Swami Ramanand Teerth Marathwada University, Nanded
Choice Based Credit System (CBCS) Course Structure
Faculty of Science and Technology
B.Sc. Bioinformatics Third Year
Fifth Semester Syllabus
Effective from June 2018

Core Course /Code No.	**Course Title**	**Instruction Hrs/Week**	**Total Period**	**Credits**
DSEBIT- 1E	Environmental Studies	03	45	***
DSEBIT -2E	Genetic Engineering	03	45	3
DSEBIT -3E	Computational Structural Biology	03	45	3
DSEBIT -4E	Chemoinformatics	03	45	3
DSEBIT -5E	Programming in JAVA	03	45	3
DSEBIP-1E	Practical based on DEST-2E & 3E	03+03	20	4
DSEBIP-2F	Practical based on DSET-4E & 5E	03+03	20	4
DEST-3E	Industrial training / Industrial Visit	….	….	2
SECBI-IV	**Skill enhanced Course-3 (Any one of SECBI-III A / III B) III A) Molecular Interactions III B) Introduction to Biosensor	**02**	**20**	**2**
Total Credits				**24**

Swami Ramanand Teerth Marathwada University, Nanded
Choice Based Credit System (CBCS) Course Structure
Faculty of Science and Technology
B.Sc. Bioinformatics Third Year
Sixth Semester Syllabus
Effective from June 2018

Core Course /Code No.	**Course Title**	**Instruction Hrs/Week**	**Total Period**	**Credits**
DSEBIT-1F	Concept of Genomics	03	45	3
DSEBIT -2F	Concept of Proteomics	03	45	3
DSEBIT -3F	Metabolomics	03	45	3
DSEBIT -4F* Elective (Select any one)	*Drug and Molecular Modelling * Advanced Techniques in Bioinformatics *Visual Basic and PHP * Biochemical and Molecular Biology Methods * Biodiversity, Agriculture, Ecosystem and Environment	03	45	3
DSEBIP-1F	Practical based on DEST-1F & 2F	03+03	20	4
DSESBIP-2F	Practical based on DSET-3F & 4F*	03+03	20	4
DESBP-3F	Project Work	02	45	2
SECBI-IV	**Skill enhanced Course-4 (Any one of SECBI-IV A / IV B) IV A) Microbial Informatics IV B) Scientific writing and Statistics	02	20	2
Total Credits				24
Total Credits of B.Sc. I, II & III Year	Total Marks of B.Sc. Biotechnology Degree (Three years course with dissertation CBCS Pattern)			44+ 48+ 48= 140

DSEBIT -2E Genetic Engineering

Salient features: This course will help to understand concept Genetic Engineering and Applications of r-DNA technology.

Utility of course: To understand basics of Genetic engineering techniques

Learning Objective: to improve the knowledge of genomic techniques
Prerequisites: Basic knowledge of biology and Genetic Engineering

Unit 1:- Principles of Gene Cloning

Endonuclease – an essential tool for Gene cloning, Types & Properties, DNA Ligases, Plasmids. Antibiotic résistance markers, Vectors: Plasmids (pBR322, pUC18/19), Bacteriophages (λ Phage, M 13 Phage), Cosmids, Artificial Chromosomes, Ti plasmid. Methods of Gene Transfer- vector based and direct transfer of DNA: Gene Cloning Strategies. Markers and reporter genes in gene cloning

Unit 2:- Techniques in Molecular Biology

Denaturation & Renaturation of DNA, Tm, GC content from Tm. Renaturation Kinetics of DNA & Complexity of DNA. Electrophoresis: Agarose Gel Electrophoresis, Blotting techniques: Southern, Northern, Western Blotting and applications. PCR: Mechanism, Types and Application. DNA Micro array principle & applications DNA Sequencing: Sanger's and Maxam Gilbert's Method, Automated DNA sequencing.

