FACULTY OF LIFE SCIENCES

SYLLABUS

FOR

B.Sc. (BIO-TECHNOLOGY)
(Semester I & II)
and
(PART: II & III)

Examinations : 2012-13

GURU NANAK DEV UNIVERSITY
AMRITSAR

B.Sc. (BIO-TECHNOLOGY) (SEMESTER I & II)

Eligibility:

a. A candidate must have passed Senior Secondary Part-II (12th Class) examination with a minimum of 40% marks in medical or non-medical science group from Punjab School Education Board.

OR

b. Any other examination recognized as equivalent to (a) above by the Guru Nanak Dev University.

Scheme of Courses

B.Sc. Biotechnology Semester-I

Sr.No.	Name of the Paper	Total Periods per week	Theory Marks	Total Periods per week	Practicals Marks
BT-1.	Zoology-A	3	40	4	20
BT-2.	Botany-A	3	40	4	20
BT-3.	Inorganic Chemistry-A	3	40	4	20
BT-4.	Organic Chemistry-A	3	40	4	20
BT-5.	Computer Fundamentals	3	40	4	20
BT-6.	Punjabi or mFll pj`bl		50		
BT-7.	General Microbiology-A	3	40	4	20
BT-8.	Biochemistry - I	3	40	4	20
			330		140

Total Marks = 470

Scheme of Courses

B.Sc. Biotechnology Semester-II

Sr.No.	Name of the Paper	Total Periods per week	Theory Marks	Total Periods per week	Practicals Marks
BT-1.	Zoology-B	3	40	4	20
BT-2.	Botany-B	3	40	4	20
BT-3.	Inorganic Chemistry-B	3	40	4	20
BT-4.	Organic Chemistry-B	3	40	4	20
BT-5.	Biostatistics	3	40		
BT-6.	Punjabi or mFll pj`bl		50		
BT-7.	General Microbiology-B	3	40	4	20
BT-8.	Biochemistry - II	3	40	4	20
			330		120

Total Marks = 450

B.Sc. Biotechnology Part-II

Sr.No.	Name of the Paper	Total periods per week	Theory Marks	Total periods per week	Practicals Marks
BT-1.	Communication Skills	3	70	-	30
BT-2.	Physical Chemistry	3	50	4	25
BT-3.	Life Sciences - III	3	50	4	25
BT-4.	Biochemistry - II	3	50	4	25
BT-5.	Cell Biology	3	50	4	25
BT-6.	Immunology	3	50	4	25
BT-7.	Genetic & Molecular Biology	3	50	4	25
BT-8.	Agro and Industrial Applications of Microbes	3	50	4	25
BT-9.	On Job Training	--	--	--	Satisfactory/ Not Satisfactory
	* EVS Compulsory Paper	--	75	4	25
			420		**205**

Total Marks: 625

* The marks of EVS Compulsory Paper will not be included in the total marks.

Part-III

Sr. No.	Name of the Paper	Total Periods per week	Theory Marks	Total Periods per week	Practical Marks
BT-1	rDNA Technology	3	50	4	25
BT-2	Plant Tissue Culture & Plant Biotechnology	3	50	4	25
BT-3	Animal Tissue Culture and Animal Biotechnology	3	50	4	25
BT-4	Patent Laws in Biotechnology and Enterpreneurship	3	50	-	-
BT-5	Bioprocess Engineering	3	50	4	25
BT-6	Biophysical and Biochemical Techniques	3	50	4	25
BT-7	Physical, Organic & Inorganic Aspects of Spectroscopy	3	50	-	-
BT-7	Practical for Spectroscopy	4	-	-	25
BT-8	Term Paper (i) On recent advances in Life Sciences using Internet and library based resources. To be presented as hard Copy/CD/Floppy. Viva/ seminar should be conducted	3	-	-	25
BT-9	Educational Tour & Written illustrated reports. Viva should be conducted				25
			350		**200**

Total Marks = 550

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT - 1 **Zoology–A**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3
Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit – I

Digestive System: Comparative account of the alimentary canal and associated glands of Rabit and Man. Teeth : types, dental formula and function. Glands: Pancreas, Liver, Gastric glands. Digestion of dietary constituents, regulation of digestive processes and absorption, Types of nutrition, feeding mechanisms, extra and intracellular digestion, enzymatic digestion, symbiotic digestion.

Unit – II

Circulatory System: General plan of circulation in various groups of Rabit and Man, evolution of heart. Origin and regulation of heart beat, cardiac cycle, electrocardiogram, Cardiac output and fluid pressure, Composition and functions of blood and lymph, Molecular structure and function of haemoglobin, Blood clotting, blood groups including Rh-factor, Homeostasis, Haemopoiesis.

Unit – III

Respiratory System: Comparative account of respiratory organs of mammals. Different kinds of respiratory mechanisms, Transport of O_2 and CO_2, Oxygen dissociation of haemoglobin, Bohr effect, chloride shift, control of breathing.

Unit – IV

Integumentary System: Comparative account of integument and its derivatives in mammals.

BT-1 **Zoology–A (Practical)**

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note. The question paper will be set by the examiner based on the syllabus.

1. Demonstration of osmosis and diffusion.
2. Demonstrate the presence of amylase in saliva, effect of pH and temperature on denaturation.
3. Determination of blood groups of human blood samples.
4. Recording of heart beat of frog.
5. Recording of blood pressure of man.
6. Estimation of hemoglobin content.
7. **Study of the following prepared slides:** histology of rat/rabbit (compound tissues).

Books:

1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers.

BT – 2 **Botany–A**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit – I

Apical Meristem: Tunica corpus and Histogen theories, reproductive apex and development of flower.
Secondary growth in stem and root of *Helianthus*.
Study of anomalous structure in *Boerhavia, Nyctanthes, Mirabilis and Dracena.*

Unit – II

Structure and development of anther and male gametophyte
Structure and development of ovule and female gametophyte; different types of ovules and embryo sacs
Palynology: Pollen morphology and its role in taxonomy and human welfare.

Unit – III

Pollination and fertilization; structure, development and function of endosperm and embryo (dicot and monocot), polyembryony, Self-pollination, cross -pollination, male sterility, self-incompatibility.

Unit – IV

Angiosperms, Gymnosperms, Bryophytes and Lichens- their general characteristics.
Terminology pertaining to floral description, taxonomic importance of floral parts.

BT-2 **Botany–A (Practical)**

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note. The question paper will be set by the examiner based on the syllabus

Plant Anatomy:

Anatomical studies of normal and abnormal secondary growth in general as mentioned in syllabus.

Embryology:

Study of the permanent slides pertaining to micro and megasporogenesis and female gametophytes and endosperms.

Taxonomy:

a) Description of flowers including floral diagram, floral formula, V.S. of flower of the representative genera of families mentioned in syllabus.
b) Identification and short morphological economic note on the specimens included in Units IV & V of the theory paper A.
c) Each student is required to submit a family wise herbarium consisting of atleast 20 properly pressed and mounted plants.

BT - 3 **Inorganic Chemistry–A**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3
Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit – I

Introduction, Wemer's coordination theory, naming of co-ordinate complexes.
Co-ordination numbers 1-12 and their stereo-chemistries. Co-ordination numbers and stereo chemistries of the common transition metal : Ti,V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, & W. Factors affecting co-ordination numbers and stereo-chemistry Isomerism in coordination compounds. **(Books Consulted-Number 1,3,8).**

Unit – II

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, electro-neutrality and back bonding, limitations of V.B. theory. **(Books 5,9)**

Unit – III

Crystal field theory-Spliting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of ligands, calculation of C.F.S.E. in high spin and low spin octahedral and high spin tetrahedral complexes, factors affecting the 10 Dq value, structure effects of crystal field splitting (Jahn-Teller distortion). Paramagnetism, diamagnetism, ferro and anti ferromagnetism, Microstates and spectroscopic terms, a calculation of spectroscopic terms for d^1 –d^2 electronic configurations using LS coupling, Hunds rule for finding the ground state term, limitations of C.F.T.

Unit – IV

Molecular Orbital Theory- Evidence for covalent character in bonding, MOEL diagram for octahedral and tetrahedral complexes involving as well as bonding, charge transfer transitions.**(Books consulted No. 3,4,5,6,7,8)**

Books Recommended:

1. G.L. Eichorn, Inorganic Biochemistry, Vol. I Elsevier,
2. R.Hilgenfeld & W.Saengar, Topics in Current Chemistry, Vol.101.page 38-65.
3. J.E. Huheey, Inorganic Chemistry, 3rd ed.
4. F.A. Cotton & G. Wilkinson, Advanced Inorganic Chemistry.
5. B.E. Douglas & D.H. McDaniel, Concepts & Models of Inorganic Chemistry,1970.
6. A. Earnshaw, Introduction of Magnetochemistry, Academic press,1968.
7. R.S.Drago, Physical Methods Inorganic Chemistry, 1971.
8. F. Basalo & R.C. Johson, Co-ordination, Chemistry, 1964.
9. Cowan, J.A. (1997) – Inorganic Biochemistry – An Introduction, Wiley-VCH.

BT-3 **Inorganic Chemistry (Practical)**

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4
Note: The question paper will be set by the examiner based on the syllabus.

- Volumetric Analysis:

Iodimetry, Iodometry, Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$.

Complexometric titration using EDTA Ca^{++},Mg^{++}: in context with study of hardness of water.

BT - 4 **Organic Chemistry–A**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

UNIT-I

Conformations of alkanes and cycloalkanes; conformational analysis of ethane, Butane, cyclohexane, monosubstituted and disubstituted cyclohexane, conformation of small, medium and large ring cycloalkanes and of polycyclic ring systems. Factors that affect reaction rates of these reactions, structure and relative stabilities of free radicals, halogenation, mechanism of chlorination of methane, selectivity in chlorination and bromination of higher alkanes .

Alcohols as Bornsted bases and acids, reactions of alcohols with hydrogen halides with detailed mechanism structure and bonding in carbocations and their relative stabilities, potential energy diagrams for chemical reactions.

UNIT-II

Stereochemistry of alkenes, naming stero isomeric alkenes by E-Z system, mechanism of hydrogenation of alkenes, stereochemistry of hydrogenation of cycloalkenes, Dehydration of alcohols and regioselectivity of these reactions, Acid catalysed dehydrohalogenation of alcohols with complete mechanistic discussion, Mechanism of dehydrohalogenation of alkylhalides (E_1 mechanism), stereoselective and antielimination in E_2 reactions, the E_1 Mechanism, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism , free radical addition of hydrogen bromide to alkenes, acid catalysed hydration of alkene with mechanism stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.

UNIT-III

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiaral structures, chiral centres in chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantionmers, chiral centres other than carbon, prochirality.

UNIT-IV

Functional group transformation by nucleophilic substitution, the biomolecular (SN^2), mechanism of nucleophilic substitution , stereochemistry of SN^2 reactions, how SN^2 reactions occur, steric effect in SN^2 reactions, nucleophiles and nucleophilicity,the unimolecular (SN^1) mechanism of nucleophilies substitution, carbocation stability and the rate of substitution, by the SN^1 mechanism sterochemistry of SN^1 reactions, carbocation real arrangements in SN^1 reactions, solvent effects, subtitution and elimination as competing reactions. The SN^1 -SN^2 continum.

