B.Sc.Biocomputing

Curriculum and Syllabus

Regulations 2021

(Based on Choice Based Credit System (CBCS)

and

Learning Outcomes based Curriculum Framework (LOCF))

Effective from the Academic year

2021-2022

Department of Bioinformatics

School of Life Sciences

VISION:

The Vision of Department of Bioinformatics is to provide the best education and training for students to prepare them for professional research careers in biological sciences as well as software industry. The Department plans to produce eminent scientists in the field of Bioinformatics.

MISSION:

To facilitate, conduct and organize research work by teams comprised of core groups leading to inventions and to cooperate to meet this end and also to work acquiring the patents of such inventions.

With its strong commitment to education, the department expects its graduates to have acquired solid subject knowledge and laboratory skills in the field of Bioinformatics upon their graduation.

In addition, with our innovative curriculum, the graduates are also expected to possess all-round competence in IT technology, information gathering and synthesis, critical thinking, efficient oral and written communication, and teamwork spirit and capability so that their career prospects go beyond the field of life sciences.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO-1: An ability to develop the practical knowledge related to Life science, Computer science and information technology in an interdisciplinary manner for providing innovative ideas to solve the biological problems and promote the research globally.

PEO-2: The extraordinary skills to analyze the scientific big data, create a novel objective, implement methodology to derive a key finding and apply this knowledge for welfare of society. Students should be able to develop as computational expert and follow the ethical rules on areas related to Life sciences and Bioinformatics.

PEO-3: Develop as a resource person with interdisciplinary knowledge who can finish the advance tasks related to biology and computer science in a challenging scientific environment.

PEO-4: Update knowledge on programming and database development on biological data and information and help the scientific research community.

PEO-5: U.G. program and its knowledge give confidence to the students and shine in the booming bioinformatics careers related to academics, research and development and industry.

PROGRAM OUTCOME (PO)

PO-1: Graduates will be able to develop, analyse, solve and troubleshoot biological problems in implementation of bioinformatics protocols and Information technology for the successful career.

PO-2: Environment sustainability and Ethics: Graduates will get adequate knowledge to use information and implement the evolving technology in Bioinformatics to find the solutions for environmental protection and remediation.

PO-3: Modern tool usage and communication: Graduates will effectively be able to manage the scientific task by utilizing the big data resources and retrieve and solve the biological problems effectively.

PO-4: Analysis of biological data: Graduates will be well versed in handling the biological data from the different database available online and the Maintenance of biological data by implementing using computer programming

PO-5: Graduates will acquire self- reliance in handling Biocomputing techniques and able to interpret, analyze the biological data and execute experimental techniques independently.

PROGRAMME SPECIFIC OUTCOME (PSO)

The B.Sc. program (Biocomputing) at VISTAS has documented measurable outcomes that are based on the needs of the programme's stakeholders. The programme specific outcomes that the department presently adapts to future graduates are as follows:

PSO-1: The primary goal is to make the students understand biological concepts and to acquire knowledge on the basics of computer and the principles of programming languages.

PSO-2: To understand the levels of programming language and its application in various fields of biology and to obtain the knowledge on basics in designing the webpage for a database as well as online tools and softwares.

PSO-3: To utilize the bioinformatics skill to venture in development of fields like pharmaceutical and biotechnological concerns.

Department of Bioinformatics

Board of Studies Members

B.Sc. BIOCOMPUTING

S.No	Name with Destination	Role
1.	Dr. Radha Mahendran, Professor & Head, Department of Bioinformatics, VISTAS, Chennai	Chairman
2.	Dr.J. Suganya Assistant Professor, Department of / Bioinformatics, VISTAS, Chennai	Internal Member
3.	Dr.M.N Ponnusamy, Emeritus Professor, Dept of Crystallography and Biophysics, University of Madras, Guindy, Chennai	Academic Expert
4.	Dr.J.Senthil Kumar, Assistant Professor, Dept of Computer Science, Loganatha Narayanasamy Government College (Autonomous), Ponneri Chennai.	Academic Expert
5.	Dr.M.Menaga, Managing Director, BioNeem Tech, Sipcot IT park, Siruseri Chennai	Industrial Expert
6.	Mr. Aganl Vincent Paul	Alumni
7.	Ms. Kanmani.R	Alumni
8.	Ms. Abinaya Gayathri E	Student

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

(VISTAS)

CHENNAI - 600 117

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM/LOCF

Common to B.sc Full-Time Programmes

DEGREE OF BIOCOMPUTING

1. DURATION OF THE PROGRAMME:

1.1. Three years (six semesters)

1.2. Each academic year shall be divided into two semesters. The odd semesters shall consist of the period from July to November of each year and the even semesters from January to May of each year.

1.3 There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION:

2.1. Candidates for admission to the first year of the degree of Bachelor of Biocomputing shall be required to pass in +2, HSC or equivalent with Biological Science or computing Science as one of the subjects along with Maths/Pure Science/Computer Applications/Life Sciences/Medical Science/Basic Science and Agriculture can be accepted as equivalent thereof by the syndicate of VISTAS.

3. MEDIUM OF INSTRUCTION:

The medium of instruction for all UG programmes is English excluding Tamil, Hindi and French Language Papers

4. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE:

A Candidate shall be eligible for the award of Degree only if he/she has undergone the prescribed course of study in VISTAS for a period of not less than three academic years

and passed the examinations of all the prescribed courses of Six Semesters earning a minimum of 140 credits as per the distribution given in for Part I, II, III and also fulfilled such other conditions as have been prescribed there of.

5. COURSE:

Each course / subject is to be designed under lectures / tutorials / laboratory or field work / seminar / practical training / Assignments / Term paper or Report writing etc., to meet effective teaching and learning needs.

6. COURSE OF STUDY AND CREDITS:

The Course Components and Credit Distribution shall consist Part I, II & III:

The UG programme consists of a number of courses. The term 'course' is applied to indicate a logical part of the subject matter of the programme and is invariably equivalent to the subject matter of a 'paper' in the conventional sense. The following are the various categories of courses suggested for the UG programmes.

Part I – Language Courses (LC) (any one of Tamil, Hindi, French or special subject designed in lieu of the above).

Part II – English Language courses (ELC) or special subject designed in lieu of.

The Language courses and English Language Courses are 4 each / 2 each in number and the LC and ELC are meant to develop the students communicative skill at the UG level.

Part III – Core courses i.e. major courses that compulsorily required for each of the programme of study (CC), Ability Enhancement Course (AHC), Discipline Specific Elective Course (DSE) and Skill Enhancement Course (SEC).

For each course, credit is assigned based on the following:

Contact hour per week		CREDITS
1 Lecture hour	-	1 Credit
1 Tutorial hour	-	1 Credit
2 Practical hours	-	1 Credit

(Laboratory / Seminar / Project Work / etc.)

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER:

7.1. **Eligibility:** Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed therefor by the Board of Management from time to time.

7.2. **Attendance:** All Students must earn 75% and above of attendance for appearing for the University Examination. (Theory/Practical)

7.3. **Condonation of shortage of attendance:** If a Student fails to earn the minimum attendance (Percentage stipulated), the HODs shall condone the shortage of attendance on medical grounds up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after paying the prescribed fee towards the condonation of shortage of attendance. The students with attendance of less than 65 and more than 50% shall be condoned by VC on the recommendation of HODs on genuine grounds, will be permitted to appear for the regular examination on payment of the prescribed condonation fee.

7.4. **Detained students for want of attendance:**

Students who have earned less than 50% of attendance shall be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the University from time to time.

7.5. **Transfer of Students and Credits:**

The strength of the credits system is that it permits inter Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities.

7.5.1. Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature, provided, there is a vacancy in the respective program of Study in the Institution where the transfer is requested.

7.5.2. The marks obtained in the courses will be converted into appropriate grades as per the University norms.

7.5.3. The transfer students are not eligible for Ranking, Prizes and Medals.

7.5.4. Students who want to go to foreign Universities upto two semesters or Project Work with the prior approval of the Departmental / University Committee are allowed to transfer of their credits. Marks obtain in the courses will be converted into Grades as per the University norms and the students are eligible to get CGPA and Classification.

8. EXAMINATION AND EVALUATION

8.1. **EXAMINATION:**

i) There shall be examinations at the end of each semester, for odd semesters in the month of October / November, for even semesters in April / May. A candidate who does not pass the examination in any course(s) shall be permitted to appear in such failed courses in the subsequent examinations to be held in October / November or April / May.

ii) A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulations prescribed OR belated joining OR on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the programme.

iii) The results of all the examinations will be published through University Website. In the case of passed out candidates, their arrear results, will be published through University Website.

8.2 **To Register for all subjects**:

Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination, except for the shortage of attendance programs. For this purpose, Students shall register for all the

arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

8.3. Marks for Continuous Internal Assessment (CIA) Examinations and End Semester Examinations (ESE) for PART I, II, III

8.3.1 There shall be no passing minimum for Continuous Internal Assessment (CIA) Examinations.

8.3.2 For End Semester examination, passing minimum shall be 40% (Forty Percentage) of the maximum marks prescribed for the Course/Practical/Project and Viva-Voce.

8.3.3 In the aggregate (CIA and ESE) the passing minimum shall be of 40%.

8.3.4. He / She shall be declared to have passed the whole examination, if he/she passes in all the courses wherever prescribed in the curriculum by earning 140 CREDITS in PartI, II, III.

9. Question Paper Pattern for End Semester Examination

SECTION – A	10 questions	10 X 2 = 20 Marks
SECTION – B	5 questions either or pattern	X 16 = 80 Marks
		Total 100 Marks

10. SUPPLEMENTARY EXAMINATION: Supplementary Examinations are conducted for the students who appeared in the final semester examinations. Eligible criteria for appearing in the Supplementary Examinations are as follows:

10.1. Eligibility: A Student who is having a maximum of two arrear papers is eligible to appear for the Supplementary Examination.

10.2. Non-eligibility for those completed the program: Students who have completed their Program duration but having arrears are not eligible to appear for Supplementary Examinations.

11. RETOTALLING, REVALUATION AND PHOTOCOPY OF THE ANSWER SCRIPTS:

11.1. Re-totaling: All UG Students who appeared for their Semester Examinations are eligible for applying for re-totaling of their answer scripts.

11.2. Revaluation: All current batch Students who have appeared for their Semester Examinations are eligible for Revaluation of their answer scripts. Passed out candidates are not eligible for Revaluation.

11.3. Photocopy of the answer scripts: Students who have applied for revaluation can download their answer scripts from the University Website after fifteen days from the date of publication of the results.

12. The examination and evaluation for MOOCs will be as per the requirements of the regulatory bodies and will be specified at the beginning of the Semester and notified by the university NPTEL-SWAYAM Coordinator (SPOC).

13. CLASSIFICATION OF SUCCESSFUL STUDENTS

13.1. PART I TAMIL / OTHER LANGUAGES; PART II ENGLISH AND PART III CORE SUBJECTS, ALLIED, ELECTIVES COURSES AND PROJECT: Successful Students passing the Examinations for the Part I, Part II and Part III courses and securing the marks

a) CGPA 9.00 to 10.00 shall be declared to have passed the examination in **First class with Outstanding**.

b) CGPA 7.50 to 8.99 shall be declared to have passed the examination in **First class with distinction**.

c) CGPA 6.00 to 7.49 shall be declared to have passed the examination in **First Class**.

d) CGPA 5.00 to 5.99 in the aggregate shall be declared to have passed the examination in the **SECOND** Class.

e) CGPA 4.00 to 4.99 shall be declared to have passed the examination in the **THIRD** Class.

14. MARKS AND GRADES:

The following table shows the marks, grade points, letter grades and classification to indicate the performance of the Student:

14.1. Computation of Grade Point Average (GPA) in a Semester, Cumulative Grade Point Average (CGPA) and Classification

GPA for a Semester: = ∑iCiGi ÷ ∑iCi That is, GPA is the sum of the multiplication of grade points by the credits of the courses divided by the sum of the credits of the courses in a semester.

Where, Ci= Credits earned for course i in any semester,

Gi = Grade Points obtained for course i in any semester

n = Semester in which such courses were credited.

CGPA for the entire programme: = ∑n∑iCniGni ÷∑n∑iCni That is, CGPA is the sum of the multiplication of grade points by the credits of the entire programme divided by the sum of the credits of the courses of the entire programme

The Students who have passed in the first appearance and within the prescribed semester of the UG Programme (Major, Allied and Elective courses only) are eligible.

Grade Conversion Table – UG			
Range of Marks	**Grade Points**	**Letter Grade**	**Description**
90 – 100	10	O	Outstanding
82 – 89	9	A+	Excellent
75 – 81	8	A	Very Good
67 – 74	7	B+	Good
60 – 66	6	B	Above Average
50 – 59	5	C	Average
40 – 49	4	D	Minimum for pass
0 – 39	0	RA	Reappear
		AAA	Absent

14.2. Letter Grade and Class CGPA

Overall Performance – UG		
CGPA	**GRADE**	**CLASS**
4.00 - 4.99	D	Third Class
5.00 - 5.99	C	Second Class
6.00 - 6.69	B	First Class
6.70 - 7.49	B+	
7.50 - 8.19	A	First Class with Distinction*
8.20 - 8.99	A+	
9.00 - 10.00	O	First Class - Outstanding*

15. RANKING

- Students who pass all the examinations prescribed for the Program in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking / Distinction.
- In the case of Students who pass all the examinations prescribed for the Program with a break in the First Appearance are only eligible for Classification.
- Students qualifying during the extended period shall not be eligible for RANKING.

16. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMS TO QUALIFY FOR A DEGREE

16.1. A Student who for whatever reasons is not able to complete the programs within the normal period (N) or the Minimum duration prescribed for the programme, may be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree. (Time Span = N + 2 years for the completion of programme)

16.2. In exceptional cases like major accidents and child birth an extension of one year considered beyond maximum span of time (Time Span= N + 2 + 1 years for the completion of programme).

17. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Academic Council with the approval of the Board of Management.

Vels Institute of Science and Technology and Advanced studies (VISTAS)

B.Sc Biocomputing

Courses of Study and Scheme of Assessment (Minimum Credits to be earned: 140)

B.Sc Biocomputing Components

Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	Total Credits
Core Courses & Languages	16+6	16+6	14+6	15+6	3	-	88
Ability Enhancement Courses (AEC)	2	-	2	-	-	-	4
Discipline Specific Elective (DSE) & Generic Elective(GEC)	-	-	-	-	17	19	36
Skill enhancement Course(SEC)	-	2	2	3	2	3	12
Total Credits	**24**	**24**	**24**	**24**	**22**	**22**	**140**

B.Sc. BIOCOMPUTING COURSE

COURSES OF STUDY AND SCHEME OF ASSESSMENT

(MINIMUM CREDITS TO BE EARNED: 140)

B.Sc Biocomputing Course Components

UGC DOCUMENT ON LOCF BIOCOMPUTING

Learning Outcomes based Curriculum Framework

(LOCF)

for

B.Sc BIOCOMPUTING

Undergraduate Programme

2021

Table of Contents

1. Introduction:

In the increasingly globalized society, it is important that the younger generation especially the students are equipped with knowledge, skills, mindsets and behaviors which may enable them to perform their duties in a manner so that they become important contributors to the development of the society. This will also help them to fully utilize their educational training for earning a decent living so that the overall standard of their families and surroundings improve leading to development of welfare human societies. To achieve this goal, it is imperative that their educational training is improved such that it incorporates the use of newer technologies use of newer assessment tools for mid-course corrections to make sure that they become competitive individuals to shoulder newer social responsibilities and are capable of undertaking novel innovations in their areas of expertise. In the face of the developing knowledge society, they are well aware about the resources of self-development using on-line resources of learning which is going to be a major component of learning in the future. The learning should also be a continuous process so that the students are able to re-skill themselves so as to make themselves relevant to the changing needs of the society. In the face of this need, the educational curricula, teaching learning processes, training, assessment methods all need to be improved or even re-invented. The higher educational institutions (HEI) all over the globe are in the grip of this urgent task and India needs to keep pace with all these developments.

2. Learning Outcomes based approach to Curriculum Planning:

Learning Outcome based approach to curriculum planning (LOCF) is almost a paradigm shift in the whole gamut of higher education such that it is based on first and foremost identifying the outcomes of the learning required for a particular subject of study, and then planning all components of higher education so as to achieve these outcomes. The learning outcomes are the focal point of the reference to which all planning and evaluation of the end learning is compared and further modifications are made to fully optimize the education of the individuals in a particular subject. For the subject of Biocomputing the outcomes are defined in terms of the understanding and knowledge of the students in biology and computer programming language. The students required the practical skills to become competitive bioinformatician, so that they are able to play their role like software

development, bio-database design and maintenance, sequence assembly, proteomics, clinical pharmacologist, sequence analysis, and bio-analytics and how they may be able to fit the bill in the industry. The students are also trained in such a way that they develop critical thinking, appreciation of the issues and problems of computational biology. The curriculum developed and the teaching and the evaluation tasks are such that the students are able to apply their knowledge and training in computational biology helps to solve the problems in biological science as these exist or appear from time to time in the society. The curriculum envisions that the student, once graduate as specialists in a discipline, have an important role to play in the newer developments and innovations in the future in the subject for advancement of the discipline.

2.1 Nature and extent of the B.Sc. Programme:

The undergraduate programme in Biocomputing is the first level of college or university degree in the country as in several other parts of the world. After obtaining this degree, a Bioinformatician may enter into the job market or opt for undertaking further higher studies in the subject. After graduation the students may join industry, academia, public health and play their role as bioinformatician in a useful manner contributing their role in the development of the welfare society. Thus the undergraduate level degree in Biocomputing must prepare the students for all these objectives. Thus the LOCF curriculum developed has a very wide range covering all aspects of bioinformatics with reasonable depth of knowledge and skills so to as to diversify them in various specialties of the subject and play their role professionally as expected of them. It is also imperative that bioinformatician are evaluated in a manner appropriate to assess their proper development as bioinformatician. The current LOCF in Biocomputing has been designed in keeping all these important points in mind.

2.2 Aims of Bachelor's degree programme in BIOCOMPUTING:

In Biocomputing apart from getting a job in the IT sector, candidates with the right skill set and knowledge can apply to pharmaceutical companies, biomedical organizations, biotech research centres, agricultural companies and even NGOs that need bioinformaticians in India & abroad. Several Indian companies have already started offering good employment opportunities for Biocomputing candidates. A broad range of course will be studied to

establish a basic understanding and appreciation of the issues and problems of computational biology. The course includes an applied component, which gives an introduction to programming for biological data and use in a range of web-based Biocomputing utilities. Biocomputing is supposed to be an enigmatic field in areas like software development, bio-database design and maintenance, sequence assembly, proteomics, clinical pharmacologist, sequence analysis, and bio-analytics there is option to become an academician too after completing the studies. Job opportunities in this field are available with research institutions, and with pharmaceutical companies, chemical industries, agriculture and allied industries working to expand the realm of information.

3. Graduate Attributes in BIOCOMPUTING:

Bioinformatics provides central, globally accessible databases that enable scientists to submit search and analyse information, applicable to a variety of sectors. In Medical Field Biocomputing plays a major role in understanding the life processes in healthy and disease state ,Genetic disease, Pharmaceutical and biotech Industry, and to find (develop) new and better drugs, Gene based or structure based drug design, In Agricultural applications Biocomputing skills can apply in finding Disease, drought resistance plants, Higher yield crops.

