Semester VII		
Course No.	**Course Title**	**Credit**
ET-472	Educational Tour	0+1
Plant Biotechnology*		
READY-PB-471	Micro-propagation of field, horticultural and Medicinal plants	0+20
	or	
READY-PB-472	DNA Fingerprinting and hybridity testing	0+20
Animal Biotechnology		
READY-AB-471	Dissemination of *Elite* germplasm of any species by frozenSemen technology	0+20
READY-AB-472	Molecular diagnostics for diseased/disordered animals	0+20
Microbial and Environmental Biotechnology		
READY-MEB-471	Production of Probiotics/ Fermented Milk Products	0+20
READY-MEB-472	Mushroom Production and Processing Technology	0+20
READY-MEB-473	Liquid Biofertilizer Production Technology	0+20
Bioinformatics		
READY-BIF-471	Biological database creation and its management	0+20
READY-BIF-472	Bioinformatics: Gene to genome	0+20
READY-BIF-473	Drug designing and pharmacogenomics	0+20
READY-BIF-474	AgriSciences utility tool designing	0+20
Total		**0+21=21**

*To opt only one module as per the chosen elective.

Semester VIII		
Course No.	**Course Title**	**Credit**
READY-482	Student READY- Project Formulation, Execution and Presentation	0+10
READY-483	Student READY- Entrepreneurial Development in Biotechnology (On-campus/Off Campus)	0+10
Total		**0+20 =20**

SEMESTER-VII

Course No	: **ET-472**	Course Title	: **Educational Tour**
Credits	: **1(0+1)**	Semester	: **V**

Syllabus:

Educational Tour for South/North India

Identified Institutes/Universities for South/North India educational tour.

1. Central Food Technology Research Institute (CFTRI), Mysore.
2. Indian Institute of Science(IISC), Bangalore.
3. National Centre for Biological Science (NCBS), Banglore.
4. University of Agricultural Sciences (UAS), GKVK Campus, Banglore.
5. University of Agricultural Sciences (UAS), Dharwad.
6. Tamilnadu Agricultural University (TNAU), Coimbatore.
7. Kerla Agricultural University,(KAU) Thrisur, Kerla.
8. International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad.
9. Centre for Cellular and Molecular Biology (CCMB), Hyderabad.
10. National Institute of Nutrition(NIN), Hyderabad.
11. Professor Jayshankar Telangana State Agricultural University, Telangana.
12. Anand Agricultural University (AAU), Anand, Gujrat.
13. Navsari Agricultural University, Navsari, Gujrat.
14. Indian Agricultural Research Institute (IARI), New Delhi.
15. ICAR-National Research Centre for Plant Biotechnology (NRCPB), New Delhi.
16. ICAR- National Bureau of Plant Genetic Resources (NBPGR), New Delhi.
17. International Centre For Genetic Engineering And Biotechnology (ICGEB), New Delhi.
18. Punjab Agricultural University (PAU), Ludhiana.
19. Central Potato Research Institute (CPRI), Shimla.

Study Tour Evaluation

Sr. No	Particulars	Marks
1.	Inquisitiveness	10
2.	Report	15
3.	Presentation	10
4.	Assignment (Leadership role, group activities during Educational Tour etc.)	10
5.	Viva	05
Total		**50**

Student READY - In-house Skill Development Modules 0+20

Four Modules (Only one module to be opted as per chosen elective)

1. Plant Biotechnology
2. Animal Biotechnology
3. Microbial and Environmental Biotechnology
4. Bioinformatics

STUDENT READY Programme

SEMESTER VII

MODULES *

1. PLANT BIOTECHNOLOGY**

i. Course No. : READY-PB-471
Course Title : Micro-propagation of field, horticultural and Medicinal plants
Credits : 0+20

ii. Course No. : READY-PB-472
Course Title : DNA Fingerprinting and hybridity testing
Credits : 0+20

2. ANIMAL BIOTECHNOLOGY**

i. Course No. : READY-AB-471
Course Title : Dissemination of *Elite* germplasm of any species by frozen Semen technology
Credits : 0+20

ii. Course No. : READY-AB-472
Course Title : Molecular diagnostics for diseased/disordered animals
Credits :0+20

