

Faculty of Life Science & Technology

Study and Evaluation Scheme

Of

Master of Science in Biotechnology

(Applicable w.e.f Academic Session 2013-15 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
Master of Science in Biotechnology
SUMMARY**

Programme :	M.Sc (Biotech)		
Duration :	Two year full time (Four Semesters)		
Medium :	English		
Minimum Required Attendance :	75 %		
Maximum Credits:	115		
Evaluation Assessment :	Internal	External	Total
	50	100	150

Internal Evaluation (Theory/ Practical Papers)

	Sessional-I	Sessional-II	Continuous Assessment & attendance
	10	10	10+20= 30
Duration of Examination :	External	Internal	
	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
Master of Science (Biotechnology)
Semester-I
Teaching & Examination scheme

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	52BT101	Cell Structure & Dynamics	3	1	-	4
2	52BT102	Microbial technology	3	1	-	4
3	52CH103	Advanced Biochemistry	3	1	-	4
4	52CA104	Biostatistics & Computer Application	3	1	-	4
5	52SS105-H/I	Spiritual Studies- Hinduism/ Islam	3	-	-	3
6	52SD106	SSD-Functional English-I	3	-	-	3
7	52CH151	Advanced Biochemistry (Lab 1)	-	-	6	3
8	52BT152	Applied Microbiology (Lab 2)	-	-	6	3
		TOTAL	18	4	12	28

Faculty of Life Science & Technology
Master of Science (Biotechnology)
Semester-II
Teaching & Examination scheme

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	52BT201	Immunology	3	1	-	4
2	52BT202	Analytical Technique & Bioinformatics	3	1	-	4
3	52BT203	Molecular Biology	3	1	-	4
4	52BT204	Stem Cell Biology	3	1	-	4
5	52BT205	Industrial Microbiology	3	-	-	3
6	52SD206	SSD- Functional English-II	3	-	-	3
7	52CH251	Immunology & Industrial Microbiology (Lab 1)	-	-	6	3
8	52BT252	Analytical Technique, Molecular Biology & Bioinformatics (Lab 2)	-	-	6	3
		TOTAL	18	4	12	28

Faculty of Life Science & Technology
Master of Science (Biotechnology)
Semester-III
Teaching & Examination scheme

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	52BT301	Environmental Biotechnology	3	-	-	3
2	52BT302	Genetic Engineering & Bionanotechnology	3	1	-	4
3	52BT303	Plant Biotechnology	3	-	-	3
4	52BT304	Animal Biotechnology	3	1	-	4
5		Elective 1 (Group A/B/C)	3	1	-	4
6		Elective 2 (Group A/B/C)	3	1	-	4
7	52SD306	Soft Skill Development	-	-	2	1
8	52BT351	Plant & Animal Biotechnology Lab	-	-	6	3
	52BT352	Genetic Engineering & Environmental Biotechnology Lab	-	-	6	3
		TOTAL	18	4	14	29

List of Elective Papers

Sr.no. Sub. Code Subject Name

Group-A: Industrial Biotechnology

- | | | |
|----------|------------------|-------------------------------------|
| 1 | 52BT304-A | Design and Operation of Bioreactors |
| 2 | 52BT305-A | Down Stream Processing |

Group-B: Pharmaceutical Biotechnology

- | | | |
|----------|------------------|---------------------------------------|
| 1 | 52BT304-B | Pharmaceutical Biotechnology |
| 2 | 52BT305-B | Vaccine Biotechnology and Drug Action |

Group-C: Bioinformatics

- | | | |
|----------|------------------|--|
| 1 | 52BT304-C | Molecular Modelling and Drug Designing |
| 2 | 52BT305-C | Bioprogramming and Soft Computing Techniques |

Note: Student can choose only one group of the above and study both the subjects of the group.

Faculty of Life Science & Technology
Master of Science (Biotechnology)
Semester-III
Teaching & Examination scheme

S.No.	Subject Code	Subject	Periods			Credit
			L	T	P	
1	52BT401	Scientific Writing	3	-	-	3
2	52BT451	5 Months Project work/ Dissertation	-	-	30	15
3	52BT452	30 Days Industrial Training	-	-	24	12
		TOTAL	3	-	56	30

Note:

1. Project work/ Dissertation is evaluated out of 400 marks. 100 marks for internal evaluation & 300 marks for external evaluation.
2. Industrial Training is evaluated out of 200 marks. 100 marks for internal & 100 marks for external.

M.Sc. (Biotechnology)
Semester: I
Cell Structure & Dynamics

Unit-I

An overview of cells and cell research: - Origin and evolution of cell, cell theory and experimental models, tools of cell biology, chemistry of cells, molecular composition of cells, biosynthesis of cell constituents.

Unit-II

Cell structure and function: - Cell wall and plasma membrane, nucleus, endoplasmic reticulum, golgi apparatus, and lysosomes. Bioenergetics and metabolism- mitochondria, chloroplast, peroxisomes, the cytoskeleton and cell movement. Cell surface-transport of small molecules, endocytosis.