Unit 3:- Library construction

Library construction, screening and applications: Genomic library, cDNA library. Nucleic Acid Probe, Chemical Synthesis of DNA, Autoradiography of DNA Screening of library-Probe based direct and indirect methods.

Unit 4:- Applications of r-DNA technology

Agricultural applications i) BT-Cotton, ii) Transgenic maize, iii) Golden rice etc.
Protein engineering: to improve properties of proteins and enzymes.
Pharmaceutical Applications: i) Recombinant hormones ii) Vaccines iii) Blood Clotting factors v) Tissue Plasminogen Activator vi) Erythropoietin v) Human growth hormone. Concept of Gene Therapy

Reference book:-

1. Principles of Genome analysis and Genomics - Old & Primrose-Black well

2. Molecular biology of Gene – J.D Watson

3. From Genes to Clones- Winnacker- Panima

4. Molecular Biotechnology –Glick-ASM

5. ABC of Gene cloing- Wong-Springer

6. Genomes 3 - T.A.Brown-Garland Science

7. Gene cloning and DNA Analysis- T.A. Brown- Wiley- Blackwell

8. Text book of Biotechnology – U Satyanarayan –Book & Allied

Practical: Based on Syllabus

DSEBIT - 3E Computational structural biology

Salient features: To understand basic Advance structural Biology
Utility of course: To uncover structure of Biomolecules through computational approach & applied Bioinformatics
Learning Objective: to improve the knowledge of computational approach & applied Bioinformatics (Visualization and Manipulation of Protein Structures, Basics of Protein Structure Modeling — Structure validation & refinement).

Prerequisites: basic knowledge about Biomolecules, structural database and Molecular visualization tools

UNIT - I
Structural data, databases and structure analysis Exploring the Database & searches on PDB and CSD, WHATIF
UNIT - II
Molecular visualization tools Visualization of tertiary structures, quaternary structures, architectures and topologies of proteins and DNA using molecular visualization softwares such as RasMol, Cn3D, Chime, PyMOL etc.

UNIT -III

Methods for prediction of secondary structure of proteins Prediction of secondary structures of proteins using at least 5 different methods with analysis and interpretation of the results. Comparison of the performance of the different methods for various classes of proteins.

UNIT - IV

Methods for prediction tertiary structure of proteins along with analysis and interpretation of results Homology modeling: InsightII, Discovery Studio, SWISSMODEL, SWISSPDB Viewer Fold recognition methods: PHYRE, TOPITS, GenThreader (or other equivalent methods)

References:

Cesareni Giovanni, Gimona Mario, Sudol Marius, Yaffe Michael (Editors). Modular Protein Domains. Publisher: Weinheim Wiley-VCH. 2005. ISBN: 352730813X.

Höltje Hans-Dieter, Sippl Wolfgang, Rognan Didier, Folkers Gerd. Molecular

Modeling: Basic Principles and Applications. Publisher: New York, Wiley-VCH.

2003. ISBN: 3527305890.

Webster David (Editor). Protein Structure Prediction: Methods and Protocols

(Methods in Molecular Biology) Volume 143. Publisher: New Jersey Humana Press. 2000. ISBN: 0896036375.

Sternberg Michael J. E. Protein Structure Prediction: A Practical Approach. Publisher: USA, Oxford University Press. 1997. ISBN: 0199634953.

Practical: Based on Syllabus

DSEBIT - 4E Chemoinformatics

Salient features: this subject will help to understand the basic concept of chemoinformatics

Utility of course: To understand the chemoinformatics for drug designing.

Learning Objective: to improve the knowledge of chemical structure representation and Chemoinformatics tools for drug discovery.

Prerequisites: basic knowledge about chemical entities, chemical databases and drug.

Unit 1: Introduction

Chemoinformatics definition, scope of chemoinformatics, history of chemoinformatics, why to use informatics methods in chemistry?