Graduates in Bioinformatics from premier institutes can be a part of leading IT firms. Many software companies recruit bioinformatician from time to time. Current biological and medical labs use methods that produce extremely large data sets, which cannot be analysed by hand - for instance sequencing human genomes. Thus, modern biological and medical research and development cannot be done without bioinformatics. Students completing a degree in Bioinformatics from premier institutes can be a part of leading IT firms. Many software companies recruit bio-information from time to time. Current biological and medical labs use methods that produce extremely large data sets, which cannot be analyzed by hand - for instance sequencing human genomes. Thus, modern biological and medical research and development cannot be done without bioinformatics.

4. Qualification Descriptors:

The following may serve as the important qualification descriptors for a UG degree in Biocomputing:

- The primary goal is to make the students to understand biological concepts.
- Acquire knowledge on the basics of computer and the principles of programming languages.
- To understand the levels of programming language and its application in various fields of biology.
- Ability to handle the biological data from the different database available online at present.
- Awareness in designing the webpage for a database as well as online tools and soft wares.
- Knowledge on the application of computer techniques in the field of chemistry, plants, microbes, etc.
- Generation of new knowledge through small research projects.
- Ability to participate in team work through small bioinformatics projects.
- To implement the computer programming knowledge in the design and maintenance of database to utilize the complex form of biological data in a simpler format.
- Utilization of the bioinformatics skill to venture in development of fields like pharmaceutical and biotechnological concerns.

5. Programme Learning Outcomes of B.Sc. Biocomputing course:

A candidate who is conferred an UG degree i.e. B.Sc. degree in Biocomputing needs to have acquired/developed following competencies during the programme of the study:

- An ability to develop the practical knowledge related to Life science, Computer science and information technology in an interdisciplinary manner for providing innovative ideas to solve the biological problems and promote the research globally.
- The extraordinary skills to analyse the scientific big data, create a novel objective, implement methodology to derive a key finding and apply this knowledge for welfare

of society. Students should be able to develop as computational expert and follow the ethical rules on areas related to Life sciences and Bioinformatics.

- Develop as a resource person with interdisciplinary knowledge who can finish the advance tasks related to biology and computer science in a challenging scientific environment.
- Update knowledge on programming and database development on biological data and information and help the scientific research community.
- U.G. program and its knowledge give confidence to the students and shine in the booming bioinformatics careers related to academics, research and development and industry.

6. Teaching learning processes:

The teaching learning processes incorporate a variety of modes and a regular use of ICT. These are listed below:

- **Classroom Teaching** for topics which are intensely information-based. This a very regular feature of all the courses in Biocomputing
- **Power Point slides** for topics which involve information related to bioinformatics databases and tools. Use of Power Point presentations are also made whenever the lectures are to be summarized in a crisp and pointwise manner to highlight salient / important conclusions from the topics.
- **Classroom Discussions** are a regular feature while teaching. The students are drawn into impromptu discussions by the teacher during the process of teaching.
- **Video Displaying**, both real-time and animations are used for topics which require 3 Dimensional viewing of the biological actions to drive the point home. These have proved to be very helpful while teaching concepts of central dogma of life like replication, transcription and translation. These are also used to convey complexities of receptor-ligand interactions, protein-protein interaction, homology modelling and virtual screening.
- **Laboratory Practical** are an integral part of every course included in UG programme in Biocomputing. It is also a daily affair for UG students of Biocomputing.

- **Problem Solving** is encouraged during the laboratory work.
- **Group Activity** as well as discussions with the laboratory supervisor/ among the students themselves/ Mentor is also encouraged during laboratory work.
- **Project Work** is included in the programme where students work individually or in groups to design experiments to solve/answer a problem suggested by the Mentor or identified by the students in consultation with the Mentor. The students are mentored regularly during the duration the project is in progress.
- **Presentations by the Students** are regularly done. The students are mentored in presentation of data, interpretation of data and articulation with the students/teachers/Research Scholars during their presentation.
- **Presentation by Experts** in different specialties of Bioinformatics are arranged to broaden the horizons of the students.
- **Interaction with Experts** is also encouraged during/after presentations to satisfy/ignite curiosities of the students related to developments in the different areas of Bioinformatics
- **Visit to Industries/Laboratories** related to Bioinformatics like big data analysis, cloud bases platform, scientific support etc. are organized to acquaint the students with real-life working environments of the professional bioinformatician with a view to broaden their perspective of the subject of Bioinformatics

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Programme: B.Sc. BIOCOMPUTING

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 1								
LANG	Tamil I/ Hindi I/ French I	3	0	0	3	40	60	100
ENG	English I	3	0	0	3	40	60	100
CORE1	Basic of Computer, Algorithm and Statistics	3	1	0	4	40	60	100
CORE2	Basic of Bioinformatics	3	1	0	4	40	60	100
CORE3	Cell Biology and Biomolecules	4	0	0	4	40	60	100
CORE	Basic Concepts and Algorithm in Computer -Practical 1	0	0	4	2	40	60	100
CORE	Basic concept of Bioinformatics Practical 2	0	0	4	2	40	60	100
AECC	Communication Skills	1	0	2	2	40	60	100
SEC	Orientation/Induction programme / Life skills	-	-	-	-	-	-	-
		17	**2**	**10**	**24**			
SEMESTER 2								
LANG	Tamil II / Hindi II / French II	3	0	0	3	40	60	100
ENG	English II	3	0	0	3	40	60	100
CORE4	Programming in C	3	1	0	4	40	60	100
CORE5	Biological databases and sequence analysis	3	1	0	4	40	60	100
CORE6	Applied Bioinformatics	4	0	0	4	40	60	100
CORE	Programming in C- Practical 3	0	0	4	2	40	60	100
CORE	Biological databases and sequence analysis - Practical 4	0	0	4	2	40	60	100
SEC	Soft Skills - I / Sector Skill Council Course	2	0	0	2	40	60	100
SEC	NSS / NCC / Swachh Bharat / Inplant Training	-	-	-	-	-	-	-
		18	**2**	**8**	**24**			

CA- Continuous Assessment SEE- Semester End Examination

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Programme: B.Sc. BIOCOMPUTING

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 3								
LANG	Tamil III / Hindi III / French III	3	0	0	3	40	60	100
ENG	English – III	3	0	0	3	40	60	100
CORE7	Programming in C++	4	0	0	4	40	60	100
CORE8	Genomics and Proteomics	3	0	2	4	40	60	100
CORE9	Enzymes and Metabolism	4	0	0	4	40	60	100
AECC	Environmental Studies	2	0	0	2	40	60	100
CORE	Programming in C++ - Practical 5	0	0	4	2	40	60	100
SEC	Soft Skills - II / Sector Skill Council Course	2	0	0	2	40	60	100
SEC	Swayam / NPTEL / Value Added Course	-	-	-	-	-	-	-
		21	**0**	**6**	**24**			
SEMESTER 4								
LANG	Tamil IV / Hindi IV/ French IV	3	0	0	3	40	60	100
ENG	English IV	3	0	0	3	40	60	100
CORE10	Programming in JAVA	4	0	0	4	40	60	100
CORE11	Plant Bioinformatics	3	0	2	4	40	60	100
CORE12	Medical Coding and Transcription	3	0	0	3	40	60	100
CORE	Programming in JAVA - Practical 6	0	0	4	2	40	60	100
CORE	Plant Bioinformatics - Practical 7	0	0	4	2	40	60	100
SEC	Soft Skills III / Sector Skill Council Course	2	0	0	2	40	60	100
SEC	Internship / Capability Enhancement Programme	0	0	2	1	-	-	-
		18	**0**	**12**	**24**			

CA- Continuous Assessment SEE- Semester End Examination

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Programme: B.Sc. BIOCOMPUTING

Code No.	Course	Hour / Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 5								
CORE	Perl for Bioinformatics	3	0	0	3	40	60	100
DSE	Python for Bioinformatics	3	0	0	3	40	60	100
DSE	Introduction to *Insilico* Drug Designing	3	0	2	4	40	60	100
DSE	Structural Bioinformatics	3	0	0	3	40	60	100
DSE	Operating systems	3	0	0	3	40	60	100
DSE	Perl and Python – Practical 8	0	0	4	2	40	60	100
DSE	Introduction to *Insilico* Drug Designing – Practical 9	0	0	4	2	40	60	100
SEC	Internship / Mini Project / Sector Skill Council Course	0	0	4	2	40	60	100
SEC	Skill Enhancement Training / Student Club Activities	-	-	-	-	-	-	-
		15	0	14	22			
SEMESTER 6								
DSE	Genome Sequencing Technology	4	0	0	4	40	60	100
DSE	Clinical Pharmacokinetics	3	1	0	4	0	60	100
DSE	R- Programing Language	3	0	2	4	40	60	100
DSE	Microarray and its Techniques	3	0	0	3	40	60	100
SEC	Entrepreneurship Development	2	0	0	2	40	60	100
DE	Project Work	0	0	8	4	40	60	100
SEC	Technical Seminar / Innovation Council / Start up Initiative	0	0	2	1	40	60	100
		15	1	12	22			

CA- Continuous Assessment SEE- Semester End Examination

List of DSE/AECC/SEC courses is specified after the curriculum:

List of DSE Course:

- Python for Bioinformatics
- Introduction to Insilico Drug Designing
- Structural Bioinformatics
- Operating systems
- Perl and Python – Practical 8
- Introduction to Insilico Drug Designing – Practical 9
- Genome Sequencing Technology
- Clinical Pharmacokinetics
- R- Programing Language
- Microarray and its Techniques

List of DSE Course:

- Project Work

List of AECC Course:

- Communication Skills
- Environmental Studies

List of SEC Course:

- Orientation/Induction programme / Life skills
- NSS / NCC / Swachh Bharat / Inplant Training
- Entrepreneurship Development
- Internship / Mini Project / Sector Skill Council Course
- Technical Seminar / Innovation Council / Start up Initiative
- Soft Skills - I / Sector Skill Council Course
- Soft Skills - II / Sector Skill Council Course
- Soft Skills III / Sector Skill Council Course
- Swayam / NPTEL / Value Added Course

Syllabus Core Course

CORE 1 – Basic to Computer, Algorithm and Statistics 3104

Course Objectives: To gain a fundamental understanding of the power and limits of basic models of computation, and to gain comfort with associated proof techniques. This course is designed to provide the non- science/ mathematics/ engineering/ business student a intense foundational introduction to the fundamental concepts in statistics. After completing the course the student should be able to work basic problem and word problems in logic, set theory, counting methods, probability, and statistics.

UNIT I Introduction to Computers 10

History of computer - Computer Generations, Types of computer, Computer components – CPU – I/P Devices and O/P devices, Functionalities of a Computer, Advantages and disadvantages, Applications of computer. Memory and memory types RAM and RAM types, ROM and ROM types, Mother Board, Memory Units, Ports.

UNIT II Computer hardware and software 10

Hardware – Types – Working methods, Software – System software and application software (MS Word, Excel and PowerPoint), Operating system, Example of Operating System. Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Introduction to Internet, Working of Internet, Internet Services, Internet addressing, E-Mail Basics- Web Development Tools, Introduction TO HTML.

UNIT III Introduction of programming concepts 10

Introduction of programming concepts-Input, process and output-Programs and programming Languages-Tools Used in problem Solving - Representing the Programming logic Using Flowcharts and Algorithms-Problem Solving Using Flowcharts & Algorithm - Processes in a Flowchart - Representing the Programming logic Using Flowcharts-Problem Solving Using Flowcharts -Representing Decision and Repetition Processes in a Flowchart.

UNIT IV Programming logic using algorithm 15

Representing the Programming Logic Using Algorithm/Pseudocode-Problem Solving Using Pseudocode-Variables and Constants-Data Types-Using Operators-Conditional Execution - Understanding Iterations and Modular Programming-Implementation Iterative Processes-Modular Approach to programming-Dividing Programs into Modules-Types of modules - Working with Large Volumes of Data-Working with Arrays.

UNIT V Statistical analysis 15

Statistics: Classification- Quantitative, Geographical, Chronological.Tabulation, Frequency, Distribution, Diagrammatic Representation- Bar diagram, Percentage Bar Diagram, Pie Diagram, Pictogram, Graphical representation, Frequency curve, Cumulative Frequency, Ogive,LorenzCurve.Measures of Averages- Introduction, Arithmetic Mean, Weighted Arithmetic Mean, Formula for calculating AM in a frequency distribution, Properties of AM, Combined Mean (CM), Geometric Mean (GM), Harmonic Mean (HM), Median, Quartiles and Deciles, Mode, Merits and Demerits. Quartile Deviation, Its Merits and Demerits, Mean Deviation, Definition, Relative Measures, Merits and Demerits, Standard Deviation (SD), Formula for calculating SD, Merits and Demerits, Relative Measure, combined Mean and SD.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To Develop a fundamental understanding of the power and limits of basic models of computers.

CO-2: To Adapt the uses of Computer Hardware.

CO-3: To Demonstrate the knowledge in fundamental concepts in statistics.

CO-4: To Construct the graphical and diagrammatic representation of data.

CO-5: To solve the average term of data through the Measures of Averages.

Text Books:

1. Anita Goel, “Computer Fundamentals”, Pearson Education India, 2010.
2. P.R.Vittal, “Mathematical Statistics”, Margham Publication. 3rd Edition, 2012.

Reference Books:

1. SangheraKamaljeet, “Fundamentals of Computing”, Kendall Hunt Publishing Company. 2nd Edition, 2007.
2. AnuragSeetha, “Introduction To Computers And Information Technology”,Ram Prasad & Sons, McGraw Hill, 2011
3. S.K.Basandra, “Computers Today”, Galgotia Publications, 2006
4. Alexis Leon & Mathews Leon, “Fundamentals of Information Technology”, Vikas Publishing House, New Delhi, 2009.

CORE 2 - Basic of Bioinformatics 3104

Course Objective: This course will enable the students to understand the nature of biological data and need for biological databases and also to explore major biomolecular sequence databases (organization and contents); search and retrieve data from the databases using their respective search engines. To understand and appreciate the need and significance of sequence analysis and the bioinformatics approaches, algorithms for sequence analysis, the application of methods for analysis of the biomolecular sequence data.

Unit I Introduction to Bioinformatics 12

Bioinformatics , Nature and scope of Bioinformatics, Branches of Bioinformatics , Introduction to DNA and Protein sequencing, Future of Bioinformatics, Human Genome Project (HGP) , Bioinformatics Industry.

Unit II Bioinformatics databases 12

Bioinformatics databases - Nucleotide sequence databases, Primary nucleotide sequence databases, Secondary nucleotide sequence databases; Protein databases- UniProt, Protein Data Bank

Unit III Sequence Analysis 12

Sequence Analysis-Basic concepts, Alignment of pairs of sequence:- Homologous, Analogue, Orhtologous, paralogous, Xenologous (Need for sequence alignment, Local and Global alignment, Scoring matrices- PAM and BLOSUM matrices

Unit IV Pairwise Sequence alignments 12

Pairwise sequence alignments: BLAST, Multiple sequence alignments (MSA) BLAST:- Nucleotide BLAST, Protein BLAST, PSI-BLAST, Analysis of BLAST results, E Value, sensitivity and specificity of BLAST, FASTA, Structure analysis tools and softwares

Unit V Visualization 12

Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To develop a fundamental knowledge of Bioinformatics and its applications.

CO-2: To study biological data using bioinformatics databases.

CO-3: To analyse the sequence alignment of various sequences and its analogues.

CO-4: To evaluate the sensitivity and specificity of the sequence data.

CO-5: To visualize the anatomical position of the biological structure using softwares.

Text Book:

1. OrpitaBosu, SimminderkaurThukral. "Bioinformatics - Databases Tools and Algorithms", Oxford University Press, 2007.

Reference Books:

1. D. Higgins and W. Taylor. (Eds), "Bioinformatics: Sequences, Structures and databanks", Oxford University Press. Oxford, UK, 2008.
2. N.Gautham, "Bioinformatics",Narosa Publishing Company, New Delhi, 2006.
3. V.R.Srinivas, "Bioinformatics: Sequences and genomics analysis", Cold Spring Harbor Laboratory press, Cold Spring harbor, USA, 2005

CORE 3 - Cell Biology and Biomolecules 4004

Course Objective: This course covers basic properties of cells and cell organelles.It also examines properties of differentiated cell systems and tissues. The Principal aim of the course is to equip students with a basic knowledge of the structural and functional properties of cells and also understanding the biological principles, and the ability to make connections across different levels of biological organization, from molecules to cells, to whole organisms, populations and ecosystems.

UNIT I Cell Biology 10

Cell as a basic unit of life. Cell organization of prokaryotic and eukaryotic cells. Structural and functional capitalization of cell:– Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus.

UNIT II Cell Cycle 10

Cell Cycle: Mitosis - Phases of mitosis (Early Prophase, Later Prophase, Metaphase, Anaphase, Telophase), Cytokinesis. Meiosis - Phases of meiosis, Meiosis I (Prophase I, Metaphase I, Anaphase I, Telophase I), Meiosis II (Prophase II, Metaphase II, Anaphase I, Telophase II). Replication, Transcription, Translation

UNIT III Mutation and Chromosomal 15

Mutation – Types of mutations, types of mutagenic agents and their molecular mechanism; DNA repair; Chromosomal types and structure; Mechanism by which genome undergoes changes, recombination, mutation, inversion, duplication, and transposition

UNIT IV Molecules of Life: Protein and Amino Acids 13

Protein: Definition, properties, occurrence and biological importance of protein, Different levels of organization-Primary, secondary tertiary and Quaternary structures. Amino acids: Definition, composition, structure, properties, stability and biological importance of Amino Acid, Formation Peptide bond, Identification of C and N terminal residues of amino acids

UNIT V Molecules of Life: Carbohydrates and Nucleotides 12

Introduction to carbohydrates-Monosaccharides and their derivatives, Disaccharides,

Polysaccharides. Nucleic acids – Purines, pyrimidines, Nucleosides and Nucleotides. Types of Nucleoside – DNA (deoxyribonucleic acid), RNA (Ribonucleic acid)

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To know the values of cells and cell organelles, tissue and its types.

CO-2: To Study about the cell cycle and different phases of mitosis and meiosis.

CO-3: To acquire the importance of mutations in the chromosome, genome and to study their molecular mechanism.

CO-4: To study the different structures of protein and amino acid composition.

CO-5: To deduct the molecules of life such as carbohydrates and DNA and its types.

Text Books:

1. Channarayappa, "Cell Biology", Universities Press, 2010.
2. P.S.Verma& V.K. Agarwal, "Cell Biology (Cytology, Biomolecules and molecular biology", S. Chand Publishing, 2015.

Reference Books:

1. Lehninger, A. L,Principles of Biochemistry. CBS publishers and distributors, New Delhi, India,1984.
2. Horton, Moran, Ochs, Rawn, Scrimgeour Principles of Biochemistry Prentice Hall Publishers.
3. David. E. Sadava, Cell Biology: Organelle Structure and Function Jones & Bartlett publishers.

CORE: Practical 1 - Basic Concepts and Algorithm in Computer 0042

Course Objective: To Train the students to operate computer systems and make use of application software. To understand and learn the concept of MS Word, MS Excel and MS PowerPoint and its applications. To ensure the clear practical knowledge on HTML tags.