Unit-III

Cell interaction and protein targeting: - cell-cell interaction- adhesion junctions, gap junctions, plasmodesmata. Protein targeting- nucleus, mitochondria, chloroplast, peroxisome, molecular chaperons and folding of polypeptides.

Unit-IV

Cell signaling and regulation: - Signaling molecules and their receptors, function, pathways of intracellular signal transduction. Cell cycle- phases of cell cycle, molecular events during cell cycle. Regulation of cell cycle- checkpoints, cyclins and protein kinases. Cell death and renewal.

Unit-V

Cellular development and cancer: - Development of multicellular organisms- Yeast, *C. elegans*, *Arabidopsis thaliana*, *Drosophila melanogaster*. Cancer as a multi evolutionary process- tumor cells, proto-oncogenes, oncogenes, tumor suppressor genes and carcinogens.

Recommended 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.*

M.Sc. (Biotechnology)
Semester: I
Microbial Technology

Unit-I

Introduction to microbiology- Discovery of the microbial world, controversy over spontaneous generation, development of microbiology in the twentieth century. Microbial life: - prokaryotes, eukaryotes, Archeas & protozoa. Classification of microorganism- Bacteria, Fungi, Cyanobacteria and Virus. Structure of microbial cell, characteristics of cyanobacteria, actinomycetes, virus, nutrition, metabolism, propagation.

Unit-II

Microscopy: light microscope-basic principles, types (phase contrast, dark field and florescent microscope). Electron microscopy – principles, working function, electron probe, transmitted electron, image formation, back scattering, secondary electrons. X ray diffraction, Augur electron, cathode luminescence's. Types of Electron microscopy TEM, SEM, STEM-sample preparation for EM analysis.

Unit-III

Microbial Growth: Mathematical expression of growth, growth curve, measurement of growth. Synchronous culture and continuous culture. Culture media, handling pathogens, sterilization, safety in microbiology laboratory. Pure culture technique, culture collection and preservation of microbial culture.

Unit-IV

Microbiology & Man: - Pathogen, source of infection- carriers and vectors. Congenital infection, mode and source of infection, pathogenesis and prophylaxis - Bacterial, Fungal, Viral and Protozoan. Antimicrobial agents and their mode of action- antibacterial, antiviral, antifungal, anti parasitic agents.

Unit-V

Microbial diversity: Methods to assess microbial diversity, merits and demerits of culture dependent and culture independent method. Molecular analysis of bacterial community: - density gradient, gel electrophoresis, restriction fragment length polymorphism, amplified ribosomal DNA and restriction.

Recommended 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.

M.Sc. (Biotechnology)
Semester: I
Advanced Biochemistry

Unit-I

Chemical foundation of biology- pH, pK, acid base concept and buffers, fundamental principles governing life. Water, properties. Definition, Nomenclature, classification, structure, properties of carbohydrates and lipid.

Unit-II

Amino acids: - Structure and properties, elucidation of primary and higher order structures of protein, Ramachandran plot, structure & function relationship in model proteins like ribonuclease A, myoglobin, hemoglobin. Plant and animal hormone. Vitamin-types and structure. Secondary metabolite - prostaglandin, leukotrienes, plant and animal pigment.

Unit-III

Enzyme- General characteristics, classification, nomenclature, isolation and purification of enzyme, mechanism of enzyme action. Kinetics of single substrate, multisubstrate reactions; enzyme inhibition, enzyme regulation. Coenzyme- TPP, pyridoxal phosphate, flavin nucleotide, nicotinamide. Immobilization of enzyme, technique and applications.

Unit-IV

Principles of bioenergetics, standard free energy change, biological oxidation-reduction reaction, metabolic roles of ATP-phosphoryl group transfer, nucleotidyl group transfer. Carbohydrate metabolism- glycolysis, gluconeogenesis, TCA cycle, glycogen synthesis and glycogenolysis, oxidative phosphorylation.

Unit-V

Biosynthesis and degradation of lipid, amino acid, and protein. Disorder associated with defect in carbohydrate, amino acid and lipid metabolism.

Recommended books:

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

M.Sc. (Biotechnology)
Semester: I
Biostatics and Computer Application

Unit-I

Statistical population and sampling methods, tabulation of data & its graphical representation. Measures of central tendency and dispersion – Mean, Median & Mode, range, Standard deviation, variance, Simple and linear regression & correlation.

Unit-II

Test of Significance- (t-test, F test, chi-square test, one & two way analysis of variance (ANVOA). Design of experiments, randomization, randomized block design. Introduction of data mining, path analysis, factor analysis.

Unit-III

Introduction of computer: Definition, characteristics, hardware, Software, Types of computer, flow chart number systems, OSI Model, Internet & its application, E-mail concept PNS.

Unit-IV

Introduction to MS-DOS, External & Internal DOS commands. Introduction to programming in C, HTML and its basic Tags, DBMS and its advantages.

Unit-V

Introduction to MS-office:

MS-word: - Features, creating a document editing a document, mail merge, hyper link.

MS-Excel: - Features of Excel, cell formatting, uses of function & Formula, Sorting & Filtering. Data validations, working with graph in excel.

MS-PowerPoint: - Features of power point, inserting a slide, working with slide, slide animation & transition, preparing a desired presentation in PowerPoint.

