



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)  
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)  
PALLAVARAM - CHENNAI

ACCREDITED BY NAAC WITH 'A' GRADE

*Marching Beyond 25 Years Successfully*

# **B.Sc. Biotechnology 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 Biotechnology  
School of Life Sciences**

## **VISION**

- ✓ To develop as a department of eminence, by achieving high standards in both research and teaching, and to become a sought-after destination for highly motivated students and faculty. The Department aspires in delivering distinctive learning skills in biotechnology enabling excellence in professional competence and innovation for further betterment of society and mankind.

## **MISSION**

- ✓ To maintain high standards of teaching by innovating pedagogy, instilling in students the ability to be lifelong learners, and continually upgrading the program curriculum with international standards of life sciences education and to meet the requirement of industry and research community.
- ✓ To adopt effective teaching methods to improve the learning process and impart knowledge of biology and technology.
- ✓ To provide a flexible curriculum that allows the students to study courses of his/her choice (through Elective courses) that will fulfill their aptitude and professional aspirations.
- ✓ To provide hands-on training and technical skills to transform students into technocrats and facilitate research and higher education in the fields of biotechnology.
- ✓ To create opportunities and a supporting infrastructure for students – through laboratory courses, projects, dissertations, and possible entrepreneurial ventures in biotechnology to achieve their aspirations. To pursue and promote cutting-edge research in selected fields of biotechnology

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

PEO I: The graduates of Biotechnology will able to attain the in-depth knowledge of the basic and application-oriented subjects of Biotechnology and allied fields.

PEO II: The graduates of Biotechnology will able to gain the ability to use the concept of theories, practical skills and latest technological tools in solving any professional issues independently in a global and societal context.

PEO III: The graduates of Biotechnology are equipped to design, analyze, conduct and interpret the experiments and data for the development of process/product within the realistic constraints.

PEO IV: The graduates of Biotechnology will continue to learn and update knowledge to become an entrepreneur in a current competitive world of Science & technology and also contribute to society.

### **PROGRAMME OUTCOMES (POs)**

**PO-1 Scientific knowledge:** Graduates will acquire biochemistry/biotechnology / bioinformatics/ microbiology specific knowledge including recent techniques in the respective fields coupled with hands-on skills and leadership skills for a successful career.

**PO-2 Problem analysis:** Graduates will be able to analyse, solve and troubleshoot problems in implementation of biochemistry/biotechnology/ microbiological protocols.

**PO-3 Design/development of solutions:** Graduates will develop creative thinking and cooperate with each other to solve problems in the field of biochemistry/biotechnology/bioinformatics/ microbiology.

**PO-4 Conduct investigations of complex problems:** Graduates will acquire practical skills – which help in planning and designing protocols to validate hypothesis and execute experimental techniques independently as well as assimilate, analyse and interpret subsequent data.

**PO-5 Modern tool usage and communication:** Graduates will effectively be able to manage resources and time using ICT and computer enabled devices and accomplish ability to understand and communicate all ideas effectively.

**PO-6 Environment sustainability and Ethics:** Graduates will get adequate knowledge to use information and implement solutions for environmental protection and remediation. Graduates will be aware of their role and responsibility in handling and use of microbes including genetically modified microorganisms.

**PO-7 Lifelong learning:** Graduates will carry on to learn and adapt in a world of constantly evolving technology.

### **PROGRAM SPECIFIC OUTCOME (PSO)**

The program specific objectives of B.Sc Biotechnology are to produce professionals who later take the role of academics, entrepreneurs and researchers with the following qualities:

- ✓ PSO1. To impart an ability to apply biotechnology skills (including molecular & micro biology, immunology & genetic engineering, bioprocess & fermentation, enzyme & food technology and bioinformatics) and its applications in core and allied fields
- ✓ PSO2. Demonstrate the application of Biotechnological processes in industries that are of social and commercial importance.
- ✓ PSO3. To impart in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

**Vels Institute of Science, Technology and Advanced Studies School of Life Sciences  
Department of Biotechnology B.Sc Biotechnology**

S.No	BOARD OF STUDIES MEMBERS	
	Name	Address
<b>BOARD CHAIRMAN</b>		
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<b>BOARD MEMBER – External</b>		
2.	<b>Dr. G. Vijaiyan Siva Associate Professor,</b>	Dept of Biotechnology, University of Madras. Chennai - 600025.
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6	<b>Dr. M. Thenmozhi Associate Professor</b>	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai.600117.
<b>STUDENT MEMBER – Student Representative</b>		
7	<b>Monisha Student</b>	Department of Biotechnology, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai- 600117.

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)  
CHENNAI - 600 117**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**&**

**LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF)**

**UG REGULATIONS 2021**

**B.Sc. Biotechnology**

**Common to All Under Graduate Full-Time Programmes**

**(Applicable to all the candidates admitted from the academic year 2021-22 onwards)**

**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 Bachelor Degree shall be required to have passed the higher secondary Examinations or equivalent with Biology/Botany/Zoology/Biochem/Biotech/Microbiology/Agriculture conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereof by Vels Institute of Science, Technology and Advanced Studies provided that candidates for admission into the specific Main Subject of Study shall also possess such other qualifying conditions as may be prescribed by the Institute.

**3. MEDIUM OF INSTRUCTION**

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

**4. CREDIT REQUIREMENTS AND ELIGIBILITY FOR AWARD OF DEGREE**

A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in the Institute for a period of not less than three academic years and passed the examinations of all the Six Semesters prescribed earning a minimum of 140 credits as per the distribution given in for Part I, II, III, IV & V and also fulfilled such other conditions as have been prescribed thereof.

## 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

6.1 (1) **FOUNDATION COURSES:** The course shall comprise the study of:

- a) PART-1 Tamil or Hindi or French
- b) PART – II English

(2) **MAIN COURSES** (consisting of (a) Core Subjects; (b) Discipline Specific Elective; (c) Generic Elective; (d) Practical, etc. if any)

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

(Minimum number of Credits to be obtained)

Credit Assignment Each course is assigned certain number of credits based on the following:

Contact period per week CREDITS

1 Lecture Period - 1 Credit

1 Tutorial Period - 1 Credit

2 Practical Periods - 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 up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after collecting the prescribed fee towards the condonation of shortage of attendance. Such fees collected and should be remitted to the University.

**7.4. Non-eligibility for condonation of shortage of attendance:** Students who have secured less than 65 % but more than 50 % of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such Students will not be permitted to appear for the regular examination, but will be

allowed to proceed to the next year/next semester of the program

**7.5. 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.

**7.6. Condonation of shortage of attendance for married women students:** In respect of married women students undergoing UG programs, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed as 55% instead of 65% if they conceive during their academic career. Medical certificate from the Doctor together with the attendance details shall be forwarded to the university to consider the condonation of attendance mentioning the category.

**7.7. Zero Percent (0%) Attendance:** The Students, who have earned 0% of attendance, have to repeat the program (by rejoining) without proceeding to succeeding semester and they have to obtain prior permission from the University immediately to rejoin the program.

**7.8. 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.

7.8.1. 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. Provided the Student should have passed all the courses in the Institution from where the transfer is requested.

7.8.2. The marks obtained in the courses will be converted and grades will be assigned as per the University norms.

7.8.3. The transfer students are not eligible for classification.

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

7.8.5. Students who want to go to foreign Universities up to two semesters or Project Work with the prior approval of the Departmental / College Committee are allowed to get transfer of credits and marks which will be converted into Grades as per the University norms and are eligible to get CGPA

and Classification; they are not eligible for Ranking, Prizes and Medals.

## **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 Part I, II, III.

**9. Question Paper Pattern for End Semester Examination**

### **APPENDIX – A- PATTERN OF QUESTION PAPER**

PART – A (50 words) Answer 10 questions without choice

10 × 3 = 30 marks



PART – B (200 words) Answer 5 questions out of 8 questions  $5 \times 8 = 40$  marks

PART – C (500 words) Answer 2 questions out of 5 questions  $2 \times 15 = 30$  marks

Total = 100 marks

## **QUESTION PAPER FOR PRACTICALS**

The External examiner will prepare a question paper on the spot from the syllabus prescribed and supplied by the Controller's Office.

**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-totalling: All UG Students who appeared for their Semester Examinations are eligible for applying for re-totalling 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

<b>Grade Conversion Table - UG</b>			
<b>Range of Marks</b>	<b>Grade Points</b>	<b>Letter Grade</b>	<b>Description</b>
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

**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: =  $\frac{\sum_i C_i G_i}{\sum_i C_i}$  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,  $C_i$  = Credits earned for course  $i$  in any semester,

$G_i$  = Grade Points obtained for course  $i$  in any semester

$n$  = Semester in which such courses were credited.

CGPA for the entire programme: =  $\frac{\sum_n \sum_i C_{ni} G_{ni}}{\sum_n \sum_i C_{ni}}$  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

#### 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*

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.

#### 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 Biotechnology

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

### B.Sc Biotechnology 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
<b>Total Credits</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>22</b>	<b>22</b>	<b>140</b>

# Learning Outcome based Curriculum Framework

## Preamble

Completion of a graduation course in biosciences basically delivers a platform for basic understanding of the subject. Inventions, innovations and technology have revolutionized and enriched the biological sciences. The demand for skilled manpower requires thorough knowledge of the subject. It also demands for incorporating latest knowledge and advanced technologies to fulfill the changing needs of society. The public private sector prefers the experienced manpower. Considering this, B.Sc. in any biological science course is designed to provide through and updated knowledge of the subject which makes easy entry of the students in public private sector. Uniqueness of the course is of having 6 months mandatory research projects. During the period students are getting an opportunity to work in nationally and internationally acclaimed research institutes and industries. This generates skilled human resources as per the demands of the society. The course has other research elements including scientific writing, writing research projects, preparing publications, preparing research posters for the conferences and the entire process also generates innovative minds to work in the capacity of scientists.

### 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 learning 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.

### 2. Learning Outcomes based approach to Curriculum Planning: (LOCF)

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 bio science, the outcomes are defined in terms of the understanding and knowledge of the students in biology and computer application in biology and the practical skills the students are required to have to be competitive biologist. So, that they are able to play their role as Biologist. The curriculum developed and the teaching and

the evaluation tasks are such that the students are able to apply their knowledge and training of Biotechnology to solve the problems of Biotechnology as these exist or appear from time to time in the society.

### **3. Aim & Objectives of the course:**

The aim and objectives of the B.Sc. Biotechnology course program essentially focus to develop skills of student for a successful career.

1. The course structure emphasizes to put enough efforts in theory as well as laboratory work so as to gain thorough knowledge of the subject.
2. The course includes project work that would develop and nourish the scientific approach and research attitude of the students.
3. Genetic engineering, Biotechnology, Bioinformatics, Immunotherapy are the new horizons of the interdisciplinary subject in biology which might provide solutions to various problems of the society. The course work is essentially framed to acquaint the students with all the recent advances in this field.
4. It is compulsory & essential for the students to read research papers, publications and deliver seminars that would better help them to know the recent advances in the subject and also develop the communication skills.
5. The program is designed in such a way that it is essential for the students to read original publications, put enough efforts in laboratory work for practical and project, be acquainted with all the recent advances in the field like Bioinformatics, drug designing and develop all the skills for a successful career

### **4. Graduate attributes in life science:**

Broaden the outlook and attitude, develop the current skills and abilities, and learn

1. New one to do extremely well in studies and career, grow into responsible global citizens. Contour the academic career of the students, make them employable, enhances
2. To shape one's life and also that of colleagues and peers. Demonstrate behavioural attributes for the enhancement of soft skills, socialistic
3. Research insight and support the participation in co-curricular and extracurricular activities. Instill skills and abilities to develop a positive approach and be self-contained
4. Approach and leadership qualities for successful career and nurture responsible human being.
5. Provide highly skilled and knowledgeable human resources for agricultural Sector, food industry, dairy industry, medical and paramedical field, pharmaceutical and research institutes

### **5. Qualification Descriptors:**

The following may serve as the important qualification descriptors for a UG degree in Biochemistry/Biotechnology/Microbiology/Bioinformatics:

1. Knowledge of the diverse places where biological science is involved.
2. Understanding of diverse biological processes.
3. Advanced skills and safety issues related to handling of Microbes, Animals and Plants Good laboratory practices etc.
4. Advanced skills in working with microbes such as pilot scale culturing, downstream processes, diagnostics etc.
5. Generation of new knowledge through research projects
6. Ability to participate in team work through biological projects.

7. Ability to present and articulate their knowledge of biology.
8. Knowledge of recent developments in the area of biology.
9. Analysis of data collected through study and projects / dissertations / reviews / research surveys.
10. Ability to innovate so as to generate new knowledge.
11. Awareness how some biology leads may be developed into enterprise.
12. Awareness of requirements for fruition of a biology-related enterprise.
13. Ability to acquire intellectual property rights.

