

# Faculty of Life Science & Technology

Study and Evaluation Scheme  
of  
Bachelor of Science (Honors)  
in  
Biotechnology

(Applicable w.e.f Academic Session 2013-16, till revised)



## AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

**\*\* The University Authorities reserve all the rights to make any additions/ deletions or changes/ modifications to this syllabus as deemed necessary.**

# AKS University, Satna

Sherganj, Panna Road, Satna (MP) 485001

## Study & Evaluation Scheme of Bachelor of Science (Honors) in Biotechnology SUMMARY

<b>Programme :</b>	<b>B.Sc (Hons.) (Biotech)</b>		
<b>Duration :</b>	Three year full time (Six Semesters)		
<b>Medium :</b>	Hindi & English Both		
<b>Minimum Required Attendance :</b>	75 %		
<b>Maximum Credits:</b>	<b>166</b>		
<b>Evaluation Assessment :</b>	<b>Internal</b>	<b>External</b>	<b>Total</b>
	50	100	150

### Internal Evaluation (Theory/ Practical Papers)

	Sessional-I	Sessional-II	Continuous Assessment & attendance
	10	10	10+20= 30
<b>Duration of Examination :</b>	<b>External</b>	<b>Internal</b>	
	3 hrs.	2 hrs	

To qualify the course a student is required to secure a minimum of 36% marks in aggregate including the semester end examination, internal assessment evaluation (Both theory & Practical Papers)

A candidate who secures less than 36% or Grade 'D' of marks in a Subject/Paper(s) shall be deemed to have failed in that Subject/Paper(s). In case a student has secured less than 36% or Grade 'R' in Subject/Paper(s), he/she shall be deemed to re-appear (ATKT Examination) in Subject/Paper(s) to achieve the required percentage (Min. 36%) or grade (Min. D) in the Subject/Paper(s).

### **Question Paper Structure**

1. *The question paper shall consist of 26 questions in three Sections. Out of which Section-A shall be of Objective type 10 questions and will be compulsory. (weightage 2 marks each).*
2. *Section-B shall contain 10 Short answer type questions and students shall have to answer any eight (weightage 5marks each).*
3. *Out of the remaining six question s are long answer type questions, student shall be required to attempt any four questions. The weightage of Questions shall be 10 marks each.*

**Faculty of Life Science & Technology**  
**Bachelor of Science (Hons.)- Biotechnology**  
**Semester-I**  
**Teaching & Examination scheme**

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	51BT101	Cell Biology and Genetics	5	-	-	5
2	51CH102	Analytical Chemistry	4	-	-	4
3	51BT103	Biomolecules	5	-	-	5
4	51SD104	SSD-Functional English-I	3	-	-	3
5	51SS105-H/I	Spiritual Studies- Hinduism/ Islam	3	-	-	3
6	51BT151	Cell Biology and Biochemistry (Lab 1)	-	-	6	3
7	51CH152	Analytical Chemistry (Lab 2)	-	-	6	3
		<b>TOTAL</b>	<b>20</b>	<b>-</b>	<b>12</b>	<b>26</b>

**Faculty of Life Science & Technology**  
**Bachelor of Science (Hons.)- Biotechnology**  
**Semester-II**  
**Teaching & Examination scheme**

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	51BT201	Principle of Microbiology	4	1	-	5
2	51CH202	Molecular Biology	5	-	-	5
3	51BT203	Intermediary Metabolism	5	-	-	5
4	51EV204	Ecology & Environmental Studies	3	1	-	4
5	51SD205	SSD-Functional English-II	3	-	-	3
6	51BT251	Microbiology (Lab 1)	-	-	6	3
7	51BT252	Advanced Biochemistry (Lab 2)	-	-	6	3
		<b>TOTAL</b>	<b>20</b>	<b>2</b>	<b>12</b>	<b>28</b>

**Faculty of Life Science & Technology**  
**Bachelor of Science (Hons.)- Biotechnology**  
**Semester-III**  
**Teaching & Examination scheme**

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	51BT301	Immunology	4	1	-	5
2	51CA302	Biostatistics & Computer Application	4	1	-	5
3	51BT303	Analytical Tools & Techniques	4	1	-	5
4	51BT304	Bioinformatics	4	1	-	5
5	51BT305	Agriculture Biotechnology	4	1	-	5
6	51SD306	Soft Skill Development		-	2	1
7	51BT351	Immunology & Biostatistics (Lab 1)	-	-	6	3
8	51BT352	Analytical Tools & Techniques and Bioinformatics (Lab 2)	-	-	6	3
<b>TOTAL</b>			<b>20</b>	<b>5</b>	<b>14</b>	<b>32</b>

**Faculty of Life Science & Technology**  
**Bachelor of Science (Hons.)- Biotechnology**  
**Semester-IV**  
**Teaching & Examination scheme**

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	51BT401	Genetic Engineering and Genomics	4	1	-	5
2	51CA402	Plant and Animal Biotechnology	4	1	-	5
3	51BT403	Fermentation Technology	4	1	-	5
4	51BT404	Environmental Biotechnology	4	-	-	4
5	51BT405	Enzymology	4	-	-	4
6	51SD406	Soft Skill Development - Cultural Orientation Skill		-	2	1
7	51BT451	Plant Biotechnology and Genetic Engineering (Lab 1)	-	-	6	3
8	51BT452	Environmental Biotechnology and Fermentation Technology (Lab 2)	-	-	6	3
<b>TOTAL</b>			<b>20</b>	<b>3</b>	<b>14</b>	<b>30</b>

**Faculty of Life Science & Technology**  
**Bachelor of Science (Hons.)- Biotechnology**  
**Semester-V**  
**Teaching & Examination scheme**

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	51BT501	Introduction to Bionanotechnology	4	1	-	5
2	51BT502	Biosafety, Bioethics & IPR	4	1	-	5
3	51BT503	Food Biotechnology	4	1	-	5
4		Elective 1 (Group A/B)	4	1	-	5
5		Elective 2 (Group A/B)	4	1	-	5
6	51BT551	Elective Course Lab (Lab 1)	-	-	6	3
7	51BT552	Food Biotechnology (Lab 2)	-	-	6	3
		<b>TOTAL</b>	<b>20</b>	<b>5</b>	<b>12</b>	<b>31</b>

**Group A (Industrial Biotechnology)**

<b>Elective-1</b>	<b>51BT504-A</b>	<b>Bioreactor Design</b>
<b>Elective-2</b>	<b>51BT505-A</b>	<b>Bioseparation Technology</b>

**Group B (Pharmaceutical Biotechnology)**

<b>Elective-1</b>	<b>51BT504-B</b>	<b>Pharmaceutical Biotechnology</b>
<b>Elective-2</b>	<b>51BT505-B</b>	<b>Stem Cell in Healthcare</b>

**Faculty of Life Science & Technology**  
**Bachelor of Science (Hons.)- Biotechnology**  
**Semester-VI**  
**Teaching & Examination scheme**

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	51BT601	Scientific Writing	4	1	-	5
2		Elective 3 (Group A/B)	4	1	-	5
3	51BT551	3 Months Project Work/Dissertation	-	-	20	10
		<b>TOTAL</b>	<b>8</b>	<b>2</b>	<b>20</b>	<b>21</b>

**Group A (Industrial Biotechnology)**

**Elective-3      51BT602-A                      Distillates and Fermentation technology**

**Group B (Pharmaceutical Biotechnology)**

**Elective-3      51BT602-B                      Molecular Diagnostics**

**B.Sc.(Hons.) (Biotech.)**  
**Semester-I**  
**Cell Biology and Genetics**

**Unit-I**

Cell as basic unit of living System: Pre-cellular evolution, cell theory, ultra structure of cell types (PPLOs, bacteria, plant and animals cell), tools and techniques of cell biology.

**Unit-II**

Ultrastructure of cell membrane, structure and function of cell organelles, golgibodies, cytosol, endoplasmic reticulum, ribosome, mitochondria, peroxisomes, nucleus, cytoskeleton structure- intermediate filament, microtubules, actin filament, cilia and centrioles.

**Unit-III**

Cell division and cycle: Mitosis, meiosis, cell cycle regulation, cell junctions, cell adhesion and extracellular matrix, programmed cell death, cell signaling, signaling molecules and their receptor. Intracellular signal transduction pathway, signaling network.

**Unit-IV**

Mendelian Genetics: Mendal and his experiment, Multiple alleles, Chromosomal theory of Inheritance, Interaction of genes- Intragenic and Intergenic Interaction ,Incomplete dominance lethal genes, Complementary genes, Supplementary genes, inhibitory genes, duplicate genes, epistatic genes and population genetics.