Recommended books:

1. Biostatistic, Danniel, W.W., 1987. New York, John Wiley Sons.
2. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian
Medical College, Vellore
3. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
4. Computer Science, J.G. Brookshear, Pearson, Addison Wesley

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

परमगुहाज्ञान

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, ॐ 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

खोदा-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”.

SSD - FUNCTIONAL ENGLISH-1
I Semester
MBA/MCA/M PHARM/M.Sc.BT/MSW

Unit-I

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, need for obligation.
Must, have, will and should for deduction and assumption.
The auxiliaries dare and used
Command, requests, invitations, advice, suggestions

Unit-II

The Present Tense:
Present Continuous, Simple present (Form and use)
The past and perfect tenses:
Simple past, The past continuous, The present perfect, The present perfect continuous, The past perfect, The past perfect continuous. (Form and use)

Unit-III

The Future: Future simple, the future continuous (Form and use)
The sequence of tenses, The conditional sentences

Unit-IV

Articles: Definite, Indefinite and Zero, The Passive voice; Active tenses and their passive equivalents, use of passive

Unit-V

The infinitive, The Gerund, The Participle, Preposition.

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

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

M.Sc. (Biotechnology)
Semester: II
IMMUNOLOGY

UNIT-I

Introduction, Phylogeny of immune system, Immunity- Innate and acquired. Organisation and structure of lymphoid organs, cells of immune system, hematopoiesis.

UNIT-II

Antigen- properties and types, super antigen, heptane carrier system, structure, classes and function of immunoglobulin, antibody engineering, hybridoma secreting monoclonal antibodies, antigen antibody interaction, complement system.

UNIT-III

Regulation of immune response- generation of humoral and cell mediated immune system, activation of B & T lymphocytes, cytokines and it's function, regulation of B & T cell, structure and function of MHC molecules.

UNIT-IV

Hypersensitivity- Delayed and immediate hypersensitivity

Autoimmunity- types of autoimmune diseases, mechanism of CD-4+ T-cell, MHC and TCR in autoimmunity, AIDS and immuno deficiency disorder.

UNIT-V

Immunity to infection and tumours,

Vaccinology- Active and passive immunization, live, killed, subunit vaccine, recombinant and protein based vaccine and plant based vaccine.

Immuno assay- RIA, ELISA, ELISPOT assay, western blotting and immunofluorescence.

Recommended books:

1. Roitt I.M, Brostoff, J., Male D.K., Immunology (Illustrated Publisher, Mosby).
2. T. J. Kindt, R.A. G. B. A. Osborne, J. Kuby. Immunology (W.H. Freeman and Company, New York).
3. Paul, W.E. (2008). Fundamental immunology (Lippincott Williams & Wilkins).
4. T.G. Parslow, D.P. Stites, A.I. Terr. Medical immunology (Lange Medical Books/McGraw-Hill).

M.Sc. (Biotechnology)
Semester: II
ANALYTICAL TECHNIQUE & BIOINFORMATICS

Unit-I

Advanced techniques in structural analysis: X-ray crystallography, autoradiography, advanced techniques in Molecular Biology Analysis: Isolation of DNA and RNA, Immobilization of Enzyme, Blotting Techniques, DNA fingerprinting, DNA foot Printing.

Unit-II

Electrophoresis: principle, factor affecting electrophoresis, types of electrophoresis, gel electrophoresis, 2D electrophoresis, Iso-electrofocusing, Iso-tachopheresis, Spectroscopy: Lambert Beer's Law, principle, instrumentation and application of UV, visible, IR, NMR, ESR, EMR Spectroscopy.

Unit-III

Chromatographic Techniques: Introduction, basic principle, types of chromatography, TLC & paper chromatography, chromatographic methods for macro molecule separation: Gel permeation, Ion exchange & Affinity chromatography, Modern chromatographic Techniques: HPLC, GLC, Centrifugation: basic principle, RCF, sedimentation coefficient, differential & density gradient centrifugation, application of centrifugation

Unit-IV

Concept of computational biology, introduction to bioinformatics, historical review, database concept, database management system, database browsing and data retrieval, sequence database, genome database, introduction to different database: Gene Bank, NCBI, EMBL, DDBJ, SWISS PROT, NCBL & PDB, searching engines: google, pubmed, NCBI.

Unit-V

Methods for searching sequence databases like FASTA & BLAST, sequence comparison methods: dot matrix plots, multiple sequence alignment: clustal W, X, concept of molecular phylogeny, sequence and similarity, sequence alignment, introduction to scoring matrices: PAM, BLOSSUM, introduction to phylogenetic tree, cluster analysis.

Recommended books:

1. K. Wilson, J. M. Walker. Principles and techniques of practical biochemistry (Cambridge University Press).
2. Introductory Practical Biochemistry – S. K. Sawhney and Randhir Singh. Narosa Publishing House
3. Principles of Applied Biomedical Instrumentation- Gedder A and L. E. Balsar, John Wiley and Sons.