**6. Programme Learning Outcome**

1. An advanced and systematic or coherent understanding of the academic field of Science, its different learning areas and applications, and its linkages with related disciplinary areas/subjects.
2. The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilized in modelling and solving real life problems.
3. Procedural knowledge that creates different types of professionals related to the disciplinary including professionals engaged in research and development, teaching and government/public service
4. Skills in areas related to one's specialisation area within the disciplinary and current and emerging developments in the field of Science
5. Demonstrate relevant generic skills and global competencies such as (i) problem solving skills that are required to solve different types of problems with well-defined solutions, and tackle open-ended problems that may cross disciplinary-area boundaries;
6. Communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences
7. Analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language
8. ICT skills
9. Personal skills such as the ability to work both independently and in a group.

**7. Teaching learning processes:**

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of respective discipline in a canonical manner. Students have great freedom of choice of subjects which they can study. The various components of teaching learning process are summarized in the following.

- ✓ The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
- ✓ Assimilating ideas, deepening understanding, and gaining mastery of new concepts all take time, commitment, and intelligent effort. To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with.



- ✓ Necessary and sufficient infrastructural facilities for the, laboratories and libraries equipped with adequate modern and modular furniture and other requirements. Modern and updated laboratory equipments needed for the undergraduate laboratories and reference and text books for the libraries
- ✓ Home assignments at regular intervals and project work involving applications of theory are necessary to assimilate basic concepts of the respective discipline. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
- ✓ The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships in their discipline. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.
- ✓ Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.
- ✓ Special attempts should be made by the institution to develop problem-solving skills and design of laboratory experiments for demonstration at the UG level. For this purpose a mentor system may be evolved where 3-4 students may be assigned to each faculty member.

#### **8. Assessment Methods:**

It is important that the students of UG Biotechnology 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 Biotechnology programme like Mid-term assessments, End-term assessments, Semester examinations, Regular assessments, viva-voce etc. The assessment tasks are listed below:

1. Multiple Choice Questions (MCQ) are one of the predominant forms of assessment tasks. This task is used during all kinds of term and semester examinations.
2. 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.
3. 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 analyze a problem and come up with proper solutions.
4. Visual/Pictorial Quizzes are used to sharpen the comprehension of the students after looking at all the components of a system.

5. Impromptu Opinions on microbiological problems are sought from student during regular teaching learning which help them to think quickly in a given context. This help build their ability to come up with solutions to problems which the students might not have confronted previously.
6. Problem Solving question are generally given during the laboratory work.
7. 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.
8. Analytical Skills are assessed during work related to several experiments like enzyme kinetics, growth of bacteria and bacteriophages, mutation frequencies.
9. 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.
10. Report Writing is used to assess the keenness of the students for details related to microbiology while visiting laboratories / industries as students invariably are required to submit a report after such visits.
11. Assignment Writing are used to assess the writing abilities of the students during midterm vacations.
12. Viva-voce during the laboratory working hours and during laboratory examination are used to assess the over-all knowledge and intelligence of the students.

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES**

**Programme: B.Sc Biotechnology**

**COURSES OF STUDY AND SCHEME OF ASSESSMENT**

**(MINIMUM CREDITS TO BE EARNED: 140)**

Code No.	Course	Hours/Week			Maximum Marks			Total
		Lecture	Tutorial	Practical	Credits	CA	SEE	
<b>SEMESTER 1</b>								
LANG	Tamil I/ Hindi / French	3	0	0	3	40	60	100
ENG	English I	3	0	0	3	40	60	100
CORE1	Fundamentals of Cell Biology	3	1	0	4	40	60	100
CORE2	Genetics and Developmental Biology	3	1	0	4	40	60	100
CORE3	Biochemistry	4	0	0	4	40	60	100
CORE	Practical 1 : Cell Biology, Genetics Developmental Biology Practical	0	0	4	2	40	60	100
CORE	Practical 2 : Biochemistry Practical	0	0	4	2	40	60	100
AECC	Communication Skills	1	0	2	2	40	60	100
SEC	Orientation/Induction programme / Life skills	-	-	-	-	-	-	-
		<b>17</b>	<b>2</b>	<b>10</b>	<b>24</b>			
<b>SEMESTER 2</b>								
LANG	Tamil II / Hindi / French	3	0	0	3	40	60	100
ENG	English II	3	0	0	3	40	60	100
CORE4	Principles of Microbiology	3	1	0	4	40	60	100
CORE5	Immunology	3	1	0	4	40	60	100
CORE6	Molecular Biology	4	0	0	4	40	60	100
CORE	PRACTICAL 3 : Microbiology Practical	0	0	4	2	40	60	100
CORE	PRACTICAL 4 : Immunology Practical	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	-	-	-	-	-	-	-
		<b>18</b>	<b>2</b>	<b>8</b>	<b>24</b>			
CA - Continuous Assessment				SEE - Semester End Examination				

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES**  
**Programme: B.Sc Biotechnology**

Code No.	Course	Hours/Week			Maximum Marks			Total
		Lecture	Tutorial	Practical	Credits	CA	SEE	
<b>SEMESTER 3</b>								
LANG	Tamil III / Hindi / French	3	0	0	3	40	60	100
ENG	English - III	3	0	0	3	40	60	100
CORE7	Genetic Engineering	4	0	0	4	40	60	100
CORE8	Bioinformatics	3	0	2	4	40	60	100
CORE9	Biophysics & Bioinstrumentation	4	0	0	4	40	60	100
AECC	Environmental Studies	2	0	0	2	40	60	100
CORE	PRACTICAL 5 : Genetic Engineering Practical	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	-	-	-	-	-	-	-
		<b>21</b>	<b>0</b>	<b>6</b>	<b>24</b>			
<b>SEMESTER 4</b>								
LANG	Tamil IV / Hindi / French	3	0	0	3	40	60	100
ENG	English IV	3	0	0	3	40	60	100
CORE10	Animal Biotechnology	4	0	0	4	40	60	100
CORE11	Food Biotechnology	3	0	2	4	40	60	100
CORE12	Plant Biotechnology	3	0	0	3	40	60	100
CORE	PRACTICAL 6 : Animal Biotechnology Practical	0	0	4	2	40	60	100
CORE	PRACTICAL 7 :  Plant Biotechnology  Practical	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	-	-	-
		<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>			

CA - Continuous Assessment

SEE - Semester End Examination

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES**  
**Programme: B.Sc Biotechnology**

Code No.	Course	Hour / Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
<b>SEMESTER 5</b>								
CORE	Bio fermentation and Down steam processing	3	0	0	3	40	60	100
DSE	Environmental Biotechnology	3	0	0	3	40	60	100
DSE	Nano Biotechnology	3	0	2	4	40	60	100
DSE	Biostatistics, IPR, & Bioethics	3	0	0	3	40	60	100
DSE	Medical Coding and Clinical Research	3	0	0	3	40	60	100
DSE	PRACTICAL 8 : Environmental Biotechnology Practical	0	0	4	2	40	60	100
DSE	PRACTICAL 9 Bio fermentation Practical	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	-	-	-	-	-	-	-
		<b>15</b>	<b>0</b>	<b>14</b>	<b>22</b>			

**SEMESTER 6**

DSE	Marine Biotechnology	4	0	0	4	40	60	100
DSE	Agricultural Biotechnology	3	1	0	4	40	60	100
DSE	Pharmaceutical Biotechnology	3	0	2	4	40	60	100
DSE / GE	-----	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
		<b>15</b>	<b>1</b>	<b>12</b>	<b>22</b>			

CA - Continuous Assessment

SEE - Semester End Examination

**UGC Recommended Generic Electives**

1. Consumer Affairs
2. Disaster Management
3. Universal Human Values

# **SEMESTER-I**

பருவம்-1

தமிழ்மொழிப்பாடம்-1

3 0 0 3

பாடக்குறியீட்டுஎண்: 21LT001

பருவம்-1, தமிழ்மொழிப்பாடம்-1, பகுதி-1, தகுதிப்புள்ளி: 3, வாரப்பாடநேரம்: 3.

தாள்-1

இக்காலக்கவிதைகள் – உரைநடை – பண்பாடு – மொழித்திறன்

அலகு 1: மரபுக்கவிதை

9மணிநேரம்

1. பாரதியார்- பாரததேசம்என்னும்தலைப்பில்ஆறுபாடல்கள்.  
(பாடல்எண்கள் 1, 6, 7, 9, 12, 13)
2. பாரதிதாசன்-தமிழுக்கும்அமுதென்றுபேர்என்னும்தலைப்பிலானகவிதை.
3. தேசிகவிநாயகம்பிள்ளை - உடல்நலம்பேணல்என்னும்தலைப்பிலானகவிதை
4. முடியரசன்-காவியப்பாவை – “புண்படுமா” என்னும்கவிதை.

அலகு 2: புதுக்கவிதை

9மணிநேரம்

1. நா.காமராசன்- கறுப்புமலர்கள்தொகுப்பில்காகிதப்பூக்கள்என்னும்தலைப்பிலானகவிதை.
2. அப்துல்ரகுமான்- ஆலாபனைதொகுப்பில்போட்டிஎன்னும்தலைப்பிலானகவிதை
3. ஈரோடுதமிழன்பன் - ஒருவண்டிசென்றியுதொகுப்பில்தேர்ந்தெடுக்கப்பட்டசென்றியுகவிதைகள்
4. ஆண்டாள்பிரியதர்ஷினி-முத்தங்கள்தீர்ந்துவிட்டனதொகுப்பில் 'இங்கேவரும்போது' என்னும்தலைப்பிலானகவிதை

அலகு 3: உரைநடை

9மணிநேரம்

1. மாணாக்கரும்தாய்மொழியும் - திரு.வி.க.,
2. மனவலிமைவேண்டும்- மு.வரதராசனார்
3. செம்மொழித்தமிழின்சிறப்புகள்
4. பண்டைத்தமிழரின்சாதனைச்சுவடுகள்

அலகு 4: தமிழர்வாழ்வுப்பண்பாடும்

9மணிநேரம்

பண்பாடு-வாழ்வியல்முறை - அகம், புறம் - உணவுமுறை - விருந்தோம்பல் - நம்பிக்கைகள்- விழாவும்தமிழ்பாடும் - கலைகள் - கட்டடம் - சிற்பம் - ஓவியம் - இசை-கூத்து- தொழிலும்வணிகமும் - அறிவியல்நோக்கு.

அலகு 5: மொழித்திறன், இலக்கியவரலாறு, இலக்கணம்

9மணிநேரம்

1. எழுத்துப்பிழை, தொடர்ப்பிழைகள்
2. வேற்றுமைஇலக்கணம்
3. செய்யுள்நலம்பாராட்டல்
4. பாடம்தழுவியஇலக்கியவரலாறு (மரபுக்கவிதை, புதுக்கவிதை, உரைநடை)

மொத்தம்: 45மணிநேரம்

## 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

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<b>Unit I</b>	‘ Ek atuut kadi’,letter writing,Technical words.	<b>9</b>
<b>Unit II</b>	‘Devi singh’ , letter writing, Technical words.	<b>9</b>
<b>Unit III</b>	‘ kabiraa ki kaashi ’, letter writing, Technical words.	<b>9</b>
<b>Unit IV</b>	‘ kabiraa ki kaashi ‘, letter writing, Technical words.	<b>9</b>
<b>Unit V</b>	‘ bharathiya vigyan ki kahaani ’- ‘hamne diyaa ,hamne liyaa’, letter writing,	<b>9</b>

**Total hours**                      **45**

### Course Outcome

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



## FRENCH I

3 0 0 3

### 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

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, négative Et interrogative.

### UNIT II- LECON 1-3

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

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

Leçon 7.Trois visages 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 :

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.

### TEXTBOOK :

1. Jack GIRARDER & Jean Marie GRIDLIG,<>, 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.

**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.

**UNIT I**

1. Dangers of Drug Abuse - Hardin B Jones
2. Tight Corners - E. V. Lucas

**Credit Hours****09****UNIT II**

3. Futurology - Aldous Huxley
4. If You are Wrong, Admit it - Dale Breckenridge Carnegie

**09****UNIT III**

5. Industry - Dr.M.Narayana Rao & Dr.B.G.Barki
6. Turning Point of My Life - A.J Cronin

**09****UNIT IV**

7. Excitement - Mack R. Douglas
8. The Kanda Man Eater - Jim Corbett

**09****UNIT V**

9. Vocabulary and Exercises under the Lessons

**09****Total****45 Hours**

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

**Course Outcome**

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:**

- English for Communication Enrichment: by Jeya Santhi June 2015.
- Dr. M. Narayana Rao and Dr. B. G. Barki – Anu’s Current English for Communication (AnuChitra). June 2012.
- 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/>

**Course Objective (Skill development)**

To provide knowledge about the morphology, structure and functions of various cells at function.

**UNIT I** **12**

**Biogenesis theory of origin of life:** dynamic cell, Evolution, the molecules of life, the architecture of cells, cell as a basic unit; cell size and shape, cells into tissues.

**UNIT II** **10**

**Cell wall and membrane:** Plasma membrane - Model of plasma membrane; fluidity of membranes; Membrane proteins and their functions; Transport across the membrane- selective permeability of membrane, Hierarchical structure of protein, folding, modification, sorting and degradation of protein, functional design of proteins.