**Unit-V**

Molecular organization of chromosome: Chromosome structure and organization in prokaryotes and eukaryotes, extranuclear genome, abnormal chromosome, chromosomal mutation, deletion duplication, Inversion, translocation, aneuploidy and polyploidy, linkage chromosome mapping. Crossing over, sex determination: chromosomal mechanism, environmental factors determining sex determination, Barr bodies and dosage compensation.

**Reference Books:**

1. Cell & molecular biology- De Robertis B.J. publications Pvt.Ltd.
2. Cell & molecular biology - Gerald karp john wills & essential cell biology Balberts D. Bray
3. Developmental biology- SF Gilbert senior associates.
4. Molecular Biology of Cell- Alberts, B *et al.*
5. Genetics- Strickberger, 2 nd.
6. Microbial Genetics – D. Frifielder.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-I**

### **Applied Chemistry**

#### **UNIT-I**

Polymers:- Introduction, definition, type mechanism of polymerization. Classification of polymer- Properties, Preparation Method and Application of Polythene, Teflon, PVC, Nylon-6, Nylon-66, Bakelite, PAN, Buna-N, Buna-S Rubbers.

#### **UNIT-II**

Water Chemistry:- Source and significance of water, Hardness of water and estimation by different methods, different parameters of water quality. Softening of water and their method. Determination of alkalinity by alkalinity scales, domestic water treatment.

#### **UNIT-III**

Corrosion and its control:- Introduction, Principles, mechanism of electrochemical and chemical corrosion. Factors affecting rate of corrosion. Type of corrosion and their control. Corrosion inhibitor- protective coating and mechanism of drying.

#### **UNIT-IV**

Introduction of spectroscopy, EMR, Types of Spectrum. Instrumental methods of analysis basic principle of UV-Vis, IR spectroscopy. Instrumentation and application of Flame photometry.

#### **UNIT-V**

Electrochemistry:- Type of conductor, Cell, Electrode potential, Types of reference electrode, Helmholtz double layer. Conductometric titration. Nernst equation. Buffer solution, PH determination by potentiometric titration for EMF measurement.

#### **Reference Books:**

1. Text Book of Polymer Science by F.W. Billmeyer, John Wiley & sons, 1994.
2. Liquid Crystals and Plastic Crystals, vol.-I, edited by G.W. Gray and P.A. Winsor,
3. Ellis Harwood Series in Physical Chemistry, New York.
4. Corrosion Engineering by M.G. Fontana McGraw Hill Publications
5. Kamaraj.P & Arthanareeswari. M, *Applied Chemistry, 2nd Edition*, Sudhandhira Publications, 2003.
6. P.Kamatchi, *Applied Chemistry-I*, Ponnuswamy publications, Chennai.
7. Dr. Helen P Kavitha, *Engineering Chemistry – I*, ILA Publications, 2002

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-I**

### **Biomolecules**

#### **Unit-I**

Introduction Scope and Importance of Biochemistry, Structure of water molecule and Hydrogen bonding.

Chemical Foundation of Biology- $P^H$ , Buffer and Biological Buffer System.

#### **Unit-II**

Carbohydrate: - Structure, Classification, Properties and function of carbohydrate.

Lipid: - Structure classification and function of lipid. Structure and function of fatty acid.

#### **Unit-III**

Protein: - Classification, Primary, Secondary and tertiary structure of protein, function of protein.

Amino acid: - Structure functions and properties of Amino acids.

Nucleic acid: - Structure and types, Nucleotides & Nucleosides.

#### **Unit-IV**

Enzymes: - Introduction, Nomenclature and classification of enzyme, Factor's affecting the rate of reaction, Michaelis -menton equation.

Co-enzymes:- Definition, NAD, FAD & TPP, Cofactor.

#### **Unit-V**

Vitamins: - Fat soluble vitamin its types and function water soluble vitamin. Its types and function, Role of minerals (Na, K, Ca, P, Fe) in the biological system.

#### **Reference Books:**

1. Outlines of Biochemistry: Conn & Stumpf
2. Principles of Biochemistry: Voet & Voet
3. Principles of Biochemistry: Jeffery Zubey
4. Clinical Biochemistry: A.C Deb
5. Biochemistry: Stryer
6. Lehninger's Principles of Biochemistry: Nelson & Cox

## SSD - FUNCTIONAL ENGLISH-1

### 1<sup>st</sup> Semester

B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc (BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/Diploma (Engg.)

**INTRODUCTION: Grammar is vital for the efficient use of language in academic as well as social environment. You already know that our speech is made up of sentences. A sentence is the basic unit of the written and spoken language. In this unit we will learn about various structural and functional parts of the sentence, their types ,subtypes and their usage.**

#### **Objectives:**

- To enable the students to use verbs in appropriate contexts.
- To improve students' command of spoken English by practicing the functional language needed in different situations
- To familiarize the students with the concept of Functional English as a multi-focal discipline.
- To enable the students to use English correctly and confidently

#### **UNIT-1**

- a. Articles: Definite, Indefinite and Zero, Noun: numbers (singular and plural) and Personal Pronouns
- b. Introduction to verb :Ordinary and Auxiliary verbs, Regular and Irregular verbs
- c.**The Present Tense:** Present Continuous, Simple Present (Form and Use)

#### **UNIT-2**

**The Past and Perfect Tenses:** Simple Past, The Past Continuous, The Present Perfect, The Present Perfect Continuous, The Past Perfect and The Past Perfect Continuous. ( Form and Use)

#### **UNIT-3**

**The Future Tense:** Future Simple, The future Continuous ( Form and Use ),Causative Verbs,The Sequence of Tenses.

#### **UNIT-4**

Introduction to Modal Auxiliaries ( Form and Use )  
May and can for Permission and Possibility.  
Could for permission in the Past  
May ,Might for Possibility.  
Can and be able for Ability.  
Ought, Should, Must, have to,had to, Need for Obligation.

#### **UNIT-5**

The Conditional Sentences, The Passive Voice; Active Tenses and their Passive Equivalents including Modals, Use of Passive Structure.

**NOTE: Coverage of 1220 Regular (600) and Irregular Verbs (620) with their meaning and uses.**

1. ( Teachers are required to Introduce 25 verbs from the given verb list in every lecture)

**SPIRITUAL STUDIES (HINDUISM)**  
**SRIMADBHAGWADGITA**  
**Compulsory for All Programme/ Courses**  
**श्रीमद्भगवद्गीता**

**UNIT-I**

**अध्याय—एक**

अर्जुन की मोहग्रस्तता,

**अध्याय—दो**

अर्जुन का नैराश्य, शरीर और आत्मा का विश्लेषण, कर्तव्यपालन, निष्काम कर्मयोग, स्थितप्रज्ञ एवं तापत्रय

**अध्याय—तीन**

कर्मयोग, षट्ठिकार

**UNIT-II**

**अध्याय—चार**

गीता का इतिहास, भगवान के प्राकट्य का कारण एवं उनकी सर्वज्ञता

**अध्याय—पांच**

ईश्वरभावनाभावित कर्म

**अध्याय—छः**

ध्यान योग या सांख्य योग, सिद्धि या समाधियोग

**अध्याय—सात**

परा और अपरा शक्ति, पुण्यात्मा मनुष्य के लक्षण

**UNIT-III**

**अध्याय—आठ**

ब्रह्मा, आत्मा, अधिभूत, अधिदैव, अधियक्ष, मुक्तिलाभ की विधि

**अध्याय—नौ**

परमगुह्यज्ञान

**अध्याय—दस**

श्रीभगवान का ऐश्वर्य

**UNIT-IV**

**अध्याय—ग्यारह**

श्रीभगवान का विराटस्वरूप

#### अध्याय—बारह

भक्तियोग का वर्णन, अव्यक्त की उपासना में क्लेश, शुद्ध भक्त के लक्षण

#### अध्याय—तेरह

क्षेत्र, क्षेत्रज्ञ एवं कर्मक्षेत्र की परिभाषा, ज्ञान, ज्ञेय, प्रकृति एवं परमात्मा, चेतना

#### अध्याय—चौदह

त्रिगुण स्वरूप

#### अध्याय—पंद्रह

परम पुरुष का स्वरूप, जीव का स्वरूप

### UNIT-V

#### अध्याय—सोलह

दैवीय स्वभाव, आसुरी स्वभाव

#### अध्याय—सत्रह

श्रद्धा के तीन प्रकार, भोजन के प्रकार, यज्ञ के प्रकार, तप के प्रकार, दान के प्रकार, ऊँ कार का प्रतिपादन, सत्, असत् का प्रतिपादन

#### अध्याय—अठारह

सन्यास एवं त्याग में अंतर, त्याग के प्रकार, कर्म के कारण, कर्म के प्रेरक तत्व, कर्म के प्रकार, कर्ता के प्रकार, चार वर्णों के स्वाभाविक गुण, प्रभु के प्रति समर्पण भाव

### Recommended books

#### संदर्भ ग्रंथ सूची

1. श्रीमद्भगवद्गीता—गीताप्रेस, गोरखपुर।
2. श्रीमद्भगवद्गीता—मधुसूदनसरस्वती, चौखम्भा संस्कृत संस्थान, वाराणसी, 1994।
3. श्रीमद्भगवद्गीता—एस.राधाकृष्णन् कृत व्याख्या का हिन्दी अनुवाद, राजपाल एण्ड सन्स, दिल्ली, 1969।
4. श्रीमद्भगवद्गीता—श्रीमद् भक्तिवेदांत स्वामी प्रभुपाद, भक्तिदांत बुक ट्रस्ट, मुंबई, 1996।
5. Srimadbhagawadgita-English commentary by Jaydayal Goyandaka, Gita Press, Gorakhpur, 1997.