Books Recommended:

1. R.T. Morison and R.N. Boyd, Organic chemistry
2. I. L. Finar, Organic Chemistry, Vol.I, IV ed. J. March, Advanced Organic Chemistry, Reactions Mechanisms and Structure.
3. Schaum's Outlines Series, Theory and Problems of Organic chemistry.
4. I.L. Finar, Problems and their solution in Organic chemistry.
5. J. D. Robert and M. C. Caserio, Modern Organic Chemistry.
6. D. J. Cram and G. S. Hammond, Organic chemistry.
7. J. E. Banks, Naming Organic Compounds - Programmed Introduction to Organic Chemistry
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F. A. Carey, Organic chemistry.

Organic Chemistry (Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

- Aromatic hydrocarbons
- Aldehydes
- Ketones
- Carbohydrates

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT - 5 **Computer Fundamentals**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

UNIT-I

Computers: General introduction to computers, organization of computers, digital and analogue computers, computer algorithm.

Introduction to Computer and Its Uses: Milestones in hardware and software -batch oriented/Online/real time applications. Use of computers in biology.

UNIT-II

Computer as a System: Basic Concepts: Stored programs, functional units and their inter-relation: communication with computer.

UNIT-III

Data Storage Devices and Media: Primary Storage: Storage addressed, and capacity, type of memory: secondary storage; magnetic tape- data representation and R/W: magnetic disc, fixed & removable, data representation and R/W: floppy disc drives.

UNIT-IV

Input/Output Devices: Key-tape/diskette devices, light pen mouse and joystick, source data automation.

Printed Output: Serial, line, page, printers; plotters, visual output; voice response units.

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Computer Fundamentals (Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Practical related to theory shall be carried out for this course.

Introduction to DOS: DOS commands are copy con, edit, doskey, type, md, cd, ver, date, time, ren, del, copy, move, attrib

Introduction to Windows

Ms-Word, Powerpoint

BT-6

ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)
ਸਮੈਸਟਰ ਪਹਿਲਾ

ਸਮਾਂ : 3 ਘੰਟੇ **ਕੁਲ ਅੰਕ : 50**

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

1. **ਗਿਆਨ ਮਾਲਾ** (ਵਿਗਿਆਨਕ ਤੇ ਸਮਾਜ-ਵਿਗਿਆਨਕ ਲੇਖਾਂ ਦਾ ਸੰਗ੍ਰਹਿ)
(ਸੰਪ. ਡਾ. ਸਤਿੰਦਰ ਸਿੰਘ, ਪ੍ਰੋ. ਮਹਿੰਦਰ ਸਿੰਘ ਬਨਵੈਤ), ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ, 2007 ।
ਲੇਖ : ਪਹੀਆ ਪ੍ਰਦੂਸ਼ਣ, ਭਰੂਣ ਹੱਤਿਆ ਦੇ ਦੇਸ਼ ਵਿਚ, ਨਾਰੀ ਸ਼ਕਤੀ, ਵਾਤਾਵਰਣੀ ਪ੍ਰਦੂਸ਼ਣ ਅਤੇ ਮਨੁੱਖ, ਏਡਜ਼ : ਇਕ ਗੰਭੀਰ ਸੰਕਟ।
2. **ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ** (ਬਲਵੰਤ ਗਾਰਗੀ), ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
ਲੇਖ : ਅੰਮ੍ਰਿਤਾ ਸ਼ੇਰਗਿਲ, ਕੇ.ਐਲ.ਸਹਿਗਲ, ਬੜੇ ਗ਼ੁਲਾਮ ਅਲੀ ਖਾਂ, ਸੋਭਾ ਸਿੰਘ, ਪ੍ਰਿਥਵੀਰਾਜ ਕਪੂਰ, ਭਾਈ ਸਮੁੰਦ ਸਿੰਘ
3. **ਪੈਰ੍ਹਾ ਰਚਨਾ**
4. **ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ**।
5. (ੳ) **ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਉਂਤ** : ਉਚਾਰਨ ਅੰਗ, ਉਚਾਰਨ ਸਥਾਨ ਤੇ ਵਿਧੀਆਂ, ਸਵਰ, ਵਿਅੰਜਨ, ਸੁਰ।
(ਅ) **ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ** : ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪ-ਭਾਸ਼ਾ ਦਾ ਅੰਤਰ, ਪੰਜਾਬੀ ਉਪਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ-ਚਿੰਨ੍ਹ।
6. **ਮਾਤ ਭਾਸ਼ਾ ਦਾ ਅਧਿਆਪਨ**
(ੳ) ਪਹਿਲੀ ਭਾਸ਼ਾ ਦੇ ਤੌਰ ਉੱਤੇ
(ਅ) ਦੂਜੀ ਭਾਸ਼ਾ ਦੇ ਤੌਰ ਉੱਤੇ

ਅੰਕ ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1.	ਕਿਸੇ ਨਿਬੰਧ ਦਾ ਸਾਰ ਜਾਂ ਉਸਦਾ ਵਿਸ਼ਾ ਵਸਤੂ (ਦੋ ਵਿਚੋਂ ਇਕ) ।	10 ਅੰਕ
2.	ਵਾਰਤਕ ਰੂਪ : ਰੇਖਾ ਚਿਤਰ, ਨਾਇਕ ਬਿੰਬ, ਕਲਾਤਮਕ ਗੁਣ, ਰੇਖਾ ਚਿਤਰ ਸਾਹਿਤ ਨੂੰ ਦੇਣ	10 ਅੰਕ
3.	ਪੈਰ੍ਹਾ ਰਚਨਾ : ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ ਕਿਸੇ ਇਕ ਉਤੇ ਪੈਰ੍ਹਾ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇ ।	5 ਅੰਕ
4.	ਪੈਰ੍ਹਾ ਦੇ ਕੇ ਉਸ ਬਾਰੇ ਪੰਜ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ	5 ਅੰਕ
5.	ਨੰਬਰ 5 ਉਤੇ ਦਿੱਤੀ ਵਿਆਕਰਨ ਦੇ ਆਧਾਰ ਤੇ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ	10 ਅੰਕ
6.	ਨੰਬਰ 6 ਵਿਚ ਮਾਤ ਭਾਸ਼ਾ ਦੇ ਪਹਿਲੀ ਭਾਸ਼ਾ ਅਤੇ ਦੂਜੀ ਭਾਸ਼ਾ ਵਜੋਂ ਅਧਿਆਪਨ, ਮਹੱਤਵ ਅਤੇ ਸਮੱਸਿਆਵਾਂ ਬਾਰੇ ਚਾਰ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਦੋ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ।	5×2=10 ਅੰਕ

BT-6

ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In the lieu of Compulsory Punjabi)

ਪਾਠ-ਕ੍ਰਮ

ਸਮਾਂ : ਤਿੰਨ ਘੰਟੇ **ਕੁਲ ਅੰਕ: 50**

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ,
   ਗੁਰਮੁਖੀ ਲਿਪੀ
   ਗੁਰਮੁਖੀ ਲਿਪੀ : ਬਣਤਰ ਅਤੇ ਤਰਤੀਬ — **20 ਅੰਕ**

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ
   ਸੂਰ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
   ਵਿਅੰਜਨ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ — **15 ਅੰਕ**

3. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ
   ਸਾਧਾਰਨ ਸ਼ਬਦ
   ਇਕ ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ — **15 ਅੰਕ**

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਾਮਕਰਣ ਅਤੇ ਸੰਖੇਪ ਜਾਣ ਪਛਾਣ, ਗੁਰਮੁਖੀ ਲਿਪੀ : ਨਾਮਕਰਣ, ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ; ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਸੂਰ ਵਾਹਕ (ਓ ਅ ਏ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵੇਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੂਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ-ਦੀਰਘ ਸੂਰ); ਸੂਰ ਅਤੇ ਲਗਾਂ ਮਾਤਰਾਂ; ਵਿਅੰਜਨਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣਾਂ (ਹ, ਰ, ਵ) ਦਾ ਉਚਾਰਨ ; ਲ ਅਤੇ ਲ਼ ਦਾ ਉਚਾਰਨ; ਭ, ਧ, ਢ, ਝ, ਘ ਦਾ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣਾਂ ਦਾ ਉਚਾਰਨ।

3. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸਾਧਾਰਨ ਸ਼ਬਦ; ਇਕੱਲਾ ਸੂਰ (ਜਿਵੇਂ ਆ); ਸੂਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੂਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੂਰ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਪਾਰ); ਕੋਸ਼ਗਤ ਸ਼ਬਦ (ਜਿਵੇਂ ਘਰ, ਪੀ); ਵਿਆਕਰਣਕ ਸ਼ਬਦ (ਜਿਵੇਂ ਨੂੰ, ਨੇ); ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ-1; ਲਿੰਗ-ਪੁਲਿੰਗ, ਇਕ ਵਚਨ-ਬਹੁ ਵਚਨ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ-1: ਖਾਣ-ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ :

1. ਯੂਨਿਟ ਪਹਿਲਾ ਵਿੱਚੋਂ ਦੋ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਇਕ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ।
   (15 ਅੰਕ)

2. ਯੂਨਿਟ ਦੂਜਾ ਅਤੇ ਤੀਜਾ ਵਿਚੋਂ ਚਾਰ ਪ੍ਰਸ਼ਨ (ਹਰ ਇਕ ਭਾਗ ਵਿਚੋਂ ਦੋ-ਦੋ ਪ੍ਰਸ਼ਨ) ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿੱਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਦੋ ਪ੍ਰਸ਼ਨਾਂ ਦਾ (ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ-ਇਕ ਪ੍ਰਸ਼ਨ), ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ।
   (10X2=20 ਅੰਕ)

3. ਯੂਨਿਟ ਪਹਿਲਾ, ਦੂਜਾ ਅਤੇ ਤੀਜਾ ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰ ਵਾਲੇ ਛੇ ਪ੍ਰਸ਼ਨ (ਹਰ ਇਕ ਭਾਗ ਵਿਚੋਂ ਦੋ-ਦੋ ਪ੍ਰਸ਼ਨ) ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਤਿੰਨ ਪ੍ਰਸ਼ਨਾਂ (ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ-ਇਕ ਪ੍ਰਸ਼ਨ) ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ।
   (5X3=15 ਅੰਕ)

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT - 7 **General Microbiology–A**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit - I

Principles of Microbiology: Principles and application of bright field, dark field phase contrast, fluorescence & immunofluorescence, electron microscopy, modern concept of bacterial nutrition. Microbial culture media, sterilization.

Unit - II

General Features: Bacteria, fungi, Neurospora, yeast and viruses. Microbes in extreme environments – the thermophiles and alkalophiles. culture collection, purification and preservation.

UNIT-III

Nature of the Microbial Cell Surface. Gram positive and gram negative bacteria. Kinds of flagella. Serotypes. Structure and anatomy of bacterial cell walls. Different types of bacterial staining.

Unit - IV

Bacterial Classification: Bacterial classification and taxonomy based on Bergey's Manual of Determinative bacteriology.

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5th Edition, The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, Londan.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBS Publishers & Distributors.
7. Purohit, S.S. (2000). Microbiology: Fundamentals and Applications (6th Edition), Agrobios (India).
8. Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.

BT-7 General Microbiology (Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Aseptic techniques

Cleaning of glassware

Preparation of media, cotton plugging and sterilization

Personal hygiene-Microbes from hands, tooth-scum and other body parts

Isolation of micro-organism from air, water and soil samples. Dilution and pour plating, Colony purification

BT - 8 **Biochemistry - I**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section A : 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section B : This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C : This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit - I

Water and its Properties: Physico-chemical properties of water, Dissociation and association constants, pH and buffers. pI, pka, Hasselbach Hendersson equation and its implications.

Unit - II

Carbohydrates: Structure of important mono,di,oligo and polysaccharides,

Unit - III

Glycoproteins and Peptidoglycans, glycolipids and lipopolysaccharides.

