

For 2011-12, 2012-13 and 2013-14 Sessions

**OUTLINES OF SYLLABI FOR B.Sc. (Biotechnology) I<sup>st</sup> semester**

<b>Paper</b>	<b>Subject</b>	<b>Name of Paper</b>	<b>Marks</b>	<b>No. of Periods/week</b>
I	Punjabi/PHC		100	2
II	Chemistry	Inorganic Chemistry	35	2
		Organic Chemistry	35	2
		Physical Chemistry	35	2
		Practical	45	6
III	Cell Biology	Cell Biology	70	6
		Practical	30	6
IV	Microbiology	Microbiology	70	6
		Practical	30	6

**NOTE:**

- 1. Syllabus for the subject of Punjabi/PHC would be qualifying paper.**
- 2. Ordinances for B.Sc. Biotechnology-1 would be common for B.Sc. (Medical/Non-Medical).**

# SEMESTER-1

f;b/p;  
(e[nkbhckfJzr gzikph])

e[b nze L 100  
;wK L 3 xzN/  
ghohnv L 2 gqsh jcsk

fbysH L 60  
w"fye L 40  
gk; nze L 35%

1 a gzikph dh gkm g[;se

Gkr gfjBk-gzikph ;kfjs

(T) eftsk

(n) ejkDh

(J) BkNe

Gkr d{ik-gzikp ;fGnkuko ns/ b'eXkok

Gkr shik-gzikph Gk;ak s/ r[ow[yh fbgh

nze tzv ns/ g/go ;?No bJh jdkfJsK

g[;se d/ fszB Gkr jB . gqzs{ gq;aB d' Gkrk ftu j't/rk . gq;aB gZso dk

gfjBk Gkr g[;se d/ gfjB/ Gkr T[s/ nXkfos j't/rk . fJ; Gkr d/ e[b 36

nze jB . gq;aB gZso dk d{ik Gkr g[;se d/ d{i/ ns/ shi/ Gkr T[s/ nXkfos

j't/rk . fJ; Gkr d/ e[b nze 24 j'Dr/ ns/ fJ; ftu g[;se d/ d{i/ ns/

shi/ Gkr d/ 12-12 nze j'Dr/ .

(1) g[;se d/ gfjB/ Gkr d/ fszB T[g-Gkr 'T', 'n' ns/ 'J' jB . fJBQK fszBK

T[g GkrK ftu' j/m fby/ nB[;ko ;[nkb g[ZS/ ikD .

(T) fJ; ftu e[b 12 gq;aB n?pi?efNe NkJhg\$wbNhgb u'D tkb/ j'Dr/ .

jo T[g-Gkr ftu 4-4 gq;aB g[ZS/ ikDr/ . ;ko/ gq;aB eoB/ bkiwh

j'Dr/ .

nze  $3 \times 4 = 12$

(n) jo T[g Gkr ftu' 5-5 bx{ gq;aB g[ZS/ ikDr/ fiBQK ftu' 3-3 gq;aB eoB/

bkiwh j'Dr/ . T[Zso gzi bkJhBK s' tZX Bk j't/ . nze  $9 \times 2 = 18$

(J) jo T[g Gkr ftu'A 1-1 gq;aB g[fSnk ikt/rk . d'JK ftu' fJe gq;aB jZb

eoBk j'r/rk . T[Zso fJe ;c/ sZe ;hws j't/ . nze = 06

ubdk gzBkaaaa

aaaaaaaaaaaaaaaa

fgSb/ gzB/ s/ aaaa

(2) g[;se d/ d{i/ ns/ shi/ Gkr ftu'A gq;aB fJ; gqeko g[ZS/ ikDr/ .

(T) jo Gkr ftu' 4-4 gq;aB n?pi?efNt NkJhg\$wbNhgb u'D tkb/ j'Dr/ .

;ko/ gq;aB eoB/ bkiawh j'Dr/ nze 4+4 = 08

(n) jo fJe Gkr ftu 4-4 ;zy/g gq;aB g[ZS/ ikDr/ . e[b gq;aB jZb eoB/

j'Dr/ .jo Gkr ftu' 2 gq;aB bkiawh jB . nze 5+ 5= 10

(J) jo fJe Gkr ftu'A 1-1 gq;aB g[fSnk ikt/rk . fJe gq;aB jZb eoBk

j't/rk . T[&Zso fJe ;c/ sZe ;hws j't/ . nze = 06

B'NL w"fyegqhfynk gk; g[;se s/ jh nXkfos j't/rh . fJ; dh ftXh gq?eNheb  
tkbh j't/rh .