**SULLABUS**  
**SPIRITUAL STUDIES (ISLAM)**  
**Compulsory for All Programme/ Courses**

**UNIT-I**

**इस्लाम धर्म:—** 6वीं शताब्दी में अरब की (राजनैतिक, धार्मिक, सामाजिक, आर्थिक परिस्थितियां व कबीलाई व्यवस्था)

मोहम्मद साहब का जीवन परिचय, संघर्ष व शिक्षाएं, इस्लाम का प्रारम्भ, इस्लाम क्या है और क्या सिखाता है, ईमान—ईमाने मोजम्मल, ईमाने मोफस्सल।

**UNIT-II**

**इस्लाम धर्म की आधारभूत बातें:—**

तोहीद, कल्मा—कल्मा—ऐ—शहादत, कल्मा—ऐ—तैय्यबा, नमाज, रोजा, जकात और, हज का विस्तारपूर्वक अध्ययन

**UNIT-III**

**खुदा—तआला की किताबें (आसमानी किताबें):—**

“वही” की परिभाषा, तौरत, जुबूर, इंजील का परिचय, पवित्र कुरान का संकलन, पवित्र कुरान का महत्व, कुरान की मुख्य आयतें, पवित्र कुरान और हाफिजा

**UNIT-IV**

**पवित्र हदीसों और सुन्नतें:—**

हदीस और सुन्नत क्या है, हदीस और सुन्नत का महत्व, कुछ प्रमुख सुन्नतें और हदीसों का अध्ययन, सोकर उठने की सुन्नतें, लेबास की सुन्नतें, बीमारी और अयादत की सुन्नतें, सफर की सुन्नतें

**UNIT-V**

**इस्लाम धर्म की अन्य प्रमुख बातें:—**

मलाऐका या फरिशते (देवदूत), खुदा के रसूल, खुदा के पैगम्बर, नबी और रसूल में अन्तर, कयामत, सहाबा, खलीफा, मोजिजा और करामात, एबादत, गुनाह (कुफ्र और शिर्फ), माता—पिता, रिश्तेदार व पड़ोसी के अधिकार, इस्लाम में औरत के अधिकार, इस्लाम में सब्र और शुक्र, इस्लाम में समानता और भाईचारा

**ADDITIONAL KNOWLEDGE:-**

IN THE LIGHT OF ‘QURAN’ AND ‘HADEES’, TEN POINTS WILL BE DELIVERED TO THE STUDENTS DAILY, IN A SECULAR COUNTRY THE STUDENTS SHOULD KNOW THE PHILOSOPHY OF OTHER RELIGION ALSO SUCH AS “JAINISM”, “BUDHISM” AND “SANATAN DHARMA”.

**B.Sc.(Hons.) (Biotech.)**  
**Semester-II**  
**Principles of Microbiology**

**Unit I**

**History of Microbes:** Definition and scope of microbiology-history and recent developments. Spontaneous generation-biogenesis contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Tyndal, Joseph lister and Fleming.

**Unit II**

**Microscopy & Staining Techniques:** Bright Field, Dark Field, Phase Contrast, SEM and TEM Microscopy. Stains and staining techniques- Stains and Dyes: classification and types. Types of staining- Simple (Monochrome, Negative), Differential (Gram and Acid fast).

**Unit III**

**Microbial Growth, Sterilization & Pure culture Techniques:** Growth curve, measurement of growth. Synchronous culture, continuous culture and culture media, Physical & Chemical Sterilization, Pure culture technique, culture collection and preservation of microbial culture.

**Unit IV**

**Microbial life:** Prokaryotes, eukaryotes, Archeas & protozoa. Classification of microorganism- Bacteria, Fungi, Cyanobacteria and Virus. Morphology and structure, physiology, reproduction and application of microbes.

**Unit V**

**Microbiology & Man:** Pathogen, source of infection, carriers and vectors. Pathogenesis and prophylaxis - Bacterial, Fungal and Viral.

**Reference books:**

1. Microbiology: Davis, B.D Dulbecco, R., Eiser, H.N. and Ginsberg, H.S.
2. Microbiology: An Introduction- Tortora, G.J., Funke, B.R. and Case, C.L.
3. General Microbiology: Stanier, R.Y.
4. Microbiology: Pelczar, M.T.
5. General microbiology: Schlegel, H.G.
6. A Text book of Microbiology: R.C. Dubey and D. K. Maheshwari
7. Microbiology: fundamentals and Applications: Purohit, S.S.
9. Microbiology: Laboratory manual: Cappuccino, J.G and Sherman, N.

**\*Note: Additional Reading topics mentioned above outside the units are not to be included in examination.**

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-II Molecular Biology**

#### **Unit-I**

Biological molecules: Molecular structure and chemical makeup of DNA, difference between B-DNA and Z-DNA. Molecular structure, chemical makeup and function of different types of RNAs.

#### **Unit-II**

Concept of gene, Structure of Prokaryotic and Eukaryotic genes. DNA replication in prokaryotes (*E.coli*) and Eukaryotic (*Saccharomyces*), Role of different types of enzymes and proteins necessary for replication, Meselson and Stahl experiment. Transcription in prokaryotes and eukaryotes.

#### **Unit-III**

RNA processing in pre mRNA, pre tRNA, rRNA, and post transcriptional modification in RNA. Translation in prokaryotes and eukaryotes, Post translational modification of proteins.

#### **Unit-IV**

Regulation of gene expression in prokaryotes, *lac* operon, *Trp* operon, Regulation of gene activity in eukaryotes at transcriptional level, RNA processing level and translation level. Developmental and Environmental regulation of gene expression in *Drosophila*.

#### **Unit-V**

Genetic recombination in prokaryotes and eukaryotes, Prokaryotic and eukaryotic transposons and transposition process, Mechanisms of mutagenesis, mutagenic agent, Application of molecular biology in signal transduction, gene therapy, apoptosis, and stem cell biology.

#### **Reference books:**

1. Watson, Hopkin, Roberts et al.: Molecular Biology of the Gene, 4 th ed.
2. Baltimore- Molecular Biology of the Cell.
3. Benjamin Levin – Genes IX, 12 th ed.

**B.Sc.(Hons.) (Biotech.)**  
**Semester-II**  
**Intermediary Metabolism**

**Unit: I**

**Basic concepts of metabolism:** Basic concept of Intermediary Metabolism, Law of thermodynamics, Concept of free energy, ATP Cycle, Chemistry & Function of ATP, Structural basis of Free Energy Change during Hydrolysis of ATP, Other high energy phospho compounds.

**Unit: II**

**Carbohydrate metabolism:** Carbohydrate catabolism- Glycolysis, Krebs's cycle. Oxidative Phosphorylation and Electron Transport Chain, Carbohydrate Anabolism - Photosynthesis (C3,C4,CAM), Gluconeogenesis .

**Unit: III**

**Lipid metabolism:** Biosynthesis of fatty acid, Degradation of fatty acid, Triglycerol and Cholesterol Metabolism; Biosynthesis of Unsaturated Fatty Acids, metabolism of phospholipids and sphingolipids, ketogenesis

**Unit: IV**

**Amino acid and protein metabolism:** Nitrogen Assimilation, Urea cycle, Biosynthesis Amino Acids, Degradation of Amino acids, protein synthesis, proteolysis.