**UNIT III** **14**

**Cell organelles:** Structural organization and function of intracellular organelles: Nucleus, mitochondria, Plastids, Golgi bodies, Lysosomes, Endoplasmic reticulum, Ribosomes, Peroxisomes, Centrioles, Cytosols, Vacuoles and Cytoskeleton - Structural comparison of microbial, plant and animal cells.

**UNIT IV** **11**

**Cell motility:** Microfilaments, Microtubules, Intermediate filaments. Specialized cells: Motile cells (amoeboid, ciliary, flagellar movements), Nerve cells and nerve impulse conduction, Muscle cells and muscle contraction - Nucleic acid structure and function.

**UNIT V** **13**

**Cell division and Regulation:** Cell division, cell cycle: Mitosis and Meiosis, their regulation, cell-to-cell signaling-hormones and receptors. Tumor cells, Proto-oncogenes and Tumor suppressor genes and their regulation.

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Understand the molecules of life and how the cell has evolved with period of time.
- CO-2: Learn about the detailed membrane organization and its functions in living cell.
- CO-3: Analysing the sub cellular organelles and its function.
- CO-4: Determine about the basic structures of cell movement and nucleic acid.
- CO-5: Knowledge about cell division and regulation

**TEXT AND REFERENCE BOOKS:**

1. Gupta P. K., Cell and Molecular Biology, Rastogi Publications. 2012 – 2013.

2. Rastogi S. C., Cell Biology, New Age International Publishers.2011.
3. NaliniChandar, Susan Viselli, Cell and Molecular Biology, Wolters Kluwer (India) Pvt. Ltd. New Delhi.2012.
4. Verma, P.S. and Agarwal, V.K. "Cell Biology". S. Chand Publication.2008.
5. Pollard, T.D. and Earnshaw, C. "Cell Biology". 2<sup>nd</sup> Edition.2008.
6. Lodish, H. Berk, A., Kaiser, Krieger, Scott, Bretscher, Ploegh and Matsudaria, P. "Molecular Cell Biology". Media connected, W. H. Freeman and company, 6<sup>th</sup> edition. 2008.
7. Cooper, G.M. and Hausman, R.E. "The Cell". Molecular approach. A.S.M press. 4<sup>th</sup> edition. 2007.

**Course Objective:** (Skill development)

To provide the knowledge from the fundamental aspects of Genetics till the molecular level and significant aspects of developmental biology.

**UNIT I****15**

**Principles in Genetics:** Principles of Mendelian inheritance – Incomplete dominance – Multiple alleles – Linkage, crossing over – Genetic mapping – recombination – Population genetics – Hardy-Weinberg law.

**UNIT II****13**

**Inheritance of Gene:** Quantitative genetics – polygenic inheritance – Extra chromosomal inheritance – Sex chromosomes – Sex determination – Sex linked inheritance – Mutation: Types – Mutagens – Ames test for mutagenesis – Chromosomal aberrations – Syndromes – DNA repair and recombination.

**UNIT III****8**

**Gene transfer mechanism:** Gene Transfer in Bacteria - Conjugation, Transformation, Transduction – operon model in prokaryotic organisms – plasmids - Transposons

**UNIT IV****12**

**Gamete cells:** Dynamics of the Sperm and Egg, Spermatogenesis, Oogenesis, Sperm and oocyte maturation. Fertilization - Types of fertilization. Hormones involved in reproduction.

**UNIT V****12**

**Embryo Development:** Cell cleavage – pattern of cleavage – Chemical changes - Distribution of cytoplasmic substances in the egg –Metamorphosis (Insects and plant, animals) – Hormone control of metamorphosis. Drosophila – life cycle – embryo development – Molecular aspect of embryogenesis.

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Idea on fundamentals of genetics and Mendelian concepts.
- CO-2: Get knowledge about chromosome, mutation and its mechanism
- CO-3: Understand the concept of gene transfer mechanism
- CO-4: Important study about gamete cells and types of fertilization.
- CO-5: Adapt the knowledge about embryo development stages and drosophila life cycle.

**TEXT AND REFERENCE BOOKS:**

1. Chand S and P.S. Verma, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing. 2006.

2. Richard Twyman, Instant notes in Developmental Biology, Taylor and Francis, 2000.
3. Robert J. Brooker, Genetics: Analysis and Principles, 5<sup>th</sup> edition, McGraw-Hill. 2014
4. Eldon John Gardner, Michael J. Simmons, D. Peter Snustad, Principles of Genetics, 8<sup>th</sup> edition, John Wiley and Sons. 2012
5. Varma P.S., B.S. Author Tyagi and V.K. Agarwas, Chordate Embryology, 1<sup>st</sup> edition, S.Chand and Company. 2006
6. Robert Tamarin, Principles of Genetics, 7<sup>th</sup> edition, Tata McGraw Hill publishing.2010.
7. Scott F. Gilbert, Developmental Biology, 9<sup>th</sup> edition. 2010.

**Course Objective:** (Employability)

To develop understanding and provide scientific basics of the life processes at the molecular level. To explain the structure, function and interrelationships of biomolecules

**UNIT I****13**

**Carbohydrates:** Basic principles of organic chemistry - role of carbon - types of functional groups - overview of biomolecules and biochemical reactions Carbohydrates – Classification and Biological Significance of Glucose, Fructose, Maltose, Lactose, Starch, Glycogen. Metabolism of Carbohydrates – Glycolysis, Gluconeogenesis, HMP Pathway, Citric Acid Cycle and its Biological significance

**UNIT II****11**

**Proteins:** Proteins and amino acids – Classification and general properties of proteins and amino acids, Biosynthesis of essential Amino acids- Lysine and Methionine, Nitrogen balance - deamination, transamination and decarboxylation and Urea cycle. DNA and RNA structure and function.

**UNIT III****10**

**Lipids:** Lipids – Classification, Biological significance of Essential Fatty Acids, Triglycerides, Phospholipids and Sterols. Metabolism of lipids, Oxidation of fatty acids,  $\beta$  – oxidation, Biosynthesis of Ketone bodies & Cholesterol.

**UNIT IV****16**

**Enzymes:** Enzymes, Nomenclature, Classification, Properties, Mechanism of action, role of coenzymes - factors affecting enzyme activity- pH, temperature, substrate and enzyme concentration. Allosteric enzymes and Enzymes of clinical importance. Classification and their properties, occurrence, functions, requirements, deficiency manifestations of vitamins, hormones and Minerals.

**UNIT V****10**

**Bioenergetics:** Biological oxidation, Electron transport chain and Oxidative Phosphorylation, Uncouplers, High energy compounds, coenzymes and ATP cycle, Calculation of ATP during oxidation of glucose and fatty acids.

**Total : 60 hrs**

**Course Outcome:**

CO-1: Memory of carbohydrates structure and their application in biological process

CO-2: Attain knowledge on structure of proteins, amino acids, nucleic acids and their application in biological process

CO-3: Importance of lipids structure and their application in biological process

CO-4: Examine on properties of enzymes, vitamins and hormones in biological process

CO-5: Find the evidence to support bioenergetics and ATP synthesis

**TEXT AND REFERENCE BOOKS:**

1. David L. Nelson and Michael M. Cox, "Lehninger's Principles of Biochemistry", 7 th Edition, W. H. Freeman Publisher, 2017.
2. Donald Voet, "Fundamentals of Biochemistry", 5th Edition, John Wiley Publishers, 2016.
3. Thomas M. Devlin, "Biochemistry with Clinical Correlations", 7th Edition, John Wiley and Sons, 2011.
4. Murray R.K., David, A, Bender, Kathleen M, Botham, Peter J. Kennelly, Victor W. Rodwell, P Anthony P, Weil D.K and Mayes P.A, "Harpers illustrated Biochemistry", 28th Edition, McGraw Hill publishers, 2009.
5. Carl, A.B, Edward R. A and Nobert W. T, "Textbook of Clinical chemistry", 3rd Edition, WB. Saunders Company, 1999.
6. Stryer L, "Biochemistry". 5th Edition, W. H. Freeman and company, 2002.
7. Donald V and Judith G. V, "Biochemistry" 4th Edition, John Wiley and Sons, 2010.
8. Rama R, "Textbook of Biochemistry", 9th Edition, UBS Publishers and Distributors, 1992.
9. Deb A.C," Textbook of Biochemistry", 10th Edition, New Central Book Agency, 2014.



**Course Objective: (Skill development)**

To get hands on experience on basic microscopy and its principles and functioning. To impart knowledge about various cell organelles and cell division

**List of Experiments:**

1. Micrometry: Calibration of stage and ocular micrometer and measurement of the given biological sample, Haemocytometer: calibration and measurement of biological samples.
2. Identification of given plant cell (*Allium cepa*),
3. Identification of given animal cells (Muscle cell, Sperm Cell)
4. Identification of given bacterial cells (*E.coli*) by microscopy
5. Leishman staining, Giemsa staining, Grams staining
6. Staining for different stages of mitosis in *Allium cepa*
7. Staining for different stages of meiosis in flower Buds of *Allium cepa*
8. Buccal smear preparation
9. Identification of chromosome abnormalities by Karyotyping (Chart preparation)
10. Construction of genetic maps based on problems in two and three factor crosses
11. Embryo development stages: Different stages of Chick embryo developmental stage 48 hrs, 72 hrs and 96 hrs. (Permanent slide)
12. Preparation of culture medium for *Drosophila*, *Drosophila* culture development and maintenance

**Total : 30 hrs**

**Course Outcome:**

CO-1: Understand the basic Microscope principle, application and handling techniques

CO-2: Identification of different types of cell using microscopic examination.

CO-3: Analyzing plant, animal and microbial cell structure using different staining methods

CO-4: Compare the different stages of embryo development.

CO-5: Formulate the preparation of culture medium for fly.

**TEXT AND REFERENCE BOOKS:**

1. Gunasekar, . P. "Laboratory Manual in Microbiology". New Age International Private Ltd. Publishers, New Delhi, Chennai. 1995
2. Jayaraman J, "Laboratory Manual in Biochemistry" (5th reprint) New Age International Publishers Mumbai, Chennai, 1996.
3. Prakash M., C.K. Arora, "Biochemical techniques", Anmol Publications (I) Ltd New Delhi. 1998.
4. Ian Freshney R. "Culture of Animal Cells: A Manual of Basic Technique", Wiley-Liss, 2005.

5. David T. Plummer, "An Introduction to Practical Biochemistry", Tata McGraw Hill Publishing Company Ltd. New Delhi. 3rd Edition, 2006
6. Robert Weaver, "Molecular Biology", , McGraw-Hill, 5<sup>th</sup> edition , 2011.
7. Bruce A. White, Methods in Molecular Biology, Chapman and Hall, London, New York., 1997.

**Course Objective:** (Entrepreneurship)

To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.) and laboratory analysis of the body fluids.

**List of Experiments:**

1. Preparation and measurement of pH in standard buffers (phosphate, carbonate, borate, TRIS etc.).
2. Validation of Beer's-Lambert Law by using  $KMnO_4/K_2Cr_2O_7$  3. Qualitative tests for carbohydrates.
4. Qualitative analysis of amino acids & proteins.
5. Qualitative analysis of lipids (triglycerides, cholesterol, phospholipids *etc.*).
6. Quantitative estimation of protein using Lowry's Reagent.
7. Estimation of Glucose by Ortho toluidine method.
8. Quantitative analysis of urea in serum
9. Quantitative estimation of serum cholesterol by Libermann Burchard's method
10. Chromatography: Separation of amino acid by Thin Layer Chromatography.
11. Extraction and assay of acid phosphatase from potato.
12. Isolation and assay of glycogen from the liver and skeletal muscle of mice.

**Total : 30 hrs**

**Course Outcome:**

CO-1: Find the knowledge about pH and calculation

CO-2: Understand the basic principles of biochemical estimations and assays

CO-3: Examine knowledge in analyzing various biomolecules both quantitatively and qualitatively.

CO-4: Evaluate the technique of chromatography and calculation

CO-5: Identify the various methods of enzyme assays needed for clinical research.

**TEXT AND REFERENCE BOOKS:**

1. Jayaraman J., Laboratory Manual in Biochemistry, 2<sup>nd</sup> Edition, New Age International Private Limited, January 2011.
2. Sawhney S. K., Randhir Singh Eds, Introductory Practical Biochemistry, 5th or later edition, Narosa Publishing House, New Delhi, 2014.
3. Gupta R.C. and Bhargavan S. Practical Biochemistry., CBS; 5th edition, 2018.
4. David T. Plummer, "An Introduction to Practical Biochemistry", Tata McGraw Hill Publishing Company Ltd. New Delhi. 3rd Edition, 2006

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5. Boyer, R., Experimental Biochemistry. Benjamin Cummings, Redwood City, California, USA. 2000.
  6. Palanivelu, P., Analytical Biochemistry and Separation Techniques. Kalaimani Printers, 2001
  7. Sadasivam, S. and A. Manickam, Biochemical Methods. New Age International Pvt Ltd Publishers, New Delhi. 2002.