M.Sc. (Biotechnology)
Semester: II
MOLECULAR BIOLOGY

UNIT-I

DNA replication, repair & recombination

Organization of prokaryotic & eukaryotic genomes, unit of replication, replication machinery in prokaryotes and eukaryotes, enzymology of DNA replication. DNA damage & repair mechanism. Homologous and non-homologous recombination, site specific recombination, holiday junction, gene targeting, gene disruption, Rec A and other recombinases.

UNIT-II

RNA Synthesis and processing

Prokaryotic and eukaryotic transcription, RNA polymerases, general and specific transcription factors, promoter, mechanism of transcription, post transcriptional processing of pre mRNA, tRNA and rRNA, 5'cap formation and 3'end processing and polyadenylation, RNA editing, nuclear export of mRNA.

UNIT-III

Protein synthesis and processing

Translation machinery in prokaryotes and eukaryotes, genetic code and wobble hypothesis, ribosome, mechanism of initiation elongation and termination, co and post translation modification of protein, molecular chaperones, protein turn over and degradation.

UNIT-IV

Regulation of gene expression

Transcriptional regulation-positive & negative, operon concept-lac, trp, his, transcriptional control in lambda phage, activator & repressor control of gene expression at transcription, translation & processing level transcription.

UNIT-V

Transposable element in prokaryotes & eukaryotes, insertion sequences, transposones, retrotransposones, mechanism of transposition.

Antisense & ribozyme technology- molecular mechanism of antisense technology, hammerhead, hairpin & others ribozymes.

Genome mapping- genetic & physical map, molecular marker in genome analysis- RFLP, RAPD&AFLP analysis.

Recommended books:

1. Molecular Biology of the cell, Alberts, B et al.
2. Molecular Cell Biology, Lodish et al.
3. Cell and Molecular Biology- De Roberties and De Roberties
4. Cell and Molecular Biology, Gerald Karp.
5. The Cell-A molecular approach- Cooper, G.M. and Hausman, R.E.4th edition. Sinauer Associates Inc.USA.

M.Sc. (Biotechnology)
Semester: II
STEM CELL BIOLOGY

UNIT-I

Basics of stem cell, properties of stem cell. Embryonic stem cell, Adult stem cell, Umbilical cord stem cell, Similarities and dissimilarities of between embryonic and adult stem cells.

UNIT-II

Embryonic stem cell- in vitro fertilization, Culturing of embryos, Isolation of embryonic stem cell- blasocyst, inner cell mass, stimulation ES cells for differentiation, properties of ES cell, Trophoblast stem cell.

UNIT-III

Adult stem cells, Somatic stem cell, Adult stem cell differentiation, trans differentiation, plasticity, Types of Adult stem cell, epidermal stem cell, Liver stem cell, Pancreatic stem cell,

UNIT-IV

Stem cell in drug discovery and tissue engineering- Stem cell therapy Vs cell protection, stem cell in cellular assays for screening, stem cell based drug discovery, drug screening and toxicology.

UNIT- V

Gene therapy, stem cells and animals cloning, transgenic animals and stem cell, therapeutic applications- Parkinson disease, limb amputation, heart disease, spinal cord injuries, diabetes, burns, HLA typing, Alzheimer's disease, production of complete organ.

Recommended books:

1. Embryonic stem cell by Karsad and Turksen, Humana Press.
2. Stem cell and future of renege rative medicine by committee on the biological and biomedical applications of stem cell Research. National Academic Press.
3. Stem cell Biological by Markshak, Cold Spring Harbar Symposium Publication.

M.Sc. (Biotechnology)
Semester: II
INDUSTRIAL MICROBIOLOGY

Unit I: Fundamentals of Industrial Microbiology: General concepts of industrial microbiology. Primary and secondary screening, Strain development strategies. Sterilization of fermentar, media and air.

Unit II: Fermentar Design: Types of fermentations processes. Design of typical batch fermentar. Factors affecting fermentar design. Control of agitation, aeration, pH, temperature and dissolved oxygen. Types of fermentar.

Unit III: Scale up and Down Stream Processing: Inoculum development. Scale up of fermentation process. Raw material for media preparation. Harvesting and product recovery. Immobilization of microbial enzymes and whole cells and their application in industries.

Unit IV: Industrial production-I: Production of antibiotics- Penicillin, Tetracycline and Streptomycin. Production of organic acids like- acetic acid, lactic acid and citric acid. Production of solvent- Ethanol and alcoholic beverages such like: wine, beer and whiskey.

Unit V: Industrial production-II: Production of Vitamins-Vitamin B12 & Riboflavin. Production of enzyme-Celluloses, Amylase. Proteases, lipases & there application. Production of Amino acids- Glutamic acid & lysine. Microorganisms as food- SCP, *Spirullina* and Mushroom.

Recommended books:

1. Patel, A.H., Industrial microbiology.
2. Reed, G., Prescott and Dunn's Industrial microbiology
3. Casida, C.E., Industrial Microbiology. Wiley Eastern.
4. Stanbury, P.F., Whitekar A. & Hall H.J., Principles of fermentation technology, pergaman Mcneal & Harvey.
5. Aneja, K.R. Jain, P. and Aneja R., A text book of basic and applied microbiology.