**Unit: V**

**Nucleic Acid Metabolism:** Biosynthesis of purine and pyrimidine nucleotides, Degradation of Purine and pyrimidine nucleotides. Biosynthesis of nucleic acid, Degradation of nucleic acid, Inborn errors in Metabolism (carbohydrate, lipid, protein, amino acid, nucleic acid ).

**References:**

1. Outlines of Biochemistry: Conn & Stumpf
2. Principles of Biochemistry: Voet & Voet
3. Principles of Biochemistry: Jeffery Zubey
4. Biochemistry: Stryer
5. Lehninger's Principles of Biochemistry: Nelson & Cox

**B.Sc.(Hons.) (Biotech.)**  
**Semester-II**  
**Subject: Ecology & Environmental Studies**

**Unit 1 :**

Definition, scope and importance, need for public awareness. Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, mining, dams and their effects on forest. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Land resources : Land as a resource, land degradation, soil erosion and desertification.

**Unit 2 :**

Food resources : World food problems, effects of modern agriculture, fertilizer-pesticide problems, Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

**Unit 3 :**

Concept of an ecosystem, Structure and function of an ecosystem. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. introduction, types, characteristic features, structure and function of the terrestrial ecosystem and Aquatic ecosystems. Diversity, Definition & types, Biogeographical classification of India, Value of biodiversity, Biodiversity at global, National and local levels. India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.

**Unit 4 :**

Definition: Cause, effects and control measures of :- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, 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.

**Unit 5 :**

Sustainable development, urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environmental legislation, Public awareness. Population growth, Population explosion - Family Welfare Programme. Environment and human health. HIV/AIDS.. Role of Information Technology in Environment and human health.

**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

**Suggested Books:**

A text book of Environmental Studies, Erach Bharucha, UGC Publication Delhi  
A text book of Environmental science: Purohit Shami & Agrawal, Agrobios Student edition Jaipur  
A text book of Environmental Studies: Kaushi & Kaushik New age International Publication  
Paryavaran Addhyan : MP Hindi Granth Academy  
Paryavaran Addhyan : KL Tiwari and Jadhav  
Paryavaran Addhyan/Shiksha by: Dr Mahendra Kumar Tiwari University Publication Delhi  
A Text Book Of Environmental Science: P.C. Joshi & Namita Joshi, APH Publication Delhi  
Concept of Ecology: E.P.Odum  
A text book of Environmental science: SC Santra, Kalyani Publication  
Ecology and Environment: PD Saharma, Rastogi publication Meerut UP

## SSD- CSEP(COMMUNICATION SKILLS ENHANCEMENT PROGRAM)

### FUNCTIONAL ENGLISH-II

#### 2<sup>nd</sup> Semester

B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc (BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/Diploma (Engg.)

#### Unit-1

Subject verb Agreement, Adjectives and Comparison of Adjectives, Determiners

#### Unit-2

Introduction to Prepositions ( Use and omission), Preposition of travel and movement, Preposition of Date and Time, Relations expressed by Preposition, Words followed by preposition, Finite and Non Finite Clauses& Uses of Let.

#### Unit-3

Conjunction: Co-ordinating and Subordinating,Sentences :Simple, Compound and Complex

#### Unit-4

Statement : Direct & Indirect, Phrasal Verb, Antonyms, Synonyms, Letter Writing: Formal (Parts& Layout)

#### Unit-5

**Communication:** Definition & Meaning of Communication, Importance &Process,Types: Verbal & Non-Verbal, Barriers, and how to overcome these barriers.

#### Reference:

Thomson, A.J and A.V. Martinet.*A Practical English Grammar*. Oxford University Press: New York.

Wren and Martin.*High School English Grammar and Composition*.S.Chand& Company Pvt. Ltd. : New Delhi

Greenbaum, Sidney. *Oxford English Grammar*. Oxford University Press: New York.

Rudzka-Ostyn, Brygida.(2003) *Word Power: Phrasal Verbs and Compounds*.Mouton de Gruyter, Berlin: New York

Chambers Dictionary of Antonyms & Synonyms

Hudson, Richard. *English Grammar*. Routledge: New York.

Rodrigues, M.V. *Effective Business Communication*. Concept Publishing Company: New Delhi.

Raman,Meenakshi&Sangeeta Sharma.Communication Skills. Oxford University Press

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-III**

## **Immunology**

### **Unit-I**

History and major milestones of Immunology. General concepts of the immune system. Innate and Adaptive immunity. Primary and Secondary immune response, Hematopoiesis. Structure, properties and function of the immune cells & organs.

### **Unit-II**

Antigens: Properties, T- dependent and T- independent antigens. Haptens and Adjuvants.

Antibodies, Structure, Properties. Production of monoclonal antibodies and application, Class switching. Major Histocompatibility complex. Antigen Presenting cells, antigen processing and presentation Pathway.

### **Unit-III**

Humoral and cell- mediated Immune response, T and B cell maturation, activation and differentiation. Function and application of cytokines, Regulation of Immune response. Immunotolerance.

### **Unit-IV**

Antigen and antibody interaction, Affinity and avidity cross activity, precipitation, agglutination, immunodiffusion, Immunoelectrophoresis, ELISA, RIA, FACS, Western blotting, immunofluorescence. Complement system.

### **Unit-V**

Hypersensitivity, Vaccine: principle of Immunization, conventional and modern vaccine. Immunodeficiency disorder. Primary and secondary disorders. Auto Immunity mechanism of auto immunity and auto immune disease.

### **Reference books:**

1. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
2. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
3. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-III**

## **Biostatistics and Computer Application**

### **Unit-I**

Introduction to biostatistics and its application, sampling: random and non random sampling, sampling errors and non sampling errors, frequency distribution, Definition and basic properties of probability and probability distribution- normal and binomial distribution.

### **Unit-II**

Measures of central tendency: calculation of arithmetic mean, median and mode, merits and demerits of mean, median and mode, measures of dispersion: range, mean deviation and standard deviation. T-test for small sample, properties and its application, chi-square test

### **Unit-III**

Introduction to computer, block diagram of computer, input and output devices of computer, primary and secondary memory,

### **Unit-IV**

MS Office Packages: MS Word- general operation on file, formatting of document, mail merge, MS Excel- introduction to excel sheet, basic functions, charts, data filter and sorting.

### **Unit-V**

MS Power Point- creating a slide and presentation, slide animation, custom animation, introduction to internet and intranet, E-mail services, WWW and web browsers, search engines.

### **Reference books:**

1. Computer Science, J.G. Brookshear, Pearson, Addison Wesley
2. Biostatistic, Danniell, W.W., 1987. New York, John Wiley Sons.
3. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
4. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
5. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-III**

#### **Analytical Tools & Techniques**

##### **Unit-I: Basics of Bioanalytical Techniques**

General laboratory setup, Instruments used in biotechnology laboratory- their working principle and instrumentation, biosafety and biohazard in laboratory, laboratory waste disposal and their management.

##### **Unit-II: General Biophysical methods**

Different types of solution and their preparation, measurement of pH, buffers, osmosis, diffusion, Physical methods of imaging intact biological structures: X-ray, CAT-Scan, ECG and EEG.

##### **Unit-III: Chromatography**

Concept of chromatography, principle, instrumentation and application of paper chromatography, thin layer chromatography, ion exchange chromatography, gel chromatography, affinity chromatography.

##### **Unit-IV: Electrophoresis**

Concept and basic principle of electrophoresis, factors affecting electrophoresis, different types of electrophoresis: moving boundary electrophoresis, zone electrophoresis, paper electrophoresis, gel electrophoresis, PAGE.

##### **Unit-V: Centrifugation**

Basic principle of centrifugation, factors affecting sedimentation velocity, instrumentation and application of preparative and analytical centrifuge, density gradient centrifugation.

##### **Reference books:**

1. Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
2. Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
3. Principles and Practice of Bioanalysis, Richard F. Venn

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-III**

## **Bioinformatics**

### **Unit I: Bioinformatics**

Definition, history of bioinformatics, Basic terminology used, Applications of Bioinformatics, introduction to NCBI, basic tools of NCBI, database searching and database retrieving from NCBI, Human Genome project.

### **Unit II: Biological Data bases**

Definition, types of database, overview of primary and secondary database, Nucleic acid sequence data bases (NCBI, EMBL and DDJB), Protein sequence data base-SWISS-PORT, database searching: BLAST and FASTA.