3. MICROBIAL AND ENVIRONMENTAL BIOTECHNOLOGY**

i. Course No. : READY-MEB-471
Course Title : Production of Probiotics/ Fermented Milk Products
Credits : 0+20

ii. Course No. : READY-MEB-472
Course Title : Mushroom Production and Processing Technology
Credits : **0+20**

iii. Course No. : READY-MEB-473
Course Title : Liquid Biofertilizer Production Technology
Credits : 0+20

4. BIOINFORMATICS**

i. Course No. **:** READY-BIF-471
Course Title **:** Biological database creation and its management
Credits **:** 0+20

ii. Course No. **:** READY-BIF-472
Course Title **:** Bioinformatics: Gene to genome
Credits **:** 0+20

iii. Course No. **:** READY-BIF-473
Course Title **:** Drug designing and pharmacogenomics
Credits **:** 0+20

iv. Course No. **:** READY-BIF-474
Course Title **:** AgriSciences utility tool designing
Credits **:** 0+20

(*To be opted only one module as per the chosen electives**)**
(** To be opted only one module as per the interest of the student and expertise available**)**

Objectives

- To promote professional skills and knowledge
- To build confidence and to work in project mode
- To provide an opportunity to the students for practical learning in agro-biotech based industries
- To develop competence, capability, capacity building, acquiring skills, expertise and built up confidence among the students to start their own enterprise and turn job creators instead of job seekers.

MODULES ON PLANT BIOTECHNOLOGY

Course No. : READY-PB-471
Course Title : Micro-propagation of field, horticultural and medicinal plants
Credits : 0+20
Semester : VII

Sr. No.	Activities	Week(s)
Stage 0 : Preparative stage		
1.	Orientation, book keeping and records, market survey to estimate the demand and source, Cleaning and fumigation of laboratory rooms *viz.*, working, transfer, culture rooms and *in vivo* transfer area; washing and sterilization of glassware's and plastic-wares, handling of laboratory equipments and chemicals, preparation of stock solution.	**1st week**
Stage 1 : Initiation of culture		
2.	Preparation of establishment media for field crops e.g. sugarcane; horticultural e.g. banana, pomegranate and ornamental flowers and medicinal plants; choice/selection of explant and its virus indexing, sterilization of explant, maintenance of environmental parameters in culture room, inoculation of explant, observations on growth and contamination of explant.	**2nd and 3rd week**
Stage 2 : Shoot multiplication		
3.	Preparation of shooting media, sub-culturing of shoots for multiplication, maintenance of environmental parameters in culture room, observations on growth and contamination of explant, shoot elongation.	**4th to 12th week**
Stage 3 : Root induction and development		
4.	Preparation of rooting media, culturing of elongated shoots for rooting, maintenance of environmental parameters in culture room, observations on growth and contamination of explant	**13th to 16th week**
Stage 4 : Hardening and marketing aspects		
5.	Primary and secondaryhardening, estimation of costs and returns, operation costs, investment capital requirement and feasibility analysis, identification of market channels and estimation of marketing costs and margins,	**17th to 20th week**
6.	Preparation of project proposal for establishments of commercial units, Entrepreneurship development in field crops e.g. sugarcane; horticultural e.g. banana, pomegranate and ornamental flowers and medicinal plants.	**17th to 20th week**
7.	Report writing and examination.	**1st to 24th week**

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Course No. **:** READY- PB-472
Course Title **:**DNA Fingerprinting and hybridity testing
Credits **:**0+20
Semester **:** VII