# **Punjab History & Culture**

(Special paper in lieu of Punjabi)

**Max. Marks : 100**

**Internal Assessment : 20**

**Time Allowed : 3 hours**

**Uni. Exam. : 80**

**Pass marks : 35%**

**NOTE :** The paper setter should keep in view the topics specified in each paper and not the title of the paper. Candidates are requested to attempt one question each from the sections A, B, C and D and the entire section E.

## **INSTRUCTIONS FOR THE PAPER SETTERS**

1. The syllabus prescribed should be strictly adhered to. The paper-setters should keep in view the topics specified in each paper and not the title of the paper.
2. The questions paper will consist of five sections. A, B, C, D and E. Sections A, B, C and D will have two questions from the respective sections of the syllabus and will carry 15 marks each. Section E will consist of 15 short answer type questions which will cover the entire syllabus and will carry 20 marks in all. There being internal choice in this section, each short answer type question will carry 2 marks. Candidates are required to attempt one question each from the sections A, B, C, D and the section E.
3. The wording of the questions should be simple and easily understandable by average students. There should be no vagueness.
4. There should be no question based upon quotations.
5. The general standard of the questions should cater to the different intellectual levels – average and below average.
6. Each paper is of 80 marks and of the three hours duration and 20 marks for internal assessment.

### **SECTION – A**

1. Teachings of Guru Nanak.
2. Development of Sikh Institutions : (1) Langar (2) Sangat (3) Manji system (4) Masand system (5) Harminder Sahib (6) Akal Takht (7) Miri Piri

### **Section – B**

3. Compilation of Adi Granth, Martyrdom of Guru Arjan,
4. Causes of Martyrdom of Guru Tegh Bahadur, Creation of Khalsa and its impact

### **Section – C**

5. Study of Institutions : Dal Khalsa, Gurmatta, Chhota Ghallughara and Wadda Ghallughara.
6. Ranjt Singh's conquest of Lahore, Personality of Ranjit Singh

### **Section – D**

7. Great Artists of Punjab : Amrita Shergill, Sobha Singh: Folk Music and Dances.
8. Famous Legends of Punjab : Heer Ranjha and Sohni Mahiwal.

### **SECTION – E**

Fifteen short answer questions will be set from the entire syllabus. The candidates will attempt any 10 questions. These questions will be based upon terms, concepts, institutions within the purview of the syllabus. The answer of these questions will be of 20-25 words and will carry 2 marks each. Thus, the total marks for these questions will be 20.

### **BOOKS SUGGESTED :**

1. Fauja Singh (ed) History and Culture of the Punjab, Vol. 11& 111
2. G.S. Chahara, The Advanced History of the Punjab, Vol. 1
3. Ganda Singh and Teja Singh: A Short History of the Sikhs
4. J.S. Grewal, The New Cambridge History of India : The Sikhs of the Punjab,
5. D.S Dhillon, Sikhism : Origin and Development
6. Hari Ram Gupta :History of the Sikhs Vol.-1.

**PAPER-II**  
**Inorganic Chemistry**

*Max. Marks: 35*  
*Pass Marks: 35%*

*Lectures to be delivered: 25*  
*(Each of 45 minutes duration)*  
*Time Allowed: 3 Hours*

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 7 marks each. Section C will consist of 7 short-answer type questions which will cover the entire syllabus uniformly and will carry 7 marks in all.

**INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

**Section - A**

- 1. Atomic Structure:** Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of,  $\Psi$  and  $\Psi^2$ , quantum numbers, radial and angular wave functions and probability distribution curve, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.
- 2. Chemistry of Noble gases:** Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.
- 3. Chemical Bonding-I:** Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions.  $\text{BeF}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{SnCl}_2$ ,  $\text{XeF}_4$ ,  $\text{BF}_4$ ,  $\text{PF}_6$ ,  $\text{SnCl}_6^{2-}$ .

**Section - B**

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

**PAPER-II**  
**Organic Chemistry**

Max. Marks: 35  
Pass Marks: 35%

*Lectures to be delivered: 25*  
*(Each of 45 minutes duration)*  
Time Allowed: 3 Hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 7 marks each. Section C will consist of 7 short-answer type questions which will cover the entire syllabus uniformly and will carry 7 marks in all.

**INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

**Section - A**

- 1. Structure and Bonding:** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.
- 2. Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements with half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents of organic reaction. Energy considerations. Reactive intermediates—ocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereo-chemical studies).
- 3. 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 Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

**Section – B**

- 4. Cyclo alkanes:** Cycloalkanes—nomenclature, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds.
- 5. 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 systems of nomenclature. Geometric isomerism—determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational

isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between conformation and conformation.

**PAPER-II**  
**Physical Chemistry**

*Max. Marks: 35*  
*Pass Marks: 35%*

*Lectures to be delivered: 25*  
*(Each of 45 minutes duration)*  
Time Allowed: 3 Hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 7 marks each. Section C will consist of 7 short-answer type questions which will cover the entire syllabus uniformly and will carry 7 marks in all.

**INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

**Section - A**

1. **Mathematical Concepts:** Logarithmic relations. curve sketching, linear graphs and calculation of slopes, differentiation of functions like  $kx$ ,  $e^x$ ,  $x^n$ ,  $\sin x$ ,  $\log x$ , maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions permutations and combinations. Factorials. Probability .
2. **Valuation of Analytical Data:** Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation, confidence limits, rejection of measurements (F-test and Q-test) numerical problems related to evaluation of analytical data.

**Section - B**

3. **Liquid State:** Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases.  
Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and eholestric phases. Thermography and seven segment cell.
4. **Gaseous State:** Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquifacation of gases (based on Joule-Thomson effect).

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

### PRACTICALS

Max Marks: 45

Pass Marks: 35%

#### *List of practicals*

#### **Inorganic Chemistry**

**Semi-micro analysis:** Cation analysis, separation and identification of ions from Groups I, II, III, IV, V and VI. Anion analysis (2 cation and 2 anion with no interference).

30 Marks

Viva-voce

10 Marks

Practical record

05 Marks

### PAPER-III

#### Cell Biology

*Max. Marks: 70*  
*Pass Marks: 35%*

*Lectures to be delivered: 75*  
*(Each of 45 minutes duration)*  
*Time Allowed: 3 Hours*

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all.

### INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

#### **Section-A**

- |    |                                       |   |   |
|----|---------------------------------------|---|---|
| 1. | Cell as basic unit of living systems. | : | Cell theory and cell principle.   |
| 2. | Broad classification of cell types.   | : | PPLO's bacteria, plant and animal cells, cell, tissue, organ and organism as different level of organization of otherwise genetically similar cells. Types of cells in organisms, size, shape and organization. |
| 3. | Evolution.                            | : | Pre-cell evolution, artificial creation of cells. Structure of eukaryotic and prokaryotic cell.   |

4. Ultrastructure and function of cell Organelles :
- : Endoplasmic reticulum: structure, types, biogenesis and functions of RER and SER.
  - : General account on microsomes and signal hypothesis
  - : Cytoplasm: Cytoskeleton, endo-membrane system and membrane organelles.
  - : Golgi bodies: Morphology of golgi complex.
  - : Cytochemistry of golgi complex. Function of golgi complex.
  - : Endocytosis, Recycling for secretion process and account on GERL, region

### Section B

5. Ultra structure and function of cell Organelles :
- : Ribosomes: Ultra structure of r-DNA, m-RNA and t-RNA.
  - : Prokaryotic and eukaryotic ribosomes. r-DNA biogenesis. Function of ribosomes.
  - : Mitochondria ultrastructure and function of mitochondria. Biogenesis of mitochondria. Bioenergetics – Role of mitochondria in Krebs' cycle, respiratory chain complexes, electron transport system, mitochondrial ATPase proton pump complexes.
  - : Chloroplast: Cell wall of plants, morphology of chloroplast. Function and biogenesis of chloroplast.
  - : Lysosomes and peroxisomes: Major characteristics of lysosomes.
  - : Functions-Intracellular digestion of endocytosis.
  - : Morphology of peroxisomes and microperoxisomes. Biogenesis of peroxisomes
6. Ultrastructure and function of cell organelles. :
- : Cytoskeletal structure (microtubules, cilia, flagella, centrioles, etc.): Microtubular organelles, ultrastructure and function of cilia flagella, centrioles and microfilaments.
  - : Nucleus: Ultrastructure of nucleus, nuclear envelope, euchromatic, microfilaments.
  - : Brief account of chromosomes.
  - : Biological Membrane: Ultrastructure of plasma membrane and cell wall. Transportation across the plasma membrane; Model membranes and liposomes; Functions of biological membranes.