# **SEMESTER-II**

பருவம்-2

தமிழ்மொழிப்பாடம்-2

3 0 0 3

பாடக்குறியீட்டுஎண்: 21LT002

பருவம்-2, தமிழ்மொழிப்பாடம்-2, பகுதி-1, தகுதிப்புள்ளி: 3, வாரப்பாடநேரம்: 3.

தாள்-2

அறஇலக்கியம் – சிற்றிலக்கியம் – சிறுகதை – பயன்பாட்டுத்தமிழ்

அலகு 1: அறஇலக்கியங்கள்

10மணிநேரம்

1. திருக்குறள்- வான்சிறப்பு(அறம்), ஊக்கமுடைமை(பொருள்), குறிப்பறிதல்(இன்பம்) – மூன்றுஅதிகாரங்கள்முழுமையும்.
2. நாலடியார் – மூன்றுபாடல்கள். (2, 3, 5)
3. பழமொழிநானூறு – மூன்றுபாடல்கள் (74, 75, 78)
4. திரிகடுகம் – மூன்றுபாடல்கள் (10, 12, 22)
5. இனியவைநாற்பது – மூன்றுபாடல்கள் (1, 12, 16)

அலகு 2: சிற்றிலக்கியம்

10மணிநேரம்

1. முத்தொள்ளாயிரம்  
சேரன் – வீரம் 14, 15 பாடல்கள்  
சோழன் – காதல் 23, 24 பாடல்கள்  
பாண்டியன் –நாடு87, 88 பாடல்கள்
2. தமிழ்விடுதாது – முதல் 20 கண்ணிகள்
3. திருக்குற்றாலக்குறவஞ்சி – மலைவளம்கூறுதல் – முதல்5 பாடல்கள்
4. முக்கூடற்பள்ளு – மூத்தபள்ளிநாட்டுவளம்கூறுதல் 3 பாடல்கள், இளையபள்ளிநாட்டுவளம்கூறுதல் 3 பாடல்கள்.
5. கலிங்கத்துப்பரணி – பாலைபாடியது – முதல் 5 பாடல்கள்

அலகு 3: சிறுகதை

9மணிநேரம்

1. அறிஞர்அண்ணா - செவ்வாழை
2. புதுமைப்பித்தன் - கடவுளும்கந்தசாமிப்பிள்ளையும்
3. ஜெயகாந்தன் - யுகசந்தி
4. கு.அழகிரிசாமி - காற்று
5. அம்பை - காட்டில்ஒருமான்

அலகு 4: பேச்சுத் தமிழ்

8 மணி நேரம்

பேச்சுத்திறன் – விளக்கம் – பேச்சுத்திறனின்அடிப்படைகள் – வகைகள் – மேடைப்பேச்சு – உடையாடல் - பயிற்சிகள்

அலகு5: எழுத்துத்தமிழ், இலக்கியவரலாறு, இலக்கணம்

8மணிநேரம்

1. கலைச்சொல்லாக்கம் – தேவைகள் – கலைச்சொற்களின்பண்புகள் – அறிவியல்கலைச்சொற்கள் – கடிதம் – வகைகள் – அலுவலகக்கடிதங்கள் – உறவுமுறைக்கடிதங்கள்.

2. பாடம்தழுவியஇலக்கியவரலாறு (அறஇலக்கியம், சிற்றிலக்கியம், சிறுகதை)
3. அணிஇலக்கணம்
4. விண்ணப்பக்கடிதம்எழுதுதல்

மொத்தம்: 45மணிநேரம்

**HINDI - II**  
**(kahani , Natak & Translation)**

**3 0 0 3**

**Course Objective:**

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

<b>Unit I</b>	- ‘zaruurath’ ( <u>kahani</u> ), Translation- Definition, Types	<b>9</b>
<b>Unit II</b>	- ‘Pandit kouun ‘ (kahani), Translation - Anuvadak ke gun	<b>9</b>
<b>Unit III</b>	- ‘Pandit kouun (kahani) , Translation Practice	<b>9</b>
<b>Unit IV</b>	- Rajani ( <u>naatak</u> ), Translation Practice	<b>9</b>
<b>Unit V</b>	- Rajani ( <u>naatak</u> ), Translation Practice	<b>9</b>

**Total Hours :45**

**Course Outcome**

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



## FRENCH II

3 0 0 3

### Course Objective:

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

### UNIT:I LECON 10-11

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

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

### UNIT III-LECON 14-15

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

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 :

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.

### TEXT BOOK :

1. Jack GIRARDER & Jean Marie GRIDLIG,<>, Clé Internationale, Goyal Publication ,New Delhi Edition 2014.

### REFERENCE BOOKS:

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

## 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.

### UNIT I

1. Growing Old - Winston Farewell
2. Ecology - A. K. Ramanujan

### UNIT II

3. Stopping by Woods on a Snowy Evening - Robert Frost
4. Our Casuarina Tree - Toru Dutt

### UNIT III

5. Goodbye Party for Miss Pushpa T.S. - Nissim Ezekiel
6. The Bull - Ralph Hodgson

### UNIT IV

7. If - Rudyard Kipling
8. The Drowned Children - Louise Glück

### UNIT V

9. Australia - A.D.Hope
10. A Far Cry from Africa - Derek Walcott

**Credit Hours**

**09**

**09**

**09**

**09**

**09**

**Total**

**45 Hours**

### Course Outcome

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:

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

### Web Sources:

- <https://www.gradesaver.com/>
- <https://www.enotes.com/>
- <https://www.jstor.org/>

- <https://www.sparknotes.com/>
- <https://www.cliffsnotes.com/>

## PRINCIPLES OF MICROBIOLOGY

3 1 0 4

### **Course Objective:** (Employability)

To provide the knowledge about various microbes and their structure, function.

### **UNIT I**

**9**

**History:** Introduction to Microbiology - History and scope of Microbiology - Classification of microbes – Numerical taxonomy – Molecular taxonomy – Methods of Microbial identification. Structure and function of the Cellular Components – Viruses, Protozoa, Bacteria, Fungi and Algae.

### **UNIT II**

**9**

**Microscopy:** Simple, Compound, Dark field, Phase contrast, Fluorescence, Electron Microscopy Cytophotometry and Flow cytometry. Fixation and staining - types of stains and dyes. Staining techniques - Simple, Differential and special staining (Endospore, Capsular).

### **UNIT III**

**15**

**Media:** Sterilization – Methods of sterilization, types of sterilant - Enumeration of microorganisms - types of culture. Microbial metabolism: common nutrient requirements, nutritional types- types of media (selective and differential media, enrichment media, microbial assay media). Aerobic and anaerobic growth - maintenance and preservation.

### **UNIT IV**

**12**

**Microbial Physiology:** Microbial growth, Growth Curve, growth factors, Impact of environmental factors on growth, microbes- energy production, oxidation, reduction reactions, aerobic and anaerobic.

### **UNIT V**

**15**

Microbial diseases: Medical microbiology – Pathogenic microbes – Bacterial, Viral, Fungal and Protozoan Diseases - Cure, control and prevention – Antimicrobial chemotherapy –Antibiotics – mode of actions –antimicrobial resistance -tests for sensitivity to antimicrobial agents. Pharmaceuticals (antibiotics, vaccines, etc.) - Application of industrial microbes.

**Total : 60 hrs**

### **Course Outcome:**

CO-1: Learn about the history, scope of microbiology and its classification.

CO-2: Comparing about various types microscope and staining methods.

- CO-3: Understand the media preparation and microorganism preservation.  
CO-4: Evaluating microbial growth curve and impact of environmental factors  
CO-5: Knowledge about microbial diseases and their impact

**TEXT AND REFERENCE BOOKS:**

1. Ananthanarayan, R and Paniker, C.K.J. A textbook of microbiology. 7<sup>th</sup> edition. Orient Longman Ltd. 2005.
2. Parija S.C, Textbook of Microbiology & Immunology, Elsevier, India. 2009
3. Pelczar M.J, Chan ECS, King NR, McGraw – Hill, Inc. NY. Microbiology- Concepts and Applications. Tata Mac. Graw Hill. 2001
4. Ananthanarayan, R and Paniker, C.K.J. A textbook of microbiology. 7<sup>th</sup> edition. Orient Longman Ltd. 2005
5. Pelzar. Microbiology, 5<sup>th</sup> edition. Tata Mac Graw Hill. 2000
6. Ingraham, J.L. and C.A. Ingraham, Introduction to microbiology, 2nd edition. Brooks/Cole, Thomson Learning, USA. 2000.
7. Kathleen Park Talaro and Talaro, A. Foundation in microbiology, 3<sup>rd</sup> edition. Mac Graw – Hill. 1999.
8. Cappucino, J.G and Sharman, N. Microbiology: A laboratory manual, 4<sup>th</sup> edition. Additional Wesley Longman, Incorporation. 1999.
9. Prescott. L.M., Microbiology. III Edition, Wm. C. Brown Publishers, London. 1996.

## IMMUNOLOGY

3 1 0 4

### **Course Objectives:** (Skill development)

Discuss the structure, function and integration of immune system. To explain the antigen antibody interactions and how the immune system is protecting the body from foreign pathogens/germs

### **UNIT I**

**10**

**Introduction to immune system:** Cells and Organs in the immune system; Primary and Secondary lymphoid organs: Thymus, Bone marrow, Lymph nodes, Spleen and MALT; Types of Immunity (Innate and Adaptive); **Cytokines:** Structure and functions; B-cell and T-cell: maturation, activation, differentiation and proliferation;

### **UNIT II**

**13**

**Antigen:** Properties of Antigen, Antigen structure, Types of Antigen: Based on their origin and Basis of immune response; Antigen Processing and Presentation; Antigen-Antibody complex and its application; **Antibodies:** General Structure; Types of antibodies, structure, properties and Function; and its Application; Antigen-Antibody Interaction; Monoclonal Antibodies, production and application.

### **UNIT III**

**14**

**Immune response:** Cell mediated and its effector mechanism; Humoral mediated and its effector mechanism; Non-specific immune response; Major Histocompatibility complex (MHC) Types and importance; MHC I and II structure, mechanism and Functions;

### **UNIT IV**

**12**

**Hypersensitivity:** An allergy, types of hypersensitivity. Immunology of hypersensitivity. Secondary immune response. Autoantibodies – Autoimmune diseases. Examples such as; Rheumatoid Arthritis, Myasthenia Gravis, Systemic Lupes Erythematus, Rhesus incompatibility, Protection of fetus from immune response.

### **UNIT V**

**11**

**Immunotechniques:** Immuno diffusion, immunoelectrophoresis ELISA, RIA, fluorescence activated cell sorter, PBMC, immunoblotting

**Total : 60 hrs**

### **Course Outcome:**

- CO-1: Relate about immune system structure, functions and cytokines
- CO-2: Identify structure of immunity to various pathogens and types of antibodies
- CO-3: Explain about MHC mechanism, functions and immune response.
- CO-4: Analyse about allergy reaction, autoantibodies and hypersensitivity reaction
- CO-5: Make use of different techniques for identification on immunological reaction

**TEXT AND REFERENCE BOOKS:**

1. Peter J Delves, Seamus J Martin, Dennis R Burton and Ivan M Roitt., Roitts Essential Immunology, 13th Edition, Wiley -Blackwell, 2016.
2. Kuby, J., Immunology, WH Freeman & Co. 2000.
3. Janeway, C.A and Paul Travers, 1994. Immunobiology, Current Biology Ltd./Garland Publishing Inc. Churchill Livingstone.
4. Roitt, I.M., J. Brestoff and D.K Male, 1996. Immunology, Mosby-Year Book Europe Limited, London.
5. Sulabha Pathak and UrmiPalan, Immunology - Essential & Fundamental, Capital Publishing Company, 301 W. Harrison Guthrie. 2005.
6. Tizard, I.R, Immunology, an Introduction, Saunders College Publishing, NewYork. 1995.
7. Weir, D.M, Immunological Techniques, Blackwell Scientific Publications, London. 1992.

**Course Objective: (Skill development)**

To impart knowledge on Nucleic acids and their characteristics, transcription, translation, and regulation of gene expression

**UNIT I 10**

**Genome Organization:** Organization of genetic material in prokaryotes and eukaryotes. Structure of chromatin - nucleosomes, histones. DNA as a genetic material - Watson & Crick model. Nucleic acids- structure, types and physicochemical properties of elements in DNA and RNA - biological significance of DNA and RNA.

**UNIT II 13**

**DNA Replication:** Central Dogma of Molecular Biology, DNA replication – Types of DNA polymerases - Mechanism of DNA replication - Enzymes and accessory proteins involved in DNA replication. Differences in prokaryotic and eukaryotic DNA replication.

**UNIT III 13**

**Gene Expression:** Gene as the unit of expression. Types of RNA (mRNA, tRNA and rRNA). Transcription in prokaryotes and eukaryotes - Mechanism of transcription, RNA polymerase - post transcriptional modifications.

**UNIT IV 12**

**Translation:** Translation in prokaryotes and eukaryotes: Elucidation of Genetic code, translational machinery, mechanism of initiation, elongation and termination. Post translational modifications.