SSD - FUNCTIONAL ENGLISH-1
II Semester
MBA/MCA/M PHARM/M.Sc.BT/MSW

Unit-1

Conceptual Sessions: Subject verb agreement, Conjunction: Co-ordinating and Subordinating, Sentences-Simple, Compound and Complex

Activity: Speaking Activities Based on Themes (College/University, Beauty and Physical attractiveness, Food and eating, Dreams, Entertainment)

Assignment : Progress Test-1

Unit-2

Conceptual Sessions: Special Expressions: Asking for Information/directions/someone to repeat/expressing uncertainty, Interrupting politely, apologizing, Giving instructions, Sequencing actions, Making suggestions, Accepting an invitation, Expressing a preference, Making recommendations, Giving permission, Agreeing and Disagreeing, Common Errors in English,.

Activity: Speaking Activities Based on Themes (Vacation, Behaviour, Facebook, Computers)

Assignment : Progress Test-2

Unit-3

Conceptual Sessions: Presentation Skills: Meaning, Need for Oral presentation, Planning of presentation, use and types of Visual aids, Kinesics: Gesture, posture, facial expressions, Eye contact, Proxemics, voice and tone, Appearance and accessories.

Activity: Speaking Activities Based on Themes (Childhood, celebrities, Films in your own language)

Assignment : Progress Test-3

Unit-4

Conceptual Sessions: Reading comprehension, Vocabulary: Antonyms, Synonyms, Phrasal verbs, British English vs. American English, Business vocabs, Dictionary of formal and Informal English, List of personality Adjectives.

Activity: Story creation and Picture description.

Assignment : Progress test-4

Unit-5

Conceptual Sessions: Business letter writing: Parts and layout, Enquiry letter, Order letter, Complaint letter, Job application and leave application

Activity: Dialogue writing

Assignment : Progress test-5

M.Sc. (Biotechnology)
Semester: III
Environmental Biotechnology

Objective:

1. *To make the student to understand the basic concepts of environmental biotechnology.*
2. *To impart knowledge on environmental biotechnology dealing with monitoring, types of microorganisms, waste removal, etc.*

Unit I : Environment

Basic concepts and Components, Conventional and Nonconventional energy sources, Modern fuels and their environmental impacts: Methogenic bacteria and biogas, Microbial hydrogen production, Conversion of sugars to ethanol.

Unit II : 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, Biofertilizers, Biopesticides

Unit III : Bioremediation

In -situ and ex -situ techniques, bioremediation of soil and water contaminated with oil spills, heavy metals and detergents, Phytoremediation: Types and its applications, Environmental monitoring: Bioindicators.

Unit IV

Biodegradation of chlorinated hydrocarbons and xenobiotic compounds, Bioleaching: Leaching of ores by microorganisms (gold, copper and uranium). Cellulose degradation for combustible fuel, Biopetroleum Production,

Unit V : Environment protection Act

Environmental laws, Environmental policies, Environmental ethics, and Environmental Impact Assessment, Ecoplanning and Sustainable Development Global environmental problems: Ozone depletion, Green house effect and acid rain.

Reference Books:

1. Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glasgow 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.

M.Sc. (Biotechnology)
Semester: III
Genetic Engineering & Bionanotechnology

Unit -I

Scope of genetic engineering, Molecular tools & their application-restriction endonuclease, DNA modifying enzymes, Isolation and purification of DNA from bacteria, plant & animal cell, cDNA synthesis and cloning- mRNA enrichment, reverse transcription, DNA primers, linker adaptors and their chemical synthesis, genomic library.

Unit -II

Host vector system- cloning vector for E.coli, cloning vector for eukaryotes, plant based vector, yeast vector, Method for selection and screening of recombinant clone, Expression strategies for heterologous gene- expression in bacteria, expression in yeast, expression in insects, and expression in mammalian cells.

Unit -III

DNA analysis-labeling of DNA and RNA probes, gel retardation technique, reporter assays, Polymerase chain reaction and its application, Application of genetic engineering- production of recombinant pharmaceuticals, gene therapy, disease diagnosis, Biosafety regulation-biological and physical containment.

Unit -IV

The journey of Biotechnology to Bionanotechnology. Historical perspectives. Introduction to Bionanotechnology: Opportunities & challenges of Bionanotechnology. Key features of Nano-size, Comparison of particle behavior at nanosize to macrosize .Strategies for Nanoarchitecture(top down & bottom up approaches). Biomolecular design and Bionanomachines in action.

Unit -V

Applications of Bionanotechnology. Microarray technology. Principle, types and Applications of Bionanoimaging, Nanobiosensors, Biochips, Biorobotics, Biomolecular motors; ATP Synthase, flagellar motors; Traffic across membranes- K channels , DNA computers. Nano drug delivery.