### Books recommended:

1. Lodish, H., et al (1995) : Molecular Cell Biology third ed., Scientific American Book Inc.
2. Geoffrey (2000) : The Cell : Molecular Approach 2<sup>nd</sup> Ed.

3. De Robertis (1991) : ASM Press.  
Cell and Molecular Biology, Saunders,  
Philadelphia.
4. C.P. Powar (2003) : Cell Biology (Indian ed.)

## PRACTICALS

Max Marks: 30

Pass Marks: 35%

### *List of Practicals*

1. Microscopy: Principles of compound, phase contrast & electron microscopy (SEM & TEM). Use & care of light and compound microscope.
2. Study of electron micrographs of various cell organelles: Plasma membrane, mitochondria, golgi complex, lysosomes, endoplasmic reticulum (SER+RER), cilia, centriole, inclusion like glycogen, lipids, etc.
3. Preparation of permanent slides: Section cutting of plant tissues and their staining
4. Study of Cells: Prokaryotic cells- Lactobacilli, *E. coli*, Blue green algae; Eukaryotic cells- Testicular material for spermatogenesis.

Practical Performance: 22 Marks

Viva voce: 4 Marks.

Practical Record: 4 Marks

## PAPER-IV Microbiology

*Max. Marks: 70*  
*Pass Marks: 35%*

*Lectures to be delivered: 75*  
*(Each of 45 minutes duration)*  
*Time Allowed: 3 Hours*

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all.

### INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

#### Section-A

1. Introduction : Historical developments and applications of microbiology
2. Modern microbiology : Relevance of microbiology to biotechnology; current status of microbiology in India.
3. Microscope & Microscopy : Brief account of structure, operation, principle and applications of bright field, fluorescence

& electron scanning microscopes (SEM & TEM).

4. Staining Techniques : Fixation and fixatives, positive, negative, capsule staining, flagella staining, acid fast, Gram staining
5. Microbial diversity : Microbiological diversity, microbial nomenclature, concept of microbial species, classification of microorganisms,
6. Microbial taxonomy : General methods of characterization, classification and identification of microorganisms. Molecular techniques for identification of microorganisms; A brief account of Bergey's system of bacterial classification..

### **Section-B**

7. Prokaryotes : A general account on characteristics, structure reproduction and functions of cell organelles of bacteria, archaeobacteria, cyanobacteria, actinomycetes, mycoplasma.
8. Eukaryotes : A general account of characteristics, morphology, nutrition, fine structure, & functions of cell organelles of molds & slime molds, yeast, algae, protozoa, etc.
9. Economic importance of microbes : Economic importance of prokaryotic and eukaryotic microorganisms
10. Bacteriophages & Cyanophages : Brief account of bacteriophages and cyanophages.
11. Plant & animal viruses : Detailed structure and reproduction of plant viruses and animal viruses.
12. Microorganisms as geochemical agents : Cycles of matter (nitrogen, carbon, water, oxygen, sulphur and phosphorus) and other interactions of microbes.

### **Books Recommended:**

1. Davis, B.D. Dullbecco R. Elisena dn Ginsberg H.S. (1990) : Microbiology: 4<sup>th</sup> Ed. Harper & Row, Publishers, Singapore.
2. Tortora, G.J. Funke, B.R. and case, C.L. (1994) : Microbiology : An introduction: 5<sup>th</sup> Ed. The Benjamin/Cunnings Publishing Company, Inc.
3. Stainer, R.Y. (1995) : General Microbiology. MacMillan Press, London.
4. Pelezar , M.T. (1995) : Microbiology, Tata Mc Graw Hill Publishing, New Delhi.
5. Schlegel , H.G. (1995) : General Microbiology 7<sup>th</sup> Ed., Cambridge Uni., Press.
6. Prescott and Dunn (1999) : Industrial Microbiology 4<sup>th</sup> Ed. By S.K. Jain for CBS Publishers & Distributors, New Delhi.