**UNIT V 12**

**Regulation of Gene Expression:** Regulation of gene expression in prokaryotes and eukaryotes- the operon concept. Types of Promoter, Role of Enhancers, Cis-trans elements, DNA methylation and Chromatin remodeling in gene expression. Environmental regulation of gene expression. **Total : 60 hrs**

**Course Outcome:**

- CO-1: Learn the concept of structure, function of DNA and RNA.
- CO-2: Compare the Prokaryote and eukaryote DNA replication and mechanism
- CO-3: Understand the concept of gene expression.
- CO-4: Determine about genetic code, translation and modification mechanism
- CO-5: Adapt the knowledge about regulation of gene expression.

**TEXT AND REFERENCE BOOKS:**

1. Harvey Lodish, Baltimore. Arnold Berk et al. "Molecular cell biology" 7<sup>th</sup> edition. Publisher: W. H. Freeman, 2011.
2. De Robertis, EDP, E.M.F Robertis, Cell and molecular biology, Saunders Company, 2006.
3. David Freifielder, "Molecular Biology", 3rd edition Jones & Bartlett publications, 2009.
4. Cooper M., "The Cell Molecular Approach", ASM Press, 2004.
5. Work.W., Laboratory Techniques in Biochemistry and Molecular Biology. Vol 5. American Elsevier, New York. 1976.
6. Bruce Alberts, D. Bray, J. Lewis, M. Raff, Roberts and J.D. Watson, Molecular Cell Biology, II Edition, Garland Publishing Inc., New York. 1994.
7. Darnell, J and H. Lodish Baltimore, Molecular Cell Biology, American Books, Inc., New York. 1994.
8. Watson, J.D., N.H. Hopkins, J.W. Roberts, J. Steitz and A.M. Weiner, Molecular Biology of Gene. IV Edition, The Benjamin Cummings Publishers Inc., California. 1987.



**Course Objective:** (Entrepreneurship)

To provide the practical knowledge about various microbiology techniques **Course**

**LIST OF EXPERIMENTS:**

1. Sterilization Techniques, Sterilization of Media, Glass Wares and Instruments
2. Media Preparation (solid & liquid).
3. Staining Techniques–Gram’s staining, Spore Staining, Acid fast, Lacto phenol Cotton Blue Staining.
4. Types of culture method Streak plate, Pour plate, Stab & Slant preparation.
5. Measurement of Growth rate of bacteria - Turbidometric method.
6. Isolation & Enumeration of Microorganism from Air, Water and Soil.
7. Hanging drop technique.
8. Catalase test, Oxidase test, Urease tests
9. Characterization of microorganisms -IMVIC tests.
10. Microscopic slide preparation –Fungi & Bacteria.
11. Antibiotic sensitivity Test - Kirby Bauer method.

**Total : 30 hrs****Outcome:**

- CO-1: Understand the importance and principle of sterilization
- CO-2: Compare the types of culture for microorganism growth
- CO-3: Learn about isolation and identification of microorganisms using different methods
- CO-4: Determine the growth of microbes and the motility of Bacteria
- CO-5: Identifying and differentiate the Gram positive, Gram negative Bacteria utilising biochemical test

**TEXT AND REFERENCE BOOKS:**

1. Bharucha, F.D. and A.I. Mehta, Handbook of Microbiological Methods and Media. Sevak Printers, Mumbai. 2000.
2. Cappuccino, J.G. and N. Sherman, Microbiology-A Lab Manual. Pearson Education, Singapore. 2004.
3. Dubey, R.B. and E. Maheswari, Practical Microbiology. S. Chand and Co. Publishers, New Delhi. 2004.
4. Goldman, E. and H. G. Lorrence, Practical Handbook of Microbiology. II Edition, CRC press, London. 2008.
5. Kannan, N., Laboratory Manual in General Microbiology. Palani Paramount Publishers, Palani, Tamil Nadu. 2002.

**Course Objective:** (Skill development)

To give practical training in the function of immune system

**List of Experiments:**

1. Demonstration of Blood Collection and Separation of serum
2. ABO Blood Grouping
3. Quantitative Precipitin Assay
4. Separation of mononuclear cells by Ficoll – Paque.
5. Isolate Monocytes from Blood
6. Qualitative test for WIDAL Test
7. ASO – Agglutination Test
8. Antigen-Antibody determination by Single diffusion (Radial immunodiffusion)
9. Double Immunodiffusion test – Ouchterlony
10. Demonstration of ELISA

**Total : 30 hrs**

**Course Outcome:**

- CO-1: Learn about Blood collection and maintenance
- CO-2: Identify types of blood grouping and Rh type
- CO-3: Knowledge about disease identification using Ag-Ab reaction
- CO-4: Evaluate immunodiffusion techniques for Ag-Ab determination
- CO-5: Judgement about information about ELISA techniques

**TEXT AND REFERENCE BOOKS:**

1. Hay, F.C. and M.R. Westwood, Practical Immunology. Blackwell Science Publishers, London. 2004.
2. Janeway, C.A., and P. Travers, Immunobiology. Current Biology Ltd., Garland Publishing Inc. Churchill Livingstone. London. 1994.
3. Talwar, G. P. and S. K. Gupta, A Handbook of Practical and Clinical Immunology. Vol 1 and 2, CBS Publications. India. 1992.
4. Weir, D.M., Immunological Techniques. Blackwell Scientific Publications, London. 1992
5. Edward A. Greenfield. Antibodies: A Laboratory Manual, , Cold Spring Harbor Laboratory Press, 2nd Edition, 2014
6. John E. Coligan.et al. Current protocols in immunology, New York : Wiley Interscience, 2003.

# **SEMESTER III**

தமிழ்மொழிப்பாடம்-3

3003

பாடக்குறியீட்டுஎண்: 21LT003

பருவம்-3, தமிழ்மொழிப்பாடம்-3, பகுதி-1, தகுதிப்புள்ளி: 3, வாரப்பாடநேரம்: 3.

தாள்-3

பக்திஇலக்கியம் – காப்பியம் – புதினம் - மொழிபெயர்ப்பு

அலகு 1:பக்திஇலக்கியம்

10மணிநேரம்

1. மாணிக்கவாசகர்- திருவாசகம் – மூன்றுபாடல்கள்
  - ✓ புல்லாகியூடாகி(சிவபுராணம்)
  - ✓ எல்லாப்பிறப்பும்(சிவபுராணம்)
  - ✓ உற்றாரையான்வேண்டேன்(திருப்புவல்பல்)
2. ஆண்டாள்- திருப்பாவை – மூன்றுபாடல்கள் (1, 3, 4)
  - ✓ மார்கழித்திங்கள் ... (பாசுரம்1)
  - ✓ ஓங்கிஉலகளந்த... (பாசுரம் 3)
  - ✓ ஆழிமழைக்கண்ணா... (பாசுரம்4)
3. வீரமாமுனிவர் - தேம்பாவணி – மூன்றுபாடல்கள்
  - ✓ நீஒருதாய்; ஒருதாதையும்நீ (698 - சூசைஇறைவனின்தாயைப்போற்றுதல்)
  - ✓ அணிக்கலத்துஅழகுஅழுந்திய (1089 - வானவர்இயேசுநாமத்தைப்போற்றிவணங்கியசெய்தி)
  - ✓ வான்முறத்துஇலகும்செஞ்சுடர்காண (3510 -  
இறைவன்சூசைமுனிவர்க்குஏழுமணிகள்முறத்தில்ஒளிவிடும்முடியைச்சூட்டுதல்)
4. குணங்குடிமஸ்தான்சாகிபு - பராபரக்கண்ணி 1-10 கண்ணிகள்
5. திருமூலர் - திருமந்திரம் – மூன்றுபாடல்கள்
  - ✓ உடம்பார்அழியின்உயிரார்அழிவர் (திருமந்திரம்:724)
  - ✓ படமாடக்கோயில்பகவற்குஒன்றுஈயில்(திருமந்திரம்: 1857)
  - ✓ மரத்தைமறைத்ததுமாமதயானை (திருமந்திரம்: 2290)
6. இராமலிங்கஅடிகள் - திருவருட்பா- மூன்றுபாடல்கள்
  - ✓ எத்துணையும்பேதமுறா... (5297)
  - ✓ ஒருமையுடன்நினதுதிருமலரடிநினைக்கின்ற(2938)
  - ✓ கோடையிலே... (4091)

அலகு 2:காப்பியம்-1

9மணிநேரம்

1. சிலப்பதிகாரம் – அடைக்கலக்காதை  
(தெரிவுசெய்யப்பட்டபாடல்அடிகள் 120-199)
2. சீவகசிந்தாமணி – விமலையார்இலம்பகம்  
(தெரிவுசெய்யப்பட்டபாடல்கள்)

### அலகு 3:காப்பியம்-2

9மணிநேரம்

1. கம்பராமாயணம் – மந்தரைசூழ்ச்சிப்படலம்  
(தெரிவுசெய்யப்பட்டபாடல்கள்)
2. பெரியபுராணம் – பூசலார்நாயனார்புராணம்  
(தெரிவுசெய்யப்பட்டபாடல்கள்)

### அலகு 4:புதினம்

8மணிநேரம்

1. கல்மரம் - கோ.திலகவதி

### அலகு 5:மொழிபெயர்ப்பு, இலக்கணம், இலக்கியவரலாறு

9மணிநேரம்

1. அலுவல்சார்மொழிபெயர்ப்பு
2. இலக்கணக்குறிப்பு
3. பாடம்தழுவியஇலக்கியவரலாறு (பக்திஇலக்கியம், காப்பியம், புதினம்)

மொத்தம்: 45மணிநேரம்

**HINDI - II**  
**( kahani , Natak & Translation)**

**3 0 0 3**

**Course Objective:**

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

<b>Unit I</b>	- 'zaruurath' ( <u>kahani</u> ), Translation- Definition,Types	<b>9</b>
<b>Unit II</b>	- 'Pandit kouun ' (kahani), Translation - Anuvadak ke gun	<b>9</b>
<b>Unit III</b>	- 'Pandit kouun (kahani) , Translation Practice	<b>9</b>
<b>Unit IV</b>	- Rajani ( <u>naatak</u> ), Translation Practice	<b>9</b>
<b>Unit V</b>	- Rajani ( <u>naatak</u> ), Translation Practice	<b>9</b>

**Total Hours :45**

**Course Outcome**

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

**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 civilisation.**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 pêche.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.**TEXTBOOK :**

Les leçons ont été choisi et tire de i &amp; ii degré de gauger&lt;&lt;Cours de Langue et de Civilisation Française&gt;&gt; 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/>

**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.

	<b>Credit Hours</b>	
<b>UNIT I</b>	<b>09</b>	
<ul style="list-style-type: none"> <li>• Introduction to Drama .</li> </ul>		
<b>UNIT II</b>	<b>09</b>	
<ul style="list-style-type: none"> <li>• Shakespeare: Funeral Oration (Act III Scene II Julius Caesar) &amp;</li> <li>• Monkey’s Paw - W.W.Jacobs</li> </ul>		
<b>UNIT III</b>	<b>09</b>	
<ul style="list-style-type: none"> <li>• Comprehension</li> </ul>		
<b>UNIT IV</b>	<b>09</b>	
<ul style="list-style-type: none"> <li>• Precis -Writing and Note Taking</li> </ul>		
<b>UNIT V</b>	<b>09</b>	
<ul style="list-style-type: none"> <li>• General Essay on Current Topics</li> </ul>		
	<b>Total</b>	<b>45 Hours</b>

**Course Outcome**

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, 1984 by 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/>



**Course Objective: (Employability)**

To understand vector biology, principles in cloning, cloning strategies for prokaryotes and eukaryotes.

**UNIT I 13**

**Introduction to Genetic engineering:** Gene cloning – isolation and purification of DNA and Plasmids. DNA manipulating enzymes – Nuclease - types, Restriction enzymes, Ligase, Polymerase, DNA Modifying enzymes, other enzymes, linkers, adaptors and homopolymer tailing.

**UNIT II 13**

**Cloning vectors:** Cloning vectors- salient features, types of plasmid vectors - Natural, Artificial - pBR322 and its construction, PUC- phage vectors (Lambda and M13 phages) - cosmids, phagemids, viral vector – baculoviral, retroviral, CaMV, TMV BAC, YAC, Shuttle vector.

**UNIT III 10**

**Identification:** Electrophoresis of DNA, RNA and Protein - Nucleic acid staining - Molecular probes, Nucleic acid Labelling methods - Southern, Northern and Western Blotting. Autoradiography.

**UNIT IV 13**

**Gene transfer techniques** - Methods of gene transfer: Chemical Transfection, Physical Transfection and Virus Mediated Transduction, PCR, Types of PCR- RFLP, RAPD – DNA Sequencing- DNA Libraries (Genomic, cDNA Libraries)

**UNIT V 11**

**Applications:** Gene therapy and its types- Protein engineering- Expression of recombinant proteins in E. coli –insulin. Recombinant vaccine, Antisense technology - DNA fingerprinting- Gene knockouts- GMO.