1. Hands-On experience: - Utilities of Windows (XP) – Browsers (I.E., Chrome, Mozilla Firefox) – Surfing the Internet – Search Engines – E-Mail (Sending and Receiving mail, attaching folders on mail) 02

2. Downloading and installing software/plug-ins on Windows – Searching / Surfing on the WWW. 03

3. Word Processing (Notepad and MS Word) 05

- Creating, Saving & Opening a document
- Editing, Inserting, Deleting, Formatting, Moving & Copying Text
- Find & Replace, Spell Checker & Grammar Checker (Thesaurus), Document Enhancement (Borders, Shading, Header, Footer), Printing document (page layout, Margins)
- Introduction to the use of Wizards & Templates, Working with Graphics (Word Art), working with Tables & Charts, Inserting pictures and files.

4. Spreadsheet Applications (MS Excel) 05

- Worksheet Basics - Entering information in a worksheet, Saving & Opening a worksheet, Editing, Copying & Moving data, Inserting, Deleting & Moving Columns & Rows, Clearing Cells & Formatting cells
- Working with workbooks, Working with formulae and functions, Printing worksheets
- An introduction to the use of advanced spreadsheet concepts, sorting records, Finding records, Adding & Deleting records, Filtering records in a worksheet.
- Working with Macros, Creating and using multiple worksheets.

5. Presentation Applications (MS PowerPoint) 05

- Creation of slides, Rapid Presentation design using wizards

- Inserting graphs & charts Action buttons
- Transitions, Build and Animation effects.

6. HTML BASICS 05
   - Creating Sample HTML page using Editors, Basic, Elements, Attributes, Headings and Paragraphs. Creating Sample HTML page using Styles, Formatting, Quotations and Comments. Creating Sample HTML page using Links, Images, Tables and Lists.

7. Solving problems using algorithm and flowchart 05

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To know the basic concepts of computer platform and search engines.

CO-2: To learn how to read write using word processing such as MS word and notepad

CO-3: To acquire the knowledge of spread sheet applications using MS Excel.

CO-4: To learn the presentation with the help of wizards and animation effects.

CO-5: To analyse HTML page with editors and basic elements.

Text Book:

1. Anita Goel, “Computer Fundamentals”, Pearson Education India, 2010

Reference Books:

1. SangheraKamaljeet, Fundamentals of Computing, Kendall Hunt Publishing Company, 2007
2. AnuragSeetha, Ram Prasad, Introduction To Computers and Information Technology By McGraw Hill, 2011.

CORE: Practical 2 - Basic concept of Bioinformatics 0042

Course Objectives: To understand various computational techniques employed to analyze biological data with the use of sequence information. Finally acquire skills to use different approaches for prediction of protein structure. This course also aims to provide students with a practical and hands-on experience with common bioinformatics tools and databases. Students will be trained in the basic theory and application of programs used for database searching, protein and DNA sequence analysis.

1.	Retrieval of DNA Sequence using Sequence Databases: NCBI	03
2.	Retrieval of DNA Sequence using Sequence Databases: DDBJ	03
3.	Retrieval of DNA Sequence using Sequence Databases: EMBL.	03
4.	Gene prediction using GenScan tool.	03
5.	Retrieval of Protein Sequence using Sequence Databases: UNIPROT	03
6.	Retrieval of 3D Protein Structure Using Protein Data Bank.	03
7.	Sequence similarity searching (BLAST).	03
8.	Sequence similarity searching (FASTA).	03
9.	Pairwise alignment – Global and Local Alignment	03
10.	3D structure Visualization tool (Rasmol)	03

Total: 30 Hours

COURSE OUTCOMESs:

CO-1: To learn how to retrieve the biological data from NCBI, DDBJ and EMBL databases.

CO-2: To analyse the genes coding and non-coding regions of sequence using Gene prediction tools.

CO-3: To acquire the knowledge of protein sequence and structure using databases.

CO-4: To learn the sequence similarity between the sequences and their alignment.

CO-5: To analyse 3D structure and their amino acids sequence using visualization tools.

Text Books:

1. D. Higgins and W.Taylor, (Eds), 'Bioinformatics: Sequences, Structures and databanks 'oxford University Press, Oxford, UK. 2008.
2. V. R. Srinivas, "Bioinformatics: Sequences and genomics analysis" cold Spring Harbor Laboratory press, Cold Spring harbor, USA, 2005.

Reference Books:

1. N.Gautham, "Bioinformatics",Narosa Publishing Company, New Delhi, 2006.
2. D.Higgins and W.Taylor, "Bioinformatics: Sequences, Structures and databanks", Oxford University Press, Oxford, UK, 2008.

CORE 4 - Programming in C 3104

Course Objective: To provide the clear concepts on programming methodology. To make the students to understand the various programming concepts in C language and to make clear understanding on C applications and make use of c programming for various calculation methods.

Unit I Introduction to C 12

Introduction:History of C Language, C Programming structures and building blocks. Fundamentals:Character set, Tokens, Keywords, Identifiers, Data Types - Integer, float, character and double, Variables , Constant, Comments – Single line comment and multiline comment.

Unit II` Introduction to Programming 12

Operators and Built in Functions: Arithmetic, Unary, Relational and logical, Assignment and Conditional Operators, precedence and Associative - Library functions - Data input and output functions. Writing C Programs:Declarations - Expressions – Statements - Simple C programs

Unit III Control Structures 12

Control Structures:Flow of control –Decision making, loop control - if, if-else, while, do-while, for loop, Nested control structures – switch, break and continue, go to statements – comma operator. Solving Problems:Problem solving concepts and techniques - Steps in problem solving - Algorithms and flowcharts – Examples.

Unit IV Functions, Arrays, Structures and Unions 1 12

Functions:Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing, Call by value, Call by reference, Scope of variable, , Recursion. Arrays:Arrays- Defining and processing Arrays,Structures & Unions.

Unit IV Pointers and Files 12

Pointers:Declarations, Pointer Variables, Operation on Pointers- Files:File Input / Output - Creating, Reading and Writing files, processing, opening and closing file data.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To adapt the fundamentals of C programming

CO-2: To utilize the concepts of operators and in build functions

CO-3: To utilize the control structures and decision-making concepts

CO-4: To design the array, structure and unions in the programming

CO-5: To design the pointers and files in the programming

Text Book:

1. E. Balagurusamy, Programming in ANSI C, 6th Edition, Tata Mc-Graw Hill, 2015.

Reference Books:

1. Kanetkar Y., Let us C, BPB Publication, New Delhi, 1999.
2. H. Schildt, C: The Complete Reference, 4th Edition, TMH Edition, 2000.
3. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, 2006.

CORE 5 - Biological Databases and Sequence Analysis 3104

Course Objective: This course will enable the students to understand the nature of biological data and need for biological databases and also to explore major biomolecular sequence databases (organization and contents); search and retrieve data from the databases using their respective search engines. To understand and appreciate the need and significance of sequence analysis and the bioinformatics approaches, algorithms for sequence analysis, the application of methods for analysis of the biomolecular sequence data.

Unit I Bioinformatics and Databases 10

Introduction to data types and Source. Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases and its classification. Types of databases, Data source, Data Access, navigating databases, Information Retrieval system, storage system of Database.

Unit II Sequences Databases and Structural Database 10

Sequences Databases: Nucleotide Sequence databases, Secondary Nucleotide databases, Protein databases, secondary and specialized protein sequence database, Information Retrieval System: Entrez and SRS. Structural Database: Structural File format, Protein structural database collaboration.

Unit III Data Submission Tool and Analysis Tools 15

Data Submission Tool: Nucleotide sequence submission tools, Protein submission tools, command line tools for Genbank. Sequence Analysis Tools: Tools for Nucleotide sequence analysis, Tools for Protein sequence analysis.

Unit IV Prediction tools and Modelling Tools 15

Prediction Tools: Phylogenetic Trees and phylogenetic analysis - Phylip, Phyml. Gene Prediction – Genscan, GrailEXP. Protein structure and Function Prediction – Prosite, 3DPSSM. Modelling Tools: Tools for 2D protein modelling –Tools for 3D protein modelling - DeepViewer.

Unit V Motif and Domain: 10

Motif and Domain: Motif databases and analysis tools. Domain databases (CDD, SMART, ProDom) and Analysis tools, Multiple alignment (Clustal W, Clustal Omega, T-Coffee, Muscle)

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To adapt the fundamentals of Bioinformatics databases and information retrieval system.

CO-2: To acquire the concepts of sequence databases and structure databases.

CO-3: To learn how to submit the biological data to the sequence databases.

CO-4: To design the evolutionary relationship using trees and Functional prediction of protein structures

CO-5: To study the motif and domain regions in the protein sequence using databases.

Text Book:

1. OrpitaBosu, SimminderkaurThukral. "Bioinformatics - Databases Tools and Algorithms", Oxford University Press, 2007.

Reference Books:

1. D. Higgins and W. Taylor. (Eds), "Bioinformatics: Sequences, Structures and databanks", Oxford University Press, Oxford, UK, 2008.
2. N.Gautham, "Bioinformatics",Narosa Publishing Company, New Delhi, 2006.
3. V.R.Srinivas, "Bioinformatics: Sequences and genomics analysis", Cold Spring Harbor Laboratory press,Cold Spring harbor,USA, 2005

CORE 6: Applied Bioinformatics 4004

Course Objective: To introduce various applications of Bioinformatics and to create awareness about various issues of relevance to a professional Bioinformatician.

Unit I Bioinformatics objectives 12

Bioinformatics objectives: Organizing the data, Analytical approaches of the data, Interpretation and application of data. Research methodology- Technical report writing, software documentation, web searching techniques.

Unit II IPR and IT 12

Introduction to IPR: Copyrights and Patents applied to software and life forms, Introduction to Bio-ethics, Indian Biotech policies and laws, Survey of Biotech.

IT knowledge in life sciences: Role of computers in biological research, File transfer protocol (FTP), Web tools and biological database. Biocomputers, DNA computing, Biochips, Biosensors, Bioelectronics and E-cell.

Unit III Applications of Bioinformatics - I **12**

Applications of Bioinformatics in Insect Resistance, Nutritional Quality, Waste Clean-up, Evolutionary Studies/Phylogenetic, Climate Change Studies, Biodefense, Forensic Science, Bioenergy/Biofuels, Veterinary Science, Plant breeding and crop improvement, Development of stress tolerant varieties. Drug Development, Structure prediction, food quality Research, Improve Nutritional Quality, Comparative Studies.

Unit IV Applications of Bioinformatics - II 12

Applications of Bioinformatics in Gene therapy, Alternative energy, Personal medicine, Preventive medicine, Predictive medicine, Molecular medicine, Biotechnology, Drug development, Antibiotic resistance, The reality of bioweapon creation, Microbial genome applications.

Unit IV Activities in India 12

Bioinformatics and Biotechnology activities in India: Biotech market in India, Indian Biotech industries, Convergence of Biotech and infotech, Indian IT companies involved in

Bioinformatics initiatives, Bioinformatics and Pharmaceutical industries in India and Worldwide, Clinical research organizations.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To analyse the web searching technique and organisation of data by research methodology.

CO-2: To acquire the knowledge of Bioethics policies through computing techniques

CO-3: To acquire the knowledge of Bioinformatics techniques in Agriculture

CO-4: By utilizing the Bioinformatics techniques to develop the personalized medicine and preventive therapy

CO-5: By acquiring the knowledge of Bioinformatics and Biotechnology to enhances the pharmaceutical industries and research organizations.

Text Book:

1. Lawrence Baker. Bioinformatics: Concepts and Applications 25 June 2019, 1641721057

Reference Books:

1. M. Govindarajan , s natarajan, v.s senthil kumar,e engineering ethics, PHI Indian copyright act and Indian patent acts.
2. Richard Stallman,free software: a perspective .,prajasakthi book house,Hyderabad.
3. Shailendra nigam, total quality management ,excel books.
4. James s bownman, et.al .the professional edge, PHI.
5. S K Agarwal, bioelectronics, APH publishing corporation New Delhi.
6. Martin amos, theoretical and experimental DNA computation , springer.

CORE: Practical 3 - Programming in C 0042

Course Objective: To provide the clear concepts on programming methodology. To make the students to understand the various programming concepts in C language and to make clear understand on C applications and make use of c programming for various calculation methods.

1. Simple Arithmetic Calculation 03
   - Program to demonstrate the Simple Arithmetic Calculation
   - Program to find the Simple Interest

2. If Control 03
   - Program to find even/odd number.
   - Program to determine whether given year is leap year or not using ‘if’ and ‘if else’
   - Program to find the sum of digits of given number using ‘else-if ladder’.

3. While and Do While 03
   - Program to find the factorial value of given number using while.
   - Program to find the Fibonacci series for given number using do-while.

4. Arrays and For control 03
   - Program to find the number of alphabets in given word sequence.
   - Program to find the frequency of Nucleotides in given DNA sequence.
   - Program to find the G-C content value of given DNA sequence.

5. Switch and Functions 03
   - Program to find the complement and reverse complement of given DNA sequence using functions.

6. Structures and Unions: 05
   - Program to create student data using Structures/Unions.
   - Program to create ‘cm – feet’ converter using Structures/Unions.
   - Program to concatenate the two DNA sequences using Structures/Unions.

7. Pointers: 05

- Arithmetic operations using pointers.

8. File: 05

- Sample Program to read and write an external file.

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To adapt the fundamentals of C programming using simple programs.

CO-2: To acquire the knowledge of if and nested if control loops.

CO-3: To utilize the control structures and decision-making concepts

CO-4: To design the array, structure and unions in the programming

CO-5: To study the arithmetic operations using pointers and file handling.

Text Book:

1. E. Balagurusamy, Programming in ANSI C, 6th Edition, Tata Mc-Graw Hill, 2015.

References:

1. Kanetkar Y., Let us C, BPB Publication, New Delhi, 1999.
2. H. Schildt, C: The Complete Reference, 4th Edition, TMH Edition, 2000
3. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, 2006

CORE: Practical 4 - Biological databases and sequence analysis 0042

Course Objectives: To understand various computational techniques employed to analyze biological data with the use of sequence information. Finally acquire skills to use different approaches for prediction of protein structure. This course also aims to provide students with a practical and hands-on experience with common bioinformatics tools and databases. Students will be trained in the basic theory and application of programs used for database searching, protein and DNA sequence analysis.

1.	Retrieval of Protein Structural information using SCOP & CATH.	04
2.	Protein sequence analysis - Prosite	02
3.	Protein sequence analysis - Pfam	02
4.	Protein sequence analysis - SOPMA	02
5.	Protein sequence analysis - Protparam	03
6.	Multiple sequence alignment (Clustal W, Clustal Omega).	03
7.	Multiple sequence alignment (T-Coffee, Muscles).	03
8.	Phylogenetic analysis (Rooted tree and Unrooted Tree)	03
9.	Predicting Active site in 3D structure (CASTP)	03
10.	Tool for 3D protein modelling - DeepViewer.	05

Total: 30 Hours

COURSE OUTCOMESS:

CO-1: To learn how to retrieve the protein structure information from the biological databases.

CO-2: To analyse the protein sequence parameters and functions using protein sequence databases.

CO-3: To learn the sequence similarity with different sequences and their alignment.

CO-4: To analyse the active site and catalytic activity of the protein using software.

CO-5: To analyse 3D structure and their amino acids sequence using protein modelling tool.

Text Book:

1. D. Higgins and W.Taylor, (Eds), 'Bioinformatics: Sequences, Structures and databanks 'oxford University Press, Oxford, UK. 2008.
2. V. R. Srinivas, "Bioinformatics: Sequences and genomics analysis" cold Spring Harbor Laboratory press, Cold Spring harbor, USA, 2005.

Reference Books:

1. N.Gautham, "Bioinformatics",Narosa Publishing Company, New Delhi, 2006.
2. D.Higgins and W.Taylor, "Bioinformatics: Sequences, Structures and databanks", Oxford University Press, Oxford, UK, 2008.

CORE 7: Programming in C++ 4004

Course Objectives:

To provide hands on experience on Programming. To make clear understand on Object Oriented Program methodology. To make the students to think and write their own C++ program by understanding the concepts of programming clearly. Be familiar with writing recursive Methods.

Unit I Introduction to C++ 10

Introduction: Basic Elements of C++ Programming, I/O Streams. Control Structures: Control and Looping Statements.

UNIT II Object Oriented Methodology 15

Object Oriented Methodology: Basic Concepts/Characteristics of OOP. Advantages and Application of OOPs, Procedural Programming Vs OOP. Classes and Objects: Specifying a Class, Creating Objects, Private & Public Data Members and Member Functions

UNIT III Functions 10

Functions: Function Prototyping, Call by value and call by Reference, Inline Function, Defining Inline Member Functions Default Arguments, Function Overloading, Arrays, Static Data Members and Member Functions.

UNIT IV Constructors and Destructors 10

Introduction Parameterized Constructors, Multiple Constructors in A Class, Constructors With Default Arguments, Dynamic Initialization of Objects, Copy Constructors, Dynamic Constructors, and Destructors.

UNIT V Operator Overloading, Inheritance and File Processing 15

Operators Overloading**:** Definition, Unary and Binary Overloading, Rules for Operator Overloading, Inheritance: Defining Derived Classes, Types of Inheritance, Constructors and Destructors in Derived Classes. Files**:** Opening, Closing a File, File Modes, File Pointers and

their Manipulation. Updating a File, Random Access, and Error Handling During File Operations.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To build the fundamentals of C++

CO-2: To choose the OOPS concepts

CO-3: To utilize the constructors and operators

CO-4: To discuss the concepts of files and inheritance

CO-5: To list the use of data structures

Text Book:

1. E Balagurusamy, "Object Oriented Programming with C++ ", 6th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2013

Reference Books:

1. K.R.Venugopal, Rajkumar, T. Ravishankar, "Mastering C++", Tata McGraw Hill, New Delhi, 1999: 25th Reprint, 2006
2. D. Ravichandran, "Programming with C++", Third Edition, Tata McGraw Hill, 2010.
3. Horowitz, Sahni & Mehta, "Fundamentals of Data Structures in C++", 2nd Edition, Silicon Press, 2006

CORE 8 - Genomics and Proteomics 3024

Course Objectives:

This course will enable the students to appreciate the importance and understanding of full genome and to explore the genomics databases & various algorithms used for comparisons of full genome and gene order. It also useful for understanding the concepts of SNPs and their significance with increase in value of proteomics concepts and technology.

Unit I Introduction to Genomics 12

Definition of Genome, Genome sequencing, genome composition & genome evolution Genome Annotation, Genome Assembly, Structural and Functional Genomics. Comparative Genomics, Restriction Fragment Length Polymorphism, (RFLP), single nucleotide polymorphism (SNP), Finding Specific Genes. Gene prediction in prokaryotes, Gene prediction in eukaryotes.

Unit II Structural genomics 12

Structural genomics: Assembly of a contiguous DNA sequence- shotgun method, clone contig method, and whole – genome shotgun sequencing. Understanding a genome sequence: locating the genes in a genome sequence, determining the functions of individual genes and by studying the activity of a protein coded of an unknown gene

Unit III Functional genomics 12

Genome annotation, ORF and functional prediction, Gene finding, Substractive DNA library screening, Differential display and Representational difference analysis, SAGE,TOGA.