Unit 2: Representations of chemical compounds

Introduction, Computer Representations of Chemical Structures: Graph Theoretic Representations, Linear Notations, Connection Tables, Canonical Representations of Molecular Structures. 2D structure databases, Reaction Databases, The Representation of Patents and Patent Databases.

Representations of 3D molecular structures: Experimental 3D Databases, 3D Database Searching.

Unit 3: Molecular Descriptors

Introduction, Descriptors Calculated from the 2D Structure: Simple Counts, Physicochemical Properties, Molar Refractivity. Structure Searching: Substructure Searching, Screening Methods, Similarity searching,

Unit 4: Drug and Drug-Targets

Drug: definition, "Drug-Likeness" and Compound Filters, rule of five. Lead Compound: definition, natural and synthetic resources of lead compounds. Drug targets: Enzymes, receptors, carrier proteins, structural proteins, nucleic acids, etc.

Unit 5: Chemoinformatics tools for drug discovery

Combinatorial Synthesis and Combinatorial Library, QSAR, 3D Pharmacophores. Screening Methods: High-throughput screening, Virtual Screening. Protein–Ligand Docking. The Prediction of ADMET Properties, Toxicity Prediction.

Reference Books:

1. Handbook of Chemoinformatics, volume 1, by John Gastiger, Thomas Engel, WILEYVCH
pub 2003.

2. An Introduction to Chemoinformatics, by Andrew R. Leach & Valerie j. Gillet, Springer

3. Instant Notes in Medicinal Chemistry, by G. Patrick, BIOS Scientific pub. 2001

Practical: Based on Syllabus

DSEBIT -5E Programming in JAVA

Salient features: understanding the basic concepts and techniques of java programming and develop skills of using recent software

Utility of course: the subject will help in skilled in programming language.

Learning Objective: To enhance the knowledge of programming.

Prerequisites: basic knowledge about programming

Unit 1: An Introduction and overview of Java

A Short History of Java, Features of Java, Comparison of Java and C++, Java Tools And Editors(Appletviewer,Jar,Jdb). Java Environment. Types of Comments, Built In Data Types, Variables and Constants(Final Keyword Related to variables), Operators, Memory Allocation Using new Operator., Output using println() method, Control Statements, Arrays, Simple Java Program.

Unit 2: Objects and Classes

Defining Your Own Classes, methods and objects, using this keyword, constructors, types of constructors, constructor overloading, static variables and methods, access specifiers (private, protected and public), packages-creating, accessing and using packages, Garbage collection, finalize() method.

Unit 3: Inheritance and Interfaces

Inheritance Basics and Types of Inheritance, use extends keyword, Super class, Subclass and use of Super Keyword, Method Overriding, Use of final keyword related to method and class, Use of Abstract class, Defining and Implementing Interfaces, interface variables and interface methods.

Unit 4: Exception Handling

Dealing Errors, types of exception, exceptions handling using try and catch, using throws keyword, uses finally block.

Unit 5: Strings, Streams and Files

String class and String Buffer Class, Stream classes, Byte Stream classes, Character Stream Classes, Using the File class, Creation of files, Reading/Writing characters and bytes, Handling primitive data types.

Unit 6: Applet Programming with Graphical User Interface

Applet Life Cycle, Applet HTML Tags, Passing parameters to Applet, Repaint() method, User Interface Components with AWT in applet, Buttons and Labels, Checkboxes and Radio Buttons, Lists and Combo Boxes, Dialogs (Message, confirmation, input (like file selection).

Reference Books:

1. Complete reference Java by Herbert Schildt(5th edition)
2. Java 2 programming black books, Steven Horlzner
3. Programming with Java , A primer ,Forth edition , By E. Balagurusamy
4. Java servlet Programming by Jason Hunter, O'Reilly
5. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell,
6. Prentice Hall, Sun Microsystems Press.
7. Core Java Volume-II-Advanced Features, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press.