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Learn about the fundamental principles of cloning vectors and enzymes involved
- CO-2: Understand about various types of vector used for cloning
- CO-3: Identification of Nucleic acids using various molecular techniques
- CO-4: Analysis of Gene transfer technologies and amplification of Nucleic acids
- CO-5: Applying the genetic engineering techniques in protein synthesis.

**TEXT AND REFERENCE BOOKS:**

1. Singh B.D., 2005, Molecular biology and Genetic Engineering, Kalyani publishers.2005
2. Primrose, S.B. Molecular Biotechnology. Panima Publishing House, New Delhi, India. 2001.
3. Winnacker, E.L., Genes to Clones. Panima Publishing House, New Delhi, India. 2003.
4. Brown T.A., Gene cloning and DNA analysis, 6th edition, Wiley Blackwell science.2010.
5. Watson, Molecular Biology of the gene, 5th edition Person education, Singapore. 2004
6. Kreuzer-Massey, Recombinant DNA and Biotechnology, ASM Press. 2001
7. Alcamo, I. Edward. DNA Technology, Academic Press.2001
8. Walker J.M. and R. Rapley, Molecular Biology and Biotechnology, 4<sup>th</sup> edition. 2006
9. Glick, B.R. and J.J. Pasternak, Molecular Biotechnology. Panima Publishing House, New Delhi, India. 2002.

## BIOINFORMATICS

3 0 0 3

**Course Objective:** (Employability)

To understand the application of various tools of bioinformatics

### UNIT I 9

**Introduction to network basics:** History of Bioinformatics, Scope of bioinformatics. Introduction to Database: Types of database. Biological Database: Need of biological database, Sequence and Structure database – (NCBI, EMBL, DDBJ, and PDB), other databases - KEGG, PubMed, OMIM, PubChem, NCI, ZINC, Drug Bank, Ligand.

### UNIT II 10

**Sequence and Phylogeny analysis:** Detecting Open Reading Frames, Mutation/Substitution Matrices, Pairwise Alignments, and Database Similarity Searching: BLAST. BLAST variants. Multiple Sequence Alignment, Phylogenetic Analysis, Data Submission: Bankit, Seqin.

### UNIT III 8

**Tools of bioinformatics:** RasMol, PyMol, Jmol, CN3D, Swiss PDB viewer, Chimera and Discovery Studio visualizer. Protein Structure Comparison, Protein Structure Comparison, Gene identification tool

### UNIT IV 9

**Gene and Promoter Prediction:** Gene Prediction in Eukaryotes, Promoter and Regulatory Element Prediction, Protein Structure Prediction and Molecular Dynamics Globular Proteins: AbInitio, Homology Based, Neural networks method. Transmembrane

### UNIT V 9

**Drug Discovery:** Molecular Docking, Chemoinformatics, Docking and Virtual Screening, Ligand – Receptor Interactions: Docking software's (AUTODOCK, LEAD IT), Post docking analysis. **Total : 45 hrs**

### Course Outcome

CO-1: Understand about the Basics of biological databases

CO-2: Demonstrate the database for sequence and phylogeny analysis.

CO-3: Analyse about sequence analysis using various tools

CO-4: Evaluate the gene and protein structure prediction

CO-5: Crating and adapting the method for drug designing and docking

**TEXT AND REFERENCE BOOKS:**

1. David W Mount, “Bioinformatics sequence and Genome analysis”, Second Edition, Cold SpringHarbor Laboratory Press, 2013.
2. Attwood T K, D J Parry-Smith, “Introduction to Bioinformatics”, Pearson Education, 2005.
3. Neil C. Jones and Pavel A. Pevzner, “An Introduction to Bioinformatics Algorithms”, MIT Press, 2005.
4. Steffen Schulze-Kremer, “Molecular Bioinformatics: Algorithms and Applications”, Walter de Gruyter, 1996.
5. Jin Xiong, Essential Bioinformatics, Cambridge University Press. 2006.
6. Rajaraman. V., Introduction to information technology. Prentice Hall of India Pvt. Ltd, New Delhi. 2003.
7. Lesk, A. M., Introduction to Bioinformatics. Oxford University Press, London. 2002.

Web resources:

- <http://www.ncbi.nlm.nih.gov/>
- <http://www.ebi.ac.uk/2can/databases/>

**Course Objective:** (Employability)

To provide the practical knowledge of the fundamental aspects of Genetics till the molecular level and significant aspects of developmental biology.

**List of Experiments:**

1. Introduction to sequence databases Protein sequence databank – UNIPROT. Nucleic acid sequence databank – Gene bank, EMBL, DDBJ.
2. Sequence alignment BLAST, FASTA Pairwise alignment- Needleman-Wunsch and Smith-Waterman algorithms multiple alignment- CLUSTALW, CLUSTAL X, TCOFFEE.
3. Evaluation of protein structure by Swiss PDB viewer and visualization tools – RASMOL.
4. Homology modeling of a given protein sequence
5. Tools of bioinformatics : Primer designing, SNP analysis, String analysis, bankit
6. Molecular Docking – Autodock

**Total : 15 hrs**

**Course Outcome**

CO-1: Learn about sequence database for analysing nucleic acid

CO-2: Understand about pairwise alignment and multiple alignment

CO-3: Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics

CO-4: Existing software effectively to extract information from large databases and to use this information in computer modelling

CO-5: Analyse about tools used in bioinformatics and molecular docking

**TEXT AND REFERENCE BOOKS:**

1. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press, Oxford. 2003.
2. David W. Mount, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbour Laboratory Press, New York. 2001.
3. Glover, D.M and Hames, B.D, DNA Cloning a Practical Approach, IRL Press, Oxford. 1995.
4. Ignacimuthu, S.J, Basic Bioinformatics, Narosa Publishing House, Chennai. 2005.
5. Steffen Schulze-Kremer, “Molecular Bioinformatics: Algorithms and Applications”, Walter de Gruyter, 1996.

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## BIOPHYSICS AND BIOINSTRUMENTATION

4 0 0 4

**Course Objective:** (Employability)

To introduce the physical aspects and bioenergetics of the living system and to familiarize the principle and working of various instruments used in biotechnology experiments

### UNIT-I

12

**Introduction:** Scope and methods of biophysics, Bioenergetics, Laws of thermodynamics – Entropy – Enthalpy – free energy of a system. Diffusion, Viscosity, Rheology, Osmosis. Structure of nucleic acid and proteins - Ramachandran plot

### UNIT-II

10

**Spectroscopic Techniques:** Beer Lambert's law - Colorimeter and its applications. Spectrophotometer- Principle and its applications - Types of Spectrophotometer- UV, visible, Infrared Spectrophotometer, Raman spectra, atomic absorption.

### UNIT-III

14

**Imaging techniques** -EEG, ECG, CT SCAN, MRI SCAN, X-RAY, EMG, NMR, XRD, PET and scan radioisotopes.

### UNIT-IV

10

**Fluorescence and radiation-based techniques:** GM Counter, LS Counter, Scintillation Counter, Flow Cytometry, FACS, Maintenance of Laboratory Instruments – LAF, Autoclave, Incubator and Hot air oven.

### UNIT-V

14

**Chromatographic Techniques:** Principle and its applications, Types- Paper, Thin Layer, Column, HPLC, GC and MS. **Centrifuge** - Principle and its applications - Types of Centrifuge

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Understand the methods and laws of biophysics
- CO-2: Knowledge about the spectroscopic techniques
- CO-3: Learn basic instruments techniques for imaging process
- CO-4: Predict the various fluorescence techniques for organism identification
- CO-5: Compare various chromatographic techniques for compound identification.

**TEXT AND REFERENCE BOOKS:**

1. William Bialek. Biophysics: Searching for Principles: ISBN-13:, Princeton University Press. 2012

2. Ghatak, K.L., Techniques and Methods In Biology. PHI Learning Private Ltd. New Delhi. 2003.
3. Upadhyay., Biophysical Chemistry-, Himalaya Publication, Edition III. 2019.
4. Philip Nelson, Biological Physics: with New Art by David Goodsell, 2013
5. Keith Wilson and John Walker, 2006. Principles and Techniques of Biochemistry and Molecular Biology, VI<sup>th</sup> Edition, Cambridge University Press, India.
6. Switzer, R and Garrity.L,1999. Experiment Biochemistry. III edition, W.H. Freeman and Company Publishers, New York.
7. Sharma, B.K, 2004. Instrumental Methods of Chemical Analysis, XXIV Edition, Goel Publishing House, Meerut.
8. Boyer, R, 2000. Modern Experimental Biochemistry, III Edition, Addison Wesley Longman, New Delhi.
9. Chatwal, G.R and S.K. Anand, 2003. Instrumental Methods of Chemical analysis.V Edition, Himalaya Publishing House, Mumbai.



**Course Objective:** (Employability)

To provide the basic practical skills of genetic engineering techniques

**List of Experiments:**

1. Isolation of genomic DNA from Bacteria
2. Isolation of genomic DNA from Plant
3. Isolation of genomic DNA from Animal
4. Isolation of plasmid DNA
5. Agarose gel electrophoresis
6. Quantification of nucleic acids
7. Estimation of DNA
8. Restriction digestion
9. Ligation
10. PCR - DEMO

**Total : 30 hrs**

**Course Outcome:**

- CO-1: Learn about culturing of bacteria for DNA Isolation
- CO-2: Understanding the knowledge about different methods of DNA isolation
- CO-3: Obtain practical knowledge in analyzing various enzymes used for cut the DNA
- CO-4: Identify which enzyme used for joining two sequences in genetic engineering.
- CO-5: Create DNA multiple copies using PCR techniques.

**TEXT AND REFERENCE BOOKS:**

1. Sambrook, J, E.F. Fritsch and T. Maniatis, Molecular Cloning, A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York. 2000.
2. Glover, D.M. and B.D. Hames, DNA Cloning a Practical Approach. IRL Press, Oxford. 2000.
3. James, J.G. and V.B. Rao, Recombinant DNA Principles and Methodologies. Marcel Dekker Publications, NewYork. 2001.
4. Maliga, P., Methods in Plant Molecular Biology. A Laboratory Course Manual, Cold Spring Harbour Laboratory Press, NewYork. 2000.
5. Sengar. R.S, Pooran Chand, Shalini Gupta, Manoj K.Yadav and Purushotam, Laboratory Manual on Molecular Biology and Genetic Engineering. Department of Agriculture Biotechnology, Modipuram. 2012.

# **SEMESTER IV**

பருவம்-4

தமிழ்மொழிப்பாடம்-4

3 0 0 3

பாடக்குறியீட்டுஎண்: 21LT004

பருவம்-4, தமிழ்மொழிப்பாடம்-4, பகுதி-1, தகுதிப்புள்ளி: 3, வாரப்பாடநேரம்: 3.

தாள்-4

சங்கஇலக்கியம் – நாடகம் – வளர்தமிழ் - பொதுக்கட்டுரை

அலகு1:சங்கஇலக்கியம்-1

10மணிநேரம்

1. புறநானூறு (மூன்றுபாடல்கள் - 183, 184, 192)
2. பதிற்றுப்பத்து (இரண்டுபாடல்கள்-14, 69)
3. பட்டினப்பாலை (காவிரியின்சிறப்புபாடல்அடிகள்01-07,சோழநாட்டுவளம்பாடல்அடிகள்20-28,பல்பொருள்வளம்பாடல்அடிகள்183-193)
4. மதுரைக்காஞ்சி (பாண்டியர்பரம்பரைபாடல்அடிகள்01-23, மன்னர்க்குமன்னன்பாடல்அடிகள்64-74, பாண்டியன்புகழ்பாடல்அடிகள்197-209).

அலகு 2:சங்கஇலக்கியம்-2

9மணிநேரம்

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

அலகு 3:நாடகம்

8மணிநேரம்

1. ஆட்டனத்திஆதிமந்தி - கவிஞர்கண்ணதாசன்

அலகு 4:வளர்தமிழ்

9மணிநேரம்

1. ஊடகத்தமிழ் - கணினித்தமிழ்அறிமுகம்

ஊடகத்தமிழ்:அச்சுக்கலை - இதழியல் - ஊடகவகைகள் - அச்சுஊடகங்கள் - மின்னணுஊடகம் -

இதழியல்முன்னோடிகள் - அச்சுஊடகங்களில்தமிழ் -கருத்துப்பரிமாற்றம் - மொழிநடையின்தன்மை -

நாளிதழ்கள்- வார, மாதஇதழ்கள் - மின்னணுஊடகங்களில்தமிழ் - வானொலி- தொலைக்காட்சி- திரைப்படம்.