Reference Books:

1. Molecular Cloning, A laboratory Manual. Sambrook, J., Fritsch, E.F., Mariatis.3rd edition. 2001. Cold Spring Harbor Laboratory, USA.
2. Recombinant DNA. Watson, 1992.
3. Gene Cloning by T.A. Brown
4. Biotechnology by B.D. Singh
5. Mark, Ratner Daniel Ratner, Nanobiotechnology- next big idea.
6. Charles P. Poole, Jr., Frank J. Owens; "Introduction to Nanotechnology", John Wiley& Sons, 2003,

M.Sc. (Biotechnology)
Semester: III
Plant Biotechnology

Unit-I

Introduction to plant cell and tissue culture: Tissue culture media, Initiation and maintenance of callus and suspension cultures; single cell clones. Biochemical production, Totipotency: Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil (hardening). Rapid clonal propagation and production of virus -free plants, *In vitro* pollination; embryo culture and embryo rescue.

Unit-II

Protoplast fusion, selection of hybrid cells; symmetric and asymmetric hybrids, cybrids, nuclear cytology of cultured plant cells and somaclonal variations. Production of haploid plants and their utilization, Cryopreservation and slow growth for germplasm conservation

Unit-III

Cloning vector for higher plant transformation: *Agrobacterium tumefaciens* Ti and Ri plasmids, basis of tumor formation, hairy root, mechanisms of DNA transfer, role of virulence genes. Viral vectors and their application: direct gene transfer: particle bombardment, electroporation, microinjection: transformation of monocots; transgene stability and gene silencing, selection of clones.

Unit-IV

Molecular marker- aided breeding RFLP maps. Linkage analysis, RAPD markers, STS, microsatellites, SCAR (sequence characterized amplified region), AFLP, QTL, Molecular assisted selection; arid and semi- arid plant biotechnology, green house and green- home technology

Unit-V

Chloroplast transformation: advantages, vectors, success with tobacco and potato; metabolic engineering and industrial products; plant secondary metabolites, control mechanism and manipulation of phenyl propanoid pathway, Shikimate pathway, alkaloids, Application of plant transformation for productivity and performance: herbicide resistance, insect resistance, virus resistance, disease resistance, abiotic stress, post harvest losses, long shelf life of fruits and flowers, edible vaccines.

Reference Books:

- 1.TH.S. Chawla: Biotechnology in Group Improvement, International Book Distributing Company. 1998.
- 2.R.J. Henry: Practical Application of Plant Molecular Biotechnology. Chapman and Hall. 1997.
- 3.P.K. Gupta Elements of Biotechnology. Rastogi and Co. Meerut. 1996.

M.Sc. (Biotechnology)
Semester: III
Animal Biotechnology

Unit-I

Structure and organisation of animal cell. Equipment and organisation for animal cell culture. Culture media, Primary and secondary cell culture. Biology and characterisation of cultured cells. Maintenance of animal cell culture. Measuring parameters of growth.

Unit-II

Organ culture, three dimensional culture and tissue engineering. Hybridoma technology- production of monoclonal antibody, application of monoclonal antibodies.

Unit-III

Cell cloning and micromanipulations, invitro fertilization and embryo transfer, Artificial insemination, scaling up of animal cell culture. Transgenic animals: vector, selectable markers, transfection methods, their applications, examples of transgenic animals.

Unit- IV

Aquaculture: fresh water fish culture techniques, seri culture: production of silk. Animal husbandry, livestock improvement. Techniques: microarray, DNA fingerprinting, Flurescent insitu hybridization, FACS, chromosome mapping,

Unit-V

Application of animal cell culture, production of biopharmaceuticals, cell culture based vaccines, gene therapy, Bio hazard and Biosecurity in Animal Biotechnology, Ethical aspects in Animal Biotechnology.

Reference Books:

1. Animal Biotechnology, M.M. Ranga, (2007).
2. Culture of Animal Cells,(3rd Edition),R.Ian Froshney,Wiley-Liss.
3. Instant Notes in Animal Biology, Richard D. Turd, (2003).

M.Sc. (Biotechnology)
Semester: III
Group A (Industrial Biotechnology)
Elective I- Design and Operation of Bioreactors

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.5th 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.

M.Sc. (Biotechnology)
Semester: III
Group A (Industrial Biotechnology)
Elective II- Downstream Processing

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).

M.Sc. (Biotechnology)

Semester: III

Group B (Pharmaceutical Biotechnology)

Elective I- Pharmaceutical Biotechnology

Unit-1

Antibiotics and synthetic antimicrobial agents

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

Chemical disinfectants, antiseptics and preservatives.

Unit-2

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 quinolinones, Bacterial resistance to quionolinones, 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-3

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-4

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-5

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)m 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. Quinolinone 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. Mercel Dekker NC New York.

M.Sc. (Biotechnology)
Semester: III
Group B (Pharmaceutical Biotechnology)
Elective II- Vaccine Biotechnology and Drug Action

Unit-I

Introduction and history of Vaccine, Vaccine Immunization, Active and Passive immunization, Immune response and its detection

Designing of vaccines, Preservation of vaccines, Method of doing vaccination and dosage, Concept of Antigen and Antibody, Antigen –Antibody reactions

Unit-II

Live Vaccines, attenuated Vaccines and killed vaccines, Recombinant DNA vaccines, Subunit vaccines, Conjugate Vaccines and Peptide Vaccines.