Unit IV Introduction to Proteomics 12

Proteome & Proteomics, Classification of proteins, Primary, secondary & tertiary structure of Proteins. Protein separation & analysis using 2D Gel electrophoresis, Chromatography.

Unit V Proteomics Databases 12

Protein structure Databases: PDB, PIR, Structural Classification- SCOP and CATH. Protein visualization tools Swiss PDB viewer, EXPASY proteomic tools, Amino acid: Structure and Properties of Amino acids- Hydrophobicity, EIIP, Molecular weight.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To acquire the knowledge Genome and its function.

CO-2: To learnt about the various sequencing methods and by studying its activity for predicting the structure of known genes.

CO-3: To annotate and analyse the functional types of the various genes.

CO-4: To acquire the knowledge proteomics and its function using *invitro* techniques.

CO-5: To analyse the sequence and structure of protein through *insilico* analysis

Text Book:

1. David W. Mount, "Bioinformatics Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press. 2001.

Reference Books:

1. Ann Gibbons, "Comparative genetics", Science. 281: 1432 – 1434, 1998.
2. Baxevanis A.D., "The Molecular Biology Database Collection: updated compilations of Biological database resources", Nucleic Acids Research.29 p 1-10, 2001.
3. Jeremy D. Peterson et.al.. The Comprehensive Microbial Resource. Nucleic Acids Research. 29: 123 – 125, 2001.
4. S.R.Pennigton and M.J.Dunn, "Proteomics", Viva Books Private Limited. New Delhi, 2002.

CORE 9 - Enzymes and Metabolism 4004

Course Objective:

This course will enable the students to understand the fundamentals and complementary aspects of enzyme and metabolism action involved in bioinformatics and wide range of enzymatic activities of different protein classes and their metabolism's which responsible for causing Disorder.

Unit I Introduction to Enzymes 12

Classification of enzymes – six major classes of enzymes with one example each. Elementary study of the factors affecting velocity of enzyme catalyzed reactions Michaelis-Menten equation. Km and its significance, Cofactors and coenzymes, Group specificity, Optical specificity, Geometrical specificity, Cofactor specificity of enzyme with example.

Unit II Introduction to Metabolism 12

Introduction to metabolism- Types of Metabolism, process of Metabolism, Catabolism, anabolism, catabolic, anabolic and amphibolic pathways, Nutrition and Energy, Overview of Carbohydrates, Proteins, Lipids in Metabolism

Unit III Carbohydrate Metabolism 12

Glycolysis, Fates of pyruvate – lactic acid fermentation, Fates of pyruvate – alcohol fermentation, Pyruvate dehydrogenase reaction, Citric acid cycle, Substrate level phosphorylation, Electron transport chain, Oxidative phosphorylation, Glycogen metabolism – glycogenesis, glycogenolysis.

Unit IV Lipid Metabolism 12

Fatty acid biosynthesis, Oxidation of fatty acids – Fatty acid activation, Carnitine shuttle. β-Oxidation of fatty acids, explain using palmitic acid and ATP yield, Ketone bodies, Cholesterol biosynthesis

Unit V Protein Metabolism 12

Decarboxylation of aminoacids, Deamination of aminoacids, Transamination of aminoacids, Urea Cycle, Glucogenic amino acids with examples, Ketogenic amino acids with examples.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To understand the fundamentals of enzymes, cofactors and coenzymes actions.

CO-2: To acquire the concepts of metabolism and metabolic pathways of macromolecules.

CO-3: To study the carbohydrate metabolism by both aerobic and anaerobic respiration.

CO-4: To acquire the knowledge of oxidation of fatty acids.

CO-5: To study the protein metabolism using cycles.

Text Book:

1. Lehninger, A. L.. Principles of Biochemistry. CBS publishers and distributors, New Delhi, India,1984.

Reference books:

1. C. K. Mathews, K. E. Van Holde, & K.G. Ahern, "Biochemistry", Third Edition, Prentice Hall, 1999.
2. Shanmughavel P, "Principles of Bioinformatics", Pointer Publishers, Jaipur, India. 2005.

CORE: Practical 5 - Programming in C++ 0042

Course Objectives: To provide the hands on experience on Programming. To make the students to think and write their own C++ program by understanding the concepts of programming clearly. Make the student to create the program using classes and objects methods of OOPS.

1.	Program to implement classes; create object and member functions.	03
2.	Program to implement the concept of function in Classes.	03
3.	Program to implement the concept of function overloading .	03
4.	Program to implement the concept of Inline function.	03
5.	Program to implement the concept of Static member functions.	03
6.	Program to implement the concept of Operator overloading.	03
7.	Program to implement the concept of Single and Multiple Inheritance.	03
8.	Program to implement the concept of Constructors & Destructors.	03
9.	Program to implement Arrays using Functions	03
10.	Program to implement file handling concepts.	03

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To build the fundamentals of C++

CO-2: To choose the OOPS concepts

CO-3: To utilize the constructors and operators

CO-4: To discuss the concepts of files and inheritance

CO-5: To list the use of data structures

Text Book:

1. E.Balagurusamy, "Object Oriented Programming with C++", 6thEdition, Tata McGraw Hill, Publishing Company Limited, New Delhi, 2013.

Reference Books:

1. K.R.Venugopal, Rajkumar, T. Ravishankar, "Mastering C++", Tata McGraw Hill, NewDelhi, 1999: 25thReprint, 2006.
2. D. Ravichandran, "Programming with C++", Third Edition, Tata McGraw Hill, 2010.

3. Horowitz, Sahni& Mehta, “Fundamentals of Data Structures in C++”, 2ndEdition,Silicon Press, 2006.

CORE 10 - Programming in JAVA 4004

Course Objective: Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc. Be aware of the important topics and principles of software development. Have the ability to write a computer program to solve specified problems.

Unit I Fundamentals of JAVA 12

Fundamentals of Object – Oriented Programming:- Introduction, Object-Oriented Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, Applications of OOP, Java Evolution:- Java History, Java Features, Java and C/C++, Java and Internet, Java and WWW, Java Environment, Overview of Java Language:- Simple java Program, java Program Structure, Java Tokens, Java Statements, Java Virtual Machine, command Line Arguments, Constants, variables and Data Types in Java.

Unit II Operators and Decision Making 12

Operators and Expressions:- Arithmetic, Relational, Logical, Assignment, Increment, Decrement, Conditional, Bitwise and Special operators, Arithmetic Expressions, Evaluation of Expressions, Arithmetic operator Precedence, Mathematical Functions. Decision Making and Branching:- if, if…Else, nesting of if…else, else if ladder and Switch statement, the ?: operator, Decision Making and Looping:- while, Do While and For statements, Jumps in Loops and Labeled Loops, Classes, Objects and Methods:- Defining a Class, fields declaration, methods declaration, creating objects, accessing class members, Constructors, methods overloading, Extending a Class (Inheritance), Overriding Methods, final variables and methods, final classes.

Unit III Arrays and Packages 12

Arrays, Strings and Vectors:- Introduction, One-dimensional Arrays, Creating an Array, Two-Dimensional Arrays, Strings, Vectors, Wrapper Classes, Enumerated Types, Strings.

Regular Expressions:- Java's Regular Expression API, Introduction to Regular Expressions, Sorting Array of Strings, Ignore Case Difference When Sorting, Replacing Substrings with case difference ignorance, Splitting a String using split(), Multiple Inheritance:- Defining Interfaces, extending interfaces, implementing interfaces, Accessing interface Variables, Packages:- Java API packages, using system packages, Naming conventions, creating packages, accessing a package, using a package, hiding classes.

Unit IV Errors and Multithread Programming 12

Errors and Exceptions:- Types of errors, Exceptions, Syntax of Exception Handling code, Multiple Catch Statements, Using Finally Statement, Throwing Exceptions, Exceptions for Debugging, File Handling:- Overview of File Handling, Reading characters from a file, Writing characters to a file, Read and write Random-Access files, Obtaining File Attributes, Formatting Data:- Overview of Formatter, Number Format and Date Format – Four Simple Numeric Formatting Techniques using formatter, Format Time and Date Using formatter, Multithreaded Programming:- Introduction, Creating Threads, Extending the thread class, Stopping and Blocking a Thread, Life Cycle of a thread.

Unit V Applet Programming 12

Applet Programming:- Introduction, preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable Applet, Designing a Web Page, Applet Tag, Applet to HTML, running the Applet, Graphics Programming:- Graphics class, Lines and Rectangles, Circles and Ellipses, Drawing Arcs, Drawing Polygons, Drawing Graphs, Using Control Loops in Applets.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To understands the fundamentals of Java and OOP technology.

CO-2: To identify classes, objects, members of a class and relationships among them needed for a specific problem

CO-3: To write Java application programs using array and String.

CO-4: To demonstrate the concepts of errors, File handling using Multithreaded Programming

CO-5: To write Java programs to utilizing the java applet code and graphics Programming.

Text Book:

1. E. Balagurusamy, “Programming with Java: A Primer”, Fourth Edition, Tata McGraw Hill, 2010.

Reference Books:

1. P. Naughton and H.Schildt- Java2 (The Complete Reference) - Third Edn.TMH 1999.
2. Deital&Deital, “How to Program Java”, Pearson Education, 1999.
3. Cays Horstmann, Gary Cornell, “Core Java 2: Advanced Features”, Sun Micro System, 2007.

CORE 11 – Plant Bioinformatics 3024

Course Objective: This understanding is fundamental to allow efficient exploitation of plants as biological resources in the development of new cultivars with improved quality and reduced economic and environmental costs. This knowledge is also vital for the development of new plant diagnostic tools. To understand the genetic and molecular basis of all biological processes in plants that are relevant to the specie.

Unit I Plant 12

Plant cell structure – nature of plant cell wall. Tissue and tissue systems - meristematic tissue, permanent tissue and secretary cells, Morphogenesis in plants, Anatomy of stem, root, leaf and anomalous secondary growth

Unit II Plant Growth and Development 12

Growth: definition and kinetics- Hormonal regulation of plant growth and development Auxin, Gibberellic acid, Cytokinin, Ethylene and abscisic acid- Bioassay and mode of action. Physiology of flowering: Photoperiodism – Vernalization – dormancy of seeds, methods of breaking dormancy , mechanism of germination of seeds – Basics of signal transduction in plant.

Unit III Plant Natural Products 12

Plant natural products - History- general significance- classification- list of floral sources- general detection, extraction and characterization procedures. Classification, therapeutic value, chemical properties & tests for identification – Glycosides, Anthocyanins, Lignans and Neolignans, Carotenoids, Alkaloids:

Unit IV Pharmacognosy 12

Introduction - history of Pharmacognosy - definitions and terms - Basic concepts: Preparation of drugs for commercial market - Organoleptic evaluation of drugs - microscopic evaluation

of drugs - Physical evaluation of drugs - Active and inert constituents of drugs - Classification of drug plants - individual drugs - drug adulteration

Unit V Herbal Preparations 12

Collection of wild herbs - Capsules - compresses - Elixirs - Glycerites - Hydrotherapy or Herbal bath - Herbal oils - Liquid extracts or Tincture - Poultices - Salves - Slippery elm slurry and gruel - Suppositories - Teas. Outline of occurrence, isolation, identification tests, therapeutic effects and pharmaceutical application of alkaloids, terpenoids, glycosides, volatile oils, tannins and resins.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To understand the plant cell structure and their morphogenesis.

CO-2: To acquire the concepts of plant growth using the hormonal actions.

CO-3: To study plant natural products and chemical properties.

CO-4: To acquire the knowledge of basics of Pharmacognosy.

CO-5: To study the herbal preparations and isolation techniques.

Text Book:

1. David Edwards, "Plant Bioinformatics – Methods and Protocols", Springer, 2007.

Reference Books:

1. Gurcharan Singh, "Plant Systematics: An Integrated Approach", Science Publishers, 2004.
2. Susheela M. Das, "A Textbook of Plant Taxonomy: Theory & Objectives", Hardcover -Wisdom Press. 2013.

CORE 12 - Medical Coding and Transcription 3003

Course Objective: The Human Anatomy course involves the study of the structure of the human body. To provide a sound knowledge of medical coding guidelines and regulations including compliance and reimbursement and to make the student to learn about ICD-10 (Diagnosis code), CPT code and medical terminologies.

Unit I Introduction to Human Anatomy - I 09

Basics of Human Anatomy and Physiology, Cell, Tissues and Membrane, The integumentary system, Skeletal system, Muscular system, Endrocrine system, Nervous system.

Unit II Introduction to Human Anatomy - II 09

Cardiovascular system, Respiratory system, Digestive system, Urinary system and Reproductive system. Coding medical procedures What to code and how to prepare the forms.

Unit III Claim Information and Medical Records 09

Professional claim information How to set up medical claims for Medicare, Medicaid, private insurance companies, HMOs, PPOs, workers' compensation and personal injury cases. Documenting Medical Records: The role medical records play in a coding specialist's job. The importance of documentation in medical records and to recognize the various types of dictation formats and manage medical records. Medical Ethics Concepts of ethics, compliance, fraud and abuse. The importance of confidentiality when dealing with medical records and insurance audits and the legal concepts involved.

Unit IV CPT Codes 09

CPT Coding: CPT Coding from the Integumentary System, from the Reproductive Systems to the Operating Microscope, for Radiology, Pathology, Medicine and Anesthesia, Evaluation and Management Services, Comprehensive CPT Evaluation and Management, Surgery Coding, Digestive System Coding, Urology system coding, Cardiovascular coding.

Unit V Diagnostic Codes 09

Diagnostic Coding - ICD-10-CM Coding Manual Introduction, Diagnosis Coding: Guidelines and Rules, from Infections to Blood Diseases, from Mental Disorders to the Respiratory System ,from the Digestive System to Pregnancy, from the Skin to Conditions of the Perinatal Period, from Symptoms to Complications, V Codes, E Codes and ICD-9-CM Coding Practicum.

Total: 45 Hours

COURSE OUTCOMES:

CO-1: Build a fundamental understanding of the human body and medical terminology as they apply to medical billing and coding.

CO-2: To acquire the concepts of human anatomy and physiology of different systems of the body.

CO-3: Demonstrate professionalism through acceptable attitude, organization and time management skills, and attire.

CO-4: Assign the diagnostic and procedure codes using CPT coding systems as used in a variety of settings.

CO-5: Understand diagnostic and procedure codes using ICD coding principles and skills in the workplace.

Text Books:

1. Beth A.Rich, "Medical Coding: A Journey", Prentice Hall, 2013. ISBN – 13: 9780132541770
2. Martini and Nath. Fundamentals of Anatomy and Physiology Modified Mastering A&P Access Code. Pearson, San Francisco, CA. 11th ed.+ ,2018.

Reference Books:

1. Karen Smiley, "Medical Coding And Billing for Dummies", Second Edition, 2012.
2. Perez. Anatomy (Flash Cards). Bar Charts Publishing, Boca Raton, FL,2008.
3. Kapit and Elson. Anatomy Coloring Book 12th ed. Pearson Education, Boston, MA,2013.

CORE Practical 6 - Programming in JAVA 0042

Course Objective: Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc. Have the ability to write a computer program to solve specified problems.

1. Operators and Expressions	02
2. Branching and Looping	02
3. Classes and Objects	02
4. Packages	02
5. Formatting Data	02
6. Sort an Array of Strings in Reverse Order	02
7. Implementing Case Differences Ignorance	03
8. Applet Example	03
9. Drawing Circle, rectangle using Java Graphics.	03
10. Reading or writing Fasta files using Biojava?	03
11. Comparing two Sequences.	03
12. Translating DNA sequence into Protein sequence in Java	03

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To understands the fundamentals of Java and OOP technology.

CO-2: To identify classes, objects, members of a class and relationships among them needed for a specific problem

CO-3: To write Java application programs using array and String.

CO-4: To demonstrate the concepts of errors, File handling using Multithreaded Programming

CO-5: To write Java programs to utilizing the java applet code and graphics Programming.

Text Book:

1. E. Balagurusamy, “Programming with Java: A Primer”, Fourth Edition, Tata McGraw Hill, 2010

Reference Books:

1. P. Naughton and H.Schildt- Java2 (The Complete Reference) - Third Edn.TMH 1999.
2. Deital&Deital, “How to Program Java”, Pearson Education, 1999.
3. Cays Horstmann, Gary Cornell, “Core Java 2: Advanced Features”, Sun Micro System, 2007.

CORE Practical 7 – Plant Bioinformatics 0042

Course Objective: This understanding is fundamental to allow efficient exploitation of plants as biological resources in the development of new cultivars with improved quality and reduced economic and environmental costs. This knowledge is also vital for the development of new plant diagnostic tools. To understand the genetic and molecular basis of all biological processes in plants those are relevant to the specie.

1. Collecting and Creating Herbarium of 5 different kinds of plants	03
2. Creating computer data for Herbaria.	03
3. Literature Survey for the identification on the compound present in the plant	03
4. Retrieving the SMILES of the plant compound.	03
5. Draw the structure of the plant the compound.	03
6. Retrieving the Physicochemical Properties of the plant the compound	03
7 Retrieving the Lipophilicity of the plant the compound	03
8. Retrieving the Water Solubility of the plant the compound	03
9. Retrieving the Pharmacokinetics of the plant the compound	03
10 Retrieving the Medicinal Chemistry	03

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To understand the plant cell structure and their morphogenesis.

CO-2: To acquire the concepts of plant growth using the hormonal actions.

CO-3: To study plant natural products and chemical properties.

CO-4: To acquire the knowledge of basics of Pharmacognosy.

CO-5: To study the herbal preparations and isolation techniques.

Text Book:

1. David Edwards. “Plant Bioinformatics – Methods and Protocols”. Springer. 2007.

Reference Books:

1. Gurcharan Singh.” Plant Systematics: An Integrated Approach”. Science Publishers, 2004.
2. Susheela M. Das “A Textbook of Plant Taxonomy: Theory & Objectives” Hardcover Wisdom Press, 2013.

CORE 13 - Perl for Bioinformatics 3003

Course Objective: To learn the fundamentals of the Perl programming language and how it can be used to write data reporting and systems administration applications. To discover how to use of the DBI.pm module and related DBD (driver) files with Perl to build database-driven applications.

Unit I Introduction to PERL 9

Getting started with perl:- A Low and Long Learning Curve, Perl's Benefits, Installing Perl on Your Computer, How to Run Perl Programs, Text Editors and Finding Help

Unit II Expressions and Files 9

The art of programming:-Individual Approaches to programming, Edit-Run-Revise (and Save), An Environment of Programs, Programming Strategies, The Programming Process

Unit III Operators 9

sequences and strings:- Representing Sequence Data, A Program to Store a DNA Sequence , Concatenating DNA Fragments Transcription: DNA to RNA, Using the Perl Documentation, Calculating the Reverse Complement in Perl, Proteins, Files, and Arrays , Reading Proteins in Files, Arrays Scalar and List Context

Unit IV Control Structures 9

Motifs and Loops:-Flow Control , Code Layout, Finding Motifs, Counting Nucleotides, Exploding Strings into Arrays, Operating on Strings Writing to Files

Unit V Packages, Modules and BIOPERL 9

Subroutines and Bugs: - Subroutines, Scoping and Subroutines, Command-Line Arguments and Arrays, Passing Data to Subroutines, Modules and Libraries of Subroutines, Fixing Bugs In Your Code.