### **Unit III: Sequence alignment**

Local and global Alignments, pair wise alignment, substitution scoring and gap penalties, Statistical significance of alignment, multiple sequences alignment: progressive alignment methods, motifs and patterns,

### **Unit IV : Phylogenetic analysis**

Element of phylogenetic model, data analysis, tree building and tree evaluation, building methods, searching for a tree, phylogenetic software, CLUSTAL, PHYLIP & UPGMA. Gene finding and gene scan.

### **Unit V: Protein structure prediction**

Physical properties, secondary structure, alpha & beta structure, motifs, tertiary structures, specialized structure and function, protein conformation and visualization tool- RASMOL, role of bioinformatics in drug discovery, docking and prediction of drug quality.

### **Reference books:**

1. Introduction to Bioinformation – T.Attawood
2. Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
3. Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
4. Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-III**

## **Agriculture Biotechnology**

### **Unit- I**

Biotechnology in Agriculture, Growth and Historical perspective of Agricultural Bio-Technology. Agricultural Bio-Technology- Risk and challenges, Advantages and Applications.

### **Unit-II**

Major crop plants and their improvement. Impact of fertilizers and possible alternatives. Losses due to biotic and abiotic stresses. Engineering for resistance against salinity, drought, herbicide, frost and pest.

### **Unit-III**

Transgenic plants, transfer of nif gene to transgenic plant. Production of therapeutic molecule in plants, edible vaccines, golden rice. Genetic basis of flowering, flower modification and colour. Delaying fruit ripening.

### **Unit-IV**

Germplasm conservation, seed bank, cryopreservation. Importance of biofertilizers in agriculture (rhizobium, azatobactor, mycorrhiza). Vermicomposting, composting.

### **Unit-V**

Role of microbes in agriculture. General symptoms of plant diseases, mode of infection, dispersal of plant pathogens and control of pathogens. Biopesticides- bacterial, fungal.

### **Reference books:**

1. Biotechnology fundamental and application (4th edition) - S.S.Purohit.
2. Plant Biotechnology – B.D.Singh
3. Plants, Genes and agriculture by Maarteen, J.Christpeels, David E.Sdava.
4. Crop Biotechnology by P.R.Yadav, Rajiv Tyagi.
5. Plant Biotechnology by Chawla. Gendel,

## SSD- CSEP (Communication skills Enhancement Program)

### 3rd Semester

**B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc (BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/B.Sc. (IT)/Diploma (Engg.)**

**CSEP PROGRAM:** This programme is devised to give you all an exposure to the language used in various communication activities. The objective of the programme is to enhance our communication skills. Research says that the more you listen and speak a language the faster you learn. In these sessions, we are going to practice to speak sentences and words used in different situations. Once you have the command on the language, you can use it for any context; be it interviews, presentations, business, technology so on and so forth.

Learning through activities is more effective than learning through lectures and books. We are going to provide you with opportunities to make speeches, presentations, interact with various people etc.

#### Unit-1

**Thematic structure:** Money, Cricket, A trip to Gizmo world, Culture and Shopping

**Assignment: Progress Test-1**

#### Unit-2

**Thematic structure:** Festivals, Computers, Auto mania, Environment and studying abroad.

**Assignment: Progress Test-2**

#### Unit-3

Thematic structure: Internet, Fashion & Style, Globalization, all about jobs and Trends in Technology.

**Assignment: Progress Test-3**

#### Unit-4

**Conversation Questions:** College, Beauty and Physical attractiveness, Food and eating, Entertainment, Advertising, Films in your own language, Books & reading.

**Activities:** Reading newspaper and news analysis, Role plays, Extempore, JAM, Story creation, Picture description, Group Discussion and celebrity Interview.

**Assignment: Post assessment Test**

**B.Sc.(Hons.) (Biotech.)**  
**Semester-IV**  
**Genetic engineering & Genomics**

*Prerequisite courses: Microbiology, Molecular Biology*

**Unit I**

Introduction to genetic engineering, Tools for genetic engineering-Restriction enzymes and DNA ligase, vector for gene cloning: Plasmid, Bacteriophage, cosmid.

**Unit II**

Purification of DNA from living cells, Gene library- genomic and cDNA library, Identification of a clone from a gene library, Transformation of r.DNA molecules into living cells.

**Unit III**

Selection of recombinant host cells, Immunological screening and colony hybridization, Polymerase chain reaction. Application of r.DNA technique in human health, agriculture and research.

**Unit IV**

**Introduction to Genomics:** Structure and organization of prokaryotic and eukaryotic genomes; Genetic variation-polymorphism, deleterious mutation; Phylogenetics, Tools for genome analysis-PCR, RFLP, DNA fingerprinting, RAPD, Automated DNA sequencing; Linkage and pedigree analysis; Construction of genetic maps; Physical maps, FISH to identify chromosome landmarks.

**Unit II**

**Genome sequencing:** Human genome project-landmarks on chromosomes generated by various mapping methods; BAC libraries and shotgun libraries preparation; Model organisms and other genome projects; Comparative genomics of relevant organisms such as pathogens and nonpathogens.

**Reference Books:**

1. Introduction to Genomics . Arthur Lesk. Oxford University Press, 2008
2. Genomes, T.A. Brown 3rd Edition, Garland Science, 2006.
3. Molecular Cloning, A laboratory Manual. Sambrook, J., Fritsch, E.F., Mariatis.3rd edition. 2001. Cold Spring Harbor Laboratory, USA.
4. Recombinant DNA. Watson, 1992.
5. Gene Cloning by T.A. Brown
6. Biotechnology by B.D. Singh

**B.Sc.(Hons.) (Biotech.)**  
**Semester-IV**  
**Plant & Animal Biotechnology**

*Prerequisite courses: Molecular Biology*

**Unit: I**

**Basics of Plant tissue culture:** Introduction, Historical perspective, Tissue culture lab and organization, preparation of stock solution, Sterilization techniques, Types of nutrient media and media composition, sterilization and preparation of explants, initiation of culture.

**Unit: II**

**Plant Tissue culture methods:** Totipotency, Establishment and maintenance of callus culture, organogenesis, cell suspension cultures, single cell clones, somoclonal variations, Protoplast isolation, Protoplast fusion, Somatic embryogenesis, germplasm conservation and cryopreservation, transfer and establishment of whole plants in soil (hardening).

**Unit: III**

**Genetic engineering in plants:** Introduction, transgenic plant production, role of *Agrobacterium tumifaciens*, structure of T-DNA, Ti plasmid derived vector systems, Physical methods of transferring genes to plants - Microprojectile bombardment, Electroporation, Introduction to genetic markers, application of transgenic plants.

**Unit: IV**

History and recent research and animal biotechnology. Basic requirements of an animal biotechnology laboratory. Culture media. Sterelization and formulation of various type of media. Primary culture and secondary cell culture.

**Unit: V**

Common cell culture contaminants. Cell cloning and selection, transfection and transformation of cell. Scaling up of animal cell culture; Preservation and characterization of animal cells. Cytotoxicity and viability assays. Stem cells and their applications. Transgenic animal production. Animal biotechnology for human welfare.

**Text Books:**

1. Plant Tissue Culture by K.K. Day
2. Plant Biotechnology by B.D. Singh
3. Plant Biotechnology by S.S. Purohit
4. R.Ian Freshney Culture of Animal cell, A Manual of basic technique 4th Edition 2002.
5. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press,2000

**B.Sc.(Hons.) (Biotech.)**  
**Semester-IV**  
**Fermentation Technology**

*Prerequisite courses: Microbiology, Molecular Biology, Biochemistry*

**Unit-1**

Introduction to fermentation technology: Interaction between chemical engineering, Microbiology and Biochemistry. History of fermentation, Introduction to fermentation processes, Microbial culture selection for fermentation processes, Media formulation and process optimization.

**Unit-2**

Strain improvement, mutations & DNA repair in prokaryotes, Forward Mutations and reverse mutation, Causes of Mutations, Detection of mutants: Regulation of gene expression in prokaryotes, eukaryotes and bacteriophages.

**Unit-3**

Gaden's Fermentation classification, growth associated and non associated fermentations, batch, fed batch and continuous fermentations, Design and operation of Fermenters, Basic concepts for selection of a reactor, continuously stirred tank reactor (CSTR), air lift bioreactor(ALBR), packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor. Bioprocess economics, General fermentation economics.

**Unit-4**

Down Stream processing, Recovery of particulate matter, product isolation, distillation, filtration, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis.