7. Purobit,S.S. (2000) : Microbiology: Fundamental and Applications (6<sup>th</sup> Ed). Agrobios, (India).
8. Postagate, J. (2000) : Microbes & MAN 4<sup>TH</sup> Ed, Cambridge Uni., Press.
9. Tortora G.J. Funke B.R. 2001 : Microbiology: An introduction. Benjamin Cummings.

## **PRACTICALS**

Max Marks: 30

Pass Marks: 35%

### ***List of Practicals***

1. Orientation of microbiology lab (working of autoclave, laminar flow bench, hot air oven, BOD incubator, etc.).
2. Structure and function of compound microscope.
3. Simple, negative, capsule, acid fast and gram staining of microorganisms.
4. Morphological & Biochemical characterization of microorganisms.
5. Determination of viability of microorganism.
6. Microscope measurement of size of microorganism.
7. Hanging drop preparation to check the mobility/Brownian movements of microorganisms

Practical Performance: 22 Marks

Viva voce: 4 Marks.

Practical Record: 4 Marks

## OUTLINES OF SYLLABI FOR B.Sc. (Biotechnology) II<sup>nd</sup> semester

Paper	Subject	Name of Paper	Marks	No. of Periods/week
V	Chemistry	Inorganic Chemistry	35	2
		Organic Chemistry	35	2
		Physical Chemistry	35	2
		Practical	45	6
VI	Cell Biology	Cell Biology	70	6
		Practical	30	6
VII	Microbiology	Microbiology	70	6
		Practical	30	6

**NOTE:**

**Ordinances for B.Sc. Biotechnology-1 would be common for B.Sc. (Medical/Non-Medical).**

# SEMESTER-II

## PAPER-V Inorganic Chemistry

Max. Marks: 35  
Pass Marks: 35%

Lectures to be delivered: 25  
(Each of 45 minutes duration)  
Time Allowed: 3 Hours

### INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 7 marks each. Section C will consist of 7 short-answer type questions which will cover the entire syllabus uniformly and will carry 7 marks in all.

### INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C.

#### Section - A

- 1. Periodic Properties:** Position of elements in the periodic table, effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.
- 2. 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.
- 1. Group No. 13:** Comparative study (including diagonal relationship) of groups 13 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13; hydrides of boron-diborane and higher boranes, borazine, borohydrides.

#### Section - B

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

**PAPER-V**  
**Organic Chemistry**

Max. Marks: 35  
Pass Marks: 35%

Lectures to be delivered: 25  
(Each of 45 minutes duration)  
Time Allowed: 3 Hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 7 marks each. Section C will consist of 7 short-answer type questions which will cover the entire syllabus uniformly and will carry 7 marks in all.

**INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

**Section - A**

- 1. Arcns 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 lengths of benzene, resonance structure, MO picture.  
**Aromaticity:** the Huckel rule, aromatic ions. Aromatic electrophilic substitution-general pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkylbenzenes and aryl benzenes.
- 2. Alkenes, Cycloalkenes:** Nomenclature of alkenes-methods of formation, mechanisms and dehydration of alcohols and dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ . Polymerization of alkenes. Substitution and the allylic and vinylic positions of alkenes. Industrial application of ethylene and propene. Methods of formation, conformation and chemical reactions of Cycloalkenes.

**Section - B**

- 3. Dienes And Alkynes:** Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction.  
Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions hydroboration-oxidation. metal-ammonia reductions, oxidation and polymerization.

4. **Alkyl and aryl halides** : Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides,  $S_N2$  and  $S_N1$  reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

**PAPER-V**  
**Physical Chemistry**

*Max. Marks: 35*  
*Pass Marks: 35%*

*Lectures to be delivered: 25*  
*(Each of 45 minutes duration)*  
*Time Allowed: 3 Hours*

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 7 marks each. Section C will consist of 7 short-answer type questions which will cover the entire syllabus uniformly and will carry 7 marks in all.

**INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

**Section - A**

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

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficients. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

**2. Colloidal State**

Definition of colloids, classification of colloids, Solids in liquids (sols): properties-kinetic, optical and electrical; stability of colloids protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions) types of emulsions, preparation, Emulsifiers. Liquids in solids, (gels) classification, preparation and properties inhibition. General applications of colloids.

**Section – B**

**3. Chemical Kinetics and catalysis**

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

of reaction-s-differential method, method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon.