Unit - IV

Nucleic Acids**:** Structure of nucleosides and nucleic acids, biologically important nucleotides and their functions. Different types of DNA & RNA

Books Recommended:

1. Rawn, J.D. (1989). Biochemistry, Neil Patterson Publishers

2. Stryer, L. (1995). Biochemistry: 4th Edition, W.H. Freeman and Company, New York

3. Zubay, G.L., Parson. W.W. and Vance, D.E. (1995). Principles of Biochemistry: Student Study Art Notebook, Wm. C. Brown Publishers.

4. Bucke C., (1999)), Carbohydrate Biotechnology Protocols, Humara Press.

5. Horton et. al., (2001), Principles of Biochemistry, Prentice Hall.

6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2005). Principles of Biochemistry 4th Ed., CBS Publishers and Distributors, New Delhi.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

Bio-Chemistry-I
(Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Preparation of physiological buffers.
2. Verification of Beer Lamberts Law for P-nitrophenol or cobalt chloride.
3. Determination of pKa value of P-nitrophenol
4. Estimation of carbohydrate in given solution by anthrone method.
5. Estimation of sugar in biological samples by dubois method.
6. Estimation of DNA/RNA

Books Recommended:

1. Plummer D.T. (1990) An Introduction of Practical Biochemistry. 3rd Ed. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
2. Bansal, D.D., Khardori, R. & Gupta, M.M. (1985) Practical Biochemistry. Standard Publication, Chandigarh.
3. Sawhney, S.K. and Randhir singh (2001). Introductory Practical Biochemistry. Narosa Publishing House.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 1 **Zoology–B**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit – I

Urinogenital System: Succession of kidney, evolution of gonads and urinogenital ducts, Urine formation, water balance in mammals.

Unit –II

Endocrine System: Structure and physiology of thyroid, parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads of mammals.

Unit –III

Nervous System: Comparative anatomy and evolution of brain and cranial nerves of mammals, Nature, origin and propagation of impulse along the axon, synapse and myoneural junctions. Sense Organs

Unit –IV

Skeletal System: Comparative account of jaw suspension & visceral arches, (striped, unstriped and cardiac). Ultrastructure, chemical and physiological basis of skeletal muscle contraction.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 1 **Zoology–A (Practical)**

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note. The question paper will be set by the examiner based on the syllabus.

1. **Examine and dissect the following animals:**

   Digestive, arterial, venous and urinogenital systems.
   Dissection of White rat / rabbit.

2. **Make a temporary preparation of the following:**

   Blood smear of mammals.

3. Study of the skeleton of *Oryctolagus* (Rabbit).and human.

4. Analysis of urine for urea, chloride, glucose and uric acid

Books:

1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 2 **Botany–B**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:
Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit - I

Systems of classification: Artificial, Natural and Phylogenetic; Salient features of Bentham & Hooker's, Hutchinson and Engler & Prantl's system of classification, (Details of Bentham & Hooker's system only).

Unit – II

Criteria for primitive and advanced nature of families and flower. Evolutionary status of Ranunculaceae, Compositae, Orchidaceae.

General characteristics (excluding economic importance) of following families of angiosperms; giving examples of few important genera:

Ranunculaceae	Ranunculus, Delphinium
Cruciferae	Brassica
Rutaceae	Citrus, Murraya

Unit – III

General characteristics (excluding economic importance) of following families of angiosperms; giving examples of few important genera:

Leguminosae	Lathyrus, Cassia and Acacia
Apiaceae (Umbelliferae)	Coriander
Asteraceae (Compositae)	Helianthus, Sonchus, Ageratum
Solanaceae	Solanum, Petunia

Unit – IV

General characteristics (excluding economic importance) of following families of angiosperms; giving examples of few important genera:

Lamianceae (Labiatae)	Ocimum/Salvia
Liliaceae	Asphodelus/Asparagus
Orchidaceae	Zeuxine
Poaceae (graminae)	Triticum

BT - 2 **Botany–B (Practical)**

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note. The question paper will be set by the examiner based on the syllabus

a) Description of flowers including floral diagram, floral formula, V.S. of flower of the representative genera of families mentioned in syllabus.

b) Identification and short morphological economic note on the specimens included in Units III, IV & V of the theory paper B.

c) Each student is required to submit a family wise herbarium consisting of at least 20 properly pressed and mounted plants.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 3 **Inorganic Chemistry-B**

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit – I

л- Acid ligands

Carbon monooxide complexes, Two methods of preparation, structural and bonding in (linear MCO groups, polynuclear metal carbonyls carbonyl hydrides and halides). Complexes of N_2, with Ru and No with Fe.**(Book consulted, No. 4 Chapter 2)**

Unit – II

Alkali metal and alkaline earth metal chelators

Definition and few examples of macrocyclic ligands, macrocyclic effect, crown ethers & podands, coronauds, cryptands, structure of 18 crown -6 complex with KNCS, ion cavity complex, effect of anion on phase transfer catalysis, sandwich formation, cryptands and their cation complexes. **(Book No. 2 pages 38-65).**

Unit –III

Stability of co-ordination compounds

Introduction Factors affecting the stability of metal ion complexes with general ligands and some biochemical ligands like amino acids, peptides, nucleotides and Nucleic acids and porphyrin **(Book consulted No. 1 Chapter 2).**

Unit – IV

Metal ions in biological system

Fe: Haemoglobin, structure and functions, oxygen transport, Bohr effect.

Mg: Chlorophyll structure and function in photosysthesis.

Zn: Carboxypeptidase enzyme functions.

(Book consulted, No. 9 Page No. 37-76).

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

Inorganic Chemistry (Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

- Inorganic qualitative analysis:

Four ions (Two cations two anions).

A. Preliminary tests: Physical examination, Dryheating test, charcoal cavity test, $Co(NO_3)_2$ test, flame test, borax bead test.

B. Acid radical analysis:
Dil H_2SO_4 gp: CO^{2-}_3, NO_2^-, S^{2-}, SO_3^{2-}
Conc, H_2SO_4 gp: Cl^-, Br^-, I^-, NO_3^-, CH_3Coo^-
Individual gp: SO_4^{2-}, PO_4^{3-}, BO_3^{3-}

C. Basic radical analysis:
NH_4^+ Pb^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+} or Fe^{3+}, Al^{3+} , Co^{2+} , Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+} Mg^{2+}, Na^+, K^+ and their confirmation.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 4 **Organic Chemistry–B**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

SectionB: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit -I

Acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkyne, with detailed discussion of mechanism of these reaction, the Diels Alder reaction, orbital symmetry and the Diels alder reaction.

Unit -II

Conversion of alcohol to ether and ester with full dicussion of the reaction, crown ethers, conversion of vicinal halohydrin to epoxides, nucleophillic ring opening reaction of epoxides ,acid catalysed ring opening of epoxides.

Unit -III

Principles of nucleophillic additon to carbonyl groups: Hydration ,acetal formation , cyanohydrin formation ; reaction with primary and secondary amines, Wittig reaction, steroselective addition to carbonyl groups mechanism of halogenation ,acid and base catalysed cholization, haloform reaction ,aldol condensaton, conjugate nucleophillic additon to unsaturated carbonyl compounds .

Unit - IV

Mechanism of acid- catalysed esterification,intramolecular ester formation lactone), Hell-Volerid-Zelinsky reaction, decarboxylation of malonic acid and related compounds. Mechanism of hydrolysis of acid chlorides, acid anhydrides, acid and base catalysed hydrolysis of esters, acid assisted hydrolysis of amides. Hoffman rearrangement of N-bromoamides. Hydrolysis of nitriles, claisen condensation ,the Deckmann condensation, acetic ester synthesis, malonic ester synthesis, Michael reaction Reformatsky reaction.

Books Recommended:

1. R.T. Morison and R.N. Boyd, Organic Chemistry
2. I. L. Finar, Organic Chemistry, Vol.I, IV Ed.
3. J. March, Advanced Organic Chemistry, Reactions Mechanisms and Structure.
4. Schaum's Outlines Series, Theory and Problems of Organic Chemistry.
5. I.L. Finar, Problems and their Solution in Organic Chemistry.
6. J. D. Robert and M. C. Caserio, Modern Organic Chemistry.
7. D. J. Cram and G. S. Hammond, Organic Chemistry.
8. J. E. Banks, Naming Organic Compounds - Programmed Introduction to Organic Chemistry
9. E.L. Eliel, Stereochemistry of Carbon Compounds.
10. W. Camp, Organic Spectroscopy.
11. F. A. Carey, Organic Chemistry.

Organic Chemistry (Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

- Amides
- Amines
- Carboxylic acids and phenols.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT-5 **Biostatistics**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

UNIT-I

Elementary Statistics: Representation of data: discrete data, continuous data, histogram, frequency curves. The mean, median, mode, standard deviation, variance, covariance of data. Introduction to statistical sampling from a population.

UNIT-II

Probability: Basic concepts, sample space and events, use of counting method in probability, addition law, sample problems involving the estimation of probabilities, Conditional Probability and Independent Events, Bayes theorem.

UNIT-III

Introduction to Correlation & Regression: Scatter diagram, Linear correlation, linear regression lines.

UNIT-IV

Probability Distributions: Bernoulli, Binomial, Poisson and Normal Distributions.

Hypothesis Testing: Concept of Null and Alternate Hypothesis, Chi-square test (Goodness of fit and association of attributes), T-test (Comparison of Sample mean with population mean, Difference of two means)

Recommended books:

Elhance D.N. (1984). Fundamentals of Statistics. *Kitab Mahal, Allahabad.*

Mendenhall W. and Sincich T. (1995). Statistics for engineering and sciences (IVth edition). *Prentice Hall.* And sciences (IVth edition). Prentice Hall.

B.A./B.Sc Part-I (12+3 System of Education) 225 Gupta S.P. (2000). Statistical methods. *Sultan Chand and Company, New Delhi.*

Kapoor V.K. and Gupta S.C. (2000) Fundamentals of Mathematical Statistics. *Sultan Chand and Company, New Delhi*

J. Crawshaw and J Chamber (2002) Advanced level Statistics, 4th Edition, *Melson Thornes.*

BT-6

ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)
ਸਮੈਸਟਰ ਦੂਜਾ

ਸਮਾਂ : 3 ਘੰਟੇ **ਕੁਲ ਅੰਕ : 50**

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

1. **ਗਿਆਨ ਮਾਲਾ** (ਵਿਗਿਆਨਕ ਤੇ ਸਮਾਜ-ਵਿਗਿਆਨਕ ਲੇਖਾਂ ਦਾ ਸੰਗ੍ਰਹਿ) (ਸੰਪ. ਡਾ. ਸਤਿੰਦਰ ਸਿੰਘ, ਪ੍ਰੋ. ਮਹਿੰਦਰ ਸਿੰਘ ਬਨਵੈਤ), ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ, 2007 ।
   ਲੇਖ : ਸਾਹਿਤ ਤੇ ਲੋਕ ਸਾਹਿਤ, ਅੱਖਾਂ, ਅਚੇਤਨ ਦਾ ਗੁਣ ਤੇ ਸੁਭਾਅ, ਕੰਪਿਊਟਰ ਅਤੇ ਇੰਟਰਨੈੱਟ, ਮਨੁੱਖੀ ਅਧਿਕਾਰ।
2. **ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ** (ਬਲਵੰਤ ਗਾਰਗੀ), ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
   ਲੇਖ : ਸਤੀਸ਼ ਗੁਜਰਾਲ, ਗੁਰਚਰਨ ਸਿੰਘ, ਠਾਕੁਰ ਸਿੰਘ, ਬਲਰਾਜ ਸਾਹਨੀ, ਸੁਰਿੰਦਰ ਕੌਰ।
3. **ਸ਼ਬਦ-ਬਣਤਰ ਅਤੇ ਸ਼ਬਦ ਰਚਨਾ** : ਪਰਿਭਾਸ਼ਾ, ਮੁੱਢਲੇ ਸੰਕਲਪ
4. **ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ**
5. **ਪੈਰ੍ਹਾ ਰਚਨਾ**
6. **ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ**
7. **ਮੁਹਾਵਰੇ ਅਤੇ ਅਖਾਣ**