**Unit-5**

Introduction to biosensors, biochips & nanotechnology, Definitions, Examples, Applications, Fermentative production of carboxylic acids, amino acids, antibiotics, vitamins and solvents,

**Reference:**

1. A Textbook of Biotechnology, R.C. Dubey, 2010, S. Chand and Co Ltd.
2. Industrial Microbiology” 2009 Reprint, Casida L. E., New Age International (P) Ltd, Publishers, New Delhi.
3. Principles of Fermentation Technology Stanbury P. F., Whitaker A. & Hall--S. J., 1997, 2nd Edition, Aditya Books Pvt. Ltd, New Delhi.
4. Industrial Microbiology, A. H. Patel, Macmillan Publishers India Limited
5. Advances in Biotechnology, S. N. Jogdand, 2007, 2<sup>nd</sup> edition
6. Genetics – a molecular approach, Peter Russell, 3<sup>rd</sup> edition, Pearson Publications

**B.Sc.(Hons.) (Biotech.)**  
**Semester-IV**  
**Environmental Biotechnology**

*Prerequisite courses: Environmental Science*

**Unit I**

Environment: Basic concepts and Components, Conventional and Nonconventional energy sources and their environmental impact, Environmental pollution: Pollution of air, water and land with reference to their causes, impact and control strategies.

**Unit:II**

Modern fuels and their environmental impacts: Methanogenic bacteria and biogas, Microbial hydrogen production, Conversion of sugars to ethanol, Cellulose degradation for combustible fuel, biopetroleum production.

**Unit –III**

Biotechnological inputs in producing good quality fibers, Biofertilizers, Degradation of pesticides and other toxic chemicals by microorganism, biopesticides, bioleaching, Bioremediation and phytoremediation.

**Unit IV**

Waste water treatment: Primary, Secondary and Final treatment process, Solid wastes: Sources and management (Composting, vermiculture and methane production), Disposal of medical waste, recycling of waste,

**Unit V**

Global Environmental Problems: Green House Effect, Acid rain, Ozone depletion, salination, biodiversity loss; chemical and radiation hazards. Environmental Management: Concept of health and sanitation, environmental laws.

**Reference Books:**

1. Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glassgow and London.
2. Environmental Biotechnology by Bruce Rittmann and Perry McCarty
3. Environmental biotechnology, 1995 S.N.Jogdand. Himalaya Publishing House, Bombay, Delhi, Nagpur.
4. Bioremediation 1994 Baker, K.H.and Herson, D.S. McGraw Hill, Inc.New York.

**B.Sc.(Hons.) (Biotech.)**  
**Semester-IV**  
**Enzymology**

*Prerequisite courses: Biochemistry, Bioenergetics and Metabolism*

**Unit: I**

Enzymes: Introduction, Nomenclature of enzyme, IUB nomenclature system, classification of enzyme, characteristics of enzyme, factors affecting enzyme activity, enzyme specificity, theories of enzyme substrate complex formation,

**Unit: II**

Enzyme Kinetics: Kinetics of single substrate reaction, Michaelis Menton equation, Briggs-Haldane modification, Line Weaver Burk Plot, Eadie-Hofstee and hanes plot, Enzyme Inhibition: Concept, types of inhibition, Kinetics of Enzyme Inhibition,

**Unit: III**

Classification of BiBi reaction, Ping pong BiBi mechanism, King Altman equation, Alberty and Dalziel Equation, Enzyme catalysis: Mechanism of enzyme catalysis, Chymotrypsin, Ribonuclease,

**Unit: IV**

Protein Ligand Binding: Cooperativity and Hill Equation, Adair Equation, Multisubstrate kinetics-allosteric enzyme, MWC and KNF model. Enzyme Immobilization: Basic concept, methods of immobilization, application of immobilized enzyme,

**Unit: V**

Extraction and purification of enzyme, Application of enzyme in molecular biology, animal nutrition, enzyme electrodes and their application as biosensors in industry, health care and environment.

**Reference books:**

1. Enzymes by Palmer (2001): Horwood Publishing Series.
2. Fundamentals of Enzymology by Price and Stevens (2002): Oxford University Press.
3. Enzyme Technology by Helmut Uhling (1998): John Wiley
4. Introduction to Proteins Structure by Branden and Tooze (1998): Garland Publishing Group.

## SSD- CPP (Campus Placement Program)

### 4th Semester

B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc  
(BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/Diploma (Engg.)

**Introduction to CPP Program:** ‘Soft skills’ are a framework of desirable qualities which gives a candidate an edge over his peers during the selection process of a company. We, at AKS University, have designed the Campus Placement Program (CPP) to help out our students who are sitting for their placement process in various Companies.

**Teaching methods:** The teaching methods in CPP training includes lectures, projects, role plays, quizzes, and various other participatory sessions. The emphasis will be on learning by doing. Since the method of training is experiential and highly interactive, the students imbibe the skills and attributes in a gradual and subtle way over the duration of the program. The students will not only learn the skills and attributes but also internalize them over a period of time.

#### **Objective of the Program:**

- ❖ Develop effective communication and Presentation skills.
- ❖ Develop all-round personality with a mature outlook to function effectively in different circumstances.
- ❖ Understand the skills tested and participate effectively in Group Discussion.
- ❖ Take part effectively in various selection procedures adopted by the recruiters.
- ❖ Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.

#### **UNIT-1**

Soft skills – a general overview, Talking about Present, Past and Future, Describing Processes and operations, Expressing Opinion: Agreement & Disagreement, Special Expressions in English, Pronunciation and neutral accent,

#### **UNIT-2**

Introduction and definition of a GD, Purpose of a GD, Types and strategies in a GD, Do’s and Don’ts in GD, Presentation skills: A presentation about the company will be made by the students throughout the Unit. Each and every student is required to go through at least 10 Companies Profile related to their domain expertise., Telephone etiquettes- Preparing for business calls/Making business calls/Telephonic phrases, Dining etiquettes, Email etiquettes

#### **UNIT-3**

Industry Expectations, SWOT & STAR, Self Discovery, Leap to success- 7 Orientations, Time Management, Team building & leadership, Goal Setting, Developing Positive Attitude, Organizing meetings, Anchoring in a formal setting.

#### **UNIT-4**

**Resume writing:** Concept and Practice, Body Language, Corporate Grooming Dressing.

**Mastering Personal Interviews:** Paper Interview, Personal Interview, FAQs, Interview Practice,

Domain Specific Interview Preparation, Peer review- Pair interview, Interview model ( Vocabulary for an effective Interview).

**Reference Books:**

1. Peter, Francis. *Soft Skills and Professional Communication*. New Delhi: Tata McGraw Hill.
2. Singh, Prakash and Raman, Meenakshi. *Business Communication*. New Delhi: Oxford UP.
3. Bailey, Edward P. *Writing and Speaking at Work: A Practical Guide for Business Communication*.
4. Pease, Allan and Peas, Barbara. *The Definitive Book of Body Language*.
5. Sherfield, R. M. ; Montgomery, R.J. and Moody, P, G. (2010). *Developing Soft Skills*. 4th ed. New Delhi: Pearson.
6. Johnson, D.W. (1997). *Reaching out – Interpersonal Effectiveness and Self Actualization*. 6<sup>th</sup> ed. Boston: Allyn and Bacon.
7. Jain, Alok, Pravin S.R. Bhatia & A.M., Sheikh *Professional Communication Skills*. S.Chand.
8. Krishnaswami, N and Sriraman, T., *Creative English for Communication*, Macmillan.
9. Mohan Krishna & Meera Banerji. *Developing Communication Skills*. Macmillan.
10. Robbins, S. P. and Hunsaker, Phillip, L” *Training in Interpersonal skills*”

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

## **Introduction to Bionanotechnology**

### **Unit-I Fundamental Concepts**

Nanotechnology: Basic concepts and introduction; Nanomechanics- Nanotribology; Scanning probe microscopy; nanomaterials and its handling; nanobots and nanofuture, nano-fying Electronics, nanofibres, nanopore and nanotubes.

### **Unit II Production and characterization of nanoparticles**

Introduction to Nanoscience Techniques used in Nanobiotechnology: Optical Microscopy, Atomic Force, Microscopy, SEM; Production of nanoparticles: Collision / Coalescence mechanism of primary particleformation, nanoparticles agglomerates & aerogels.

### **Unit III Nanoparticles for Cancer Drug Delivery**

Cancer and current approach to its cure through nanoparticles, characteristics of tumor tissues, drug delivery to tumors, physio-chemical properties of nanoparticles in cancer therapy, site specific delivery of chemotherapeutic agents using nanoparticles.

### **Unit IV Non-viral Gene Therapy with nanoparticles**

Introduction, Hyperthermia, controlled delivery of chemotherapeutic drugs, nanoparticles to circumvent MDR, potential problems using nanoparticles. Application of Nanotechnology in Agriculture, Medicine, Communication technology, Biotechnology and Bioinformatics.