Practical: Based on Syllabus

Skill enhancement Course- 3A Molecular Interactions

Unit I: Fundamentals of atomic and molecular orbitals:

Theory of atomic and molecular orbitals; Linear combination of atomic orbitals; Quantitative treatment of valency bond theory and molecular orbital theory;

Unit II: Fundamentals of chemical bonding and non-bonding interactions:

Electrovalent bond, stability of electrovalent bond. Co- valent bond – partial ionic character of co-valent bonds. Shape of orbitals and hybridization. Co-ordination bond, Vander Waals forces; Metallic bond. Molecular geometry-VSEPR Theory

Unit-III: Folding pathways:

Principles of protein folding, role of chaperons, hydrophobic interactions, electrostatic interactions, non-bonded interactions

Unit IV: Molecular interactions:
protein-protein, protein-DNA, DNA-Drug, Protein-Lipid, Protein-Ligand, Protein-Carbohydrate interaction

Reference Books

1) Frenking, G. and Shaik. S. (2014). The Chemical Bond: Fundamental Aspects of Chemical Bonding, Wiley Publishers.
2) Gromiha, M.M. (2010). Protein Bioinformatics: From Sequence to Function, Academic Press, First Edition.
3) Meyerkord, C.L. and ui , H. (2015). Protein-Protein Interactions: Methods and Applications, Humana Press, second edition
4) Winter, M.J. (2016). Chemical Bonding. Oxford University Press, Inc., New York.

Practical: based on syllabus

Skill enhancement Course-3B Introduction to Biosensor

Unit-I

Sensor: Introduction and classification, history, principles of physical and chemical and mechanism chemical sensors.

Unit-II

Biosensor: Definition, Introduction of Avidin-Biotin mediated biosensor, Luminescent and Glucose biosensors.

Unit-III

Nanomaterials based Biosensor: Introduction and challenges of biosensor. Nanomaterials and nanodevices, nanocrystalline and carbon nanotube based biosensor.

Unit-IV Medical biosensor: Introduction to biosensors for medical applications

Reference Books:

1. Blum, “Biosensor Principles and Applications”, Vol-15, CRC Press, (1991).
2. J. Vetelino, and A.Reghu, (2010) “Introduction to Sensors”, Publisher-CRC Press.
3. A. Mulchandani and K. Rogers, (2010) “Enzyme and Microbial Biosensors: Techniques and Protocols”, Publisher-Humana Press.
4. S. Higson, (2012) “Biosensors for Medical Applications”, Publisher-Elsevier.
5. J. Li, N. Wu, (2013) “Biosensors Based on Nanomaterials and Nanodevices”, PublisherCRC press.
6. M. Bock Gu, H-S. Kim, (2014) “Biosensors Based on Aptamers and Enzymes”, Springer.

Practical: based on syllabus

DSEBIT-1F Concept of Genomics

Salient features: To introduce with basic Genomics and bioinformatics tools and methods to help student in order to conduct advanced research in genomics.

Utility of course: To understand complex biological systems and computational research

Learning Objective: To enhance the knowledge of genomics

Prerequisites: Basic knowledge of genome and genomics databases

Unit 1: Introduction.

Genomics definition, History- Early sequencing efforts DNA sequencing technology developed, Complete genomes, The "omics" revolution, C-Value paradox, Human Genome Project.

Unit 2: Genome Analysis

Sequencing- Shotgun sequencing, High-throughput sequencing, Illumina (Solexa) sequencing, Ion Torrent Assembly- Assembly approaches, Finishing. Annotation. Genome databases

Unit 3: Introduction to Research Areas of Genomics

Functional genomics, Structural genomics, comparative genomics Epigenomics, Metagenomics, Pharmacogenomics. Study systems - Viruses and bacteriophages genomics, Cyanobacteria genomics, Human genomics.

Unit 4: Applications of genomics

Biomarker discovery, gene expression, transfection, epigenetics, agriculture, Pharmaceuticals, genomic medicine, Synthetic biology and bioengineering, etc.