Sr. No.	Activity	Week(s)
1.	Preamble, book keeping and records, market survey to estimate the demand and source, sterilization of glassware's, and plastic wares and some reagents by autoclaving and ultra filtration, handling of laboratory equipments and chemicals, selection of the crop for DNA Fingerprinting of the released varieties and hybridity testing of newly developed hybrids.	**1st to 2nd week**
2.	Preparation of stock solution for DNA isolation, preparation of extraction buffer and crushing sample in liquid nitrogen (LN), DNA isolation by suitable reported method.	**3rd and 6th week**
3.	Qualitative and quantitative analysis of the isolated DNA by spectrophotometer.	**7th week**
4.	Preparation of 0.8% agarose gel, resolution of isolated DNA by agarose gel electrophoresis, documentation of gel under UV Trans-illuminator for quantification and checking of the quality of the isolated DNA	**7th week**
5.	Selection/designing of primers for fingerprinting or hybridity testing (RAPD, SSR, ISSR, SNP, SCAR, candidate gene specific primers etc.,), standardization of annealing temperature for primers, PCR amplification of DNA with particular primers at standardized annealing temperature.	**8th to 12th week**
6.	Preparation of appropriate conc. of agarose gel, resolution of amplified DNA by agarose gel electrophoresis, documentation of gel under UV Trans-illuminator, analysis of data with appropriate software.	**13th to 15th week**
7.	Estimation of costs and returns, operation costs, investment capital requirement and feasibility analysis, Identification of market channels and estimation of marketing costs and margins	**16th to 19th week**
8.	Preparation of project proposal for establishments of commercial units, Entrepreneurship development in DNA Fingerprinting and hybridity testing.	**16th to 19th week**
9.	Report writing and examination.	**1st to 24th week**

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MODULES ON ANIMAL BIOTECHNOLOGY

Course No. **:** READY-AB-471
Course Title **:** Dissemination of Elite germplasm of any species by frozen semen technology
Credits **:** 0+20
Semester **:** VII

Sr. No.	Activities	Week(s)
1.	Orientation, book keeping and records, market survey to estimate the demand and source,	**1st week**
2.	Identification of frozen semen straws of species to be manufactured Analysis of the existing status of the identified product and targeted market and customer. Innovativeness and creativity Preparation of the project proposal	**2nd and 3rd week**
3.	Organization of resources Organizing utility Sequential grouping of activities Packaging and storage Frozen semen straws pricing-physical inputs, man hands, delectation.	**4th to 10th week**
4.	Regularity in production SOP QC testing Maintenance of production records Team work	**11th to 18th week**
5.	Strategy Sales volumes Assessment of sale performance Profit generated including C/B ------ pay back period etc.	**18th to 20th week**
6.	Preparation of project proposal for establishments of commercial units, Entrepreneurship development in Elite Germplasm of any species by Frozen Semen Technology	**18th to 20th week**
7.	Report writing and examination.	**1st to 24th week**

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Course No. : READY-AB-472
Course Title : Molecular diagnostics for diseased animals
Credits : 0+20
Semester : VII

Module III.Molecular diagnostics for diseased animals

Sr. No.	Activity	Week(s)
1	Preamble, book keeping and records,market survey to estimate the demand and source, sterilization of glassware's, and plastic wares and some reagents by autoclaving and ultra filtration, handling of laboratory equipments and chemicals	**1st to 2nd week**
2	Preparation of stocksolution for DNA isolation, preparation of extraction buffer, sample collection and DNA isolation by suitable reported method.	**3rd and 6th week**
3	Qualitative and quantitative analysis of the isolated DNA by spectrophotometer.	**7th week**
4	Preparation of 0.8% agarose gel, resolution of isolated DNA by agarose gel electrophoresis, documentation of gel under UV Trans-illuminator for quantification and checking of the quality of the isolated DNA	**7th week**
5	Selection/designing of primers for diagnosis of diseased animals, standardization of annealing temperature for primers, PCR amplification of DNA with particular primers at standardized annealing temperature.	**8th to 12th week**
6	Preparation of appropriate conc. ofagarose gel, resolution of amplified DNA by agarose gel electrophoresis, documentation of gel under UV Trans-illuminator, analysis of data with appropriate software.	**13th to 15th week**
7	Estimation of costs and returns, operation costs, investment capital requirement and feasibility analysis, Identification of market channels and estimation of marketing costs and margins	**16th to 19th week**
8	Preparation of project proposal for establishments of commercial units, Entrepreneurship development inmolecular diagnostics for diseased animals.	**16th to 19th week**
9	Report writing and examination.	**1st to 24th week**