ਅੰਕ ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1.	ਕਿਸੇ ਨਿਬੰਧ ਦਾ ਸਾਰ ਜਾਂ ਉਸਦਾ ਵਿਸ਼ਾ ਵਸਤੂ (ਦੋ ਵਿਚੋਂ ਇਕ) ।	10 ਅੰਕ
2.	ਵਾਰਤਕ ਰੂਪ : ਰੇਖਾ ਚਿਤਰ, ਨਾਇਕ ਬਿੰਬ, ਕਲਾਤਮਕ ਗੁਣ, ਰੇਖਾ ਚਿਤਰ ਸਾਹਿਤ ਨੂੰ ਦੇਣ	10 ਅੰਕ
3-4.	3-4 ਨੰਬਰ ਉੱਤੇ ਦਿੱਤੀ ਵਿਆਕਰਣ ਦੇ ਆਧਾਰ ਤੇ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ।	10 ਅੰਕ
5.	ਪੈਰ੍ਹਾ ਰਚਨਾ : ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿਚੋਂ ਕਿਸੇ ਇਕ ਉਤੇ ਪੈਰ੍ਹਾ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇ ।	5 ਅੰਕ
6.	ਪੈਰ੍ਹਾ ਦੇ ਕੇ ਉਸ ਬਾਰੇ ਪੰਜ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ	5 ਅੰਕ
7.	ਨੰਬਰ 7 ਵਿਚ ਅੱਠ ਅਖਾਣ ਅਤੇ ਅੱਠ ਮੁਹਾਵਰੇ ਪੁੱਛੇ ਜਾਣਗੇ, ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਪੰਜ-ਪੰਜ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤ ਕੇ ਅਰਥ ਸਪੱਸ਼ਟ ਕਰਨੇ ਹੋਣਗੇ ।	5+5= 10 ਅੰਕ

BT-6

ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In the lieu of Compulsory Punjabi)

ਪਾਠ-ਕ੍ਰਮ

ਸਮਾਂ: ਤਿੰਨ ਘੰਟੇ **ਕੁਲ ਅੰਕ: 50**

1. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ,
   ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
   ਬਹੁ-ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ — 20 ਅੰਕ

2. ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ
   ਸਾਧਾਰਨ ਵਾਕ : ਕਿਸਮਾਂ
   ਸੰਯੁਕਤ ਵਾਕ : ਕਿਸਮਾਂ
   ਮਿਸ਼ਰਤ ਵਾਕ : ਕਿਸਮਾਂ — 15 ਅੰਕ

3. ਪ੍ਰਕਾਰਜੀ ਪੰਜਾਬੀ
   ਚਿੱਠੀ ਪੱਤਰ
   ਪੈਰਾ ਰਚਨਾ
   ਸੰਖੇਪ ਰਚਨਾ
   ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ — 15 ਅੰਕ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰਰੂਕਤੀ (ਜਿਵੇਂ ਧੂੜ੍ਹੀਧਾੜ/ਭਰ ਭਰ), ਮਿਸ਼ਰਤ ਸ਼ਬਦਾਂ ਦੀ ਬਣਤਰ/ਸਿਰਜਨਾ; ਅਗੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਉਪ ਭਾਸ਼ਾ), ਪਿਛੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਰੰਗਲਾ), ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ-2: ਪੜਨਾਵੀਂ ਰੂਪ, ਕਿਰਿਆ/ਸਹਾਇਕ ਕਿਰਿਆ ਦੇ ਰੂਪ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ-2: ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ।
2. ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ : ਕਰਤਾ ਕਰਮ ਕਿਰਿਆ; ਸਾਧਾਰਨ ਵਾਕ, ਬਿਆਨੀਆ, ਪ੍ਰਸ਼ਨਵਾਚਕ, ਆਗਿਆਵਾਚਕ, ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕਾਂ ਦੀਆਂ ਕਿਸਮਾਂ; ਸੁਤੰਤਰ ਅਤੇ ਅਧੀਨ ਉਪਵਾਕ; ਸਮਾਨ (ਤੇ/ਅਤੇ) ਅਤੇ ਅਧੀਨ (ਜੋ/ਕਿ) ਯੋਜਕਾਂ ਦੀ ਵਰਤੋਂ; ਪੰਜਾਬੀ ਵਾਕਾਂ ਦੀ ਵਰਤੋਂ : ਵਿਭਿੰਨ ਸਮਾਜਕ/ਸਭਿਆਚਾਰਕ ਪ੍ਰਸਥਿਤੀਆਂ ਦੇ ਅੰਤਰਗਤ; ਘਰ ਵਿਚ, ਬਾਜ਼ਾਰ ਵਿਚ, ਮੇਲੇ ਵਿਚ, ਸ਼ੌਪਿੰਗ ਮਾਲ/ਸਿਨਮੇ ਵਿਚ, ਵਿਆਹ ਵਿਚ, ਧਾਰਮਿਕ ਸਥਾਨਾਂ ਵਿਚ, ਦੋਸਤਾਂ ਨਾਲ ਆਦਿ।
3. ਇਸ ਯੂਨਿਟ ਵਿਚ ਚਿੱਠੀ ਪੱਤਰ (ਨਿੱਜੀ/ਦਫ਼ਤਰੀ/ਵਪਾਰਕ), ਪੈਰਾ ਰਚਨਾਂ, ਸੰਖੇਪ ਰਚਨਾ ਅਤੇ ਅਖਾਣ ਮੁਹਾਵਰਿਆਂ ਦੀ ਵਰਤੋਂ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀ ਦੀ ਭਾਸ਼ਾਈ ਯੋਗਤਾ ਨੂੰ ਪਰਖਿਆ ਜਾਵੇਗਾ।

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਯੂਨਿਟ ਪਹਿਲਾ ਵਿੱਚੋਂ ਦੋ ਵਰਣਨਾਤਮਕ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਇਕ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ। (15 ਅੰਕ)
2. ਯੂਨਿਟ ਦੂਜਾ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਇਕ ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ। (10 ਅੰਕ)
3. ਯੂਨਿਟ ਪਹਿਲਾ ਅਤੇ ਦੂਜਾ ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰ ਵਾਲੇ ਚਾਰ ਪ੍ਰਸ਼ਨ (ਹਰ ਇਕ ਭਾਗ ਵਿਚੋਂ ਦੋ-ਦੋ ਪ੍ਰਸ਼ਨ) ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੇ ਦੋ ਪ੍ਰਸ਼ਨਾਂ (ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ-ਇਕ ਪ੍ਰਸ਼ਨ) ਦਾ ਉੱਤਰ ਦੇਣਾ ਹੋਵੇਗਾ। (5x2=10 ਅੰਕ)
4. ਨਿੱਜੀ, ਦਫ਼ਤਰੀ ਅਤੇ ਵਪਾਰਕ ਚਿੱਠੀ : ਵਿਦਿਆਰਥੀ ਨੂੰ ਦੋ ਵਿੱਚੋਂ ਕਿਸੇ ਇਕ ਵਿਸ਼ੇ ਤੇ ਚਿੱਠੀ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (5 ਅੰਕ)
5. ਵਿਦਿਆਰਥੀ ਨੂੰ ਤਿੰਨ ਵਿਸ਼ਿਆਂ ਵਿੱਚੋਂ ਕਿਸੇ ਇਕ ਤੇ ਪੈਰਾ ਲਿਖਣ ਲਈ ਜਾਂ ਕੋਈ ਪੈਰਾ ਦੇ ਕੇ ਉਸ ਬਾਰੇ ਪੰਜ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ ਦੇਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (5 ਅੰਕ)
6. ਅੱਠ ਅਖਾਣ/ਮੁਹਾਵਰੇ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ ਨੂੰ ਕਿਸੇ ਪੰਜਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤ ਕੇ ਅਰਥ ਸਪਸ਼ਟ ਕਰਨ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (5 ਅੰਕ)

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 7 **General Microbiology–B**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit - I

Microbial Growth: Bacterial generation doubling time and specific growth rate. Monoauxic, diauxic and synchronised growth curve. Sporulation and regeneration of bacteria

Unit – II

Classification of viruses. Plant and animal viruses, Life cycle of bacteriophage.

Unit- III

Pathogenic micro-organisms. Defence mechanism against micro-organisms.

Symbiosis and antibiosis among microbial populations

N_2-fixing microbes in agriculture

Unit - IV

Microbial metabolism. Fermentation products. A survey of products from micro-organisms. Production of heterologous proteins of interest in micro-organisms.

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5th Edition, The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, Londan.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBS Publishers & Distributors.
7. Purohit, S.S.(2000). Microbiology: Fundamentals and Applications (6th Edition), Agrobios (India).
8. Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

General Microbiology–B (Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Enumeration of microorganism. Total vs viable counts.

Identification of isolated bacteria. Gram staining, other staining methods.

Growth curve of micro-organisms

Testing of water quality

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (1999). Microbiology: A Laboratory Manual 4th Ed: Harlow, Addition-Wesley.
2. Sambrook, J., Russel, D.W. (2001). Molecular Cloning. A laboratory manual 3rd Ed., Cold Spring Harbor Laboratory Press, New York.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 8 **Biochemistry - II**

Time: 3 Hrs. **Max. Marks: 40**
Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

Unit - I

Lipids: Classification of lipids and fatty acids. General structure and function of major lipid subclasses, acylglycerols, phosphoglycerides, Sphingolipids, glycosphingolipids and terpenes, sterols, steroids.

Unit -II

Proteins: Structure of amino acids, non-protein and rare amino acids and their chemical reactions. Structural organization of proteins (Primary, Secondary, Quaternary and domain structure, protein classification and function. Forces stabilizing Primary, Secondary and Tertiary structure.

Unit - III

Vitamins: Types of vitamins and their deficiency symptoms, vitamins as cofactors.

Unit - IV

Hormones: Steroid and peptide hormones.

Books Recommended:

1. Rawn, J.D. (1989). Biochemistry, Neil Patterson Publishers.
2. Stryer, L. (1995). Biochemistry: 4th Edition, W.H. Freeman and Company, New York
3. Zubay, G.L., Parson. W.W. and Vance, D.E. (1995). Principles of Biochemistry: Student Study Art Notebook, Wm. C. Brown Publishers.
4. Bucke C., (1999)), Carbohydrate Biotechnology Protocols, Humara Press.
5. Horton et. al., (2001), Principles of Biochemistry, Prentice Hall.
6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2005). Principles of Biochemistry 4th Ed., CBS Publishers and Distributors, New Delhi.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

Bio-Chemistry-II
(Practical)

Time: 3 Hrs. **Max. Marks: 20**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Protein estimation by Lowry's method.
2. Protein estimation by Bradford method.
3. Protein estimation by UV spectrophotometeric method
4. The determination of acid value of a fat.
5. The saponification value of a fat.