Viral Vaccine-Vaccinia, Polio, Hepatitis B, Influenza and HIV; Bacterial Vaccine -Pertussis, Cholera vaccine, Tetanus, BCG Vaccine

Unit-III

Introduction to Antibiotics and mechanism of their action :Structure, chemistry and SAR of: Beta lactam Antibiotics, Pencillins, Cephalosporins, Tetracyclines, Macrolides, Aminoglycoside antibiotics and other miscellaneous antibiotics .Antitubercular Agents and their mechanism of action. AIDS, Life Cycle of HIV, Potential Targets for Anti-HIV agents; Nucleoside and Non Nucleoside Analogues.

Unit-IV

Introduction to Cancer; Classification of Anti cancer Agents, Structure, Chemistry, SAR and Mechanism of action of: Alkylating Agents, Antimetabolites, Antibiotics, Plant Products, Miscellaneous Agents.

Anti-Parkinson's Agents, Introduction to Dementia and Alzeheimer's Disease, Narcotic Analgesics

Unit-V

Antipyretics and Non-steroidal Anti-Inflammatory Drugs. Biosynthesis of Eicosanoids, Mechanism of Anti-Inflammatory Action and their side effects. Chemistry, Structure and SAR of Salicylates -Aspirin as an example, p-Aminophenol derivatives-Paracetamol as an example.

References

- 1) Medicinal Chemistry;D.Sriram,P.Yogeeswari
- 2) An Introduction to Medicinal Chemistry ;Graham.L.Patrick ,John Spencer 2009
- 3) Medicinal Chemistry;Ashuthosh Khar Revised Third Edition,New Age Publishers
- 4) Textbook of Medicinal Chemistry,Volume 2;Prof.Dr.V.Alagarwamy
- 5) Pharmaceutical Chemistry 2;Dr.A.V.Kasture,Dr.S.G.Wadodkar
- 6) Kubly, 'Immunology', W. H. Freeman & Company, New York.
- 7) Singh B.D., 'Text Book of Biotechnology'.

M.Sc. (Biotechnology)
Semester: III
Group C (Bioinformatics)
Elective I- Biomolecular Modelling and Drug Designing

Unit-I

Drug target classification: DNA, RNA, post-translational processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors, small molecule receptors, transporters;

Drugs: Major Characteristics, Mode of Action, Agonist and Antagonist, Drug discovery, History of drugs and drug discovery classical drug discovery approaches, serendipity, concept of Hit and lead; drug discovery pipeline.

Unit-II

Introduction to the concept of Molecular Modeling, Molecular structure and Internal energy, Application of Molecular graphics Energy Minimization of small molecules; empirical representation of molecular energies, use of Force fields and the molecular mechanics method. Discussion of local and global energy minima.

Unit-III

Technique of Molecular Dynamics and Monte Carlo simulation for conformational Analysis Abinitio, dft and semi-empirical methods.

Unit-IV

Introduction to macromolecular Modeling Design of ligands for known macromolecular target sites; Drug receptor interactions, classical QSAR studies and their implications to the 3D Modeler, 2D and 3D database searching. Pharmacophore identification and novel drug design.

Unit-V

Finding new drug targets to treat disease, New targets for Anti-Cancer drugs. Structure based drug design for all classes of targets.

Introduction, History, Pharmacogenomics vs Pharmacogenetics, Pharmacokinetics and Pharmacodynamics, Personalized Medicine and ethical issues in pharmacogenomics.

Reference

1. N.Clauden Cohen-Guide book on Molecular Modelling in Drug Design
2. Andrew R. Molecular Modelling Principles and Applications
3. V.Kothekar – Essentials of Drug designing
4. Paul.S Charifson –Practical application of computer Aided Drug Design.
5. Tamas Barl F; and Graham V. Lees- Drug Discovery
6. K.D. Tripathi –Essentials of Medical Pharmacology.

M.Sc. (Biotechnology)
Semester: III
Group C (Bioinformatics)
Elective II- Bioprogramming and Soft Computing Techniques

Unit-I: Introduction to R Programming

Overview of the R Language; Defining R Project; Obtaining R, where to get help Generating R Code –Basic Programming Concepts, Scripts, Text editors for R, Graphical User Interfaces (GUI's) for R; Vectors and Matrices, Data Frames and tests, Datasets included in R Packages; Manipulating objects, Graphics (Basics) Mathematical Operations, Basic Matrix computation Regular Sequences, Searches, strings and Pattern matching, Hypothesis testing and data handling; t-tests and ANOVA (Basics).

Unit-II: Introduction to MATLAB

MATLAB as calculator, standard Matlab windows, operations with variables, arrays, writing script files, writing functions, simple graphics, Data types, File Input-output, Communication with external devices.

Unit-III: Introduction to Python

Features of Python, Data types, Variables operators, Features of Python, Data types, Variables, operators and expressions, control flow tools, functions, Data structures, Input and Output, Introduction to object oriented programming CSS and Zope.

Introduction to PERL, Variable Types, Data types, operators, control structures, lists and Arrays, Subroutines, Hash functions, other useful functions, Regular expressions.