Reference Books:

1. Principles of Genome analysis and Genomics-Primrose and Twyman-Blackwell Publishing

2. Principles of Proteomics-R.M Twyman-BIOS advanced text

3. Functional Genomics-Stephen Hunt, Livesey- Oxford

4. Genetic Programming-W. Banzhaf, Nordin, Keller, Francone- Elsevier Bioinformatics: sequence and genome analysis by David Mount, cold springer harbour press, 2004.

5. Comparative genomics: empirical and analytical approaches to gene order dynamics, map alignment and the evolution of gene families by Sankoff, D. & Nadeau, J.H., Netherlands, Kluwer Academic Publishers, 2000.

Practical : Based on Syllabus

DSEBIT -2F Concept of Proteomics

Salient features: To introduce with basic proteomics and bioinformatics tools and methods to help student in order to conduct advanced research in proteomics.

Utility of course: To understand complex biological systems and computational research

Learning Objective: To enhance the knowledge of proteomics

Prerequisites: Basic knowledge of genome, proteome and genomics databases

Unit 1: Introduction.

Definition, Proteome, Different protein functions, What Is Proteomics?; Why Proteomics?; Applications of proteomics, Protein Structure Basics- Amino Acids, Peptide bond, Hierarchy, Determination of Protein Three-Dimensional Structure, Protein Structure Database.

Unit 2: Protein synthesis and Modifications

Translation, Post translational modifications- Protein processing in Endoplasmic Reticulum and Golgi apparatus, role of chaperons, The modifications such as proteolytic cleavage; formation of disulfide bonds; addition of phosphoryl, methyl, acetyl, or other groups onto certain amino acid residues; attachment of oligosaccharides or prosthetic groups to create mature proteins.

Unit 3: Protein separation and Identification

Extracting Proteins from Biological Samples, Protein Separations- 1D- and 2DSDS- PAGE, Isoelectric Focusing (IEF), HPLC (reverse phase (RP), size exclusion, ion exchange, or affinity chromatography), identification using MS, MALDI-TOF etc.

Unit 4: Protein Analysis

Protein-protein interactions, Protein array, protein structure prediction Tools and servers.

Reference Books:

1. Principles of Genome analysis and Genomics-Primrose and Twyman-Blackwell Publishing

2. Introduction to proteomics: tools for the new biology by Liebler, D.C. & Yates, J.R.III, Humana Press

3. Protein Science-Arthur M. Lesk- Oxford

4. Proteomics: from protein sequence to function by Pennington, S. R. & Dunn, M. J.: Viva Books Introduction to proteomics: tools for the new biology by Liebler, D.C. & Yates, J.R.III, New York. Humana Press, 2002.

Practical: Based on Syllabus

DSEBIT -3F Metabolomics

Salient features: To understand basic metabolomics
Utility of course: To uncover Biological pathway through computational approach & applied Bioinformatics
Learning Objective: to improve the knowledge of computational metabolomics, Metabolite separation and Detection, etc

Prerequisites: basic knowledge about Biomolecules, biological pathways database

Unit 1: Introduction to Metabolomics
Definition, origin, Terms- metabolom, metabolites, catabolism, anabolism, metabolism metabonomics. Applications- medical diagnosis, biomarker discovery, agriculture, Toxicity assessment/toxicology, Functional genomics. Nutrigenomics, etc

Unit 2: Metabolic Pathways
Major Metabolic Pathways: Gluconeogenesis, Pentose phosphate pathway, Glycogen synthesis and degradation, Fatty acid oxidation and synthesis, Amino acid catabolism, Purine and pyrimidine nucleotide synthesis,

Unit 3: Metabolite separation and Detection Methods
Separation -Gas chromatography, HPLC, CE. Detection- Mass spectrometry (MS), MALDI, Nuclear magnetic resonance (NMR) spectroscopy. Statistical methods- XCMS, MZmine, MetAlign, etc.