Theories of chemical kinetics, effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis and general characteristics of catalytic reactions. Homogeneous catalysis, acid base catalysis and enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis and its mechanism.

## PRACTICALS

Max Marks: 45

Pass Marks: 35%

### *List of practicals*

#### **A. Organic Chemistry**

1. Determination of melting points:  
Naphthalene, 80-82°. Benzoic acid, 121.5-122°  
Urea, 132.5-133° Succinic acid, 184.5-185°  
Cinnamic acid, 132.5-133°, Salicylic acid, 157.5-158°  
Acetanilide, 113.5-114°, m-Dinitrobenzene, 90°  
p-Dichlorobenzene, 52°, Aspirin, 135°
2. Determination of boiling points:  
Ethanol, 78°, Cyclohexane, 81.4°. Toluene, 110.6°, Benzene, 80°
3. Crystallization: Concept of induction of crystallization,  
Phthalic acid from hot water (using fluted filter paper and seamless funnel)  
Acetanilide from boiling water, naphthalene from ethanol  
Benzoic acid from water

#### **B. Physical Chemistry**

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethylacetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. Viscosity & Surface Tension of pure liquids.  
To determine the viscosity and surface tension of C<sub>2</sub>H<sub>5</sub>OH and glycerin solution in water
4. Molecular weight determined by Part method. 30 Marks

Viva voce

10 Marks

Practical Record

5 Marks

**PAPER-VI**  
**Cell Biology**

Max. Marks: 70  
Pass Marks: 35%

Lectures to be delivered: 75  
(Each of 45 minutes duration)  
Time Allowed: 3 Hours

**INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all.

**INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

**Section- A**

- |                                      |   |  |
|--------------------------------------|---|--|
| 1. Biochemical composition of cells. | : | Cellular pool, water, mineral salts, proteins, carbohydrates, lipids & nucleic acids.  |
| 2. Cell Division & Cell Cycles.      | : | Cell cycle and general description of mitosis & meiosis; binary fission; amitosis; molecular organization of mitotic spindle apparatus.  |
| 3. Cellular interactions             | : | Cell recognition & cell coat; differentiation of cell membrane; cell surface of cancer cells & altered coupling of cancer cells; inter cellular communication & gap junctions. |
| 4. Cell locomotion                   | : | Cytoplasmic streaming in plant cells.<br>: Amoeboid motion.<br>: Cilial & flagellar movements.   |

**Section- B**

- |  |   |  |
|--|---|--|
| 5. Cell senescence & death                   | : | Apoptosis & necrosis.  |
| 6. Cell differentiation in plants & animals. | : | General characteristics of cell<br>Differentiation; molecular mechanism of cell differentiation.   |
| 7. Cellular & molecular neurobiology.        | : | General organization of nerve fibres;<br>functions of nerve fibres; structure of synapse & synaptic transmission; synaptic vesicles & synaptic receptor.   |
| 8. Cellular & molecular biology of muscle    | : | Structure of striated muscle fibre;<br>molecular organization of contractile system;<br>regulation and energetic of contraction; sliding mechanism of muscle contraction; excitation-contraction coupling. |

**Books recommended:**

- |                                    |   |  |
|------------------------------------|---|--|
| 1. Lodish, H. <i>et al.</i> (1995) | : | Molecular Cell Biology third ed.,<br>Scientific American Book Inc. |
|------------------------------------|---|--|

- |    |                    |   |   |
|----|--------------------|---|---|
| 2. | Geoffrey (2000)    | : | The Cell : Molecular Approach 2 <sup>nd</sup> Ed.<br>ASM Press. |
| 3. | De Robertis (1991) | : | Cell and Molecular Biology, saurders,<br>Pholadelphia.          |
| 4. | C.P. Powaar (2003) | : | Cell Biology (Indian ed.)                                       |

### **PRACTICALS**

Maximum Marks: 30

Pass mars: 35%

#### ***List of Practicals***

1. Cytochemical techniques to study: Carbohydrates, nucleic acids & proteins.
2. Microtomy: Instruments introduction, use, care and section cutting.
3. Study of permanent slides of various tissues: Gut region, liver, lung, spleen, kidney, pancreas, testis, ovary, tongue & skin.