**கணினித்தமிழ்:** கணினித்தமிழின் அடிப்படையும் பயன்பாடும்-கணிப்பொறியின் வரலாறும் வளர்ச்சியும்,கணினியும் தமிழும், விசைப்பலகை (Keyboard) - எழுத்துருக்கள்(Fonts) -தமிழைத்தட்டச்சு செய்ய உதவும் மென்பொருள்கள், தமிழைத்தட்டச்சு செய்யும்முறைகள் -தமிழ்த்தட்டச்சுப்பயிற்சி - இணையமும் தமிழ்ப்பயன்பாடும் - தேடுபொறி(Search) -வலைப்பூ(Blog), மின்னூலகம் (Online e-Library),- மின்னகராதி (e-Dictionary), -மின்செய்தித்தாள் - e-Paper, - இணையவழித் தமிழ்க்கற்றலும்-கற்பித்தலும்- மின்வழிக்கற்றல் - e Learning.

**அலகு 5:பொதுக்கட்டுரை, இலக்கியவரலாறு, இலக்கணம்** 9மணிநேரம்

1. பொதுக்கட்டுரைவரைதல்
2. பாடம்தழுவியஇலக்கியவரலாறு (சங்கஇலக்கியம், நாடகம், வளர்தமிழ்)
3. இலக்கணம் (பொருளிலக்கணம்) திணை, துறைவிளக்கம்.

மொத்தம்: 45மணிநேரம்

## HINDI - IV

3003

( 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

<b>Unit I</b>	- ‘Adhunik kavitha(Sansar), Journalism	<b>9</b>
<b>Unit II</b>	- ‘Adhunik kavitha ( Mouun nimanthran), Journalism	<b>9</b>
<b>Unit III</b>	- Adhunik kavitha (‘rah rahkar Tuutthaa rab kaa kahar ), Journalism	<b>9</b>
<b>Unit IV</b>	-‘ Adhunik kavitha (‘samarpan’), Advertisement writing	<b>9</b>
<b>Unit V</b>	- ‘Adhunik kavitha (‘panthrah agasth kii pukaar ’), Advertisement writing	<b>9</b>

**Total Hours : 45**

### Course Outcome

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

- Padya khosh
- Hindi patrakaritha ek parichaya

## 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 féminin 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.

### 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

### WEB SITE RESOURCES LINK;

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

## 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.

	<b>Credit Hours</b>	
<b>UNIT I</b>	<b>09</b>	
i. At the Airport		
ii. In a Bank		
iii. On a Bus		
<b>UNIT II</b>	<b>09</b>	
iv. In Flight		
v. In a Hotel		
vi. In a Library		
<b>UNIT III</b>	<b>09</b>	
vii. Tea Time		
viii. On a Train		
ix. In a Restaurant		
<b>UNIT IV</b>	<b>09</b>	
x. On a Picnic		
xi. In a Police station		
xii. In a Post office		
<b>UNIT V</b>	<b>09</b>	
xiii. In a travel agency		
xiv. Asking the way		
xv. At the theatre		
<b>Total</b>		<b>45 Hours</b>

### Course Outcome

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:

- English Conversation Practice, D.H.Spencer, Oxford.
- 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>

## **ANIMAL BIOTECHNOLOGY**

**4 0 0 4**

**Course Objective:** (Skill development)

Wide scope for animal biotechnologists is there as they can be absorbed by the biotechnology industry, research organizations, food – processing units, the defense sector and pharmaceutical industry.

### **UNIT-I**

**11**

**History and Scope of Animal tissue culture:** Design & layout of ATC laboratory. Requirements for Animal cell culture. Types of media, ingredients of media. Foetal Bovine Serum. Metabolic profiling of Animal cell culture.

### **UNIT-II**

**13**

**Basic Techniques of mammalian cell culture:** Disaggregation of animal tissue. Primary culture & secondary culture. Evolution of cell line & continuous cell line, characterization of cell lines. Monolayer, suspension culture. Organ culture, Embryo culture. Maintenance of cell culture. Common cell culture contaminants. Cell lines – (HELA) and other types

### **UNIT-III**

**11**

Sericulture, Commercial production of silk, Silkworm as a bioreactor. Biotechnology of aquaculture, apiculture. Animal cloning vectors. History, Principles and Scope of Tissue Engineering.

### **UNIT-IV**

**12**

Embryo Technology and Animal Breeding : Artificial insemination, In vitro fertilization, Embryo transfer, ICSI, Embryo splitting, Fertility control & regulation, test tube babies. Introduction to Stem Cell Technology and its applications- Different kinds of stem cells

### **UNIT-V**

**13**

Applications of animal tissue culture for invitro testing of drugs. Production of transgenic animals & molecular pharming, animal cloning techniques. Cell culture based vaccines and hormones. Production of human proteins in milk and meat. Ethical values in animal biotechnology.

**Total : 60 hrs**

### **Course Outcome:**

- CO-1: Idea about Animal tissue culture techniques and design
- CO-2: Understand the types of various cell culture techniques



CO-3: Gain the information about various organ culture techniques

CO-4: Identify best embryo technology for animal breeding

CO-5: Apply various animal biotechnology techniques for high yield production

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**TEXT AND REFERENCE BOOKS:**

1. Ranga M., Animal Biotechnology, Studam publishers. 2006.
2. Sasidhara R., Animal Biotechnology, MJP Publishers. 2006.
3. Satyanarayana U., Biotechnology, Books and Allied (p)Ltd .2008.
4. Primrose, S.B., R.M. Twyman& R.W. Old, Principles of Gene Manipulation, Blackwell Scientific Publications, London. 2000.
5. Freshney, R.I., Animal Cell Culture: A Practical Approach (V Edn.), John Wiley & Sons, NY. 2004.
6. Davies, J.M., Basic Cell Culture, Oxford University Press, Oxford. 2002.
7. R.C. Dubey., A Text Book of Biotechnology. S. Chand& Co Ltd, NewDelhi. 5<sup>th</sup> edition. 2014.
8. Sudha Gangal, Animal Tissue culture. University Press (India)PvtLtd. Hyderabad. Second edition.2010.

**Course Objective: (Enterprenuership)**

To provide the knowledge about various Food and nutrients and their function.

**UNIT-I****13**

**Introduction:** Nutritive value of food, Food as a substrate for microorganisms, biological factors affecting microbial growth. Physical and physiological changes caused by microorganisms, control measures for food poisoning out breaks. Fermented foods – Types

**UNIT-II****10**

**Food borne diseases:** Role of microbes in fermented foods and genetically modified foods. Evaluation of food quality, food adulteration. Food preservation and additives and packaging methods. Food borne infections and intoxications; bacterial with examples of infective and toxic types – *Clostridium*, *Salmonella*, *Staphylococcus*.

**UNIT-III****13**

**Food preservation:** Nutritive value, structure composition preservation (Acids, Salts, Sugars, Antibiotics, Ethylene oxide, Antioxidants) and storage- of cereal products, pulses, nuts and oil seeds, milk and milk products - milk tests - dye reduction, eggs, fish foods, vegetables and fruits, sugar and related products, fats and oils.

**UNIT-IV****11**

**Food Production:** Food safety - HACCP System to food protection, Responsibility for food safety. Natural Food Additives Colors -Types, Applications. Modern concepts and principles of in diet therapy. Dietary management in metabolic disorders. Diet, nutrient and drug interaction.

**UNIT-V****13**

**Applications of Enzymes in food industry:**  $\alpha$ -amylases, proteases, resins, lipases, glucoseisomerase, lactases, pectinases in food industry. Production of bread, cheese and idly. SCP Production. Beverages and appetizers.

**Total : 60 hrs**

**Course Outcome:**

CO-1: Learn about nutritive value of food and fermented foods.

CO-2: Knowledge about food borne diseases and food preservation techniques.

CO-3: Understand the fermentation processes and appreciate the role of microorganisms in industrial processes.

CO-4: Analyse the importance of microorganisms in foods and understand the biological factors that affect their development in these substrates.

CO-5: Apply gained knowledge make use of value added product production for industry.

**TEXT AND REFERENCE BOOKS:**

1. Fraizer, WC. Food Microbiology, McGraw Hill Inc. 4th Edition. 1998
2. Vijayakhader. Text book of Food Science and Technology, ICAR, New Delhi. 2001
3. Knorr, D. Food Biotechnology. Marcel Dekker, New York. 1982
4. King, R.D and P. S.J.Chettam,. Food Biotechnology, Elsevier Applied Science, NewYork. 1986
5. Creuger, W. and Creuger, A. Biotechnology: A Text book of industrial microbiology 1984.
6. Bains W. Biotechnology from A to Z. Oxford University press. 1993.
7. Pelczar, M.I and Reid. Microbiology. McGraw Hill Book Company. 1993
8. Toledo, R.T, Fundamentals of Food Process Engineering, AVI Publishing Company, USA. 1980.
9. Joshi, V.K., Biotechnology-Food Fermentation. Educational Publishers and Distributors, New Delhi. 1999.
10. Adam, M.R. and Moss, M.O., 2003. Food Microbiology, New Age International Pub.New Delhi, India.

**Course Objective:** (Skill development)

To provide the knowledge about various Food products and analyze their nutrients composition. The uses of microbes in various industries.

**List of Experiments:**

1. Testing of physico chemical properties in foods. Acidity, pH, TSS. Moisture and colors.
2. Enzymes in foods (milk and potatoes)
3. Identification of foodborne pathogens/contaminants.
4. Assessment of surface sanitation of food preparation units, swab and rinse techniques.
5. Visits to food processing units or any other organization dealing with advanced methods in food microbiology.
6. Fermented food product preparation : Yogurt, Pickle and Cheese
7. Fermented fish/meat product preparation
8. Isolation of Probiotics from fermented food products
9. Survey of preserved foods available in the local markets to study methods of preservation, preservatives used, shelf life, cost and form of availability.
10. Identification of genetically modified plants by the polymerase chain reaction (Demonstration)

**Total : 15 hrs****Course Outcome:**

CO-1: Understand about food physical and chemical properties

CO-2: Learn to estimate the various chemicals present in food sample.

CO-3: Identification of sugar and protein level present in food sample

CO-4: Recommended the technique of milk product preparation

CO-5: Adapt the techniques for preservation of food

**TEXT AND REFERENCE BOOKS:**

1. Harrigan, W. F., Laboratory methods in Food Microbiology, III Ed. Academic Press, New York, USA. 1998.
2. Jay, J.M., Modern Food Microbiology, IV Ed. Chapman and Hall, New York, USA. 1992.
3. Dubey, R.C. and E. Maheshwari, Practical Microbiology, S.Chand & Co. Publishers, New Delhi, India. 2004.
4. Toledo, R.T, Fundamentals of Food Process Engineering, AVI Publishing Company, USA. 1980.
5. Heldman, D.R, Food Process Engineering, AVI Publishing Company, USA. 1977.

**Course Objective: (Skill development)**

The objective of this course is to introducing students to the basic aspects of plant biotechnology and to know about the production and application of transgenic plants.

**UNIT-I****10**

**Genome Organization:** Plant genome organization – nuclear, organelle genomes – mitochondria and chloroplast genome. Introduction - gene structure and gene expression-regulation. *Arabidopsis thaliana* – a model plant for genome analysis.

**UNIT-II****13**

**Plant Tissue Culture:** Plant tissue culture – History and scope, totipotency, plant growth hormones in plant tissue culture – micropropagation – callus induction, organogenesis, embryogenesis, somatic embryogenesis, somaclonal variation, Protoplast culture.

**UNIT-III****11**

**Plant Genetic Engineering:** gene transfer methods in plants – types of plant cloning vectors, Agrobacterium mediated gene transfer –Ti-plasmid-process of T-DNA transfer and integration, Direct gene transfer methods. Binary vectors- basic features of vectors-optimization-clean gene technology.

**UNIT-IV****12**

**Transgenics in Crop Improvement:** Production of high yielding varieties, Biotic stress - resistance to herbicides, resistance to pests - Bt approach to insect resistance and disease resistance. Abiotic stress - water deficit stress and various approaches for tolerance.

**UNIT-V****14**

**Applications of Transgenic Plants:** Transgenic plants- Bt cotton, Bt corn, Golden rice. Genetically modified crops-current status-concerns about GM crops. Molecular farming-Edible vaccines, plantibodies, fruit ripening. Molecular pharming of proteins. Bio fuel production.

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Learn about plant genome organization and gene families
- CO-2: Knowledge on plant tissue culture and plant hormones
- CO-3: Understand different gene transfer methods in plants through plant genetic engineering
- CO-4: Discover different stress resistance in plants for crop improvement
- CO-5: Improve quality of GM crops and their products

**TEXT AND REFERENCE BOOKS:**

1. Singh, B.D. Text Book of Biotechnology, Kalyani Publishers. 1998.
2. Neal Stewart, C. Plant Biotechnology & Genetics. John Wiley & Sons Inc., NJ. 2008.
3. Ignacimuthu S, "Plant Biotechnology", Tata Mcgraw-Hill Pub., New Delhi, 2006.
4. Dubey R.C., "Textbook of Biotechnology. S. Chand publishers, 2005.
5. Satyanarayana U., "Biotechnology" KrishnaPakashan, 2009.
6. Neal Stewart, C. 2008. Plant Biotechnology & Genetics. John Wiley & Sons Inc., NJ.
7. Slater, A., W. Nigel & M.R. Fowler. Plant Biotechnology, Oxford Univeristy Press, Oxford. 2008.
8. Hammond, J, P McGravy, and V. Yusibov, Plant Biotechnology, Springer Verlag, NewYork. 2000.