Unit 4: Computational metabolomics
Full Genome Annotation through knowledge of Metabolic Pathways
Organism Specific Metabolic Pathways, Comparison of Metabolic Pathways

Reference Books:
1. Fundamentals of Biochemistry (2nd edition) by D.,Voet, Voet, J.G. & Pratt, C. W. John Wiley & Sons, 2006.
2. Lehninger Principles of Biochemistry (4th edition) by D. L. Nelson & M. M. Cox, W. H. Freeman & Co, 2005.
3. Gene regulation and metabolism: postgenomic computational approaches. By Collado-Vides, J. & Hofestadt, R. Cambridge, The MIT Press, 2002.

Practical: Based on Syllabus

DSEBIT - 4F* Elective Drug and Molecular Modelling

UNIT I

Classification of drugs, routes of drug administration. Absorption & Distribution of drugs. Role of kidney in drug interaction with biomolecules. Binding of drugs to plasma proteins.

UNIT II

Drug receptors: Drug-receptor interaction, Drug action not mediated by receptors. Structural based drug design, mechanism of their action. Lipinski's rule of 5, Clinical trials

UNIT III

Effect of drug doses on the rate of metabolism- mechanisms and importance of Phase I and Phase II biotransformation. Role of cytochrome p450. Enzyme inhibition strategies, enzyme induction and pharmacological activity, LD50 and IC50.

UNIT IV

Principles & mode of action cancer and HIV chemotherapy agents and target sites for cancer and HIV chemotherapeutic agents. antimetabolites, antibodies, plantibodies, radiation therapy and alkylating agents. PUBCHEM database. Quantitative Structure Activity Relationship (QSAR). Types of descriptors

Reference Books:

Singh.H and Kapoor. V.K, 2002. Organic pharmaceutical chemistry. Vallabh prakashan publishers. New Delhi

Andrew, R., 1998. Molecular modeling: principles and application. Leach. Harlow.

Andrew, R., 1997. Molecular modeling: Basic principles and applications. Hans- X.

Leach A. R., "Molecular Modeling- Principles and applications", Prentice Hall, 2ndedition, 1996.

Paul S Charifson, "Practical application of CADD", Informa Health Care, 1997.

PerunT.J. and C.L. Propst, "Computer Aided Drug Design", Informa Health Care, 1992.

Rastogi et al, "Bioinformatics – Genomics, proteomics, and drug discovery", PHI Publishing, 2008.

Practical: Based on Syllabus

DSEBIT - 4F* Elective Advanced Techniques in Bioinformatics

Unit 1: Introduction

Biological data representation in digital form, Microarray, Next Generation Sequencing, Introduction to Artificial Intelligent, Introduction to search, Search algorithms, Heuristic search methods, optimal search methods,

Unit 2: Machine learning approaches

Principles Methods and Applications of: - Dynamic programming, Hidden Markov Model, Neural networks, Genetic algorithms.

Unit 3: Molecular Modeling

An overview. Introduction and challenges Molecular modeling methods – Conformational searching, Ramachandran maps, Ab-initio methods, Homology Modeling.

Unit 4: Data Mining

Introduction to Data Mining in Bioinformatics, data mining process- Data collection, Data preprocessing, data mining, information interpretation, visualization. Data mining tasks, classification, clustering, association, summarization, text mining etc. Data mining techniques- Databases and data ware housing, statistics, machine learning

Reference Book:-

1) Handbook of Hidden Markov models in Bioinformatics-Martin Gollery- CRC Press
2) Algorithms in Bioinformatics-Ed. Gary Benson, Roderic Page- Springer
3) Bioinformatics-The machine learning Approach- Pierre Baldi and Soren Brunek
4) Advance data mining techniques in Bioinformatics- Hui- Huan G Hsu- IGP
5) Building Bioinformatics Solutions –Cornod Bessant, I Shadforth, Oakley-oxford
6) Bioinformatics - machine learning Data mining in Bioinformatics - Bedi & Brunak
7) Protein Bioinformatics-Eidhammer, Jonassen, Taylor-Wiley
8) Bioinformatics: sequence and genome analysis by David Mount, cold spring harbor