Total: 45 Hours

COURSE OUTCOMES:

CO-1: Write and execute a script in Perl.

CO-2: Able to formulate stepwise implementation of a Perl script using Expressions and Files

CO-3: To learnt how to utilize the operators and arrays to analyse the sequence data

CO-4: To write the program to find the motif using control structures.

CO-5: Enable routine and module calls and their implementation using Bioperl.

Text Book:

1. Martin C Brown, "Perl The Complete Reference", Second Edition, Tata McGraw Hill, 2001

Reference Books:

1. Erick Storm, "Perl CGI Programming", BPB Publication, 1998.
2. Steven Holzner, "Per: Black Book", Second Edition, Dreamtech Publication, 2007.
3. Ed Peschko& Michele Dewolf, "Perl Developer's Guide", Tata McGraw Hill, 2000.

DISCIPLINE SPECIFIC ELECTIVE

DSE 1- Python for Bioinformatics 3003

Course objective: Read and understand the Python syntax. Be familiar with Python's fundamentals and develop simple applications. Apply the principles and techniques of object-oriented programming. Use sophisticated techniques and Python modules that are particularly useful for bioinformatics programming. Build new Python software tools for life science research. Summarize text patterns using regular expressions.

Unit I Introduction to Python 9

Introduction to Python, History of Python, Python Features, Python Development Tools, Writing Python Program, Values and Variables:- Numeric Values, Variables and Assignment, Keywords, Identifiers, print function, Statements, Indentation and Comments, Namespace.

Unit II Expression 9

Expressions and Arithmetic: Operator Precedence and Associativity, Errors (Syntax, Run-time errors, Logic Errors), Arithmetic Examples, Variables, Constants and Literals, Data types, Type Conversion and Type Casting, Input, Output and Import, File I/O, File Methods, Directory and Files Management.

Unit III Conditional Execution 9

Conditional Execution: Conditional statement in Python, Simple if Statement, if/else statement, else – if ladder, While Statement, For Statement, Nested Loops, the break statement, the continue statement, Pass. Infinite Loops,

Unit IV Functions 9

Function: Introduction, Docstring, return statement, Scope and Lifetime of variables, Types of Functions, Built-in functions, User-defined functions, Arguments, Recursion, Global, Local and Nonlocal variables, Global Keyword.

Unit IV Sequence Analysis through Python 9

Modules: Definition, import modules, import statement, Module Search Path, Reloading a module, dir () built-in function, Packages, Importing module from a package.

Total: 45 Hours

COURSE OUTCOMES:

CO-1: To understand why Python is a useful scripting language for developers.

CO-2: To learn how to design object- oriented programs with Python classes.

CO-3: To learn how to use indexing and slicing to access data in Python programs.

CO-4: To learn how to write functions and pass arguments in Python.

CO-5: To learn how to use exception handling in Python applications for error handling.

Text Book:

1. Jason Kinser, "Python for Bioinformatics", Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009.

Reference Books:

1. Richard L., Halterman, "Learning to Program With Python", 2011.
2. Kent D. Lee, "Python Programming Fundamentals: Second Edition", Springer, 2010.
3. Cody Jackson, "Learning to Program Using Python", Second Edition, 2013.
4. Mark Lutz, "Learning Python", Third Edition, O'Reilly

DSE 2 - Introduction to *Insilico* Drug Designing 3003

Course Objective: This course will enable the students to understand the critical relationship among biomolecular structure, function and force field models. To utilize basic modeling techniques to explore biological phenomena at the molecular level. To emphasize Modelling drug/receptor interactions in detail by molecular mechanics, molecular dynamics simulations and homology modeling.

Unit I Introduction to drug design 9

Introduction: - Natural product, Drugs; principles of drug Development. Bioinformatics in drug development, Chemoinformatics and Pharmacoinformatics. Applications of Drug Discovery and *In-Silico* Drug Designing, Area influencing drug discovery; Molecular Biology, pharmacogenomics and pharmacoproteomics

Unit II Structure-based drug designing 9

Introduction, Structure-based drug designing approaches: - Target Identification and Validation, homology modeling and protein folding, receptor mapping, active site analysis and pharmacophore mapping, Grid maps**.**

Unit III Ligand-based drug designing 9

Introduction, Ligand-based drug designing approaches: Lead Designing, combinatorial chemistry, High Throughput Screening (HTS), QSAR, Database generation and Chemical libraries, ADME property.

Unit IV Policies in drug designing 9

Policies in drug designing:- Quality assurance: ISO, WHO, certification, Good manufacturing practices, GMP, GLP, Government regulations, policies, Food and drug administration. IPR (Intellectual Property Rights)

Unit V Drug Discovery 9

Drug Discovery and design : Target identification , Target Validation , Lead Identification, lead optimization, preclinical Pharmacology & Taxology. Chemical databases: CSD, ACD, WDI, ChemBank, hazardous chemical database, PUBCHEM.

Total: 45 Hours

COURSE OUTCOMES:

CO-1: To understand the chemistry of drugs with respect to their biological activity.

CO-2: To know the metabolism, adverse effect and therapeutic activity of drugs.

CO-3: To describe physicochemical Properties and the techniques involved in QSAR

CO-4: To learn how to design the drug as per rules and policies of FDA.

CO-5: To have been introduced to a variety of drug classes and some pharmacological properties

Text Book:

1. Satyanarayanajois. Drug Design and Discovery - Methods and Protocols. ISBN 978-1-61779-012-6

References Book:

1. Basic Principles of Drug Discovery and Development by Benjamin Blass.
2. D. C. Young by Computational Drug Design: A Guide for Computational and Medicinal Chemists. ISBN: 978-0-470-12685-1

DSE3 - Structural Bioinformatics 3024

Course Objective: This course will enable the students to explore primary and derived databases in the field of computational structural biology and to visualize macromolecular structures using various visualization tools. Finally acquire skills to use different approaches for prediction of protein structure.

Unit I Structural biology 12

Nucleic acid structures, RNA folding, RNA loops, various ribose ring conformations, Ribose-ring puckering, Protein Structure, Protein-protein interactions, Protein ligand interactions, DNA-binding proteins, RNA-binding proteins. Ramachandran plot, 3-dimensional structures of membrane proteins, importance of 310 helix and loops, biophysical aspects of proteins and nucleic acids.

Unit II Structural databases 12

Strutural databases:- Protein Data bank (PDB), Nucleic Acid Data Bank (NDB),Molecular modeling Data Bank (MMDB). Secondary structure, three-dimensional structure prediction, protein folding and functional sites, protein folding classes. Predicting transmembrane helices, Primary structure analysis and prediction, Secondary structure analysis and prediction, motifs, profiles, patterns and fingerprints search. Methods of sequence based protein prediction.

Unit III Protein structure prediction 12

Protein Structure Prediction:- Homology modeling, prediction of protein structure from sequences, functional sites, Protein folding problem, protein folding classes, protein identification and characterization:- AACompIdent, TagIdent, PepIdent and MultiIdent, PROSEARCH, PepSea, PepMAPPER, FindPept,

Unit IV Molecular Modeling 12

Molecular modeling:-Introduction, force field, quantum chemistry, Schrödinger equation, potential energy functions**,** energy minimization, local and global minima, saddle point, grid search, various approximations; LCAO, HF, semi-empirical calculations; single point

calculations, full-geometry optimization methods, ZDO, MNDO, CNDO, NDDO, AM1, PM3, RM1. conformational search, Z-matrix, docking, molecular modelling packages.

Unit V Structural features of RNA 12

Molecular mechanics:-Definition, balls and springs, force fields, bond-stretching, bond-bending, dihedral motions, out of plane angle potential, non-bonded interaction, coulomb interactions, conformational search, united atoms and cut-offs. Derivative methods:- First-order methods; Steepest descent, conjugate gradient, Second order methods; Newton-Raphson method.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To understand the structural organisation, structural properties and various techniques employed in the structure determination of biological macromolecules – DNA, Protein and Carbohydrates

CO-2: To explain about primary and secondary structures of proteins

CO-3: To describe criteria for assessing and refining a predicted protein structure.

CO-4: To learn about various methods used in energy minimization.

CO-5: To have been introduced to a variety of drug classes and some pharmacological properties

Text Book:

1. Webster David (Editor). Protein Structure Prediction: Methods and Protocols (Methods in Molecular Biology) Volume 143. Publisher: New Jersey Humana Press. 2000. ISBN: 0896036375.

Reference Books:

1. D. C. Rapaport 1. Cesareni Giovanni, Gimona Mario, Sudol Marius, Yaffe Michael (Editors). Modular Protein Domains. Publisher: Weinheim Wiley-VCH. 2005. ISBN: 352730813X.

2. Höltje Hans-Dieter, Sippl Wolfgang, Rognan Didier, FolkersGerd. Molecular Modeling: Basic Principles and Applications. Publisher: New York, Wiley-VCH. 2003. ISBN: 3527305890.

DSE4 - Operating Systems 3003

Course Objectives: Aims to give clear view of operating system structure, Processing and its memory. Also to make the student to clear understand on OS memory management system and its implementations on computer programming structures.

UNIT I Operating Systems Introduction 9

Introduction - Views- Goals - types of operating systems – Operating System Structure – Components of Operating System - Operating System services - system calls and system programs, Development of Operating Systems, Uses of Operating Systems, Types of Operating Systems, .

UNIT II Process Management and Process Scheduling 9

Process management - Process concepts - process scheduling - operation on process Inter process communication - CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple- processor scheduling – Real time scheduling – Algorithm Evaluation. Case study: Process scheduling in Linux.

UNIT III Storage Management 9

Memory Management - Single and multiple partitioned allocation – paging - segmentation - internal & External Fragmentation. Non-Contiguous Allocation: Paging and Segmentation Schemes - Implementation - Hardware-Protection - Sharing – Fragmentation. Virtual Memory Management - Demand paging and Page Replacement Algorithms, Information management - File concept - Access methods - Directory structure - allocation methods - free space management - disk scheduling.

UNIT IV File System 9

File-System Interface: File concept – Access methods – Directory structure – File system mounting – Protection. File-System Implementation: Directory implementation – Allocation methods – Free-space management – efficiency and

performance – recovery – log-structured file systems. Case studies: File system in Linux – file system in Windows.

UNIT V I / O Systems 9

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem – streams – performance. Mass-Storage Structure: Disk scheduling – Disk management – Swap-space management – RAID – disk attachment – stable storage – tertiary storage.

Total: 45 Hours

COURSE OUTCOMES:

CO-1: To build the basics of operating system and services
CO-2: To choose the suitable methods for process management and scheduling
CO-3: To utilize the storage management and virtual memory management
CO-4: To discuss the file system and its protection.
CO-5: To list the use of I/O systems.

Text Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004

References Books :

1. Davis Rajkumar, "Operating System: A Systematic View", Pearson Education, 2007
2. H. M. Deitel, "Operating System", Second Edition, Pearson Education, 1990.
3. Harvery M. Deitel, Paul J. Deitel, "Operating System", Third Education, Pearson Education, 2004

DSE Practical 8 - Perl and Python 0042

Course Objective: To learn the fundamentals of the Perl programming language and how it can be used to write data reporting and systems administration applications. To discover how to use of the DBI.pm module and related DBD (driver) files with Perl to build database-driven applications.

1.	Calculating the true length of a Sequence?	3
2.	Program to complement and reverse complement of DNA sequence?	3
3.	Program to calculate GC content in the given DNA sequence?	3
4.	Program to translate DNA into Protein Sequence?	3
5.	Retrieving DNA Sequence from the Database and translating it into Protein Sequence using Perl and BioPerl.	3
6.	Parsing PDB and FASTA file using BioPerl?	3
7.	Program to convert DNA to RNA using python.	2
8.	Program to calculate the frequency of aminoacid.	2
9.	Program to frequency, reverse of DNA Sequence.	2
10.	Program to complement and reverse complement of DNA sequence.	2
11.	Program to open a FASTA file of DNS Sequence.	2
12.	Program to find the GC content given sequence in the existing sequence.	2

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To write the program to analyze the length of the given sequences.

CO-2: Able to formulate stepwise implementation of a Perl script using Expressions and Files

CO-3: To learnt how to utilize the operators and arrays to analyse the sequence data

CO-4: To learn how to write reverse complement to access data in Python programs.

CO-4: To learn how to write functions and pass arguments in Python.

CO-5: To learn how to use exception handling in Python applications to study the GC content

Text Books:

1. Martin C Brown, “Perl The Complete Reference”, Second Edition, Tata McGraw Hill, 2001.
2. Jason Kinser, “Python for Bioinformatics”, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009.

Reference Books:

1. Erick Storm, “Perl CGI Programming”, BPB Publication, 1998.
2. Steven Holzner, “Per: Black Book”, Second Edition, Dreamtech Publication, 2007.
3. Richard L., Halterman, “Learning to Program With Python”, 2011
4. Kent D. Lee, “Python Programming Fundamentals: Second Edition”, Springer, 2010

DSE Practical 9 - - Introduction to *Insilico* Drug Designing 0042

Course Objective: This course will enable the students to understand the critical relationship among biomolecular structure, function and force field models. To utilize basic modeling techniques to explore biological phenomena at the molecular level. To emphasize Modelling drug/receptor interactions in detail by molecular mechanics, molecular dynamics simulations and homology modeling.

1.	Retrieving the 2D structure of Drug molecule from PubChem.	3
2.	Retrieving the 2D structure of Drug molecule from Drug Bank.	3
3.	Retrieving the 2D structure of Drug molecule from Chem Bank.	3
4.	Small molecule building, using CHEM SKETCH.	3
5.	Small molecule building, using Chem Doodle.	3
6.	Predict the molecular properties for the drug	3
7.	Predict the Biological properties for the drug	3
8.	Predict the Druglikness properties for the drug	3
9.	Predict the ADMET properties for the drug	3
10.	Virtual screening using NCI database.	3

Total: 30 Hours

COURSE OUTCOMES:

CO-1: To understand the structural organisation properties of a drug using various techniques.

CO-2: To explain how to model the ligand molecules using tools primary and secondary structures of proteins

CO-3: To describe molecular and biological properties of a drug using tools.

CO-4: To learn about various methods used in energy minimization.

CO-5: To screen to a variety of drug classes and some pharmacological properties.

Text Book:

1. Satyanarayanajois. Drug Design and Discovery - Methods and Protocols. ISBN 978-1-61779-012-6

References Book:

1. Basic Principles of Drug Discovery and Development by Benjamin Blass.
2. D. C. Young ,Computational Drug Design: A Guide for Computational and Medicinal Chemists ISBN: 978-0-470-12685-1

DSE 7 - Genome Sequencing Technology 4004

Course Objective: This course will enable the students to provide an overview of whole-genome sequencing and next-generation sequencing, including historical, technical and utilization perspectives. To understand the importance and role of the bioinformaticist in Genome Sequencing. To understand the relationship between sequencing coverage and depth

UNIT 1 Introduction 12

Platform overview - Biological applications - Basic concepts - Recent scientific breakthroughs using GS technology – Data processing - Analysis workflow - Sequence quality evaluation - Alignment theories - Dataformats - Data visualization - DNA sequencing - genetic variations - GS and genetics of complex disease .

UNIT 2 DNA Sequencing 12

Experimental considerations - Whole genome sequencing - Target sequencing - Pool sequencing -Sequencing mappability - Refined alignment - Base quality recalibration - Variants identification for Diploid genome,Pooled DNA sequencing, Prioritizing genetic variants - Non-synonymous variants (SIFT, PolyPhen) – Synonymous variants - Regulatory variants - Statistical methods on rare variants. Short read assembly, alignment and applications – denovo Sequencing, resequencing, gene expression.

UNIT 3 RNA Sequencing 12

Biological theories on RNA-seq experiments - Experimental considerations - Published examples – Major scientific advance using RNA-seq – Alignment - Gene expression analysis - Differential expression analysis -Alternative splicing - Transcript variation - Allele-specific expression - RNA editing – smRNA.

UNIT 4 CHIP – SEQ 12

Biological theories on ChIP-seq analysis - Published studies - Experimental considerations - DNA fragment evaluation - Peak identification - Two condition comparison - Saturation analysis - Motif finding and related theories -DNA methylation - Experimental considerations - Statistical considerations - Bioinformatics tools – Histone modification - Experimental approaches - Statistical considerations - Hidden Markov model annotating histone

UNIT 5 Analysis 12

Using RNA-seq Data to Detect Differentially Expressed Genes.- Differential Expression Analysis of Complex RNA-seq - small RNA sequencing. Epigenetics Next generation sequencing applications in Agri-Biotech, health care, metagenomics, GWAS and basic sciences.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To gain knowledge on various techniques, algorithms and tools employed in DNA sequencing, assembly and its applications.

CO-2: To explain about various techniques and instrumentations used for nucleotide sequencing.

CO-3: To describe about various approaches in genome sequencing and splicing techniques.

CO-4: To analyse the biological data information through CHIP technique.

CO-5: To utilize the sequencing technology in agri and healthcare management.

Text Book:

1. Somnath Datta, Nettleton Dan (Eds.) Statistical Analysis of Next Generation Sequencing Data, 2014.

Reference Books:

1. Stuart M. Brown. Next-Generation DNA Sequencing Informatics, 2013.
2. Ali Masoudi-Nejad, Zahra Narimani, Nazanin Hosseinkhan. Next Generation Sequencing and Sequence Assembly:
3. Methodologies and Algorithms (SpringerBriefs in Systems Biology), ISBN-10: 1461477255, Springer; 2013.

DSE 8 - Clinical Pharmacokinetics 3104

Course Objective: This course will enable the students to assist in developing their skills to understand and assess clinically relevant drug interactions in a way to finally contribute for minimizing adverse drug interactions (ADRs) in healthcare. To acquire knowledge and practical skills as practitioners in order to improve drug efficacy and safety profiles in clinical practice.

UNIT I Basic principles of Drug 12

Protein binding of drugs, Intestine drug metabolism, Hepatic drug metabolism, Assessment of drug interactions mechanisms, Drug-drug drug-food and drug-herb interactions, Mechanisms involved in the emergence of adverse drug interactions, Pharmacogenomics and adjustment of drug dosage delivery,

UNIT II - Basic principles of clinical pharmacokinetics: 12

Drug uptake - assessment and clinical utility, Drug distribution - assessment and clinical utility, Drug elimination - assessment and clinical utility, Drug metabolism - assessment and clinical utility. Protein binding and drug distribution: Consequences for drug bioavailability and clinically relevant interactions, Hepatic function and drug distribution

UNIT III - Drug response - I 12

Absorption - Drug Dissolution, Membrane permeability, Routes of administration, Bioavailability, Drug Interactions on absorption.

Distribution - Apparent volume of distribution, Protein binding, Unbound fraction of drug, Drug interactions on distribution.

UNIT IV - Drug response - II 12

Renal Elimination - Mechanisms of renal elimination, Rate of elimination, Drug remaining to be excreted, Drug interactions in renal excretion.

Hepatic Elimination - Effect of hepatic blood flow, Effect of protein binding, Effect of intrinsic clearance, Drug interactions on hepatic elimination, First pass effect and bioavailability, Differences between low and high extraction drugs.

