, Giardia, Entamoeba, Elphidium (Polystomella), Foraminiferous shells, Moneystis, Plasmodium, Paramecium, Paramecium showing binary fission and conjugation Opalina, Nyctotherus, Balantidium Vorticella.

**Porifera**: Leucosolenia, TS, Sycon, Spicules, Spongin fibres, Gemmules.

**Coelenterate** : Millepora, Physalia, Porpita, Vellela, Aurelia, Alcyonium, Gorgonia, Penatula, Sea anemone, Stone corals, Obelia colony and medusa.

**Ctenophora** : Any ctenophore

## II. Anatomy

- Earthworm** : External features, general viscera and alimentary canal, reproductive system, nervous system.
- Cockroach** : External features, appendages (wing and leg), Mouth parts Alimentary canal, reproductive and nervous system and salivary gland.

## III. Permanent Preparation and Study of the following:

Paramecium, Euglena, Foraminiferous shells, Sponge spicules, spongin fibres, gemmule, Hydra, Obelia colony and medusa. Parapodium of Nereis and heteronereis, Ovary, Nephridia, Nerve ring and setae of earthworm. Salivary glands and trachea of cockroach.

## IV. Exercise in Cell Biology

1. Squash preparation for the study of mitosis in onion root tip.

2. Squash preparation for the study of meiosis in grasshopper or cockroach testes.
3. Study of giant chromosomes in salivary glands of chironomus or Drosophila larva.
4. Study of Cell permeability using mammalian RBC.

#### V. Exercise in Genetics

##### a. Study of Drosophila-

1. Life cycle and an idea about its culture
2. Identification of male and female.
3. Identification of wild and mutants (yellow body, ebony, vestigial wings, and white eye)
4. Study of permanent prepared slides : Sex comb, salivary gland chromosomes.

##### b. Identification of blood groups ( A, B, O & Rh Factor)

#### VI. Developmental Biology

##### a. Study of development of frog/toad with the help of -

1. Preserved material available : eggs, cleavage, blastula, gastrula, neurula, tail-bud, hatching, mature, tadpole larvae, metamorphic stages, toadlet/froglet.
2. Histological Slides : cleavage, blastula, gastrula, neurula and tailbud state.

##### b. Study of development of chick with the help of whole mounts

1. 18 hrs., 21 hrs., 24 hrs., 33 hrs., 72 hrs and 96 hrs of incubation.
2. Primitive streak stage in living embryo (if possible), after Removal of the blastoderm from the egg.
3. Study of the embryo at various stages of incubation in, vivo by making a window in the egg-shell may also be demonstrated.
4. Study of various foetal membranes in a 10-12 day old chick embryo.

#### Scheme of Practical Examination and Distribution of marks

Time : 5 Hrs.	Min. Pass Marks. 18	Max. Marks. 50
	Regular	Ex. Students
1. Dissection	12	14
2. Permanent Preparation	5	7
3. Exercise in Cell Biology/Genetics/ Developmental Biology	7	8
4. Identification and Comments on Spots ( 1 to 8)	16	16
5. Viva Voce	5	5
6. Class Record	5	-

**Total**

**50**

**50**

**Note -**

1. With reference to dissection candidates must be well versed with the technique of flag labeling and black paper insertion as the case may be for a clear illustration.
2. With reference to whole mounts and museum specimens in case of unavailability of certain animal types, diagrams, photographs, models etc. should be substituted, study will include classification (upto classes) with diagnostic characters and comments.
3. Candidates will keep a record of all work done in the practical class and it will be submitted for inspection at the time of the practical examination.
4. Mounting material as per the syllabus or available from collection and culture methods.
5. The detailed methodology may be asked to write wherever necessary and separate marks may be allocated for its.