Practical: Based on syllabus

DSEBIT - 4F* Elective Visual Basic and PHP

Unit 1: VB Fundamentals
Introduction to visual basic, menu bar, tool bar, project explorer, tool bar property window, form layout window, project types . Anatomy of forms – properties, methods & forms working with MDI form.

Unit 2 : Study of Various Controls
Command button, text button, Label box, Option button, check bar, frame controls, combo box, image controls, picture box, scroll bar, list bar, designing menu structure, Visual basic programming

Unit 3: Introduction to PHP
Evaluation of PHP, Basic Syntax, Defining variable and constant Php Data type, Operator and Expression Handling, Html Form With Php, Capturing Form Data, Dealing with Multivalue filed, Generating File uploaded form, Redirecting a form after submission.

Unit 4 : Decisions and loop and Function
Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html What is a function, Define a function, Call by value and Call by reference, Recursive function

Unit 5: String and Array
Creating and accessing String, Searching & Replacing String, Formatting String, String Related Library function Definition, creation of array in PHP, Accessing array, Performing different operation in array

Reference Books:
1. Mastering Visual Basic by BPB publication
2. Peter Norton Guide to visual Basic
3. visual Basic 6 by Gary Cornell
4. Beginning with SQL server (TMH publication)
5. VB. Black book
6. PHP, My SQL, Apache –J C Meloni

Practical : Based on Syllabus

DSEBIT - 4F* Elective Biodiversity, Agriculture, Ecosystem and Environment

UNIT – I Biodiversity:

Biodiversity: status, scope, types, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Uses of Biodiversity, Loss of biodiversity, Metadatabases, Virtual libraries, Special interest networks, Biodiversity Application Software

UNIT – II Agriculture:

Crops: Comparative genomes of plant and model plants, Insect resistance, Improve nutritional quality, Grow drought resistant crops in poorer soils, Biodiversity of Indian medicinal plants. Ecosystem: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C, N, P); primary production and decomposition; structure and function of some Indian ecosystems.

UNIT – III Conservation Biology:

Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves)

UNIT – IV Environment:

Waste cleanup: Superbugs and their concept, Microbes and Climate change, Alternative energy sources and Fuel cells. Biotechnological applications of microbes, Antibiotic resistance, Forensic analysis of microbes, the reality of bioweapon, Metagenomics.

Reference Books:

1. Tandon, P., Abrol, Y.P. and Kumaria, S. (2007). Biodiversity and its Significance. I. K. International Publishing House Pvt. Ltd, New Delhi.

2. Singh, J.S., Singh, S.P. and Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi.

3. Raven, P.H., Berg, &ninKWuano .tKeuniKSnKE .)2012(.M.D ,aKa kassnK ana .R.L .tu nEtauEuiK.cKI,miKs

Practical : Based on Syllabus

DSEBIT - 4F* Elective Biochemical and Molecular Biology Methods

UNIT –I

Bio-safety rules and regulations and Good Laboratory Practice (GLP), Material safety Data sheets (MSDS). Preparation of Reagents, buffers, pH Analysis,

UNIT –II

Various Centrifugation methods, Quality and Quantity analysis of nucleic acids by Spectrophotometer and Bio Photometer. Quantification of Proteins by Lowry's and Bradford's methods

Unit -III:

Isolation and Separation of Genomic DNA from plants/human/microorganisms; Plasmids isolation from microorganisms; RNA from Yeast; Agarose Gel Electrophoresis; Isolation, separation and analysis of Proteins by Native-PAGE and SDS-PAGE.