UNIT V - Drug metabolizing enzymes **12**

Drug metabolizing enzymes and transporters: Function, tissue distribution, pharmacokinetics-pharmacogenomics evaluation and pharmacological assessment, Drug-food interactions: Mechanisms and clinical relevance, Drug-herb interactions: Mechanisms and clinical relevance, Drug-drug interactions: Mechanisms and clinical relevance. Environmental toxicants and drug distribution: clinical evaluation

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To contribute at planning, design and analysis of clinical studies, from a PK and PD perspective.

CO-2: To apply pharmacokinetic (PK) and pharmacodynamic (PD) information in clinical drug development.

CO-3: To describe various types of variables that are used to measure and model drug effects.

CO-4: To analyse the drug interaction techniques.

CO-5: To Interpret the impact of genetic poylmorphisms of individuals on pharmacokinetics and pharmacodynamics of drugs

Text Books:

1. Zdanowicz M, "Concepts in Pharmacogenomics", ASHP, 2010.

References Books:

1. Adam Hedgecoe, "The Politics of Personalized Medicine- Pharmacogenetics in the Clinic", Cambridge University Press, first edition, 2004.
2. Werner Kalow, Rachel F Tyndale, Urs A Meyer, "Pharmacogenomics", Marcel Dekker Inc., 2001

DSE 9 - R- Programing Language 3024

Course Objective:

This course will enable the students to understand the basics in R programming in terms of constructs, control statements, string functions. To understand the use of R for Big Data analytics. To able to appreciate and apply the R programming from a statistical perspective

UNIT I Introduction to R 12

R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA andNULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT II Data types and variables 12

R-Data Types: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with

R – Variables - Variable Assignment -R Programming - Data Type of a Variable- Finding Variables- Deleting Variables.

UNIT III Decision making and loop control structure 12

R-If Statement: If...Else Statement -The if...else if...else Statement- Switch Statement- Repeat Loop-While Loop – For Loop - Loop Control Statements – Break Statement – Next Statement.

UNIT IV Function and strings 12

R-Function: Function Definition -Function Components-Built-in Function-User-defined Function-Calling a Function-Lazy Evaluation of Function-

R – Strings -Rules Applied in String Construction-String Manipulation String – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

UNIT V Vectors 12

R-Vectors: Vector Creation- Accessing Vector Elements- Vector Manipulation - Vector Arithmetic - Vector Element Recycling- Vector Element Sorting.

Total: 60 Hours

COURSE OUTCOMES:

CO-1: To understand the basics in R programming in terms of constructs, control statements, string functions.

CO-2: To understand the use of R for Big Data analytics

CO-3: To learn to apply R programming for Text processing

CO-4: Able to appreciate and apply the R programming from a statistical perspective.

CO-5: To write the program using R-Vector elements.

Text Books:

1. Norman Matloff. "The Art of R Programming"-
2. Zumel & John Mount. Practical Data Science with R- Nina

Reference Books:

1. Trevor Hastie and Rob Tibshirani.,An Introduction to Statistical Learning with Applications in R.
2. Mark P.J.van der Loo & Edwin de Jonge. Learning RStudio for R Statistical Computing.
3. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics.

DSE 10- Microarray and its Techniques 3003

Course Objective: This course will enable the students to o provide instructions to analyze, interpret, design and endorse the use of statistical tools used to analyze high dimensional microarray data. To indulge the facts and elements of applications of genomic and proteomics technologies, and functioning.

UNIT 1 Introduction 09

Introduction - The Central Dogma - Basic Genetic Mechanisms - Nucleic acid structure; transcription of protein encoding gene; Decoding mRNA by tRNAs - Stepwise synthesis of proteins on ribosomes; DNA replication; DNA repair - Transcription Control of Gene Expression - Post-transcriptional Control - Signal Transduction Leading to Gene Expression.

UNIT 2 Concept of Microarray 09

Introduction and Overview of Microarray analysis -- DNA MicroArray - The Technical Foundations-Why are MicroArrays Important- What is a DNA MicroArray- Types of MicroArray - NCBI and MicroArray Data Management, GEO (Gene Expression Omnibus) - MAML - The benefits of GEO and MAML - The Promise of MicroArray Technology in Treating Disease.

UNIT 3 Microarray Data Analysis. 09

Microarray Data analysis - Statistical analysis of array data: Dimensionality reduction, clustering, and regulatory regions - Problems and approaches - Visualization, dimensionality reduction, and principal component analysis - Clustering overview - Hierarchical clustering - K-means, mixture models, and EM algorithms - DNA arrays and regulatory regions.

UNIT 4 Microarray Experimental Design 09

The design, analysis, and interpretation of gene expression profiling experiments - Experimental design - Identification of differentially expressed genes - Determination of the source of errors in DNA array experiments - Estimation of the global false positive level for a DNA array experiment - Improved statistical inference from DNA array data using a Bayesian statistical framework - Application of clustering and visualization methods.

UNIT 5 Modern Techniques 09

New Trends in Mining Gene Expression Microarray Data - Meta-Analysis of Microarray Data - Meta-Analysis of Differential Genes - Meta-Analysis of Co-Expressed Genes - Semi-Supervised Clustering - General SemiSupervised Clustering Algorithms - A Seed-Generation Approach - Integration of Gene Expression Data with Other Data - A Probabilistic Model for Joint Mining - A Graph-Based Model

Total: 45 Hours

COURSE OUTCOMES:

CO-1: To understand the basic concepts of genetic mechanisms.

CO-2: To the study the expression of many genes using Microarray technology.

CO-4: To gain knowledge on experimental design to analyse microarray techniques.

CO-5: To analyse the probabilistic model and graphical learning using modern techniques.

CO-3: To explain about the methods to characterise and manage the different types of biological data using algorithms.

Text Books:

1. Pierre Baldi and G. Wesley Hatfield, DNA Microarrays and Gene Expression: From Experiments to Data Analysis and Modeling Cambridge University Press 2002
2. Aidong Zhang, Advanced Analysis of Gene Expression Microarray Data. World Scientific Company Ptre. Ltd. ISBN: 2006

Reference Books:

1. Helen Causton, Microarray Gene Expression Data Analysis: A Beginner's Guide. 2003
2. Michael J. Korenberg, Microarray Data Analysis: Methods and Applications (Methods in Molecular Biology) 2007

PROJECT 0 0 8 4

- Student should do research on their own interest or research guide interest on any biotechnology topic for 6 month in the university or any industries or laboratories.

- The candidates shall undertake the major project work in the Sixth Semester either in the Department concerned or in industries, institutes or any other organizations and theproject report shall be submitted at the end of the Sixth semester.

- In case the candidate undertakes the project work outside the Department, the Staff concerned within the Department shall be the Main guide and the Staff/scientist under whom the work is carried out will be the Co-guide. The candidate shall bring the attendance certificate from the place of project work carried out.

- After the research, he/she should submit the detailed reports about the research in a dissertation and should present in an external examiner.

- Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

- The report will be evaluated by duly appointed teaching faculty from head of department

SKILL ENHANCEMENT COURSE

SOFT SKILLS I **2 0 0 2**

COURSE OBJECTIVE:

- To enable participants Business Communication Skills
- To enhance participants E-mail writing skills
- To impart Leadership and Team Bonding skills

UNIT I: EFFECTIVE COMMUNICATION SKILLS **06**

Talking about your company – Making Polite requests – Introducing yourself and others – Socialising with others – Talking about work activities – Talking about your job – Communication practice – Role plays

UNIT II: WRITTEN BUSINESS COMMUNICATION **06**

Essential Email writing skills – Formal and Informal E-mails – Usage of formal language – Report Writing – Writing project reports – Extended writing practice – Email Etiquette – Understanding Business E-mails

UNIT III: TELEPHONE ETIQUETTE **06**

The basics of Telephone Etiquette – Customer Service – Being courteous – Making arrangements – Giving clear and concise information – Tone and Rate of speech – Pronunciations – Summarisation – Mock Telephonic Conversations

UNIT IV: LEADERSHIP SKILLS **06**

Essential Leadership Skills – Interpersonal Skills – Team Building – Team work – Do's and Don'ts of Leadership skills – Importance of communication in Leadership – Delegating and Handling of Projects

UNIT V: LISTENING AND ANSWERING QUESTION **06**

Listening for the main ideas – Listening for details – Listening for specific information – Predicting and listening for opinions – Recognising context – Listening for sequence – Understanding Pronunciation – Listening practice

Total 30 Hours

COURSE OUTCOMES:

CO1 To enhance participant's Business Communication Skills

CO2 To enhance the participant's Reading, Speaking, Listening and Writing capabilities

CO3 To engage in a conversation with others to exchange ideas

CO4 To impart leadership qualities among the participants

CO5 To express opinions to enhance their social skills

BOOKS PRESCRIBED:

1. Raman, M. & Sangeeta Sharma. Technical Communication.OUP.2008
2. Taylor, Grant.English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd. 2005
3. Tiko, Champa & Jaya Sasikumar. Writing with a Purpose.OUP. New Delhi. 1979

WEB SOURCES:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://blog.smarp.com/top-5-communication-skills-and-how-to-improve-them
- https://blog.hubspot.com/service/phone-etiquette

SOFT SKILLS II **2 0 0 2**

COURSE OBJECTIVE:

- To enable students to develop their communication skills effectively
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence through communicatio

UNIT I: READING COMPREHENSION AND VOCABULARY **06**

Reading Techniques – Types of Reading – Skimming – Scanning – Reading for detail – Identifying key words – Underlining unfamiliar key words – Vocabulary Building – Reading Comprehension practice

UNIT II: PRESENTATION SKILLS **06**

Presentation Methods – Preparation and Practice – Organising content – Do's and Don'ts of a Presentation – Presentation Techniques – Mock Presentation

UNIT III: GROUP DISCUSSION **06**

Introduction to Group Discussion – Preparation for GD – Structure of GD's – Do's and Don'ts – Tips and Strategies – Etiquette and Practice – Body Language and Posture – Sharing Ideas with respect – Understanding Opinions – Mock GD Practice

UNIT IV: CONVERSATIONAL SKILLS **06**

Introduction to Small talk – How to start and end a conversation – Exchanging ideas – Expressing Interests – Giving Opinions – Social skills and Etiquette – Informal Conversations – Formal Meetings – Group Practice

UNIT V: SELF – INTRODUCTION AND ROLE PLAY **06**

Introducing oneself – Exchange of Greetings – Appropriate Greetings – Usage of

Vocabulary – Rapport Building – Handshakes and First Impressions – Basic Etiquette

Total 30 Hours

COURSE OUTCOMES:

CO1 To get students to understand the importance of communicating in English

CO2 To understand effective communication techniques

CO3 To increase self-confidence through regular practice

CO4 To encourage active participation in their regular class

CO5 To enable participants to face large group of audience with confidence

BOOKS PRESCRIBED:

1. English for Competitive Examinations by R.P.Bhatnagar & Rajul Bhargava Macmillan India ltd. Delhi.
2. Carnegie, Dale. The Quick and Easy Way to Effective Speaking. New York: Pocket Books, 1977.
3. Kalish, Karen.How to Give a Terrific Presentation. New York: AMACOM, 1996

WEB SOURCES:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://venngage.com/blog/presentation-skills/
- https://gdpi.hitbullseye.com/Group-Discussion.php

SOFT SKILLS III **2 0 0 2**

COURSE OBJECTIVE:

- To enable students to develop their soft skills and Body Language
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence to excel at Interviews

UNIT I: SKILL ENHANCEMENT **06**

Time Management – Planning and Organisation – Scheduling – Prioritization – Delegation – Task Management – Stress Management – Overcoming anxiety – Confidence Building – Body Language

UNIT II: RESUME / COVER LETTER WRITING **06**

SWOT Analysis – Details and Resume Writing – Resume Examples – Building Resume using SWOT – Writing Resume – Writing Cover Letter – Resume Correction – Resume Feedback

UNIT III: INTERVIEW SKILLS **06**

Interview Do's and Don'ts – First Impression – Grooming – Body Language – Frequently asked questions – Useful Language – Mock Interview

UNIT IV: QUANTITATIVE ABILITY **06**

Permutation & Combinations – Probability – Profit & Loss – Ratio Proportions & Variations – Cubes – Venn Diagrams – Logical Reasoning – Critical Reasoning

UNIT V: REVISIONARY MODULES **06**

Group Discussions – HR Process – Interview Process – Mock Group Discussions

Total 30 Hours

COURSE OUTCOMES:

CO1 To develop participants social and professional skills

CO2 To help participants manage time effectively

CO3 To build a strong resume to suit corporate requirements

CO4 To face interviews confidently

CO5 To enhance their aptitude abilities

BOOKS PRESCRIBED:

1. Meena. K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills: A Road Map to Success) P.R. Publishers & Distributors.
2. Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, NewDelhi
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. NewDelhi: Tata McGraw-Hill Publishing Company Limited, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

WEB SOURCES:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://www.businessnewsdaily.com/5836-top-interviewing-skills.html
- https://gdpi.hitbullseye.com/Group-Discussion.php

Internship / Capability Enhancement Programme 0021

COURSE OBJECTIVES:

- For the benefit of the students, it has been mandatory to attend a minimum of one internship/ Capability Enhancement Programme during semester vacation

- Student should go for internship/ Capability Enhancement Programme in any bioinformatics industries or laboratories and learn their laboratory techniques by hands on training.

- After the internship/ Capability Enhancement Programme, student should submit detailed reports about the internship/ Capability Enhancement Programme in printed format.

- Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

- The report will be evaluated by duly appointed teaching faculty from head of department.

ENTREPRENEURSHIP DEVELOPMENT 2 0 0 2

COURSE OBJECTIVE:

- To develop and strengthen entrepreneurial quality and motivation in students.
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
- To understand the concept and process of entrepreneurship and its contribution in and role in the growth and development of individual and the nation.

UNIT I Entrepreneurship 6

Entrepreneur – Personality characteristics of successful entrepreneur– Types of Entrepreneurs – Knowledge and skills required for an entrepreneur –Difference between Entrepreneur and Intrapreneur.

UNIT II Business: 6

Business: Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business –Market Survey and Research–Techno Economic Feasibility Assessment

UNIT III Business Plan Preparation 6

Business Plan Preparation: Sources of product for business – Pre-feasibility study – Criteria for selection of product– Ownership – Capital – Budgeting project profile preparation – Matching entrepreneurwith the project – Feasibility report preparation and evaluation criteria.

UNIT IV Business Plan Preparation 6

Support to Entrepreneurs: Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry.

UNIT V Entpreneurship Development Programme 6

Entpreneurship Development Programme: Meaning, Objectives–Phases of EDP– steps in EDP–Strategies for Entrepreneurship development– Institutions in aid of Entrepreneurship Development Programme–Use of IT enabled services in entrepreneurship - E Licensing, E filing.

Total 30 hrs

COURSE OUTCOMES:

At the end of the course, a student will be able to

- Define the need and importance of entrepreneurship concepts.
- Understand the concept of Entrepreneurship
- Explain the meaning, importance and functions of entrepreneur.
- Evaluate the role of mentoring in small industries development industries.
- Identify, create and analyze entrepreneurial opportunities.
- Develop and promote entrepreneurial and innovative project report.
- Discuss about challenges faced by women entrepreneurs.
- Develop motives to become an entrepreneur
- State various statutory legislations involved in the process of Entrepreneurship development
- Explain Entrepreneurship Development Programme.

TEXT BOOKS:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2016
2. Khanka S.S., "Entrepreneurial Development" S Chand & Company; edition, 2016

REFERENCE BOOKS:

1. Sharma, "Entrepreneurship Development", Phi Learning Pvt Ltd, (2017)
2. Abhinav Ganpule&AdityaDhobale, "Entrepreneurship Development", Kindle Edition, Jatayu Publication; 1 edition ,2018.

3. Sangeeta Sharma, “Entrepreneurship Development”, 10th Edition, Kindle EditionPHI Learning, 2018

ABILITY ENHANCEMENT COURSES

COMMUNICATION SKILLS 2002

Course Objective:

- This course is to subject the students to practise the components in various units.
- To make students ready for placement interviews within campus.
- To infuse confidence to face job situations.

Credit Hours

UNIT I **06**

- Resume and CV Writing
- Complaint Letter
- Social Correspondence
- Letter of Enquiry

UNIT II **06**

Short Essay Writing

UNIT III **06**

Explaining Proverbs

UNIT IV **06**

Use of Prepositions

UNIT V **06**

Synonymous Words

Total 30 Hours

COURSE OUTCOMES:

CO1 To enhance learners' confidence level.

CO2 To make learners' feel the assimilation of skills.

CO3 To engage in a conversation with others to exchange ideas.

CO4 To impart leadership qualities among the participants.

CO5 To express opinions to enhance their social skills.

BOOKS PRESCRIBED:

1. For Unit I – V Effective Communication For You – V. Syamala Emerald Publishers, Chennai.
2. Cameron, David. Mastering Modern English, Hyderabad: Orient Blackswan, 1978 (rpt. 1989, 1993, 1995,1998).
3. Freeman, Sarah. Written Communication in English, Hyderabad: Orient Blackswan, 1977 (21st Impression,2007).
4. Singh, Vandana R. The Written Word. New Delhi: Oxford university Press, 2003 (3rd Impression, 2007)
5. Seely, John. Oxford Guide to Effective Writing and Speaking. New Delhi: Oxford University Press, 2000 (4thImpression,2008)

Web Sources:

- https://www.myperfectresume.com/career-center/resumes/how-to/write
- https://www.englishgrammar.org/
- https://www.thesaurus.com/browse/

ENVIRONMENTAL STUDIES 2002

COURSE OBJECTIVE;

- To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.

Unit-I Multidisciplinary nature of environmental studies, Natural Resources 06

Definition, scope and importance, need for public awareness.
Renewable and non-renewable resources - Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources- Equitable use of resoureces for sustainable lifestyles.

Unit-II Ecosystems, Biodiversity and its conservation 06

Concept of an ecosystem. - Structure and function of an ecosystem Producers, consumers and decomposers. -Energy flow in the ecosystem. Ecological succession. - Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Introduction–Definition,genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels. Inida as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-III Environmental Pollution 06

Definition, Cause, effects and control measures of a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards. Solid waste Management. Causes, effects and control measures of urban and industrial

wastes. Role of an individual in prevention of pollution. Pollution case studies. Diaster management- floods, earthquake, cyclone and landslides.

Unit-IV Social Issues and the Environment 06

From Unsustainable to Sustainable development, Urban problems related to energy - Water conservation, rain water harvesting, watershed management- Resettlement and rahabilitation of people; its problems and concerns. Case Studies - Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act - Issues involved in enforcement of environmental legislation. Public awareness.

Unit-V Human Population and the Environment 06

Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

Field work - Visit to a local area to document environmental assetsriver/ forest/grassland /hill/ mountain, Visit to a local polluted site-Urban/Rural/Industrial/Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes, etc.

Total: 30 hrs

COURSE OUTCOME:

CO1: To understand the nature and facts about environment.

CO2: To find and implement scientific, technological, economic solutions to environmental problems.

CO3: To know about the interrelationship between living organisms and environment.

CO4: To understand the integrated themes and biodiversity, natural resources, pollution control and waste management.

CO5: To appreciate the importance of environment by assessing its impact on the human world.