Books Recommended:

1. Plummer D.T. (1990) An Introduction of Practical Biochemistry. 3rd Ed. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
2. Bansal, D.D., Khardori, R. & Gupta, M.M. (1985) Practical Biochemistry. Standard Publication, Chandigarh.
3. Sawhney, S.K. and Randhir singh (2001). Introductory Practical Biochemistry.
4. Narosa Publishing House.

BT-1 **Communication Skills**

Time : 3 Hrs **M. Marks: 100**
Credit Hours: 6 **Theory: 70**
Practical: 30

1. Reading Skills: Model of Reading to learn – P.S.O.R.; Reading Tactics and strategies; Reading purposes – kinds of purposes and associated comprehension; Reading for meaning; Reading outcomes structure of meaning technique, paraphrase, summary writing.

Activities:

a) Developing an awareness of "Reading to learn Procedure"
b) State Reading purposes and comprehension
c) Check on Reading outcomes including paraphrasing and writing of summary.

2. Writing Skills: Guidelines for effective writing; writing styles for application, personal resume, business letter, memo; technical report-style, arrangements, illustration, main section and appendices, conclusion, list references, table of contents, synopsis, revision.

Activities:

a) Writing of an application, business letter, memo and personal resume.
b) Writing a technical report.

3. Listening Skills: Barriers to listening, effective listening skills; feedback skills. Attending telephone calls; note taking.

Activities:

a) Listening exercises – Listening to News/TV
b) Note-taking of a speech/ lecture.

4. Speaking and Discussion Skills: Components of an effective talk/ presentation; planning and organizing content for a talk/ presentation, use of visual aids, effective speaking skills, discussion skills.

Activities:

a) Making presentation on a given topic.
b) Participating in a group discussion.
c) Conducting a meeting.

Note: Adequate allocation be made for practical training within the approved number of periods.

Recommended Books:

1. Geetha Nagaraj, A Course in Grammar and Composition, Foundation Books, 2006.
2. John Seely, Oxford Guide to Effective Writing and Speaking, OUP.

Instructions for paper-setter/examiner:

Practical:

1. Oral presentation with/ without audio visual aids.
2. Group discussion
3. Listening to any recorded material and asking oral questions for listening comprehension.

Theory:

A) The question paper will consist of five skill-oriented questions from Reading and Writing Skills. Each question will carry 10 marks. There will be internal choice wherever possible.

i) Comprehension of a passage.
ii) Summary/ Precis
iii) Application
iv) Business correspondence
v) Minutes of a meeting
vi) Business/ Technical reports
vii) Memo
viii) Resume

B) There will be two simple questions on the theory of four skills. Each question will be 10 marks. There will be internal choice, if possible.

i) Different types of reading
ii) Skimming
iii) Scanning
iv) Reading purpose
v) Learning to Read
vi) Reading to Learn
vii) Topic Sentence
viii) Coherence
ix) Unity
x) Barriers to Listening
xi) How to prepare for Presentation
xii) How to conduct a meeting
xiii) How to make communication effective etc.

Note: Similar question can be added on the four skills.

Oral Testing

Marks: 30

Contents:

1. Oral Presentation with/ without audio visual aids.
2. Group Discussion.
3. Listening to any recorded material and asking oral questions for listening comprehension.

Note:

1. Oral Presentation will be of 5 to 10 minutes duration.
   (Topics can be given in advance or it can be of student's own choice). Use of audio visual aids is desirable but not necessary.
2. Group discussion comprising 8 to 10 students of a familiar topic. Time for each group will be of 15 to 20 minutes.
3. Oral test will be conducted by external examiner with the help of internal examiner. The oral test examiner will be appointed from those teachers who are actually teaching the subject.

BT- 2 **Physical Chemistry**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners :
Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Chemical Thermodynamics:
State of a system, state variables, thermodynamic equilibrium, thermodynamic properties, Intensive and Extensive properties, various types of processes. First Law of Thermodynamics, internal energy and enthaply, change in internal energy and change in enthalpy for expansion of real and ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes. Relation between C_p and C_v. Internal energy change and enthaply change in a chemical process. Hess's law of heat summation. Enthaply of formation, enthaply of ionisation and calculation of bond dissociation energies from thermochemical data.

Second law of thermodynamics, entropy and Gibb's free energy, Carnot's cycle, Calculation of entropy change for reversible and irreversible processes under isothermal and non-isothermal conditions. Gibbs Hemholtz equation. Third law of thermodynamics, Nernst heat theorem, claculation of absolute entropies of substances.

Meaning of chemical equilibrium, homogeneous and heterogeneous equilibrias. Thermodynamic derivation of law of chemical equilibrium, Van't Hoff relation, Relation between free energy change and equilibrium constants K_p K_c and K_f . Temperature and pressure dependence of equilibrium constant.

Unit-II

Solutions:
Definition, types of solutions, vapour pressure of solution and Raoult's law. Factors influencing the solubility of gas in liquids, Henry's law. Ideal solutions, Duhem Margules equation. Distillation of ideal solutions, Lever rule, vapour pressure of ideal solutions and non ideal solutions. Distillation of non ideal solutions. Azeotropes colligative properties, lowering of vapour pressure, depression in freezing point, elevation in boiling point, osmotic pressure. Their common features and applications. Thermodynamic derivation of elevation in boiling point, depression in freezing point and osmotic pressure. Van't Hoff factor and its application to calculate degree of association and degree of dissociation.

Unit-III

Phase Equilibria:
Definition of phase, component and degree of freedom, Phase rule and its thermodynamic derivation. Derivation of Clausius-Clapeyron equation and its importance in phase equilibria, phase diagrams of water system, KI water system and lead-silver system.

Electrochemical Cells:
Electrode poential, Electromotive force (EMF). Reversible and irreversible cells, measurement of EMF of a cell. Nernst equation. Reference electrodes and other electrodes, standard electrode potential. Activity and activity coefficient determination from EMF results. Concentration cells with transference and without transference, liquid function potential, pH, glass electrode, quinone-hydroquinone electrode, Potentiometric titrations.

Unit-IV

Chemical Kinetics:
Rate of reaction, rate constant, factors influencing rate of reaction, order, molecularity. Rate equations for Ist order, IInd order & IIIrd order reactions. Methods for determining order of reaction. Half Life Complex reactions, consecutive reactions, parallel reactions, chain reactions and opposing reactions. Activation energy and calculation from Arrhenius equation. Theories of reaction rates collision theory and transition state theory of biomolecular processes. Catalysis, acid base catalysis, enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis. Heterogeneous catalysis and its mechanism. Surface reactions with special reference to Unimolecular surface reactions.

Unit-V

Ionic Equilibria and Conductance:
Conductivity, equivalent and molar conductance. Variation of equivalent conductance with dilution of weak and strong electrolytes. Arrhenius and Debye Huckel theory. Kohlraush law of independent migration of ions. Transference number and their experimental determination using Hittorf and moving boundary methods. Ionic elocity, ionic mobility. Applications of conductance measurements. Determination of degree of ionisation of weak electrolyte, solubility, solubility product of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt, conductometric titrations. Ionic strength. Debye Huckel theory of activity coefficients.

Mathematical treatment of multistage equilibria of acids and bases. Salt hydrolysis, calculation of hydrolysis constant, Buffer solutions, Buffer index, Buffer capcity universal buffer preparation. Acid base indicators. Theory of acid base indicators. pH change and selection of indicators in different acid base titrations.

Physical Chemistry (Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Physical Chemistry Experiments:

1) Study of distribution law by iodine distribution between water and CCl_4. Given standard solution $Na_2S_2O_3$.
2) Study of distribution law of Benzoic acid between benzene and water.
3) Determination of adsorption isotherm of oxalic acid on charcoal.
4) Surface tension: Determination of surface tension of a given liquid by Stalgmometer.
5) Determination of viscosity of a pure liquid (Acetone, ethanol, propanol, butanol, glycol) (Effect of hydrogen bonding on viscosity).
6) Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).
7) Polarimetry: Determine the %age composition of an optically active solution.
8) **Conductometry:**

   a) Determination of cell constant.
   b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).
   c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.
   d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

9) a) pH of buffer solution.
   b) Acid base titration HCl vs. NaOH.
   c) Determination of ionization constant of a weak acid (CH_3COOH).

10) Calorimetry:
   a) Determination of Heat of neutralization
      (i) Strong acid-strong base
      (ii) Weak acid-strong base.
   b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3.

11) Photometry:
   Verification of Lambert beer's law for solution of $CoCl_2.5H_2O$ (in water) and $K_2Cr_2O_7$ (in water).

BT-3 **Life Science - III**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters / examiners :
Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Water relations, osmosis, transpiration, water potentials, its components, physiological & molecular adaptations in plants with respect to cold-heat-drought and salt stress. Heat shock proteins, dehydrins, late embryogenesis abundant proteins, role of different osmolytes in stress tolerance.

Unit-II

Plant Pathology & epidemiology: Definition, classification, mode of transmission & control measures of plant diseases. Disease resistance host pathogen interaction. Phytoalexins, PR proteins.

Unit-III

A detailed account of the following plant diseases with respect to casual agents, symptoms, epidemology, disease cycle & their control measures.

Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, False smut of rice, Bacterial blight of rice, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi, Bunchy top of banana, Downy mildew of bajra.

Unit-IV

Introduction to parasitology (pertaining to various terminologies in use). Brief account of Life history, mode of infection and pathogenicity of the following pathogens with reference to man, prophylaxis and treatment, Entamaeba, Trypanosoma, Leishmania, Giardia, Trichomonas and Plasmodium.

Histopathological changes in organs in relation to diseases such as livers, cirrhosis, nephrosis, tumors, cancer, AIDS.

Unit-V

Arthropod vectors of human diseases : Malaria, Yellow fever, Dengue haemorragic fever, Filariasis, Plague and Epidemic typhus. Distribution and control of the above mentioned vectors.

General account of diseases such as AIDS, Hepatitis, typhoid and cholera, their occurence and eradication programmes. General account of drug therapy and drug resistance.

References:

1. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2nd Ed., Academic Press.

2. G.N. Agrios (1997), Plant Pathology 4th Ed., Academic Press.

3. R.S. Mehrotra (1980) Plant Pathology Tata McGraw Hill New Delhi.

4. Harrison A. (2000). Principles of Medicine.

Life Science - III
(Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

- Estimation of relative water content of leaf
- Measurement of osmotic potential of different tissues by Chardokov method
- Study of Plant pathogens

  (a) Symptoms of the diseases
  (b) Morbid anatomy of the plants
  Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, False smut of rice, Bacterial blight of rice, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi, Bunchy top of banana, Downy mildew of bajra.

- Preparation of blood smear showing different stages of plasmodium

- Study of permanent slides and specimens of parasitic protozoans, helminth and arthropods: Entamoeba, Giardia, Plasmodium, Trypanosoma, Leishmania, Trichomonae,

  Anopheles,culex (mouth parts), lice, rat flea, Aedes Agypti, Tapeworm, Ascaris, Wuchereria, Trichinella, Ancylostoma, Oxyuris.

- Pathological examination of blood and urine.

- **Blood Tests:**

  (a) Erythrocyte sedimentation rate
  (b) Bleeding time
  (c) Clotting time
  (d) Prothrombin time

BT- 4 **Biochemistry - II**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners :

Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit - I

Enzymes: Classification, nomenclature, general properties, regulation of enzyme activity, steady state kinetics, first order and second order kinetics, proteinaceous and non-proteinaceous enzymes.

Unit - II

Metabolism : Metabolic pathways, Biochemical reaction mechanisms, Energy rich metabolites, Interorgan metabolic pathways.
Carbohyrdate metabolism : Biosynthesis and degradation of carbohydrates; Feeder pathways for glycolysis; regulation of carbohydrate metabolism.