Unit -IV:

Gene amplification and Screening techniques: Primer Design, PCR; Blotting techniques: Southern, Northern and Western Blots; Bio Probe (Demonstration) and Radioactive probe (Theory). Molecular Markers by RFLP, AFLP, RAPD methods (Demo).

Reference Books

1) John M. Walker and Ralph Rapley, (2002) "Molecular Biology and Bio technology"; University of Hertfordshire, Hatfield, UK, Fourth Edition

2) Bansal, M. P. (2013) "Molecular Biology and Biotechnology": Basic Experimental Protocols, New Delhi: TERI.

3) R.H. Burdon, P.H. Van Knippenberg, (1990) "Laboratory techniques in Biochemistry and Molecular biology"; Elsevier Amsterdam. New York. Oxford, Second Edition, volume 8.

4) Michael R. Green, Joseph Sambrook, (2012) "Molecular cloning: a laboratory manual"; Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press, 4th Edition.

Practical : Based on Syllabus

Skill Enhancement Course- IV A) Microbial Informatics

Unit 1
Bioinformatics, Genomics, and Antimicrobial Drug Discovery, Genomics of Bacterial Pathogens, Global Aspects of Antibiotic Resistance
Unit 2
The Pathway Tools Software and Its Role in Antimicrobial Drug Discovery.
Unit 3
Genomic Strategies in Antibacterial Drug Discovery, Genomics-Based Approaches to Novel Antimicrobial Target Discovery, Pathogenesis Genes as Novel Targets.
Unit 4
Microbial Proteomics: New Approaches for Therapeutic Vaccines and Drug Discovery Phenotype Micro Arrays: Their Use in Antibiotic Discovery, Surrogate LigandBased Assay Systems for Discovery of Antibacterial Agents for Genomic Targets.
Practical : Based on Syllabus
Reference Books

1) R.H. Burdon, P.H. Van Knippenberg, (1990) “Laboratory techniques in Biochemistry and Molecular biology”; Elsevier Amsterdam. New York. Oxford, Second Edition, volume 8.

2) Michael R. Green, Joseph Sambrook, (2012) “Molecular cloning: a laboratory manual”; Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press, 4th Edition.

3) Prescott's Microbiology 10th Edition By Joanne Willey and Linda Sherwood and Christopher J. Woolverton

4) Drug Discovery, Design & Development Singh Arjun Edition: 2013

ISBN: 9783659459986, 3659459984

Skill Enhancement Course- IV B) Scientific writing and Statistics

unit – I

Research Definition ,Characteristics, Objectives, Research and Scientific method, and Types of Research

UNIT – II

Literature Review, Review Concepts and Theories , Formulation of Hypothesis

Sources of Hypothesis, Characteristics of Hypothesis, Role of Hypothesis and

Tests of Hypothesis Threats and Challenges to Good Research

UNIT-III

Writing a Article, Essay, Research Paper, Research Project, Thesis, dissertation, Book Research Ethics , Citation Methods, Bibliography, Citation Rules

UNIT-IV

Statistics: Probability & Sampling distribution; Estimation, Hypothesis testing & application; Correlation

Reference Books:

1) Russell A Jones: Research Methods in Social and Behavioural Sciences (Sinauer Associates Inc., Publishers, Sutherland Massachusetts 1996)
2) Fredrick L. Whitney – Elements of Research
3) Kothari C.K. (2004) 2/e, Research Methodoloy – Methods and Techniques (New Age International, New Delhi)

DESTP-3F Lab Course XII (Project Work)

Guidelines for project work

1. The projects will be allotted during V semester
2. Students will design experiment of project under guidance of supervisor
3. Selection of topic relevant to priority to areas of biotechnology
4. Collection of literature from various sources
5. Planning of research experiments
6. Performing the experiments with scientific and statistical analysis
7. Project writing and compilation of report
8. Presentation of experimental data in schedule of practical examination
9. Project to be carried out individually or in group of three students maximum