### **Unit V**

Channel Gating Biomimetic Membranes for Biosensor Applications, Membrane Biosensors Based on Ion Channel Gating, Nanofabrication, medicine-Potential Biomedical Applications of Polymer Nanostructures.

### **References**

1. Bharat Bhushan., Nanotribology and Nanomechanics - An introduction, Springer.
2. Mark, Ratner Daniel Ratner, Nanobiotechnology- next big idea.
3. Challa S.S.R.Kumar, Joseph Hornes, Carola Leuschner, Nanofabrication towards Biomedical applications.
4. Charles P. Poole, Jr., Frank J. Owens; "Introduction to Nanotechnology", John Wiley& Sons, 2003,

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

## **Biosafety, Bioethics and IPR**

### **Unit-I**

**Biosafety:** Introduction, Historical prospective, objectives, risk assessment in biotechnological research and their regulation, physical and biological contaminants, field trial and planned introduction of GMOs, Biosafety guidelines in India, Biosafety levels for plant, animal and microbial researches.

### **Unit-II**

**Bioethics:** Introduction, Ethical issues related to biotechnology, legal and socioeconomic impacts of biotechnology, health and safety issues, possible benefits of successful cloning, Ethical concerns of gene cloning, hazards of environmental engineering, Ethical issues in Human Cloning and stem cell research.

### **Unit-III**

**Intellectual Property Right:** Introduction, intellectual property: trade secret, patent, copyright, plant variety protection, WIPO, GATT, TRIPs, plant breeder's rights, protection of plant varieties and former's right act (2001), Choice and management of IPRs, advantage and limitations of IPRs.

### **Unit-IV**

**Patents and patent processing:** Introduction, Essential requirements, International scenario of patents, patenting of biological materials, significance of patents in India, Patent application, Procedures and granting, protection of biotechnological inventions, Patent Act (1970), Patent (Amendments) Act (2002).

### **Unit-V**

**Regulatory framework in Biotechnology:** Regulation of RDT research, Regulation of food and food ingredients, Regulatory framework in India governing GMOs, Recombinant DNA Guidelines (1990), Revised Guidelines for Research in Transgenic Plants (1998), Prevention Food Adulteration Act (1955), Food Safety and Standards Bill (2005),

### **Reference**

1. The law and strategy of Biotechnological patents by Sibley. Butterworth publications.
2. Intellectual property rights – Ganguli – Tat McGraw-Hill
3. Biotechnology-B. D. Singh- Kalyani Publications

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

## **Food Biotechnology**

### **Unit-I**

Introduction: factors affecting the growth & survival of microorganisms in food, Microbial spoilage of food-milk, meat, plant products.

### **Unit-II**

Food borne diseases; Bacterial agents of food borne illness-clostridium, Listeria, Salmonella, Shigella, Staphylococcus, Vibrio, Yersinia, Non-bacterial agents of food borne illness-helminthes and protozoa toxigenic algae, toxigenic fungi, food borne viruses

### **Unit-III**

Fermented and microbial foods; fermented milk, cheese, sauerkraut, fermented meat, beer, vinegar, mould fermentation.

### **Unit-IV**

Microbiological examination of foods; direct examination, culture techniques, MPN count, Dye reduction assay, immunological methods, advance techniques

### **Unit-V**

Microbiology of food preservation; physical, chemical, and biological base preservation system; Quality control using microbiological criteria; facilities and operation, cleaning and disinfection code for good manufacturing practices, hazard analysis and critical control points, record keeping

### **References**

1. Prescott, Harley and Klein, ' Microbiology', MC Graw Hill, International Edition.
2. Willian C. Fraizier and Dennis C. Westhoff, 'Food Microbiology', Tata McGraw Hill Publishing Company, New Delhi.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

#### **Group A (Industrial Biotechnology)**

#### **Elective I- Bioreactor Design**

##### **Unit-I**

Fundamental studies; Mathematical Model and Applications of Batch, Fed Batch and Continuous Fermentation, Wall growth and Wash out Conditions. Aerobic and Anaerobic Fermentations. Bioreactor, Introduction and type Plug flow reactor.

##### **Unit-II**

Types of Fluid flow, Newtonian and Non-Newtonian Fluid flow, Fluid flow Regimes, Fundamentals of Heat and Mass transfer, and their application, Heat and mass Transfer Coefficient.

##### **Unit-III**

Stirred Tank reactors, Reactors with recycle, Series of connected Reactors, Bubble-column, Fluidized bed, Trickle bed Photobioreactor, Bioreactor for Solid State Fermentation

##### **Unit-IV**

Residence Time in Bioreactor, Damkohler No., Aeration, Agitation systems in Reactors, Agitator blade patterns, Power No., Design Requirements of different parts of bioreactors, materials of construction of Bioreactors.

##### **Unit-V**

Animal plant cell cultivation techniques – Sources of cells, cell bank, Techniques of cell culture, the substrate on which cells grow in Laboratory, Media handling Equipment, Cell culture media, animal tissue culture media, Preparation of material. Types of animal cell culture bioreactors, Products from plant cell culture.

##### **References:**

1. Crueger and Crueger, 'Biotechnology' Panima Publishing Corporation, New Delhi.
2. Patel A.H., 'Industrial Microbiology', MacMillian India Ltd.
3. Geankoplis C.J. Transport Processes and Unit Operations. Prentice Hall India.2002.
4. McCabe W.L., Smith J.C. Unit Operations In Chemical Engineering.5<sup>th</sup> Edition.Mcgrawhill.1993.
5. Incropera F.P. Fundamentals Of Heat And Mass Transfer. John Wiley.1998.
6. Sachdeva R.C., Fundamentals of engineering heat & mass transfer, New age international publishers, New Delhi – 1995.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

#### **Group A (Industrial Biotechnology)**

#### **Elective II- Bioseparation Technology**

##### **Unit-I Downstream processing**

Bioseparation processes; analysis of bioseparations; stages in downstream processing; process and product quality. Cell disruption for product release—mechanical, enzymatic and chemical methods. Pretreatment and stabilisation of bioproducts.

##### **Unit-II Physical methods of separation**

Filtration –principles, conventional and cross flow filtration; filter media; membrane fouling; rotary vacuum filtration-equipment details; sedimentation – principles sedimentation coefficient; centrifugation—tubular and disk centrifuges; ultracentrifugation—sedimentation at low accelerations; flocculation-principles

##### **Unit-III Isolation of products**

Aqueous two-phase extraction principles –phase separation; plate extraction column and centrifugal extractors; membrane separation –ultrafiltration and dialysis; precipitation of proteins by different methods

##### **Unit-IV Product purification by chromatography**

Chromatography principles, chromatography—equipments and detectors; Principles of reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

##### **Unit-V Final product formulation and finishing operations**

Crystallization, Drying principles—dryers description and operations of vacuum shelf dryers; batch vacuum rotary dryers, freeze dryers and spray dryers.

##### **References:**

1. Roger G.Harrison, Paul Todd, Scott R.Rudge and Demetri P. Pterides – Bioseparations Science and Engineering – Oxford University Press - 2003
2. R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By
3. Open Learning Series, Butterworth-Heinemann (1992).
4. J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.
5. R.K. Scopes – Protein Purification – Principles and Practice, Narosa Pub. (1994).

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

#### **Group B (Pharmaceutical Biotechnology)**

#### **Elective I- Pharmaceutical Biotechnology**

##### **Unit-1 Antibiotics and synthetic antimicrobial agents**

Antibiotics and synthetic antimicrobial agents, (Aminoglycosides,  $\beta$ -lactams, tetracyclines, ansamycins, macrolid antibiotics), Antifungal antibiotics, antitumor substances, Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolone antimicrobial agents.

Chemical disinfectants, antiseptics and preservatives.

##### **Unit-II Mechanism of action of antibiotics**

Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis), Molecular principles of drug targeting.

Drug delivery system in gene therapy, Bacterial resistance to antibiotics, Mode of action of bacterial killing by quinolones, Bacterial resistance to quinolones, Mode of action of non-antibiotic antimicrobial agents, Penetrating defences, How the antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system and drug diffusion).

##### **Unit-III Microbial production and Spoilage of pharmaceutical Products**

Microbial contamination and spoilage of pharmaceutical products (sterile injectibles, non-injectibles, ophthalmic preparations and implants) and their sterilization. Manufacturing procedures and in process control of pharmaceuticals. Other pharmaceuticals produced by microbial fermentations (streptokinase, streptodornase).

New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.