Unit - III

Kreb's Cycle: Enzymes of Kreb's cycle; amphibolic nature of the Kreb's cycle; regulation of Kreb's cycle.
Electron Transport and Oxidative phosphorylation :
Mitochondrial electron transport chain; oxidative phosphorylation; regulation of ATP synthesis.

Unit – IV

Lipid Metabolism: Biosynthesis and degradation of fatty acids; metabolism of triacyl glycerols; cholesterol metabolism; complex lipids.

Unit - V

Nitrogen Metabolism: Reduction and assimilation of atmospheric nitrogen; Biosynthesis and degradation of amino acids; amino acids as recursors of heme; biogenic amines; biosynthesis and degradation of nucleic acids.

Books Recommended:

1. Rawn, J.D. (1989), Biochemistry, Niel Patterson Publications, North Carolnia.
2. Stryer, L. (1995), Biochemistry, 4th Ed., W.H. Freeman & Co., San Francisco.
3. Voet, D. and Voet, J.G. (1995). Biochemistry, 2nd Ed., John Wiley and Sons Inc., New York.
4. Voet, D., Voet, J.G. and Pratt, C.W. (1999). Fundamentals of Biochemistry, John Wiley and Sons, New York.
5. Lehninger, A.L. Ntison, D.L. and Cox, M.M. (2005), Principles of Biochemistry, 2nd Ed., Worth Publishers, New York.

Biochemistry - II (Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Estimation of -amylase activity from saliva.

2. Assay of acid phosphatase activity.

3. Effect of temperature on enzyme activity.

4. Effect of pH on enzyme activity

5. Determination of Km for acid phosphatase.

6. Purification of protein using salt precipitation

7. Chromatographic methods for separation of macromolecules

- Paper chromatography

- Thin layer chromatography

- Gel permeation chromatography.

Books Recommended:

1. Plummer D.T. (1998). An Introduction of Practical Biochemistry, 3rd Ed. Tata McGraw Hill Publishers Co. Ltd., New Delhi.

2. Bansal, D.D., Khardori, R. & Gupta, M.M. (1985). Practical Biochemistry. Standard Publication, Chandigarh.

3. Sawhney, S.K. and Randhir Singh (2001). Introductory Practical Biochemistry. Narosa Publishing House, New Delhi.

BT- 5 **Cell Biology**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners :

Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit - I

Cell as a basic unit of living systems. The cell theory

Broad Classification of Cell Types: PPLO's, bacteria, eukaryotic microbes, plant and animal cells. A detailed classification of cell types within an organism. Cell, tissue, organ and organism as different levels of organizations of otherwise genetically similar cells.

Unit - II

Ecological amplitude of cells in high altitude, sediments, arctic, hotspring, arid, brackish extremophytes and freshwater environments.

Biochemical composition of cells (proteins, lipids, carbohydrates, nucleic acids and the metabolic pool).

Biological Membranes: Supramolecular architecture of membranes; Solute transport across membranes; Model membranes and Liposomes.

Unit - III

Structure and function of cell organelles, ultrastructure of cell membrane, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.), Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

Unit - IV

Cell Division and Cell Cycle: mitosis, meiosis, stages of cell cycle, binary fission, amitosis
Cell-cell interaction
Cell locomotion (amoeboid, flagellar and ciliar).

Unit – V

Cell Senescence and Death: Apoptosis and necrosis

Cell Differentiation in Plants and Animals: Totipotent, multipotent, pleuripotent cell.

Precellular Evolution: artificial creation of "cells"

Books Recommended:

1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (1991) Cell and Molecular Biology, Saunders, Philadelphia.
2. Lodish, H., Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P. and Darnell, J. (1995). Molecular Cell Biology 3rd Edition, Scientific American Books Inc.
3. Geoffrey, M. (2000). The Cell : A molecular approach 2nd Edition, ASM Press.

Cell Biology (Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

-Microscopy: (a) Principles of compound, phase contrast, electron microscopy.
(b) Use and care of Light compound microscope.

-Study of Cells: (a) Prokaryotic cells: *Lactobacillus, E. coli*. Blue green algae.
(b) Eukaryotic cells: Testicular material (for studies of spermatogenesis)

- Microtomy: Introduction of the instrument- its use, care, section cutting and stretching.

-Preparation of Permanent Slides: Principles and procedures- Section cutting of tissues - and staining of tissues with Haematoxylin/eosin method.

- Study of permanent slides of various tissues (gut region, liver, lung, spleen, kidney, pancreas, testis, ovary, tongue, skin etc.).

- Study of electron micrographs of various cell organelles-plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic Reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids, etc.

Books Recommended:

1. Shah, V.C., Bhatavdekar, J., Chinoy, N.J. and Murthy, S.K. (1988). Essential techniques in Cell Biology. Anand Book Depot, Ahemadabad.

2. Celis, J.E. (1998) Cell Biology: A Laboratory handbook. Vol. 1-3. Academic Press, UK.

BT- 6 **Immunology**

Time: 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners :
Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

UNIT-I

Introduction:
Types of immunity-innate and adaptive; Features of immune response-memory; Specificity and recognition of self and non-self; Terminology and approaches to the study of immune system; Immunity to viruses bacteria; fungi and tumours; vaccines.

UNIT-II

Cells and Organs of the Immune System:
Lymphoid cells, heterogeneity of lymphoid cells; T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic.

UNIT-III

Humoral Immunity:
Antigen-antibody interactions; affinity and avidity; high and low affinity antibodies; Immuno-globulins, classes and structure; Molecular mechanism of generation of antibody diversity; Complement fixing antibodies and complement cascade.

UNIT-IV

Cell Mediated Immunity:
T-cell subsets and surface markers, T-dependent and T-independent antigens, recognition of antigens by T-cells and role of MHC, structure of T-cell antigen receptors.

UNIT-V

Immunodiagnostic Procedures:
Various types of immunodiffusion and immunoelectrophoretic procedures. Immunoblot, ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and haemagglutination inhibition.

Books Recommended:

1. Austyn, J. M. and Wood, K. J. (1993), Principles of Cellular and molecular Immunology, Oxford University Press Inc., New York.
2. Paul, W.E. (1995), Fundamental Immunology, 3rd Ed., Raven Press, New York.
3. Britch, J. R. and Lennox, E.S.(1995), Monoclonal Antibodies Principles and Application, Wiley Liss.
4. Roitt, I. M., Brostoff, J. and Male, D. K. (1996), Immunology, 4th Edition, Grower Medical Publishing, New York.
5. Strites D. P., Terr. A.I. & Parslow T.G. (1997), Medical Immunology, 9th Ed., PHI, Cambridge.
6. Kanfmann S.H.E., Sher, A., Ahmed, R.(2002). Immunology of Infections Diseases, ASM Press, Washington.
7. Kuby, J. (2004), Immunology. 5th Edition, W. H. Freeman and Company, New York.

Immunology (Practical)

Time: 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Differential leucocytes count
2. Total Leucocytes count
3. Total RBC count
4. Haemagglutination assay
5. Haemagglutination inhibition assay
6. Separation of serum from blood
7. Enumeration of T-cells by E-rosetting method
8. Double immunodiffusion test using specific antibody and antigen.
9. Separation of peritoneal macrophages from rat.
10. Isolation of mononuclear cells from peripheral blood and viability test by dye exclusion method.
11. Direct and indirect ELISA.

Books Recommended:

1. Stevens, C.D. (1996). Clinical Immunology and Serology: A Laboratory Perspective, F.A. Davis Company, Philadelphia
2. Celis, J.E. (1998). Cell Biology : A laboratory handbook. Vol-I, Academic Press, U.K.
3. Hay, F.C., Westwood, O.M.R. (2002). Practical Immunology, 4th Ed., Blackwell Science, U.K.

BT- 7 **Genetics and Molecular Biology**

Time: 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners :

Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit - I

Organization of Chromosomes: Genome size and complexity, the supercoiling of DNA, the structure of prokaryotic and eukaryotic chromosome, Polytene chromosomes, euchromatin and heterochromatin, satellite DNA, centromere and telomere structure.

Mendelian laws of inheritance, gene interactions

Unit - II

Gene Linkage and Chromosome Mapping: Linkage and recombination of genes in chromosomes, crossing over and its molecular mechanism, gene mapping by three point test crosses, mapping by tetrad analysis, somatic cell hybridization for gene linkage studies, recombination within genes.

Mutation: Spontaneous versus induced mutations, types of mutations, the molecular basis of mutations, mechanisms of DNA repair, mutations frequency, mutagenic agents, chemical & radiation.

Basic microbial genetics: Conjugation, transduction, transformation,

Unit - III

Molecular basis of life. Structure of DNA. DNA replication both prokaryotes and eukaryotes. DNA recombination molecular mechanisms : prokaryotic and eukaryotic. Insertion elements and transposons.

Unit - IV

Structure of prokaryotic genes. Prokaryotic transcription. Prokaryotic translation. Prokaryotic gene expression (lac, his, trp, catabolic repression).

Unit - V

Structure of eukaryotic genes. Eukaryotic transcription. Eukaryotic translation.
Eukaryotic gene expression transcription factors etc. Gene expression in yeast.
Post translation regulation of gene expression.

Books Recommended:

1. Maloy, S.R., Crown, J.E. and Freifelder, D. (1994). Microbial Genetics: 2nd Edition, Jones & Bartlett Publishers.
2. Hartl, D.L. (1994). Genetics : 3rd Edition, Jones & Bartlett Publishers.
3. Brooker, R.J. (1999). Genetics : Analysis and Principles, Jim Green.
4. Antherly A.G., Girton. J.R. (1999), The Science of Genetics. Harcourt college Publishers
5. Freifelder, D. (2000). Microbial Genetics, Narosa Publishing House.
6. Hartl. D.L., Jones E.W., (2001). Genetics : Analysis of Genes & Genomes 5th Edition. Jones & Bartlett Publishers.
7. Adams, R. L. P., Knowler, J. T., and Leader, D. P. (1992). The Biochemistry of Nucleic acids, 11th ed., Champman and Hall, The New York/London/Tokyo/Melbourne/Madras.
8. Bolsover, S. R., Hyams, J. S., S. Shephard, E. A. and White H. A. (1997) from Genes to Cells., John Wiley and Sons.
9. Lewin, B (1997), Gene VI, Oxford University Press.
10. Maulik, S. and Patel, S. D. (1997). Molecular Biotechnology Therapeutic Application and Strategies, John Wiley & Sons.
11. R. W. Old and S. B. Primrose (1989): Principles of Gene Manipulation : An Introduction to Genetic Engineering. Black Well Scientific Publications.
12. Strachan, T. A. and Read, A. P. (1996). Human Molecular Genetics, John Willey and Sons.

Genetics (Practical)

Time: 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Demonstration of Law of segregation and Independent assortment (use of coloured beads, capsules etc.). Numericals for segregation and Independent assortment. Use of Chi^2 for prediction of phenotype/genotype frequencies of parents from progeny and vice-versa, Epistasis

2. Segregation demostration in preserved material (Maize)

3. Detection of Blood groups (A B O, & Rh Factors)

4. Inheritance of other human characteristics, ability to last PTC, Thiourea

5. Comparison of variance in respect of pod length and number of seeds/pod.

6. Calculation of gene frequencies and random mating (coloured beads, capsules).

7. Paternity disputes (Blood groups)

8. Dermatographics : Palm print taking and finger tip patterns.

9. Prepartaion and study of mitosis slides from buccal mucosa and onion root tips by squash method.

10. Preparation and study of meiosis slides from meristem tissue by squash method.

11. Demonstration of sex chromatin from buccal smear using thionin stain.

BT- 8 **Agro and Industrial Applications of Microbes**

Time: 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners :

Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Intorduction:
Basic concept of agriculture as industry. Industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Differences between microbial industrial processes and chemical industrial processes.