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MODULES ON MICROBIAL AND ENVIRONMENTAL BIOTECHNOLOGY

Course No. : READY-MEB-471
Course Title : Production of Probiotics/ Fermented Milk Products
Credits : 0+20
Semester : VII

Sr. No.	Activities	Week(s)
1	Orientation, book keeping and records,market survey to estimate the demand and source, Cleaning and fumigation of laboratory rooms *viz.*, working, transfer, culture rooms; washing and sterilization of glassware's and plastic-wares, handling of laboratory equipments and chemicals, preparation of stock solution.	**1st 2nd & 3rd week**
2	Culture activation	**4th& 5th week**
3	Culture preparation : Isolate the best culture and inoculate the same and store as a stock culture	**6th, 7th& 8th week**
4	Preparation of various fermented milk products or probiotics.	**9th, 10th, 11th, 12th, & 13th week**
5	Packaging ofvarious fermented milk products or probiotics in proper packaging material with proper label.	**14th, 15th& 16th week**
6	Preparation of project proposal for establishments of commercial units, Entrepreneurship development in Production of Probiotics/ Fermented Milk Products	**17th &20th week**
7	Report writing and examination.	**1st to 24th week**

Course No. : READY-MEB-472
Course Title : Mushroom Production and Processing Technology
Credits : 0+20
Semester : VII

Sr. No.	Activities	Week(s)
1.	Orientation, book keeping and records,market survey to estimate the demand and source, Cleaning and fumigation of laboratory rooms *viz.*, working, transfer, culture rooms; washing and sterilization of glassware's and plastic-wares, handling of laboratory equipments and chemicals, preparation of stock solution.	**1st& 2nd week**
2.	Preparation & sterilization of media; Isolation of culture and maintenance of pure culture	**3rd week**
3.	Substrate sterilization and preparation: sterilisation/pasteurisation; Spawn production : Spawn produced on sterilized wheat grains.	**4th& 5thweek**
4.	Substrate inoculation and spawn run : Fermentation and composting, filling of the beds in plastic bags; perforation of the plastic bags	**6th& 7thweek**
5.	Casing of mushroom bed; formation of pinhead	**8thweek**
6.	Harvesting and Packaging : Harvest crop after 3-4 days of pinhead initiation and packed in proper packaging material with proper label. Store at 4^{o}C in cold storage rooms and processed (drying).	**9th to15thweek**
7.	Sales and marketing: Simultaneously sale will be continue throughout the production period as fresh, dry mushroom or as mushroom products.	**16th&17thweek**
8.	Preparation of project proposal for establishments of commercial units, Entrepreneurship development in Mushroom Production and Processing Technology	**18th &20thweek**
9.	Report writing and examination.	**1st to 24th week**

Course No. **:** READY-MEB-473
Course Title **:** Liquid Biofertilizer Production Technology
Credits **:** 0+20
Semester **:** VII

Sr. No.	Activities	Week(s)
1	Orientation, book keeping and records,market survey to estimate the demand and source, Cleaning and fumigation of laboratory rooms *viz.*, working, transfer, culture rooms; washing and sterilization of glassware's and plastic-wares, handling of laboratory equipments and chemicals, preparation of stock solution.	**1st& 2nd week**
2	Isolation of beneficial microorganism from plant & soil	**3rdto 6thweek**
3	Preparation of mother or starter cultures	**7th&8thweek**
4	Preparation of broth cultures and preparation of liquid biofertilizer with cell protectants and aduvants	**9thto12thweek**
5	Filling and packaging of bottleswith proper labels	**13hto16thweek**
6	Preparation of project proposal for establishments of commercial units, Entrepreneurship development in Liquid Biofertilizer Production Technology	**17th& 20thweek**
7	Report writing and examination.	**1st to 24th week**

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MODULES ON BIOINFORMATICS

Course No. **:** READY-BIF-471
Course Title **:**Biological database creation and its management
Credits **:**0+20
Semester **:** VII