Text Books:

1. De AK, Environmental Chemistry, Wiley Eastern Ltd.

2. Bharucha Erach, 2003. The Biodiversity of India, Mapin Publishing Pvt. Ltd, India.
3. Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
4. Clark RS, Marine Pollution, Clanderson Press, Oxofrd (TB).

Reference Books:

1. Agarwal KC, 2001. Environmental Biology, Nidi Publishers Ltd. Bikaner.
2. Gleick HP, 1993. Water in Crisis, Pacific Institute for Studies in Development, Environment and Security. Stockholm Environmental Institute, Oxford University Press, 473pgs.
3. Heywood VH, and Watson RT, 1995. global Biodiversity Assessment. Cambridge University Press 1140pgs.
4. Jadhav H and Bhosale VM, 1995. Environmental Protection and Laws. Himalaya Publishing House, Delhi 284pgs.
5. Miller TG, Jr. Environmental Science, Wadsworth Publishing CO. (TB)

Web links:

1. https://easyengineering.net/ge6351-environmental-science
2. https://learnengineering.in/ge8291-environmental-science-and-engineering/

ENGLISH

ENGLISH I - PROSE **3 0 0 3**

COURSE OBJECTIVE:

- To enable students to develop their communication skills effectively. To make students familiar with usage skills in English Language.
- To enrich their vocabulary in English
- To develop communicative competency.

Credit Hours

UNIT I **09**

1. Dangers of Drug Abuse - Hardin B Jones

2. Tight Corners - E. V. Lucas

UNIT II **09**

3. Futurology - Aldous Huxley

4. If You are Wrong, Admit it - Dale Breckenridge Carnegie

UNIT III **09**

5. Industry - Dr.M.Narayana Rao & Dr.B.G.Barki

6. Turning Point of My Life - A.J Cronin

UNIT IV **09**

7. Excitement - Mack R. Douglas

8. The Kanda Man Eater - Jim Corbett

UNIT V **09**

9. Vocabulary and Exercises under the Lessons

Total 45 Hours

Note: Lessons prescribed are from various anthologies and respective exercises therein will be taught.

COURSE OUTCOMES

At the end of this course students will be able to,

CO1 Examine the language of prose.

CO2 Utilize instructions on fundamentals of grammar

CO3 Develop their own style of writing after studying diverse prose essays.

CO4 Classify different essays on the basis of their types.

CO5 Critically comment on the textual content of prose.

BOOKS PRESCRIBED:

1. English for Communication Enrichment: by Jeya Santhi June 2015.
2. Dr. M. Narayana Rao and Dr. B. G. Barki – Anu's Current English for Communication(AnuChitra). June 2012.
3. Dr. Ananthan , R. Effective Communication. Ed. Chennai : Anu Chithra Pub.2010.

WEB SOURCES:

- https://www.gradesaver.com/
- https://www.enotes.com/
- https://www.jstor.org/
- https://www.sparknotes.com/
- https://www.cliffsnotes.com/

ENGLISH II – POETRY **3 0 0 3**

COURSE OBJECTIVE:

- To enable students to develop their communication skills effectively.
- To enrich their vocabulary in English
- To develop communicative competency.

Credit Hours

UNIT I **09**

1. Growing Old - Winston Farewell

2. Ecology - A. K. Ramanujan

UNIT II **09**

3. Stopping by Woods on a Snowy Evening - Robert Frost

4. Our Casuarina Tree - Toru Dutt

UNIT III **09**

5. Goodbye Party for Miss Pushpa T.S. - Nissim Ezekiel

6. The Bull - Ralph Hodgson

UNIT IV **09**

7. If - Rudyard Kipling

8. The Drowned Children - Louise Glück

UNIT V **09**

9. Australia - A.D.Hope

10. A Far Cry from Africa - Derek Walcott

Total 45 Hours

COURSE OUTCOMES

At the end of this course students will be able to,

CO1 Learn to employ Poetic expressions in the course of daily speech.

CO2 Prove their better communicative ability.

CO3 Prove their skill in writing sentences with poetic impact.

CO4 Develop different sensibilities in approaching life.

CO5 Solve life's problems as highlighted in the selections.

BOOKS PRESCRIBED:

1. Selections from Caribbean Literature. Mahaam Publishers, Chennai.
2. Our Casuarina Tree - Vasan Publication By Dr.A Shanmugakani

WEB SOURCES:

1. https://www.gradesaver.com/
2. https://www.enotes.com/
3. https://www.jstor.org/
4. https://www.sparknotes.com/
5. https://www.cliffsnotes.com/

ENGLISH III - DRAMA AND COMPOSITION - 3 0 0 3

Course Objective:

To train students in the use of English language in varied literary and non-literary contexts.

To teach them soft skills and strengthen their foundation in grammar and composition.

To evaluate their comprehension skills.

Credit Hours

UNIT I **09**

Introduction to Drama .

UNIT II **09**

Shakespeare: Funeral Oration (Act III Scene II Julius Caesar) &

Monkey's Paw - W.W.Jacobs

UNIT III **09**

Comprehension

UNIT IV **09**

Precis -Writing and Note Taking

UNIT V **09**

General Essay on Current Topics

Total 45 Hours

COURSE OUTCOMES

At the end of this course students will be able to,

CO 1 Estimate the dramatic scenes in the light of appeal of values.

CO 2 Prioritize pragmatic day- to - day communication through comprehension.

CO 3 Develop dramatic skill after reading the scenes of plays.

CO 4 Improve their own style of writing after an expose to the prescribed dramatic pieces.

CO 5 Adapt themselves to life - context wherein soft skill demonstration is a must.

BOOKS PRESCRIBED:

- An Introduction to Drama. IInd Edition by George Whitfield
- Reading Comprehension for College Students Paperback – Import, 1984by Reinhart G. Kussat (Author)
- The Monkey's Paw By W. W. Jacobs Publisher: Perfection Learning

WEB SOURCES:

- https://www.gradesaver.com/
- https://www.enotes.com/
- https://www.jstor.org/
- https://www.sparknotes.com/
- https://www.cliffsnotes.com/

ENGLISH IV - PRACTICAL ENGLISH (CONVERSATION PRACTICE) - 3 0 0 3

COURSE OBJECTIVE:

- To train students in the use of English language in varied literary and non-literary
- contexts.
- To teach them soft skills and strengthen their foundation in grammar.
- To evaluate students to sensitivity in conversational competency.

Credit Hours

UNIT I **09**

i. At the Airport

ii. In a Bank

iii. On a Bus

UNIT II **09**

iv. In Flight

v. In a Hotel

vi. In a Library

UNIT III **09**

vii. Tea Time

viii. On a Train

ix. In a Restaurant

UNIT IV **09**

x. On a Picnic

xi. In a Police station

xii. In a Post office

UNIT V **09**

xiii. In a travel agency

xiv. Asking the way

xv. At the theatre

Total 45 Hours

COURSE OUTCOMES

At the end of this course students will be able to,

CO1 Feel confident to speak in different situations.

CO2 Learn befitting vocabulary words.

CO3 Have the ability to visualize speaking situations.

CO4 Be conversant with other conversational situations.

CO5 Categorize the nature of questions asked usually in interviews.

BOOKS RECOMMENDED:

1. English Conversation Practice, D.H.Spencer, Oxford.
2. Communicative English by Department of English, National College(Autonomous), Trichy.

WEB SOURCES:

- https://self-publishingschool.com/how-to-write-dialogue/
- https://www.masterclass.com/articles/how-to-write-dialogue

LANGUAGES

தமிழ்மொழிப்பாடம்-1 **3003**

இக்காலக் கவிதைகள் – உரைநடை – பண்பாடு – மொழித்திறன்

அலகு 1: மரபுக்கவிதை 9 மணி நேரம்

1. பாரதியார் - பாரத தேசம் என்னும் தலைப்பில் ஆறு பாடல்கள். (பாடல் எண்கள் 1, 6, 7, 9, 12, 13)
2. பாரதிதாசன் – தமிழுக்கும் அமுதென்று பேர் என்னும் தலைப்பிலான கவிதை.
3. தேசிக விநாயகம் பிள்ளை - உடல் நலம் பேணல் என்னும் தலைப்பிலான கவிதை
4. முடியரசன் - காவியப் பாவை – "புண்படுமா" என்னும் கவிதை.

அலகு 2: புதுக்கவிதை 9 மணி நேரம்

1. நா. காமராசன் - ***கறுப்பு மலர்கள்*** தொகுப்பில் ***காகிதப்பூக்கள்*** என்னும் தலைப்பிலான கவிதை.
2. அப்துல் ரகுமான் - ***ஆலாபனை*** தொகுப்பில் ***போட்டி*** என்னும் தலைப்பிலான கவிதை
3. ஈரோடு தமிழன்பன் - ***ஒரு வண்டி சென்ரியு*** தொகுப்பில் தேர்ந்தெடுக்கப்பட்ட சென்ரியு கவிதைகள்
4. ஆண்டாள் பிரியதர்ஷினி – ***முத்தங்கள் தீர்ந்துவிட்டன*** தொகுப்பில் ***'இங்கே வரும் போது*** என்னும் தலைப்பிலான கவிதை

அலகு 3: உரைநடை 9 மணி நேரம்

1. **மாணாக்கரும் தாய்மொழியும்** - திரு.வி.க.,
2. **மன வலிமை வேண்டும் - மு.வரதராசனார்**
3. **செம்மொழித் தமிழின் சிறப்புகள்**
4. **பண்டைத் தமிழரின் சாதனைச் சுவடுகள**

அலகு 4: தமிழர் வாழ்வும் பண்பாடும் 9 மணி நேரம்

பண்பாடு – வாழ்வியல் முறை – அகம், புறம் - உணவு முறை - விருந்தோம்பல் - நம்பிக்கைகள் – விழாவும் வழிபாடும் - கலைகள் - கட்டடம் - சிற்பம் - ஓவியம் - இசை – கூத்து – தொழிலும் வணிகமும் – அறிவியல் நோக்கு.

அலகு 5: மொழித்திறன், இலக்கிய வரலாறு, இலக்கணம்
9 மணி நேரம்

1. எழுத்துப் பிழை, தொடர்ப் பிழைகள்
2. வேற்றுமை இலக்கணம்
3. செய்யுள் நலம் பாராட்டல்
4. பாடம் தழுவிய இலக்கிய வரலாறு (மரபுக் கவிதை, புதுக்கவிதை, உரைநடை)

மொத்தம்: 45 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம்
2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம்
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம்
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி ,
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம் -** https://archive.org/

தமிழ்மொழிப்பாடம்-2 **3003**

அற இலக்கியம் – சிற்றிலக்கியம் – சிறுகதை – பயன்பாட்டுத் தமிழ்

அலகு 1: அற இலக்கியங்கள் 10 மணி நேரம்

1. திருக்குறள் - வான் சிறப்பு(அறம்), ஊக்கமுடைமை(பொருள்), குறிப்பறிதல்(இன்பம்) – மூன்று அதிகாரங்கள் முழுமையும்.
2. நாலடியார் – மூன்று பாடல்கள். (2, 3, 5)
3. பழமொழி நானூறு – மூன்று பாடல்கள் (74, 75, 78)
4. திரிகடுகம் – மூன்று பாடல்கள் (10, 12, 22)
5. இனியவை நாற்பது – மூன்று பாடல்கள் (1, 12, 16)

அலகு 2: சிற்றிலக்கியம் 10 மணி நேரம்

1. முத்தொள்ளாயிரம்
   சேரன் – வீரம் 14, 15 பாடல்கள்
   சோழன் – காதல் 23, 24 பாடல்கள்
   பாண்டியன் – நாடு 87, 88 பாடல்கள்
2. தமிழ்விடு தூது – முதல் 20 கண்ணிகள்
3. திருக்குற்றாலக் குறவஞ்சி – மலைவளம் கூறுதல் – முதல் 5 பாடல்கள்
4. முக்கூடற்பள்ளு – மூத்த பள்ளி நாட்டு வளம் கூறுதல் 3 பாடல்கள், இளைய பள்ளி நாட்டு வளம் கூறுதல் 3 பாடல்கள்.
5. கலிங்கத்துப் பரணி – பாலை பாடியது – முதல் 5 பாடல்கள்

அலகு 3: சிறுகதை 9 மணிநேரம்

1. அறிஞர் அண்ணா - செவ்வாழை
2. புதுமைப்பித்தன் - கடவுளும் கந்தசாமிப் பிள்ளையும்
3. ஜெயகாந்தன் - யுகசந்தி
4. கு.அழகிரிசாமி - காற்று
5. அம்பை - காட்டில் ஒரு மான்

6. **அலகு** 4: **பேச்சுத் தமிழ்**

8 மணி நேரம்

பேச்சுத் திறன் – விளக்கம் – பேச்சுத்திறனின் அடிப்படைகள் – வகைகள் – மேடைப்பேச்சு – உடையாடல் - பயிற்சிகள்

அலகு 5: எழுத்துத் தமிழ், இலக்கிய வரலாறு, இலக்கணம்

8 மணி நேரம்

1. கலைச் சொல்லாக்கம் – தேவைகள் – கலைச்சொற்களின் பண்புகள் – அறிவியல் கலைச் சொற்கள் – கடிதம் – வகைகள் – அலுவலகக் கடிதங்கள் – உறவுமுறைக் கடிதங்கள்.
2. பாடம் தழுவிய இலக்கிய வரலாறு (அற இலக்கியம், சிற்றிலக்கியம், சிறுகதை)
3. அணி இலக்கணம்
4. விண்ணப்பக் கடிதம் எழுதுதல்

மொத்தம்: 45 மணி நேரம்

பார்வை நூல்கள்

1. **பேசும் கலை,** முனைவர் கு.ஞானசம்பந்தன் விஜயா பதிப்பகம்
2. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., சாகித்திய அக்காதெமி , புது தில்லி
3. **தமிழ் நடைக் கையேடு,** மொழி அறக்கட்டளை
4. **பயன்பாட்டுத் தமிழ்**, முனைவர் அரங்க இராமலிங்கம், முனைவர் ஒப்பிலா மதிவாணன், சென்னை பல்கலைக்கழகம், 2007
5. **மொழிபெயர்ப்பியல் அடிப்படைகள்,** கா. பட்டாபிராமன், யமுனைப் பதிப்பகம், திருவண்ணாமலை

6 பாடநூல் தேடலுக்கான இணையம்

- http://www.tamilvu.org/library
- https://archive.org/

தமிழ்மொழிப்பாடம்-3 **3003**

பக்தி இலக்கியம் – காப்பியம் – புதினம் - மொழிபெயர்ப்பு

அலகு 1: பக்தி இலக்கியம் 10 மணி நேரம்

1. **மாணிக்கவாசகர்** - திருவாசகம் – மூன்று பாடல்கள்
   - ✓ புல்லாகி பூடாகி (சிவபுராணம்)
   - ✓ எல்லாப் பிறப்பும் (சிவபுராணம்)
   - ✓ உற்றாரை யான் வேண்டேன் (திருப்புலம்பல்)
2. **ஆண்டாள்** - திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)
   - ✓ மார்கழித் திங்கள் ... (பாசுரம் 1)
   - ✓ ஓங்கி உலகளந்த... (பாசுரம் 3)
   - ✓ ஆழிமழைக் கண்ணா... (பாசுரம் 4)
3. **வீரமாமுனிவர்** - தேம்பாவணி – மூன்று பாடல்கள்
   - ✓ நீ ஒரு தாய்; ஒரு தாதையும் நீ (698 - சூசை இறைவனின்தாயைப்போற்றுதல்)
   - ✓ அணிக் கலத்து அழகு அழுந்திய (1089 - வானவர் இயேசு நாமத்தைப் போற்றி வணங்கிய செய்தி)
   - ✓ வான் புறத்து இலகும் செஞ் சுடர் காண (3510 - இறைவன் சூசை முனிவர்க்கு ஏழு மணிகள் புறத்தில் ஒளிவிடும் முடியைச் சூட்டுதல்)
4. **குணங்குடி மஸ்தான் சாகிபு** - பராபரக் கண்ணி 1-10 கண்ணிகள்
5. **திருமூலர்** - திருமந்திரம் – மூன்று பாடல்கள்
   - ✓ உடம்பார் அழியின் உயிரார் அழிவர் (திருமந்திரம்: 724)
   - ✓ படமாடக் கோயில் பகவற்கு ஒன்று ஈயில் (திருமந்திரம்: 1857)
   - ✓ மரத்தை மறைத்தது மாமத யானை (திருமந்திரம்: 2290)
6. **இராமலிங்க அடிகள்** - திருவருட்பா – மூன்று பாடல்கள்
   - ✓ எத்துணையும் பேதமுறா... (5297)
   - ✓ ஒருமையுடன் நினது திருமலரடி நினைக்கின்ற (2938)
   - ✓ கோடையிலே... (4091)

அலகு 2: காப்பியம்-1 9 மணி நேரம்

1. சிலப்பதிகாரம் – அடைக்கலக் காதை
   (தெரிவுசெய்யப்பட்ட பாடல் அடிகள் 120-199)
2. சீவக சிந்தாமணி – விமலையார் இலம்பகம்
   (தெரிவுசெய்யப்பட்ட பாடல்கள்)

அலகு 3: காப்பியம்-2 9 மணி நேரம்

1. கம்பராமாயணம் – மந்தரை சூழ்ச்சிப் படலம்
   (தெரிவு செய்யப்பட்ட பாடல்கள்)

2. பெரியபுராணம் – பூசலார் நாயனார் புராணம்
(தெரிவு செய்யப்பட்ட பாடல்கள்)

அலகு 4: புதினம் 8 மணி நேரம்

1. கல்மரம் - கோ. திலகவதி

அலகு 5: மொழிபெயர்ப்பு, இலக்கணம், இலக்கிய வரலாறு
9 மணி நேரம்

1. அலுவல்சார் மொழிபெயர்ப்பு
2. இலக்கணக் குறிப்பு
3. பாடம் தழுவிய இலக்கிய வரலாறு (பக்தி இலக்கியம், காப்பியம், புதினம்)

மொத்தம்: 45 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., சாகித்திய அக்காதெமி , புது தில்லி
2. **தமிழ் நடைக் கையேடு,** மொழி அறக்கட்டளை
3. **பயன்பாட்டுத் தமிழ்**, முனைவர் அரங்க இராமலிங்கம் முனைவர் ஒப்பிலா மதிவாணன், சென்னை பல்கலைக்கழகம், 2007
4. **மொழிபெயர்ப்பியல் அடிப்படைகள்,** கா. பட்டாபிராமன், யமுனைப் பதிப்பகம், திருவண்ணாமலை

5 பாடநூல் தேடலுக்கான இணையம்

- http://www.tamilvu.org/library
- https://www.tamildigitallibrary.in/book

சங்க இலக்கியம் – நாடகம் – வளர் தமிழ் - பொதுக்கட்டுரை

அலகு 1: சங்க இலக்கியம் - 1 10 மணி நேரம்

1. புறநானூறு (மூன்று பாடல்கள் - 183, 184, 192)
2. பதிற்றுப்பத்து (இரண்டு பாடல்கள் – 14, 69)
3. பட்டினப்பாலை (காவிரியின் சிறப்பு பாடல் அடிகள் 01-07, சோழநாட்டு வளம் பாடல் அடிகள் 20-28, பல்பொருள் வளம் பாடல் அடிகள் 183-193)
4. மதுரைக் காஞ்சி (பாண்டியர் பரம்பரை பாடல் அடிகள் 01-23, மன்னர்க்கு மன்னன் பாடல் அடிகள் 64-74, பாண்டியன் புகழ் பாடல் அடிகள் 197-209).