Unit-II

Improvement of Industrial Microbes:
Improvement programme of industrial microbes, mutational programme of penicillin producing microorganisms, selection pressure in maintaining the hyper producing microbes, revertant back of higher yielding microbes into lower production, media formulation and process optimisation of industrial and agro industrial microbes.

Unit-III

Industrial and Agro-industrial Microbes:
Microbes involved in antibiotics, pharmaceutical drugs, enzymes production, solvent production, surfactants, aq. culture, vermiculture, composting, herbicides and biopesticides production, biotransformation, Nitrogen fixation, organic acids production, vitamins, aminoacids, single cell protein, biofertilizers, alcohols, wine, beers, mycotoxins.

Unit-IV

Microbial Processes in Agrobiotechnology:
Introduction, plant microbe interactions, BT gene in BT cotton, *Rhizobium, Azospirillum, Azobacter, Anabena* in nitrogen fixation, Agrobacterium, Spirulina production, soil treatment with microbes, Mycorrhizal fungi, microbial pesticides, mycoherbicides.

Unit-V

Microbial Process in Industrial Biotechnology:
Introduction, primary and secondary metabolites production, production of vitamins B_{12}, alcohols, wine, beer, cheese, bread, citric acid, penicillins, glutamic acid, cellulases, proteases in leather industries, Biochips.

Agro and Industrial Applications of Microbes (Practical)

Time: 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Autoclaving.
2. Microbial cells counting by serial dilution techniques.
3. Microbial cell counting by pore plate techniques.
4. Measurement of bacterial size.
5. Screening of cellulase producing microorganism from wood degrading soil.
6. Antibiotic sensitivity of the above microorganism.
7. Minimum inhibitory concentration of a antibiotics for the above microorganism.
8. Additive and synergistic effect of two drugs on the above microorganism.
9. Plating the milk samples for microbial contamination.
10. MBRT Test for determination of milk quality.
11. Metabolic Characterization (e.g. IMVIC test)
12. One Step Growth of Bacteriophage.
13. Alcoholic and Mixed–Acid Fermentation.

On Job Training

The students should be assigned to assist a clinic (in a hospital), immunology / veterinary / virology / fermentation institute or industry. Prior arrangements must be made of the mode of interaction of the educational institution with the clinic and the industry.

Environmental Studies (Compulsory Paper)

Time: 3 Hours **M. Marks: 100**
Theory Lectures: 50 Hours

Section A (30 Marks): It will consist of ten short answer type questions. Candidates will be required to attempt six questions, each question carrying five marks. Answer to any of the questions should not exceed two pages.
Section B (45 Marks) : It will consist of six essay type questions. Candidates will be required to attempt three questions, each question carrying fifteen marks. Answer to any of the questions should not exceed four pages.
Section. C (25 Marks): It will consist of two questions. Candidate will be required to attempt one question only. Answer to the question should not exceed 5 pages. In this section the students will be required to write on the environment of an area/ ecosystem/ vi1lagel industry/ disaster/ mine/ dam agriculture of an area/ ecosystem/ village/ industry/ disaster/ mine/dam / agriculture filed/ waste management/ hospital etc. with its salient features, limitations, their implications and suggestion for improvement.

1. **The Multidisciplinary Nature of Environmental Studies:** Definition, scope & its importance, Need for public awareness.
2. **Natural Resources**: Natural resources and associated problems.

a) **Forest Resources**: Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) **Water Resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral Resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food Resources**: World food problems, change caused by agriculture and overgrazing, effects or modern agriculture, fertilizer-pesticide problem, salinity, case studies.

e) **Energy Resources**: Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.

f) **Land Recourses**: Land as a resource, land degradation, soil erosion and desertification.

g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

3. Ecosystem:

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its Conservation:

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts

Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. 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

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

* From unsustainable to sustainable development
* Urban problems related to energy
* Water conservation, rain water harvesting, watershed management
* Resettlement and rehabilitation of people; its problems and concerns. Case studies
* Environmental ethics: Issues and possible solutions.
* Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents and holocause. Case studies.
* Wasteland reclamation
* Consumerism and waste products

* Environmental Protection Act
* Air (prevention and Control of Pollution) Act
* Water (prevention and Control of Pollution) Act
* Wildlife Protection Act
* Forest Conservation Act
* Issues involved in enforcement of environmental legislation
* Public awareness

7. Human Population and the Environment

* Population growth, variation among nations
* Population explosion-Family welfare programme
* Environment and human health
* Human rights
* Value education
* HIV / AIDS
* Women and child welfare
* Role of information technology in environment and human health
* Case studies
* **Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs
* **Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

8. Field Work: Visit to a local area to document environmental assets–river / forest / grassland / hill / mountain. Visit to a local polluted site–Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems–pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.

9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar

BT- 1 rDNA Technology

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setter/examiners:
Each question paper will consist of three sections as follows:

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

1. Restriction enzymes, Ligases, DNA polymerases, kinases, Reverse transcriptases, Phosphatases.

Unit-II

2. Vectors : Plasmids, Expression Vectors, Lambda, M-13, Cosmid, BAC, YAC, TAC.

Unit-III

3. Radioactive & non radioactive DNA and RNA labelling techniques: Nick translation, random priming.

Unit-IV

4. Introduction to PCR, Southern & Northern blotting, hybridization. Brief introduction to microarrays, proteomics and bioinformatics.

Unit-V

5. Transformation of E.coli cells. Genomic cloning, cDNA cloning, colony hybridisation. (Purification of DNA from bacterial, plant and animal cells. Introduction of DNA into living cells. Application of cloning in gene analysis: How to obtain a clone of a specific gene, Studying gene location and structure, Studying gene expression needs to be introduced)

rDNA Technology (Practicals)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. DNA isolation from plants.

2. DNA isolation from E.Coli.

3 Spectrophotometer analysis of DNA.

4. Agarose gel electrophoresis of DNA.

5. Plasmid DNA isolation.

6. Restriction digestion of DNA.

7. Southern Blotting.

8. Making competent cells.

9. Transformation of competent cells.

Books Recommended:

1. R. W. Old and S.B. Primrose (1989) : Principles of Gene Manipulation: An introduction to Genetic Engineering. Black Well Scientific Publications.

2. B.D. Hames and S.J. Higginis (1995). Gene Probes I.A. Practical approach, Oxford University Press.

3. Tuan Rockey, S. (1997). Recombinant gene expression protocols, Humana Press, Totowa.

4. White Bruce, A (1997). PCR Cloning Protocols, Humara Press, New Jersy.

5. J. Sambrook, E.F. Fritsch and T. Maniatis (Latest Edition). Molecular cloning. A laboratory Manual, 3rd ed., Cold Spring Harbor Laboratory Press.

BT -2 **Plant Tissue Culture and Plant Biotechnology**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setter/examiners:
Each question paper will consist of three sections as follows:

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Plant nutrition & deficiency symtoms, Plant growth regulators and their physiological functions & role in morphogenesis, Plant water relationships.

Unit-II

Culture media, Culture techniques, Sterilisation techniques: for glassware, tissue and media.

Unit-III

Totipotency, somatic embryogenesis, micropropagation, somaclonal variations.

Unit-IV

Protoplast culture & somatic cell hybridization, Induction of haploids & polyploidy through tissue culture, embryo rescue, embryo culture

Unit-V

Production of secondary metabolites by plant tissue culture, production of transgenics.

Books:

1. Bhajwani, S.S, & Razdan, M.K. (1996). Plant Tissue Culture. Theory and Practice Elsevier.

2. Chahal, S.S. and Gosal, S.S. (2002). Principles and Procedures of Plant Breeding: Biotechnology and Conventional Approaches. Narosa Publishing House, New Delhi.

3. Singh, B.D. (2004). Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

Plant Tissue Culture and Plant Biotechnology (Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Sources of contamination and decontamination measures.

2. How to clean glass/plasticware.

3. Operational use of an antoclave.

4. Functions and operations of a Laminar Air flowhood

5. Laboratory design set up for a PTC Laboratory.

6. Preparation of simple growth nutrient (knop's medium), Full strength, half strength, solid and liquid.

7. Preparation of complex nutrient medium (Murashige & Skoog's medium)

8. Plugging and sealing of culture vessels.

9. To select, Prune, sterilize and prepare an explant for culture.

10. Significance of growth hormones in culture medium.

11. To culture different explants for raising callus cultures.

12. To demonstrate various steps of Micropropagation.

Books Recommended:

1. I.Razdan, M.K. (1994), An introduction of Plant Tissue Culture, Oxford and IBM Publishing Co., London.
2. Narayanaswamy, S. (1994), Plant Cell and Tissue Culture, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi
3. Rudolf, E. (1994), Plant cell Biotechnology, Springer verlag.
4. Bhojwani, S.S. and Razdan, M.K. (1996), Plant Tissue Culture theory and Practice, a Revised Edition, Elsevier Science, Netherlands.
5. Gemborg, O.L. and Phillips, G.C. (1996), Plant cell Tissue and Organ Culture, Naros. Pub. House.

BT- 3 Animal Tissue Culture and Animal Biotechnology

Time: 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setter/examiners :
Each question paper will consist of three sections as follows :

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Introduction: History of development of cell cultures; The natural surroundings of animal cells; stimulating natural conditions for animal cells; metabolic capabilities of animal cells.
Sterilization techniques: Aseptic techniques in Animal tissue culture; sterilization of culture media; glassware, and tissue culture laboratory; detection of contamination; safety considerations in ATC laboratory.
Clean Environment: P1, P2, P3 facility and their applications.

Unit -II

Animal cell culture techniques: Dispersion and disruption of tissues; Primary cultures : anchorage and non-anchorage dependent cells; Secondary cultures: transformed animal cells established/continuous cell lines; measurement of growth and viability of cells in culture; importance of growth factors of the serum.

Unit-III

Commonly used animal cell lines; their origin and characteristics; Growth kinetics of cells in culture; Differentiation of cells; organ culture; expressing cloned protein genes in animal cell cultures; The need to express proteins in animal cells.

Unit-IV

Applications: Cell fusion and production of monoclonal antibodies; scale up methods for propagation of anchorage dependent and suspension cell culture; Bioreactors for large scale culture of cells; micro carrier cultures; Transplanting cultured cells, Stem cells & therapeutic cloning.

Unit-V

Genetic Engineering in animal cells: Transformation of animal cells; vectors and expression vectors; Genetic engineering in production of regulatory proteins, blood products, vaccines and hormones; Transgenic animals and production of useful products in transgenic animals.

Books Recommended:

1. Butler, M. (1991), Mammalian Cell Biotechnology- A Practical Approach, IRL, Oxford University Press.
2 Gareth, E.J. (1996), Human Cell Culture Protocols, Humara Press.
3. Butler, M. (1996), The Animal Cell Culture and Technology, IRL Oxford Univ. Press.
4. Julio, E., Celis (1998), Cell Biology-A laboratory hand book, Vol. I-IV, 2nd ed., Academic Press, New York.
5. Wolff, J.E.D. (1993): Gene Therapeutics Birkhuser
6. Rasko, I., and Downes, C.S. (1995). Genes in Medicine, Champan & Hall
7. Maulik, S. and Patel, S.D. (1997). Molecular Biotechnology Therapeutic Application and Strategies, John Wiley & Sons.
8. Freshney, R, T. (2006), Culture of Animal Cells 5^{th} ed., John Wiley and Sons, New York.