Sr. No.	Activities	Week(s)
1	Orientation, Market survey and industrial potential of bioinformatics, Introduction to operating system, Introduction to bioinformatics and the internet • Internet Basics • Connecting to the Internet • Electronic Mail • File Transfer Protocol • The World Wide Web Overview of Bioinformatics resources on the web Example: NCBI/EBI/EXPASY etc.	**1st week**
2	Biological databases retrieval systems • ENTREZ • SRS Exploring sequence databases • Biological literature databases (PubMed, Agricola) • Nucleic acid sequence databases (NCBI's GenBank + the European Nucleotide Archive [ENA] + the DNA Data Bank of Japan [DDBJ], RefSeq database, dbEST) • Protein sequence databases (UniProtKb) • RNA sequence databases (miRBase, lncRNAdb)	**2nd and 3rd week**
3	Study of Derived databases • Interpro and its constituent databases like Prosite, PIR, Prodom, Prints,Hamap, Gene3D etc., Exploring Structural database • PDB, Nucleic acid databank Specialized databases • Genome database • Metabolic pathway database (KEGG, BioCyc, BRENDA) • Chemical database • Gene expression database • Crop databases	**4th to 7th week**
4	Introduction: Biological data types, collection, classification schema of biological databases • Sequence and molecular file formats	**8th to 10th week**

	Introduction to database management system • Database designing, data acquisition • Data Abstraction, Data Models, Instances & Schemes • 5E-R Model o Entity and entity sets o Relations and relationship sets o E-R diagrams • Reducing E-R Diagrams to tables • Relational Algebra and relational Calculus • Data Normalization • Basic concepts and applications of Network Data Model, Hierarchical Data • Model, Multimedia Database, Textual Databases	
5	Introduction to WAMP • Windows Apache MySQL PHP Databases & Computational Biology o MySQL database architecture (basics). o The Client/Server architecture o Server Application Programming concept • Parsing large scale data • Various file formats • Perl Advance Modules ▪ LWP ▪ Mechanize ▪ HTML/XML parsing • MySQL Advance programming • Loading database by parsing all parsable file • Web based front-end designing ▪ HTML introduction • Server side communication with web based front end. ▪ CGI & PHP ▪ MySQL-PHP Connectivity, Querying ▪ MySQL-PERL Connectivity, Querying • Server Development using available packages WAMP/XAMPP/LAMP	**11th to 13th week**
6	Creation of web page(s)- HTML Creation of web page(s)- HTML Case study and analysis on any one biological database IPR related issues regarding biological database creation and management Market survey Industrial potential of biological database(s) Entrepreneurship development in the field of biological database	**14th to 19th week**
7	Preparation of project proposal	**19th to 20th week**
8	Report writing and examination.	**1st to 24th week**

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Course No. : READY-BIF-472
Course Title : Bioinformatics: Gene to genome
Credits : 0+20
Semester : VII

Sr. No.	Activities	Week(s)
1.	Orientation, Market survey and industrial potential of bioinformatic Introduction to operating system Introduction to bioinformatics and the internet • Internet Basics • Connecting to the Internet • Electronic Mail • File Transfer Protocol • The World Wide Web Overview of Bioinformatics resources on the web. Example: NCBI/EBI/EXPASY etc., Biological databases retrieval systems • ENTREZ • SRS	**1st week**
2.	Sequence validation and submission to public database Biomolecular sequence analysis: Overview and Concepts Pairwise sequence alignment algorithms (Dot Matrix analysis, Needleman &Wunsch, Smith & Waterman) Scoring matrices for Protein and Nucleotide sequences (PAM series and BLOSUM series) Database Similarity Searches (BLAST & FASTA) Multiple sequence alignment algorithms (CLUSTAL,T-Coffee)	**2nd and 3rd week**
3.	Nucleotide sequence analysis using EMBOSS Protein sequence analysis using ExPasy Molecular phylogenetics: Overview, Concepts in molecular evolution 1. Molecular Phylogeny: Concept & overview 2. Distance-based methods: Neighbour joining 3. Character-based methods: Maximum Parsimony 4. Reliability of trees: Bootstrap	**4th to 6th week**
4.	Structural Bioinformatics 1. Protein structural classification databases (CATH and SCOP) 2. 3D-Structural databases searching and retrieval (PDB + Nucleic acid databank, PMDB) Structural visualization tools (SPDBV) • To perform following tasks on a molecule using DeepView o Selecting and Displaying o Colouring o Measuring and labeling • Apply crystallographic symmetries: • To build a full multimer from a pdb file containing only a monomer (subunit) of a protein by applying non-crystallographic symmetries.	**7th to 9th week**