##### **Unit-IV Regulatory practices, biosensors and applications in Pharmaceuticals**

Financing R&D capital and market outlook. IP, BP, USP. Government regulatory practices and policies, FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers. Biosensors in pharmaceuticals. Application of microbial enzymes in pharmaceuticals.

##### **Unit-V Quality Assurance and Validation**

Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Regulatory aspects of quality control. Quality assurance and quality management in pharmaceuticals ISO, WHO and US certification.

Sterilization control and sterility testing (heat sterilization, D value, z value, survival curve, Radiation, gaseous and filter sterilization) Chemical and biological indicators. Design and layout of sterile product manufacturing unit. (Designing of Microbiology laboratory), Safety in microbiology laboratory.

## References

1. Pharmaceutical Microbiology – Edt. By W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.
2. Analytical Microbiology –Edt by Frederick Kavanagh Volume I & II. Academic Press New York.
3. Quinolone antimicrobial agents – Edt. by David C. Hooper, John S.Wolfson .ASM Washington DC.
4. Quality control in the Pharmaceutical Industry - Edt. by Murray S.Cooper Vol.2. Academic Press New York.
5. Biotechnology – Edt. by H.J.Rehm & G.Reed, Vol 4. VCH Publications, Federal Republic of Germany.
6. Pharmaceutical Biotechnology by S.P.Vyas & V.K.Dixit. CBS Publishers & Distributors, New Delhi.
7. Good Manufacturing Practices for Pharmaceuticals Second Edition, by Sydney H.Willig, Murray M.Tuckerman, William S.Hitchings IV. Merceel Dekker NC New York.
8. Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association by Paine Webber. Gulf Publishing Company Houston.
9. Drug Carriers in biology & Medicine Edt. by Gregory Gregoriadis. Academic Press New York.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-V**

#### **Group B (Pharmaceutical Biotechnology)**

#### **Elective II- Stem Cell in Healthcare**

##### **Unit-I**

Basic introduction of stem cell, properties of stem cell , types of stem cell, sources of stem cell ,umbilical cord stem cell, technology of stem cell therapy.

##### **Unit-II**

Embryonic stem cell – isolation, stimulation of ES cell for differentiation , adult stem cell - differentiation, trans differentiation and plasticity, similarity and dissimilarity between adult and embryonic stem cell, **Potential uses of stem cell** - - Parkinson disease, Limb Amputation, Heart Disease, Spinal Cord Injuries, Diabetes, Burns, , Alzheimer’s Disease etc.

##### **Unit-III**

**Tissue engineering present concept and strategies** –introduction , general strategy to replace the tissue ,tissue engineering using open system of cell transplantation, present status of tissue engineering ,future aspects and research.

##### **Unit-IV**

##### **Biomaterials for tissue engineering:**

Biomaterials: Degradable polymeric scaffolds, Acellular Bio- Matrices, Biological derived polymers in tissue engineering: Natural BD Polymers & Synthetic BD polymers, Cell seeding of scaffolds, Cell source: Allogenic cells, Autologous cells & stem cells. Bioreactors used in tissue engineering: Nail Naughtom’s Bioreactor, Pulsatile Bioreactor

##### **Unit-V**

##### **Principles and practice gene therapy:**

Introduction to gene therapy, Requirements of gene therapy, Genetic defects, Target cells for gene therapy, process of gene therapy , Factors responsible for gene therapy for making effective treatment of genetic disease, Recent developments in gene therapy research, ethical considerations of gene therapy.

##### **References**

1. S. S. Bhojwani, M. K. Razdan, ‘Plant Tissue Culture (Theory and Practice), North Holland.
2. M. M. Ranga , ‘ Animal Biotechnology ’, 2<sup>nd</sup> Edition, Agrobios (India) .
3. James D. Watson , Michael Gilman, ‘ Recombinant DNA’ ,Scientific American Books.

**B.Sc.(Hons.) (Biotech.)  
Semester-VI**

**Scientific Writing**

**Unit-I**

Scientific Writing & Research- meaning, types, objectives, and approaches: Literature collection.

**Unit-II**

Different sources, Biological online databases, Determining sample design, collecting data, analysis and hypothesis testing, generalization and interpretation.

**Unit-III**

Writing reviews and journal articles, books, and monographs-bibliography, Structure of thesis; Manuscript and proof correction, Research Process: selection of problems: stages in the execution of research; Research Designs.

**Unit-IV**

Data Collection: Secondary Data, Primary Data, and Methods of Collection, Scaling Techniques: Concept, Types, Rating scales & Ranking Scales, Scale Construction Techniques, Multi Dimensional Scaling.

**Unit-V**

Journals: standard of research journals - impact factor - citation index.

**References**

1. Writing the doctoral dissertation. Barrons Educational series, 2nd edition, Davis, G.B. and C.A. Parker, 1997. pp 160.
2. Authoring a PhD, thesis: how to plan, draft, write and finish a doctoral dissertation, Duncary, P. 2003.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-VI**

#### **Group A (Industrial Biotechnology)**

#### **Elective III- Distillates and Fermentation technology**

##### **Unit-1: Microbial Fermentations**

Metabolic pathways and metabolic control mechanisms, industrial production of citric acid, lactic acid, enzymes (alpha-amylase, lipase, xylase, pectinases, proteases), acetone- butanol, lysine and glutamic acid.

##### **Unit-2 : Microbial production of therapeutic compounds**

Microbial production of therapeutic compounds (β-lactam, aminoglycosides, Ansamycins (Rifamycin), peptide antibiotics Quinolones), biotransformation of steroids, vitamin B12 and riboflavin fermentation.

##### **Unit-3 : Modern trends in microbial production**

Modern trends in microbial production of bioplastics (PHB, PHA), bioinsecticides (thuricide), biopolymer (dextran, alginate, xanthan, pullulan), Biofertilizers (nitrogen fixer Azotobacter, Phosphate solubilizing microorganisms), Single Cell Protein and production of biological weapons with reference to anthrax.

##### **Unit-4 : Biofuels**

Useful features of bio-fuels. The substrate digester and the microorganisms in the process of biogas production (biomethanation). Production of bioethanol from sugar, molasses, starch and cellulosic materials. Ethanol recovery. Microbial production of hydrogen gas, biodiesel from hydrocarbons.

##### **Unit-5: Immobilization techniques , IPR and Patents**

Some industrial techniques for whole cell and enzyme immobilization. Application and advantages of cell and enzyme immobilization in pharmaceutical, food and fine chemical industries.

## References

1. Biotechnological Innovations in Chemical Synthesis. BIOTOL. Publishers / Butterworth - Heinemann.
2. Industrial Microbiology by G. Reed (Ed), CBS Publishers (AVI Publishing Co.)
3. Biology of Industrial Microorganisms by A.L. Demain.
4. Genetics and Biotechnology of Industrial Microorganisms by C.I. Hershenberg, S.W. Queener and Q. Hegeman. Publisher. ASM. Ewings ET. AL. 1998. Bioremediation Principles. Mac Graw Hill.
5. Annual Reports in Fermentation Processes by D. Pearlman, Academic Press.
6. Fundamentals of Biochemical Engineering by Bailey and Ollis.
7. Annual Review of Microbiology by Charles E. Clifton (Volumes)
8. Biotechnology, A textbook of industrial Microbiology by Creuger and Creuger, Sinauer associates.
9. Manual of industrial Microbiology and Biotechnology 2nd edition by Davis J.E. and Demain A.L. ASM publications.

## **B.Sc.(Hons.) (Biotech.)**

### **Semester-VI**

#### **Group B (Pharmaceutical Biotechnology)**

#### **Elective III- Molecular Diagnostics**

##### **Unit-1**

Introduction to medical Biotechnology; immunodiagnostic procedures; Monoclonal antibodies and its medical application

##### **Unit-2**

HLA Typing; DNA diagnostic systems; hybridization probes; Diagnosis of malaria and other diseases, non-isotopic hybridization procedures, in situ hybridization ; Molecular beacons and oligoriboprobes, ribozymes

##### **Unit-3**

Diagnosis of genetic diseases; Detection of mutation in DNA, DNA amplification and quantification, PCR/OLA procedures.

##### **Unit-4**

Molecular markers and DNA polymorphism, DNA finger printing

##### **Unit-5**

Bioinformatics and molecular diagnostics; Biosensor detection technology.

##### **References:**

1. Prescott, Harley and Klein, ' Microbiology', MC Graw Hill, International Edition.
2. James D. Watson , Michael Gilman, ' Recombinant DNA', W. H. Freeman & Company, New York
3. Brown T.A., ' Genomes 3', Garland Science Publishing