Animal Tissue Culture and Animal Biotechnology (Practical)

Time: 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

1. Sterilization techniques: Theory and Practical

    -Glass ware sterilization
    -Media sterilization
    -Laboratory Sterilization

2. Sources of contamination and decontamination measures.

3. Preparation of Hanks Balanced salt solution

4. Preparation of Minimal Essential Growth medium.

5. Isolation of lymphocytes for culturing

6. Isolation of rat macrophages from peritoneum for *culturing*

7. Primary Lymphoid *culture*.

8. DNA isolation from animal tissue.

9. Quantification of isolated DNA.

10. Resolving DNA on Agarose Gel.

11. Isolation of mononuclear cells from spleen and their culture

Books Recommended:

1. Butler, M. C. (1991) Mammalian Cell Biotechnology. A practical approach. IRL, Oxford University Press.

2. Freshney, R.T. (2006), Culture of Animal Cells. 5th ed., John Wiley and Sons, New Delhi.

BT- 4 **PATENT LAWS IN BIOTECHNOLOGY AND ENTEREPRENEURSHIP**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setter/examiners:

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Introduction to Indian Patent law. World Trade Organisation and its related intellectual property provisions.

Unit-II

Intellectual/Industrial property and its legal protection in research, design and development.

Unit-III

Patenting in Biotechnology, economic, ethical and depository considerations.

Unit-IV

Patentable subject matter and legal aspects of transfer of Biotechnology in India. Writing a patent specification.
Information sources in Patent literature search.

Unit-V

Enterepreneurship:

Selection of a product line, design and development processes, economics on material and energy requirement, stock the product and release the same for marketing etc.
The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations~ export potential etc.

B.Sc. (BIO-TECHNOLOGY) (PART-III)

BT- 5 **BIOPROCESS ENGINEERING**

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setter/examiners:
Each question paper will consist of three sections as follows:

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-1

Introduction:
Fundamental principles of Chemical Engineering and biochemical engineering. Applications of physical and chemical laws on biological samples e.g. : light reaction, photolysis of water, enzymatic reaction and simple kinetics.

Unit-II

Microbial Growth Kinetics :
Simple kinetics of microbial growth, yield coefficient, doubling time, specific growth rate, substrate inhibition kinetics, product inhibition kinetics, internal & external feed back systems, effector molecules and its kinetics, metabolic and biomass productivities, Effect of temperature, pH and inducer on product synthesis.

Unit-III

Sterilization:
Introduction, air and media sterilizations, design of batch sterilization process, Del factor, sterilization cycle, continuous sterilization process, sterilization of fermenters.

Unit-IV

Design of a Fermenter:
Introduction, fermenter for microbial, animal & plant cell culture, Aseptic operation of fermenter, control and measurement equipments of fermenter, pH & D.O. probes,mpeller and spargers, batch, fed batch, C.S.T.B.R, plug flow and air loop bioreactors and its kinetics, operation and agitation and its kinetics.

Unit-V

Down Stream Processing: Introduction, removal of microbial cells and other solid matters. Foam separation, filtration, industrial filters and its principles, centrifugation and industrial centrifuges, cell disruption, aqueous two phase extraction system, super critical fluid extraction, whole broth processing, effluent treatment, aerobic and anaerobic slug treatment process, fermentation economics.

Books Recommended:

1. Stanbury, P.F., Whitaker, A. and Hall, S.J. (2001), Principles of Fermentation Technology 2nd ed., Pergamon Press, Oxford.

2. Young, M.Y. (2000), Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.

3. Young, M.Y. (1996), Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.

4. Bailary, J.E. and Ollis, D.F.,(1986), Biochemical Engineering Fundamentals, McGraw Hills, N.Y.

5. S.J. Pirt (1985), Principles of microbes and cell cultivations. Blackwell Scientific Publication, London.

Bioprocess Engineering (Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Students will go for two week training in fermentation technology in industry/institute and the students will be required to submit written report of their training which will be evaluated by the teacher who has taught theory course.

BT- 6 BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setter/examiners :
Each question paper will consist of three sections as follows:

Section A : 10 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise of four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

Unit-I

Centrifugation: Basic principles, theory and applications of preparative and analytical centrifugation, rotor types, sedimentation co-efficient and care of rotors.

Unit-II

Chromatography: Theory, principle and application of column, paper, thin layer, ion-exchange affinity chromatography, GLC, HPLC and FPLC. **(Book Nos. 1, 3 & 4)**

Unit-III

Spectroscopy: Lambert Beer's law, theory & principles of single and double beam UV/Visible spectroscopy, Principle or NMR, ESR, Mass spectroscopy and their application in biology for qualitative and quantitative determination of biomolecules. Introduction to fluorescence spectroscopy, MALDI TOF and MALDI Q. **(Book No.1,3,4 & 5)**

Unit-IV

Electrophoresis : Basic principles, theory and application of native, SDS-PAGE and Agarose Gel electrophoresis. Introduction to IEF, (Iso-electric focusing) 2-D gel and capillary electrophoress. Applications in biology for isolation of biomolecules based on charge and molecular weight. **(Book No.1,3 & 4)**

Unit-V

Radioisotopic Techniques: Basic concepts of radioisotopy, theory and applications of Geiger-Muller tube, solid and liquid scintillation counters, primary and secondary fluors. Safety rules for radioisotopic studies. **(Book No.2)**

Books & Internet files:

1. Freifelder, D(1982). Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd edition, W.H. Freeman & Company, San Fransisco.
2. Slater, R.J.(1990). Radioisotopes in Biology- A Practical Approach, Oxford University Press, NY.
3. Wilson, K and Goulding, K.H. (1991). Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd., Edward Arnold, London.
4. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
5. Tinoco Kenneth Saur and J.C. Wang. Physical Chemistry: Principles and Applications in Biological Sciences, 3rd edition.
6. www.google.com
7. www.thebritishmuseum.ac.uk/science/techniques
8. www.wiley.com
9. www.applied spectroscopy.com/plasma.htm

BT-6 Biophysical and Biochemical Techniques (Practical)

Time : 3 Hrs. **Max. Marks: 25**
Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Chromatography Techniques:

1. Separation of proteins by ion-exchange column chromatography.
2. Separation of proteins by affinity column chromatography.

Spectrophotometric Techniques:

3. Spectrophotometry, the measurement of the transmission of light throught different solutions or substances at different wavelengths of light.

   (a) Preparation of standard curve of BSA
   (b) Preparation of standard curve of DNA using absorption at 260nm.

Electrophoresis Techniques:

4. Preparation of native polyacrylmide gel.
5. Gel separation of proteins by native PAGE.
6. Preparation of SDS-polyacryamide gels.
7. Separation of proteins by SDS-PAGE.

Centrifugation:

8. Sedimentation using Swing Out Rotor and Angle Rotor.

BT-7 Physical, Organic & Inorganic Aspects of Spectroscopy

Time : 3 Hrs. **Max. Marks: 50**
Periods: 3

Note for the paper setters/examiners:
Each question paper will consist of three sections as follows:

Section-A : 10 very short answer questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 10 marks.

Section-B : This section will comprise of 9 questions. Six questions to be attempted and maximum length of answer can be upto two pages. Each question will carry four marks, total weightage being 24 marks.

Section-C : This section will comprise to four essay type questions, two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 8 marks, total weightage being 16 marks.

UNIT-I

1. **Energy and electromagnetic Spectrum:**
Introduction, electromagnetic spectrum and Units, regions of the spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degree of freedom.

II. Ultraviolet and Visible Spectroscopy:
The energy of electronic excitation, measurement techniques, Beer- Lambert Law, Molar extinction coefficient. The Frank Condon Principle. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, auxochromes, factor affecting max Effect of steric hindrance to coplanarity, Solvent Effects. Application of UV spectroscopy.

UNIT-II

III. Infrared Spectroscopy:
Vibrational Energy Levels, Selection Rules, Force Constant, Fundamental Vibration Frequencies, Factor influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effects, Bond Angles, field Effects) of different functional groups. Sampling Techniques, Absorption of Common functional Groups, Interpretation, Finger print Regions.

UNIT-III

IV. Proton Magnetic Resonance Spectroscopy (1H NMR):
The Nuclear spin, Larmour frequency, the NMR isotopes, population of nuclear spin level, spin and spin lattice relaxation. Measurement techniques (CW & FT method), solvent used. Chemical shifts, reference compounds, shielding constant, range of typical chemical Shifts simple application of chemical shifts, ring current and aromaticity. Low and High resolution spectra with various examples. Such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-, acetophenone, tribromoethane, ethyl acetate, toluence, o-,m-,p-anisidine, o-,m-,p- nitrophenols, acetophenone etc.

UNIT-IV

V. Mass Spectrometery:

Basic Principles Elementary theory. –M, resolution, exact masses of nuclides, Molecular ions, isotope ions, fragment ions of odd and even electron types, rearrangement ions. Factors affecting cleavages patterns, simple cleavages, cleavages at a heteron atom, multicenre fragementations rearrangements, diels- Alder fragmentation. Cleavage associated with common functional groups (Aldehydes, ketones cyclic and acyclic esters, alcohols, olefins, aromatic compounds amines)-Interpretation of the spectrum of an unknown.

UNIT-V

VI. Solution of structural problems by combined use of the following spectroscopic techniques:

Electronic spectra, Vibrational spectroscopy, H NMR spectroscopy and Mass Spectroscopy**.**

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher-Palgrave, New York.
2. D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
3. Spectrometeric Indentification of Organic Compounds- R.M. Silverstein & F.X. Webster; Publisher: John Willey & Sons, Inc.
4. Introductory Problems in Spectroscopy-By R.C. Banks, E.R. Matejha and G. Mercer; Publisher: The Benzamine/ Cummings Publishing Company Inc.
5. Introduction to Spectroscopy- D.L. Pavia, G.M. Lampman, and G.S. Kriz Publisher: Brooks / Cole, A Part of Cengage Learning.

Pratical for Spectroscopy (BT – 7)

Periods Per Weeks – 4

Marks: 25

1. Record of IR spectra of diethyl ether, ethyl acetate and butanone and make comparisons.
2. Record the ^1H NMR spectra of ethyl acetate and ethyl acetoacetate (in $CDCI_3$ or CCI_4) and show the presence of tautomeric structures.
3. Synthesis and electronic spectral studies of d-d bands of $[Ni(NH_3)_6]Cl_2$ and $[Ni(en)_3]Cl_2$ complexes. A comparison of their electronics spectra with that of $[Ni(H_2O)_6]Cl_2$ for the calculation of 10 Dq values.
4. Convert cyclohexnone to cyclohexanol and hydrazine of cyclohexazone. Compare the UV-vis and IR spectra of the products with that of the starting material.
5. Preparation of benzillic acid from benzaldehyde. (Green Chemistry Experiment)
6. Separation of components of spinach using column chromatography.
7. Prepare *p*-nitroacetanllide and make comparison of ^1H NMR spectral data of aniline, acetanilide (starting material) and *p*-nitroacetanillede (product).
8. Preparation of $[Fe(py)_4(NCS)_2]$ and its IR characterization.
9. Take commercial sample of methyl orange and record its UV-vis and flourencence spectra under neutral, acidic and basic medium and make comparisons.
10. Compare the IR and ^1H NMR spectra of aspirin and salicyclic acid.
11. To Verify Beer – Lambert Law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of given $KMnO_4/K_2Cr_2O_7$ solution.