	• Study the interactions in the subunit interface.
	• Comparing Conformations of proteins: example Deoxyhemoglobin AND Oxyhemoglobin Using Ramachandran Plot
	• Examining Electron density maps
	• Performing in silico mutagenesis and analyzing Side chain conformations
	  • Alter the model (PDBID 1HEW) by changing an isoleucine residue to glutamine.
	  • Investigate whether the new residue might form an additional H-bond to inhibitor tri-NAG.	

5.	Protein secondary and tertiary structure prediction
	  • protein secondary prediction using online servers
	Protein tertiary structure prediction
	  • tertiary structure prediction (CPH, MODELLER, SWISS Model, EasyModeleretc)
	  • Estimation of predicted models: ProCheck, ERRAT, Verify3D, Prove, Prosa etc.,
	ProteinMotifs and Domain Prediction
		10th to 11th week

6.	Gene Prediction Promoter and Regulatory Element Prediction RNA Structure Prediction Genome Mapping, Assembly, and Comparison	**12th to 14th week**
7.	Bioinformatics in functional genomics, Primer designing and e-PCR, Marker databases and its utility Assembling large data sets in genomics and proteomics Computational analysis of large data sets, building networks Next generation sequencing analysis (NGS)	

8.	Practicals using CellDesigner and Gepasi/Copasi,
	1. Getting to Know CellDesigner
	  • Starting the program
	  • Navigation
	2. Creating a new Model
	  • Species
	  • Add a Protein on the Canvas
	  • Add Protein Residues
	  • Change the Residue/Region Status
	  • Create Reaction
	  • Tidy up your diagram layout
	  • Export Images / Print Images
	  • Customizing Properties
	  • Add Notes (e.g. literature references) and MIRIAM to Proteins/Reactions
	  • Refer to the databases
	3. Running the simulation
	  • Set the Kinetic Laws / Parameters
		15th to 17th week

	• Set the values of the Species • Using Control Panel for simulation 4. Import / Export SBML file 5. Conducting knock-out, knock-down prediction 6. Practical's using Metexplore/Cell Designer • Constraint based modeling - Flux balance analysis • Analysis of Topological properties of network- choke point analysis 7. Cytoscape based practicals • Topological properties of biochemical networks	
9.	Principal component analysis, ANOVA; AMOVA and different clustering methods;Gene Prediction algorithms and Phylogeny algorithms; Basics of R statistical package, Case study and analysis of any DNA/Protein sequence using existing tools, Entrepreneurship development in the field of bioinformatics : Gene to genome	**18th&19th week**
10.	Preparation of project proposal	**19th to 20th week**
11.	Report writing and examination.	**1st to 24th week**

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Course No. : READY-BIF-473
Course Title : Drug designing and pharmacogenomics
Credits : 0+20
Semester : VII