Introduction to BIO-PERL, BIO-PERL objects, implementation of Bioinformatics algorithms for searching and matching in PERL, BLAST parsing, handling PDB files, sequence retrieval, alignments. Database concept, working with forms, Data Definition Languages, Data Manipulation Language, Data Control Languages, Structural Query Language, creating triggers. Introduction to PL/SQL, SQL plus and SQLJ.

Unit- IV

Soft Computing Techniques and Algorithms, Introduction to Soft computing, Hidden Markov Models: Application in Bioinformatics ANN (Artificial Neural Networks) and their applications in Bioinformatics. Concepts and Applications of SVM (Support Vector Machines) in Bioinformatics. Basic concepts and Applications of Genetic Algorithms.

Unit-V

Visual Basic- Introduction to Client/Server Technology, Introduction to VB, Features, Data types, Strings, Variant, Constant, Data Arrays, Looping and Interactive statements Functions in VB, Working with controls and procedures, Introduction to Data Connectivity, Different Database Connectivity.

References

1. Nathan Yan- The Art of R Programming
2. Rudra Prathap –Getting started with MATLAB
3. Pratihari- Soft Computing
4. D.M.Etter et al –Introduction to MATLAB-6
5. Mark Lutz Programming Python
6. David M.Beazly Python Essential Reference
6. C.A.Orango, D.T. Jones and J.M.Thornton-Bioinformatics –Genes Proteins and computers
7. Zhumur Ghosh & Mallick Bioinformatics Principles and Applications
8. D.Maunt Bioinformatics sequence & Genome Analysis

SSD- (Soft Skills Development)

3rd Semester

2 years Program (MBA/MCA/MSW/M.Sc (BT)/M.Pharma)

Soft Skills Competency: Soft skills are essential skills in the workplace. Students with excellent soft skills can fit into most environments because they are adaptable, flexible, committed and persevering, and display the right attitude. Such qualities cut across all disciplines. In order to perform well and advance in one's career, one needs to have high levels of soft skills in dealing with people. In short, technical skills need to be complemented with soft skills.

Learning Outcome: On completion of the course (SSD), the student should be able:

- Understand the Importance of various skills involved in developing enriching Interpersonal relationship.
- Be more aware of his/her own self- Confidence and values.
- Learn how to go about being a good team player and form an effective team.
- Understand the skills tested and participate effectively in Group discussion.
- Learn the basics of how to make an effective Presentation and have numerous practice Presentation in small groups and larger audiences.

Unit-1

Conceptual Sessions: Soft skills – a general overview, Industry Expectations, SWOT & STAR, Self Discovery, Leap to success- 7 Orientations,

Activity: Castle Plan.

Assignment : Sentence fluency assignment

Unit-2

Conceptual Sessions: Telephone etiquettes- Preparing for business calls/Making business calls/Telephonic phrases, Dining etiquettes, Email etiquettes, Corporate grooming and dressing.

Activity: Role play in different scenarios/ Socialization and networking.

Assignment : Progress test on general etiquettes.

Unit-3

Conceptual Sessions: Organizing meetings, Time Management, Team building and leadership, Resume writing Concept and Practice, Reading Comprehension.

Activity: Lost at Sea.

Assignment : Reading Comprehension Assignment.

Unit-4

Conceptual Sessions: Group discussion: Introduction and definition of a GD, Purpose of a GD, Types and strategies in a GD, Do's and Don'ts in GD, Speak to Impress (Presentation skill), Personal Interview, Frequently asked Questions (FAQ'S), Interview flow.

Activity: GD Practise and Presentation on Company profile.

Assignment : Communication assignment- GD.

M.Sc. (Biotechnology)
Semester: IV
Scientific Writing & Patenting Process

Unit: I

Scientific Writing & Research- meaning, types, objectives, and approaches: Literature collection: Different sources, Biological online databases, Determining sample design, collecting data, analysis and hypothesis testing, generalization and interpretation.

Unit: II

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: III

Data Collection: Secondary Data, Primary Data, and Methods of Collection, Scaling Techniques: Concept, Types, Rating scales & Ranking Scales, Scale Construction Techniques, Multi Dimensional Scaling. Journals: standard of research journals - impact factor - citation index.

Unit: IV

The legal and socioeconomic impacts of biotechnology, ethical concerns of biotechnology research and innovation, Intellectual property rights, Regulatory framework in India governing GMOs Recombinant DNA Guidelines (1990), Revised Guidelines for Research in Transgenic Plants (1998), Prevention Food Adulteration Act (1955), The Food Safety and Standards Bill (2005), National Environment Policy (2006).

Unit: V

Objectives of the patent system: Basic principles and general requirements of patent law, biotechnological inventions and patent law, Legal development, Patentable subjects and protection in biotechnology, The patenting living organisms, International conventions patents and methods of application of patents- legal implications, biodiversity and farmer right.

REFERENCES:

1. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection- Oxford and IBH Publishing Co. New Delhi.
2. Singh K, Intellectual Property rights on Biotechnology, BCIL, New Delhi
3. Writing the doctoral dissertation. Barrons Educational series, 2nd edition, Davis, G.B. and C.A. Parker, 1997. pp 160.
4. Authoring a PhD, thesis: how to plan, draft, write and finish a doctoral dissertation, Duncary, P. 2003.