அலகு 2: சங்க இலக்கியம் - 2 9 மணி நேரம்

1. நற்றிணை (இரண்டு பாடல்கள் - 1, 172)
2. குறுந்தொகை (மூன்று பாடல்கள் – 3, 40, 135)
3. ஐங்குறுநூறு (மூன்று பாடல்கள் – 281, 283, 286)
4. அகநானூறு (இரண்டு பாடல்கள் – 4, 86)
5. கலித்தொகை (இரண்டு பாடல்கள் – 9, 133)

அலகு 3: நாடகம் 8 மணி நேரம்

1. ஆட்டனத்தி ஆதிமந்தி – கவிஞர் கண்ணதாசன்

அலகு 4: வளர்தமிழ் 9 மணி நேரம்

1. **ஊடகத் தமிழ் – கணினித் தமிழ் அறிமுகம்**

ஊடகத் தமிழ்: அச்சுக்கலை – இதழியல் - ஊடக வகைகள் - அச்சு ஊடகங்கள் - மின்னணு ஊடகம் - இதழியல் முன்னோடிகள் - அச்சு ஊடகங்களில் தமிழ் - கருத்துப் பரிமாற்றம் - மொழி நடையின் தன்மை - நாளிதழ்கள் - வார,

மாத இதழ்கள் - மின்னணு ஊடகங்களில் தமிழ் - வானொலி- தொலைக்காட்சி- திரைப்படம்.

கணினித் தமிழ்: கணினித் தமிழின் அடிப்படையும் பயன்பாடும் -கணிப்பொறியின் வரலாறும் வளர்ச்சியும், கணினியும் தமிழும், விசைப்பலகை (Keyboard) - எழுத்துருக்கள் (Fonts) - தமிழைத் தட்டச்சு செய்ய உதவும் மென்பொருள்கள், தமிழைத் தட்டச்சு செய்யும் முறைகள் - தமிழ்த் தட்டச்சுப் பயிற்சி - இணையமும் தமிழ்ப் பயன்பாடும் - தேடுபொறி (Search) - வலைப்பூ (Blog), மின்னூலகம் (Online e-Library), - மின்னகராதி
(e-Dictionary), - மின் செய்தித்தாள் - e-Paper, - இணையவழித் தமிழ்க் கற்றலும்-கற்பித்தலும் - மின்வழிக் கற்றல் - e Learning.

அலகு 5: பொதுக்கட்டுரை, இலக்கிய வரலாறு, இலக்கணம்

9 மணி நேரம்

1. பொதுக்கட்டுரை வரைதல்
2. பாடம் தழுவிய இலக்கிய வரலாறு (சங்க இலக்கியம், நாடகம், வளர்தமிழ்)
3. இலக்கணம் (பொருளிலக்கணம்) திணை, துறை விளக்கம்.

மொத்தம்: 45 மணி நேரம்

பார்வை நூல்கள்

1. **கணினித்தமிழ்**, முனைவர் இல.சுந்தரம், விகடன் பிரசுரம்
2. **கணிப்பொறியில் தமிழ்**, த.பிரகாஷ், பெரிகாம்
3. **தமிழ்க் கணினி இணையப் பயன்பாடுகள்**, முனைவர் துரை. மணிகண்டன், மணிவானதி பதிப்பகம்
4. **இதழியல் கலை**, டாக்டர் மா. பா. குருசாமி, குரு - தேமொழி பதிப்பகம், திண்டுக்கல்
5. **அச்சுக் கலை வழிகாட்டி**, பாலசுப்பிரமணியன், ஆ., சென்னை : தனசு பதிப்பகம், 1966

6. **தொலைக்காட்சிக் கலை,** முனைவர் வெ. நல்லதம்பி,
மங்கைப் பதிப்பகம்,
சென்னை 42

8 பாடநூல் தேடலுக்கான இணையம்

- http://www.tamilvu.org/courses/nielit/Chapters/Chapter1/11.pdf
- https://www.tamildigitallibrary.in/

HINDI - I 3 0 0 3

(Prose, Letter writing & Technical words)

COURSE OBJECTIVE:

- To enable the students to develop communication skills
- To train students in official language
- To enrich their knowledge in Hindi literature

Unit I - ‘ Ek atuut kadi’,letter writing,Technical words. **09**

Unit II ‘Devi singh’ , letter writing, Technical words. **09**

Unit III ‘ kabiraa ki kaashi ’, letter writing, Technical words**.** **09**

Unit IV ‘ kabiraa ki kaashi ‘, letter writing, Technical words**.** **09**

Unit V ‘ bharathiya vigyan ki kahaani ’- ‘hamne diyaa ,hamne liyaa’ ,

letter writing, 0**9**

Total hours 45

COURSE OUTCOMES

At the end of this course

CO 1 Students will be familiar with official letter writing.

CO 2 Will be trained in writing various letters.

CO 3 Students will be moulded with good character understand human values.

CO 4 Students will gain knowledge about ancient India

CO 5 Will know the equivalent hindi words for scientific terms

Text Book:

Gadya Khosh , Prashasanik shabdavali, Patra lekhan

HINDI – II 3 0 0 3

(kahani , Natak &Translation)

COURSE OBJECTIVE:

- To train students in translation
- To develop reading & writing skills
- To create interest towards reading different types of literature

Unit I	-	‘ zaruurath’ (kahani), Translation- Definition,Types	0**9**
Unit II		‘Pandit kouun ‘ (kahani), Translation - Anuvadak ke gun	**09**
Unit III	-	‘Pandit kouun (kahani) , Translation Practice	**09**
Unit IV	-	Rajani (naatak), Translation Practice	**09**
Unit V	-	Rajani (naatak), Translation Practice	**09**

Total Hours :45

COURSE OUTCOMES:

At the end of this course

CO 1 Students will know the importance & process of translation

CO 2 They can develop the skill of translation

CO 3 Will know the different writing skills of authors

CO 4 Gain knowledge in hiindi literature

CO 5 Will acquire knowledge in hindi sahithya

TEXT BOOK:

Gadya Khosh , Prashasanik shabdavali, Patra lekhan

HINDI – III 3 0 0 3

(Ancient poetry,Hindi sahitya ka Ithihas)

COURSE OBJECTIVE:

- To enrich the knowledge of students through Tamil literature
- Enable them to learn ancient poems
- To develop interest in learning history of hindi literature

Unit I	**'**Thirukkural', Hindi Sahitya ka ithihas (aadikal)	**09**
Unit II	**'**Kabir ke pad', Hindi Sahitya ka ithihas (aadikal)	0**9**
Unit III	'Sur ke pad', Hindi Sahitya ka ithihas (bhakthi kal)	**09**
Unit IV	Thulsi ke pad, Hindi Sahitya ka ithihas (bhakthi kal)	**09**
Unit V	Thulsi ke pad, Hindi Sahitya ka ithihas (Rithikal)	**09**

Total Hours :45

COURSE OUTCOMES:

At the end of this course

CO 1 Students will know the valuable messages in Thirukkural

CO 2 Will create interest in knowing ancient poems .

CO 3 Gain knowledge in Hindi literature

CO 4 Will know the difference between Hindi & the languages used by ancient poets

CO 5 Will be familiar with different styles of poetry writing

RERERENCE BOOKS:

1. Thirukkural translation by Venkata krishnan
2. Hindi Sahitya ka Ithihas by Dr.Nagendra,Dr.Hardayal mayur paper bags Noida

HINDI – IV **3 0 0 3**

(Modern Poetry, Hindi sahithya ka ithihas –Adhunik kal,,Journalism, Advertisement writing)

COURSE OBJECTIVE:

- To develop interest in modern poetry
- To teach them the importance & development of hindi journalism.
- To train them in advertisement writings

Unit I	- ‘Adhunik kavitha(Sansar), Journalism	**09**
Unit II	- ‘Adhunik kavitha (Mouun nimanthran), Journalism	**09**
Unit III	- Adhunik kavitha (‘rah rahkar Tuutthaa rab kaa kahar), Journalism	**09**
Unit IV	-‘ Adhunik kavitha (‘samarpan’), Advertisement writing	**09**
Unit V	- ‘Adhunik kavitha (‘panthrah agasth kii pukaar ’), Advertisement writing	**09**

Total Hours : 45

COURSE OUTCOMES:

At the end of this course

CO 1 Students will be familiar with modern poetry

CO 2 Students will understand the origin& development of Hindi journalism

CO 3 Will know about different sources of journalism &their qualities

CO 4 Will get the ability to write various types of advertisement

CO 5 Will understand the different methods adopted in writing them

REFERENCE BOOKS:

1. Padya khosh
2. Hindi patrakaritha ek parichaya

FRENCH I **3003**

COURSE OBJECTIVE:

- To introduce French language.
- To enable the students to understand and to acquire the basic knowledge of French language with elementary grammar.

UNIT: I **INTRODUCTION** **09**

Introduction-Alphabet-comment prononcer, écrire et lire les mots-base: les prénoms personnel de 1er , 2eme et 3eme personnes-conjugaisons les verbes être et avoir en forme affirmative, negative Et interrogative.

UNIT: II **LECON 1-3** **09**

Leçon 1 :Premiers mots en français- 2.Les hommes sont difficiles 3.Vive la liberté-Réponses aux questions tires de la leçon-Grammaire: Les adjectives masculines ou féminines-Les article définies et indéfinis-Singuliers et pluriels.

UNIT: III **LECON 4-6** **09**

Leçons 4. L'heure c'est l'heure 5.Elle va revoir sa Normandie 6.Mettez-vous d'accord groupe de nom-Réponses aux questions tires de la leçon-Grammaire :A placer et accorder l'adjectif en groupe de nom-Préposition de lieu-A écrire les nombres et l'heure en français

UNIT:IV **LECON 7-9** **09**

Leçon 7.Trois visage de l'aventure , 8. A moi Auvergne 9.Recit de voyage-Réponses aux questions tires de la leçon- Grammaire : Adjectif processif- Les phrases au présent de

l’indicatif-Les phrases avec les verbes pronominaux au présent.

UNIT:V COMPOSITION 09

A écrire une lettre a un ami l’invitant a une célébration différente ex :mariage-A faire le dialogue- A lire le passage et répondre aux questions.

Total Hours: 45

TEXT BOOK :

Jack GIRARDER & Jean Marie GRIDLIG,<<Méthode de Français PANORAMA>>, Clé Internationale, Goyal Publication ,New Delhi Edition 2014.

REFERENCE BOOKS:

1. DONDO Mathurin, “Modern French Course”, Oxford University Press, New Delhi Edition 2014.
2. Nithya Vijayakumar get ready French grammar-Elementary Goyal publications ,New Delhi Edition 2014.

FRENCH II **3003**

COURSE OBJECTIVE:

1. To fortify the grammar and vocabulary skills of the students.
2. To enable the students have an idea of the French culture and civilization

UNIT:I **LECON 10-11** **09**

Leçons :10 Les affaires marchent,11 un repas midi a problèmes- Réponses aux questions tires de la leçon-grammaire ;présent progressif passe récent ou future proche-complément d'Object directe-complément d'objet

UNIT II **LECON 12-13** **09**

Leçons 12 :tout est bien qui fini bien,-13 aux armes citoyens-réponses aux questions tires de la leçon-grammaire :les pronoms<<en ou y>> rapporter des paroles-Les pronoms relatifs que, qui ou ou.

UNIT III **LECON 14-15** **09**

Leçons 14.Qui ne risque rien n'a rien-15.la fortune sourit aux audacieux-réponses aux questions tires de la leçon-grammaire : comparaison-les phrases au passe compose.

UNIT :IV **LECON 16-18** **09**

Leçons 16 la publicité et nos rêves 17 la France la monde 18 campagne publicitaire réponses aux questions tires de la leçon-grammaire :les phrases a l'imparfait-les phrases au future

UNIT :V **COMPOSITION** **09**

A écrire une lettre de regret//refus a un ami concernant l'invitation d'une célébration reçue-a écrire un essaie sur un sujet générale-a lire le passage et répondre aux questions

Total Hours: 45

TEXT BOOK :

Jack GIRARDER & Jean Marie GRIDLIG,<<Méthode de Français PANORAMA>>, Clé Internationale, Goyal Publication ,New Delhi Edition 2014.

REFERENCE BOOKS:

1. DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi Edition 2014.
2. Nithya Vijayakumar get ready French grammar-Elementary Goyal publications ,New Delhi Edition 2014.

FRENCH III 3 0 0 3

COURSE OBJECTIVE:

- To strengthen the Grammar and Composition in French language.
- To train the students to enhance his skills in French language for communication

UNIT I: LECON 11 09

AIM : Is to impart the basics of french culture and civilisation.

CONTENT :Leçon 16-La famille Vincent. Page 44-Grammaire :Passe compose. Leçon 29-Vers l'hôtel.Page80- Grammaire :Impératif, a mettre phrases Singulier, Pluriel.

OUTCOME : The content of the unit 1 aids the students to explore the basics of the new french culture and civilsation.

UNIT II: LECON 12-13 09

AIM : Is to impart the french poetry and intermediate grammer.

CONTENT : Leçon 40-L'Epicerie les Légumes et les Fruits. Page 112-Grammaire;Présent del'indicatif. Leçon 44 La poste. Page-124 l'Grammaire :A mettre les phrases a l'impératif

OUTCOME : The content of the unit 2 aids the students to know about the french poetry and grammar.

UNIT III: LECON 14-15 09

AIM : Is to impart the french habitat and daily norms and activity.

CONTENT : Leçon 51-Le café et tabac page142- Grammaire :A changer les phrases en interrogatif. Leçon 58-La chasse et la pèche.Page160-Grammaire :Le plus que parfait.

OUTCOME : The content of the unit 3 aids the students to adapt to the french society.

UNIT IV: LECON 16-18 09

AIM : Is to impart the importance of francophonie

CONTENT : Leçons 61-Un mariage a la campagne. Pagé-170 -grammaire :a changer au participe présent**.**

OUTCOME : The content of the unit 4 aids the students to know about francophonie.

UNIT :V- COMPOSITION 09

AIM : Is to impart the production ecrit and lire

CONTENT: A écrire une lettre a un ami l'invitation d'une célébration différente ex:Mariage-a faire un essaie sur un sujet générale-a lire le passage et répondre aux questions.

OUTCOME: The content of the unit 5 aids the students to acquire the language proficiency.

Total Hours: 45

TEXTBOOK :

- Les leçons ont été choisi et tire de i & ii degré de gauger<<Cours de Langue et de Civilisation Française>> The Millenium, Publication Hachette, édition 2002

REFERENCE BOOKS:

- DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi Edition 2014

WEB SITE RESOURCES LINK;

- https://www.thoughtco.com/french-reading-tips-1369373 https://www.bnf.fr/fr
- https://www.laits.utexas.edu/tex/

FRENCH IV **3 0 0 3**

COURSE OBJECTIVE:

- To strengthen the Grammar and Composition in French language.
- To train the students to enhance his skills in French language for communication.

UNIT:I **09**

AIM : To teach about the advanced grammar and slam poetry.

CONTENT: Leçon 20 : Une grande Nouvelle-Grammaire Le future.Leçon 46 :Le mètre ;l'autobus-Grammaire-A former ou a changer L'adjectif masculin ou féminine a l'adverbe-Trouvez les noms qui correspondent aux verbes suivants.

OUTCOME: This unit enables the student to know about the french poet and poetry.

UNIT :II **09**

AIM : To teach about the advanced grammar and the civic responsibility.

CONTENT : Leçon 48 : A la préfecture de police-Grammaire Les pronoms relatifs. Leçon 63 :les sports-Grammaire le conditionnel présent**.**

OUTCOME : This unit enables the student to know about the french poet and poetry**.**

UNIT :III **09**

AIM : To teach about the advanced grammar and the french monuments.

CONTENT : Leçon :56 A Biarritz la page-Grammaire le future antérieure.

OUTCOME : This unit enables the student to know about the french poet and poetry. Leçon :57 Dans les Pyrénées-Grammaire le future antérieure suite.

UNIT :IV **09**

AIM : To teach about the advanced grammar and french topographies.

CONTENT : Leçons 65-a fin des vacances Grammaire-a changer les phrases du pluriel au singulier, le présent du subjonctif.

OUTCOME : This unit enables the student to know about the french topographies.

UNIT :V **09**

AIM : To teach about the advanced grammar and formal letter drafting.

CONTENT : Grammaire et composition :Transduction - réponses aux questions sur les passage-essaie sur un sujet générale, :lettre :Ecrire une lettre a une amie.

OUTCOME : This unit enables the student to know about the formal letter drafting.

Total Hours: 45

TEXT BOOK :

- Les leçons ont été choisi et tire de i & ii degré de gauger<<Cours de Langue et de Civilisation Française>> The Millenium, Publication Hachette, édition 2002

REFERENCE BOOKS:

- DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi Edition 2014

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- https://www.thoughtco.com/french-reading-tips-1369373 https://www.bnf.fr/fr
- https://www.laits.utexas.edu/tex/

7. Assessment Methods:

It is important that the students of UG Biocomputing program achieve the desired results in terms of the learning outcomes to be professionally sound and competitive in a global society. Achieving the desired learning outcomes is also imperative in terms of job employment leading to a happy and prosperous individual further leading to a happy and prosperous family and thereby a happy and prosperous society or nation. The assessments tasks are pivotal to get an authentic feedback for the teaching learning process and for mid-course corrections and further improvements in future. The assessment tasks are carried out at various stages of the duration of the UG Biocomputing programme like Mid-term assessments, End-term assessments, Semester examinations, Regular assessments, viva-voce etc. The assessment tasks are listed below:

- **Multiple Choice Questions (MCQ)** are one of the predominant form of assessment Tasks. This task is used during all kinds of term and semester examinations.
- **Short-Answer Questions** during term and semester examinations are used to assess the ability of the student to convey his thoughts in a coherent way where prioritization of the information in terms of their significance is tested.
- **Surprise Quizzes** are regularly used during continuous assessment while the teaching learning process is continuing which prepares the student to quickly recall information or quickly analyse a problem and come up with proper solutions.
- **Visual/Pictorial Quizzes** are used to sharpen the comprehension of the students after looking at all the components of a system.
- **Impromptu Opinions** on Biocomputing problems are sought from student during regular teaching learning which helps them to think quickly in a given context. This helps build their ability to come up with solutions to problems which the students might not have confronted previously.
- **Problem Solving** question are generally given during the laboratory work.
- **Data Interpretation** is also another assessment task which is used to develop analytical skills of the students. This assessment is used during laboratory work as well as during conduction of project work.

- **Paper/ Project presentations** are used to assess the articulation skills of the student. These are carried out both during the duration of the teaching learning processes as well as during end-Semester examinations.
- **Report Writing** is used to assess the keenness of the students for details related to Biocomputing while visiting laboratories/industries as students invariably are required to submit a report after such visits.
- **Assignment Writing** is used to assess the writing abilities of the students during midterm vacations.
- **Viva-voce** during the laboratory working hours and during laboratory examination are used to assess the over-all knowledge and intelligence of the students.