Sr. No.	Activities	Week(s)
1.	Orientation,Market survey and industrial potential of bioinformatics Introduction to operating system, Introduction to bioinformatics and the internet, • Internet Basics • Connecting to the Internet • Electronic Mail • File Transfer Protocol • The World Wide Web Overview of Bioinformatics resources on the web. Example: NCBI/EBI/EXPASY etc., Biological databases retrieval systems • ENTREZ • SRS	**1st and 2nd week**
2.	Pharmacogenomics Chemoinformatics • Chemical Structure representation: 1D, 2D and 3D structures • Molecular file formats (SMILES, WLN, SDF, MOL,PDB etc) • Compound library formatting and filtering (Physicochemical and substructure filters) Pharmacophore modelling • Pharmocophore: Definition and classes (HBA, HBD, Aromatic etc.) • Identification of pharmacophore features	**3rd to 5th week**
3.	Molecular Docking Docking Studies • Approaches in Target identification • Methods of Active site analysis • Ligand preparation and conformational analysis • Rigid and flexible docking • Structure based design of lead compounds • Library docking • Molecular vizualition of docked complexes • Interaction analysis Preparing Publication quality molecular graphics and illustration	**6th to 8th week**
4.	Molecular Dynamics (MD) • Concept of Molecular dynamics MD using NAMD Basic steps in preparing MD system (Generating PDB+PSF pair, Solvation, Ionization, creating and editing configuration files and	**9th to 12th week**

	other required scripts in MD system preparation) Conventional Molecular Dynamics (Energy Minimization, Heating, Equilibration, Production)	
5.	Trajectory Analysis: RMSD, RMSF, SASA, hydrogen bonding analysis, distance based analysis etc. preparing Movie for trajectories MD using GROMACS • Generate Topology (pdb2gmx commands) • Define box and solvate (editconf and solvate commands) Add ions (grompp, genion commands)	**13th to 15th week**
6.	Energy Minimization, Heating, Equilibration, Production and Trajectory Analysis: Same as NAMD Parametrizing novel residues and using it in MD (ParamChem, swissparam, prodrgetc)	**16th week**
7.	Free Energy calculations using NAMD/Gromacs: Linear interaction energy (LIE) method/ Theromdynamic integration method/ Alchemical method for estimating free energies for calculation of Free energy of Protein Ligand System (any one of these) Case study and analysis of known drug using Docking and/or MD Entrepreneurship development in the field of bioinformatics : Drug designing and Pharmacogenomics	**17th to 19th week**
8.	Preparation of project proposal	**19th to 20th week**
9.	Report writing and examination.	**1st to 24th week**

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Course No. : READY-BIF-474
Course Title : AgriSciences utility tool designing
Credits : 0+20
Semester : VII

Sr. No.	Activities	Week(s)
1.	Orientation,Market survey and industrial potential of bioinformatics Introduction to operating system, Introduction to bioinformatics and the internet, • Internet Basics • Connecting to the Internet • Electronic Mail • File Transfer Protocol • The World Wide Web Overview of Bioinformatics resources on the web. Example: NCBI/EBI/EXPASY etc., Biological databases retrieval systems • ENTREZ • SRS	**1st and 2nd week**
2.	Programming in C language Basics of C • History, constant, variables and identifiers, character set, logical and relational operators, data input and output concepts; • Decision making: if statement, if else statement, • for loop, while loop and do-while loop; • Arrays and functions, Structures, Pointers; • Programs related to arithmetic operations, arrays and file handling in C. Writing C programs for Bioinformatics applications • Determining the base composition in a nucleic acid sequence and amino acid composition in a protein sequence. • Generating the complimentary sequence of a DNA sequence • Pattern search algorithms • Search for a specific oligonucleotide pattern (eg. GAACATCC) in a given DNA sequence. • Find the position where a specific sequence say "GGTCCCGAC" will hybridize a given DNA sequence. • Find the restriction enzyme cleavage sites eg. where PVUZ, ECORI etc. will cut the DNA. • Locate palindromic sequence stretches in a DNA sequence. • Count the number of Open Reading frames (ORF's) in a DNA sequence. • Calculate the codon usage in a nucleic acid sequence. • Translate a DNA sequence into protein sequence in the forward and reverse frames.	**3rd to 10th week**