Practical Performance:	22 Marks
Viva voce:	4 Marks
Practical Record:	4 Marks

### **PAPER-VII Microbiology**

*Max. Marks: 70*  
*Pass Marks: 35%*

*Lectures to be delivered: 75*  
*(Each of 45 minutes duration)*  
*Time Allowed: 3 Hours*

### **INSTRUCTIONS FOR THE PAPER SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 12 marks each. Section C will consist of 11 short-answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all.

### **INSTRUCTIONS FOR CANDIDATES**

Candidates are required to attempt two questions from each section A and B and the entire section C.

#### **Section- A**

- |    |                         |   |   |
|----|-------------------------|---|---|
| 1. | Microbial nutrition     | : | Requirement of nutrients for microbes and nutritional categories among micro-organisms; choice of media and conditions of Incubation. |
| 2. | Culture characteristics | : | Colony and broth culture characteristics. Maintenance and preservation of pure Cultures.  |
| 3. | Culture media           | : | Preparation of culture media; types of culture media- selective/enrichment, differential, empirical and synthetic media               |
| 4. | Pure culture            | : | Pure culture techniques; methods of culturing   |

- aerobic and anaerobic bacteria; culture characteristics, smearing and staining, sterilization techniques.
5. Microbial growth : Growth curve, mathematical expression of growth, methods of measurements of growth. Factors affecting growth in continuous and batch cultures, synchronous and diauxic growth.
  6. Strain improvement : Methods of improvement and stability of biotechnologically importance cultures.

### Section- B

7. Microbial Genetics : Modes of bacterial conjugation, transduction, transformation; role of surface properties in conjugation
8. Mutation : Spontaneous and non-spontaneous mutations. Origin and use of mutations.
9. Mutagenesis : Physical and chemical mutagenesis in microbes.
10. Biological Nitrogen Fixation. : Microbiology of symbiotic and Non-symbiotic nitrogen fixation.Symbiotic Nitrogen fixing system, process of root nodule formation. Metabolism of free living and symbiotic microorganism. Nitrogen fixation mechanism with structure and function of nitrogenase.
11. Food Poisoning : Microbiology of food intoxications. Epidemiology of food intoxications. Food borne infections-mode of Transmission and ther control (*Clostridium*, *Salmonella*, *Shigella*, *Escheria Coli* *Staphylococcus aureus*, *Aflatoxin* and *Algal* toxins).
12. Human Microflora : Microbial flora of healthy human host-origin, distribution and occurrence of normal flora germ free and gnotobiotic life. Effect of antimicrobial agents.

### Books Recommended:

1. Davis, B.D. Dullbecco R. Elisenadn Ginsberg H.S. (1990) : Microbiology: 4<sup>th</sup> Ed. Harper & Row, Publishers, Singapore.
2. Tortora, G.J. Funke, B.R. and case, C.L. (1994) : Microbiology : An introduction: 5<sup>th</sup> Ed. The Benjamin/Cunnings Publishing Company, Inc.
3. Stainer, R.Y. (1995) : General Microbiology. MacMillan Press, London.
4. Pelezar, M.T. (1995) : Microbiology, Tata Mc Graw Hill Publishing, New Delhi.
5. Schlegel, H.G. (1995) : General Microbiology 7<sup>th</sup> Ed., Cambridge Uni.,

6. Prescott and Dunn (1999) : Press.  
Industrial Microbiology 4<sup>th</sup> Ed. By S.K. Jain  
for CBS Publishers & Distributors, New Delhi.
7. Purobit, S.S. (2000) : Microbiology: Fundaments and  
Applications (6<sup>th</sup> Ed). Agrobios, (India).
8. Postagate, J. (2000) : Microbes & MAN 4<sup>th</sup> Ed, Cambridge Uni.,  
Press.
9. Tortora G.J. Funke : Microbiology: An introduction.  
B.R. 2001 Benjamin Cummings.

## **PRACTICALS**

Maximum Marks: 30

Pass Marks: 35%

### **List of Practicals**

1. Isolation of microorganisms by pour plate and streak plate method.
2. Strain improvement by physical & chemical mutagenesis.
3. Determination of coliform bacteria in water.
4. Microbial growth curve & measurement of microbial growth.
5. Factors affecting the growth of microorganisms.
6. Isolation of nitrogen fixing microorganism from root nodule.
7. Study of human skin micro-flora.

Practical Performance: 22 Marks

Viva voce: 4 Marks

Practical Record: 4 Marks