3.	Programming in Scripting Language (Perl) PERL-Language: Introduction, variables, arrays, string, hash, subroutines, file handling, conditional blocks, loops string operators and manipulators, pattern matching and regular expressions in PERL; Sequence handling in PERL demonstrating string, array and hash. Bioinformatics Applications in Perl. Write scripts of regular bioinformatics tasks 1. Programs using simple scalar and array variables • Transcribe DNA sequence to RNA • Concatenate sequences • Make reverse complement of sequence • Reverse transcribe RNA to DNA sequence 2. Programs based on conditional statements and loops • Search motifs in DNA or protein • Counting nucleotides from given DNA and RNA sequences • Reporting percentage of hydrophobic amino acid in given protein • Write perl script to report GC content of sequence • Search a motif in DNA and Protein sequence using regular expression and print it on screen (use special variables '$&' if required) • Focus using following PERL features for above mentioned programs (1) Open and unless calls (2) do-until loop (3) foreach loop (4) Perl built in functions like Split, Pop, Shift etc. 3. Programs based on subroutines • Writing a subroutine and calling it. Scoping a subroutine. Passing arguements to subroutine. Using Pass by value and Pass by reference. • Programs demonstrating Perl Debuggers like starting a debugger, setting breakpoints. Usage of 'use warnings' and 'use strict' utilities. 4. Programs based on concept of randomization • Write a program to simulate DNA mutation • Write programs calculating percent identity between pairs of random DNA sequence 5. Introduction to hash datatype • Write a program to manage Genetic code and redundancy in genetic code • Write program that translate DNA into protein • Write a program that Read FASTA file and extract the sequence data • Read DNA sequence from FASTA file, translate to protein and report the formatted output • Working with reading frames.Example: writing progtams that translate DNA in all six reading frames 6. Working with Restriction Maps and regular expressions	**11th to 16thweek**

	• Program for parsing REBASE datafile and creating a subroutine • Making restriction map from user input on names of restriction enzymes 7. Working with GenBank files • Program for separating Annotation from sequences from GenBankflatfile • Programs for parsing annotation using arrays • Program for parsing FEATURE table data 8. Working with PDB files • Program to extract sequence from PDB file • Program that extract secondary structure information from PDB file. Example HELIX, SHEET, TURN record types of PDB file 9. Working with BLAST output • Parsing BLAST output. Example : extract annotation and alignment Using BIOPERL module	
4.	Creation of web page(s)- HTML Creation of a tool based upon simple biological processes Entrepreneurship development scope in the field of bioinformatics : AgriSciences utility Tool Designing	**17th to 19th week**
5.	Preparation of project proposal	**19th to 20th week**
6.	Report writing and examination.	**1st to 24th week**

Evaluation Criteria:

Activity within each Module	**Marks Distribution (%)**
Attendance	10
Mid-term	25
Practical Assignments	15
Final Exam for Practical Skill Assessment	40
Oral Examination	10
Total	**100**

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SEMESTER-VIII

Semester VIII		
Course No.	**Course Title**	**Credit hours**
READY-482	Student READY- Project Formulation, Execution and Presentation	0+10
READY-483	Student READY- Entrepreneurial Development in Biotechnology (On-campus/Off Campus)	0+10
Total		**0+20 =20**

Course No : **READY-482** Course Title : **Student READY - Project Formulation, Execution and Presentation**

Credits : **10(0+10)** Semester : **VIII**

Evaluation Criteria:

Parameter	**Marks Distribution (%)**
Project Formulation and Implementation	20
Work Performance	30
Regularity, General Conduct and Discipline	10
Initiative and Creativity	10
Final Presentation	15
Final Project Report	15
Total:	**100**

Course No	: **READY-483**	Course Title	: **Student READY-Entrepreneurial Development in Biotechnology (On campus/Off Campus)**
Credits	: **10 (0+10)**	Semester	: **VIII**

Syllabus:

Micropropagation; DNA fingerprinting; Genetic purity for maintenance breeding; Marker assisted selection; Haploid production; Database Management skills; Molecular Diagnostics; Recombinant protein production; Animal cell culture and maintenance; Fermentation, Biopharma production; Bioprocess enrichment; Bioremediation; Biofules, etc.

Evaluation Criteria:

Parameter	**Marks Distribution (%)**
Project Planning, Writing and Presentation	20
Regularity	10
Monthly Assessment	10
Output Delivery	15
Technical Skill Development	15
Entrepreneurial and Business Networking Skills	10
Report Writing	10
Final Presentation	10
Total	**100**