**Course Objective:** (Skill development)

To develop their skills in the Animal tissue culture techniques

**List of Experiments:**

1. Cleaning and sterilization of glassware.
2. Designing of animal cell culture laboratory.
3. Preparation of tissue culture media, sera for animal cell culture.
4. Preparation of single cell suspension from Animal tissue (Primary cell culture).
5. Chick embryo cell Culture
6. Trypsinization of monolayer and sub culturing;
7. Cryopreservation and thawing of cell line.
8. Cell counting and Cell viability assay
9. Fish/shrimp cell culture
10. Identification of fish/poultry pathogens

**Total : 30 hrs****Course Outcome:**

CO-1: Learn about basic concept of animal tissue culture techniques

CO-2: Understand about medium used for animal tissue culture

CO-3: Compare various methods cell culture technique

CO-4: Importance of cryopreservation methods to maintain cell culture

CO-5: Estimate about fish and shrimp culture farming.

**TEXT AND REFERENCE BOOKS:**

1. Davis, J.M, Basic Cell Culture, Oxford University Press, Oxford, UK. 2002.
2. Freshney, R.I, Animal Cell Culture: A Practical Approach, John Wiley Publication, NewYork. 2000,
3. Glover, D.M and B.D. Hames, DNA Cloning a Practical Approach, IRL Press, Oxford. 1995.
4. John R.W. Masters, Animal Cell Culture: Practical Approaches, Oxford University press, London. 2000.
5. Muthukkaruppan, V.R, S Baskar and F. Sinigaglia, Hybridoma Techniques: A Laboratory Course, Macmillan India Limited, Bangalore. 1986.
6. Sambrook, J, E.F. Fritsch and T. Maniatis, Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York. 2000.

## **PRACTICAL 7: PLANT BIOTECHNOLOGY PRACTICAL 0042**

**Course Objective:** (Skill development)

To develop their skills in the plant tissue culture techniques

### **List of Experiments:**

1. Preparation of media for plant tissue culture
2. *In vitro* germination of seeds
3. Callus induction and differentiation
4. Plant regeneration and pot-gardening
5. Micro propagation
6. Anther and pollen cultures - production of haploids
7. Embryo Culture
8. Artificial seed production
9. Isolation of protoplast culture
10. Agrobacterium mediated gene transformation (demo)

**Total : 30 hrs**

### **Course Outcome:**

- CO-1: Learn to prepare the plant tissue culture media
- CO-2: Knowledge about callus formation and micropropagation
- CO-3: Understand about seed germination and germination
- CO-4: Simplify the fusion of nucleus using protoplast culture
- CO-5: Gain the information about Ti plasmid mediated gene transfer

### **TEXT AND REFERENCE BOOKS:**

1. Gelvin, S.B., R.A. Schilperoort and D.P.S. Verma, Plant Molecular Biology Manual, Kluwer Academic Publishers, Dordrecht, The Netherlands. 1991.
2. Glover, D.M and B.D. Hames, DNA Cloning A Practical Approach, IRL Press, Oxford. 1995.
3. Sambrook, J, E.F.Fritsch, and T. Maniatis, Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York. 2000.
4. Aneja, K.R., Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology. III Edition, New Age International Publishers, New Delhi. 2005.
5. Ignacimuthu, S., Plant Biotechnology. Oxford and IBH Publishing House, New Delhi. 2004.
6. Maliga, P., Methods in Plant Molecular Biology- A Laboratory Course. Oxford Press, New York. 1995.



## **BIOFERMENTATION AND DOWNSTREAM PROCESSING 3 0 0 3**

**Course Objective:** (Skill development)

To provide the knowledge about various fermentation mechanism and its application

### **UNIT-I 11**

**Introduction to Fermentation Technology** – Range of Fermentation Process; Microbial Growth Kinetics – Batch, Continuous and Fed-batch; Isolation, screening and maintenance of industrially useful microorganisms – Strain improvement

### **UNIT-II 13**

**Media for Industrial Fermentations:** Media ingredients, media formulation, oxygen requirements, antifoams, medium optimization; Media Sterilization – Batch sterilization, Continuous sterilization process and, Filter sterilization of media and air.

### **UNIT-III 13**

**Fermentation Process** – Submerged and solid state; Design and parts of Fermenter – agitation, aeration, pH, temperature, dissolved oxygen – control and monitoring; Types of Bioreactor – Packed bed Bioreactor, Fluidized bed Bioreactor, Trickle bed reactor, Bubble column reactor

### **UNIT-IV 11**

**Downstream Processing** – Solid and liquid separation, cell disruption, separation, liquid – liquid extraction, precipitation, chromatography and drying. Immobilization of Enzymes.

### **UNIT-V 12**

**Application:** Industrial scale production of yeast biomass. Production – Alcohol, Penicillin, Citric acid, Vitamin B12, Riboflavin, alpha amylase and protease.

**Total : 60 hrs**

#### **Course Outcome:**

CO-1: Basics concept of various industrial important microorganisms isolation

CO-2: Understand media preparation and role of media in fermentation process

CO-3: Describing various types of fermentation process.

CO-4: Formulate the downstream processing and its importance

CO-5: Build the knowledge of number of products which are produced by industrial fermentation process

#### **TEXT AND REFERENCE BOOKS:**

1. Emt.el-Mansi and CFA. Bryce. Fermentation Microbiology & Biotechnology, Taylor & Francis Ltd. 2004.
2. Stanbury, P.F., A. Whitaker & S.J. Hall. Principles of fermentation technology Oxford Press. 1997.

3. Allman, A.R., Fermentation Microbiology and Biotechnology, Taylor and Francis, New York, USA. 2007.
4. Crueger, W. and A. Crueger, Biotechnology – A TextBook of Industrial Microbiology, Panima Publishing Corporation, New Delhi, India. 2004.
5. Brian, M. and L. Harvey, Practical Fermentation Technology, John Wiley & Sons Inc., New Jersey, USA. 2008.
6. Frazier, W.C., Food Microbiology, TataMcGraw – Hill Publication, New York, USA. 2004.
7. Charles, W. B., Food Fermentation and Microorganisms. John Wiley & Sons Inc., New Jersey, USA. 2010.

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**DISCIPLINE  
SPECIFIC ELECTIVE**

**Course Objective: (Employability)**

The course is to introduce environmental biotechnology and focuses on the utilization of microbial processes in waste and water treatment, and bioremediation.

**UNIT- I****12**

**Introduction:** Scope – Branches of ecology – Abiotic factors – water – soil – temperature – light. Biotic factors – Animal relationship – symbiosis – commensalisms – mutualism – Antagonism – Antibiosis – Parasitism – Predation – competition - Multiple interactions microbial populations- Microbial ecosystems and biogeochemical cycles.

**UNIT II****11**

**Environment Treatment:** Waste Water Treatment, Solid waste Management and disposal- land filling, incineration, chemical degradation, heavy Metals. Treatment of wastes - Pulp industry, Tanning industry, Distilling industry, Dye industry, Pharmaceutical industry. Biotechniques for air pollution abatement and odour control

**UNIT- III****15**

**Scope of environmental biotechnology:** Biodegradation, Bioconversion, Bioaccumulation, Biomagnifications, Bioremediation, Bioabsorption, Bioleaching, Xenobiotics, Biofeasibility, Bioreduction, Phytoremediation, bioconcentration, Denitrification and Methanogenesis, Biofuel- Biodiesel, Biogas, Bioplastics, Bioscouring. Biocontrol agents

**UNIT- IV****10**

**Conservation:** Microorganisms in Agricultural Waste treatment, Composting, Vermiculture, Biofertilizers, Biopesticides. Biomedical waste management. Bioresource, Uses and types of biodiversity conservation

**UNIT-V****12**

**Environmental Management** – Concept of health and sanitation, environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases. Disasters Management - Environmental Impact Assessment - GIS technology and remote sensing

**Total : 60 hrs****Course Outcome:**

CO-1: Basic knowledge of ecology and importance of microorganism role in ecology

CO-2: Understand the waste water and solid waste treatment.

CO-3: Analyse about scope of environmental biotechnology

CO-4: Identifying importance of Conservation and natural method adopting

CO-5: Determine the biotechnological approach for environmental management

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**TEXT AND REFERENCE BOOKS:**

1. Dubey, R.C., A Textbook of Biotechnology–S. Chand and Co., New Delhi. 5<sup>th</sup> edition. 2014
2. Sawyer, C.N., Mc Carty, P.L., and Parkin, G.F., Chemistry for Environmental Engineering and Science, TMH Edition, Tata McGraw Hill Co. Ltd.,New Delhi. 5th Edition, 2003
3. Paul. A, Rochelle, Environmental Molecular Biology, Horizon Press. 2001.
4. Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, Industrial and Environmental Biotechnology, Horizon Press. 2006.
5. Agarwal, K.M., Sikdar, P.K. and S. C. Deb, A Text Book of Environment. Mac Millan India Ltd, Kolkatta, India. 2002.
6. Evans, G.M. and J. C. Furlong, Environmental Biotechnology: Theory and Applications. John Wiley & Sons Ltd, West Sussex, England. 2003.
7. Jordening, H.J. and J. Winter, Environmental Biotechnology. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. 2005.
8. Agarwal, S.K., Environmental Biotechnology. APH Publishing Corporation, New Delhi, India. 2002.
9. Mara, D., The Handbook of Water and Wastewater Microbiology. Academic Press, London, England. 2003.

**Course Objective: (Employability)**

The aim of this course is to provide knowledge about the basics, principles and applications of nanotechnology in the field of Biotechnology

**UNIT- I** **8**

**Introduction to Nanoparticles:** History of Nanoscience - Definition – Quantum dots - Nanospheres – Nanorods - nanoclusters – nanofibers - Nanotubes – Properties of Nanoparticles (Physical and chemical). DNA – Peptide – Protein as Nanomaterials.

**UNIT- II** **9**

**Biosynthesis of Nanoparticles:** Synthesis - Biological methods – Extra cellular and Intracellular synthesis - Bacteria, actinomycetes, algae, fungi and plants in synthesis of Nanoparticles. Optimization – pH, temperature, concentration.

**UNIT- III** **11**

**Characterization principles of Nanoparticles:** Plasmon resonance – UV Spectrophotometer – Dynamic light scattering – particle size analyzer – Size Determination – SEM, TEM, STEM, AFM, Energy Dispersive Spectroscopy (EDS) - X-ray diffraction (XRD) – Fourier transform Infra Red (FTIR) spectrophotometry, Surface analysis of Nanoparticles – Brunauer Emmett Teller (BET) surface area analysis.

**UNIT- IV** **9**

**Biological Applications of Nanomaterials:** Application of Nanoparticles in Nanomedicine, Relevance of Nanoparticles to our Traditional system of Medicine (Siddha) - Nanosensor, Natural Nanoparticles - Clinoptilolite – Adsorption of dyes and heavy metals.

**UNIT- V** **8**

**Biosafety :**Particulate matters – Nanoparticulates – BioSoot as Nanomaterial - Exposure to Nanoparticles – Toxicity of nanoparticles - Health Impact - Occupational hazards, PPE.

**Total : 45 hrs**

**Course Outcome:**

CO-1: Define Nanoparticle and differentiate their types based on their structure.

CO-2: Demonstrate the principles of biological materials as nanomaterial

CO-3: Elaborate a method for synthesis of Nanoparticles using biological methods.

CO-4: Gains knowledge on application of Nanoparticles in medicine, environment and other biological sciences

CO-5: Adapt the importance of biosafety, occupational exposure and exposure hazard to Nanoparticles and make risk assessment of Nanoparticles

**TEXT AND REFERENCE BOOKS:**

1. Rao, C.N.R., The Chemistry of Nanomaterial: Synthesis, Properties and Applications. Vol I and III, Springer on line book. 2006.
2. Muralidharan, V.S. and A. Subramanian, Nanoscience and technology. CRC Press, New Delhi. 2009.
3. Ratner, M. and Ratner, D. Nanotechnology- a Gentle Introduction to the Next Big idea. Pearson Education, Inc. London. 2005.
4. Dinh, T.V. Nanotechnology in Biology and Medicine: Methods, Devices and Applications. CRC Press. New Delhi. 2007.
5. Niemeyer, C.M. and C. A. Mirkin, Nanobiotechnology Concepts, Application and Properties. Wiley – Vch Publishers, New York. 2004.

**Course Objective:** (Employability)

The aim of this course is to provide basic knowledge in the interface between chemistry, physics and biology on the nano structural level with a focus on biotechnological usage.

**List of Experiments:**

1. Green synthesis of nanoparticle
2. Synthesis of Silver nanoparticle
3. Antibacterial activity of nanoparticle
4. Antioxidant activity of silver nanoparticle
5. Silver nanoparticles in dye effluent treatment
6. Characterization of nanoparticle : UV Vis, FTIR, X Ray analysis (Demonstration)

**Total : 15 hrs**

**Course Outcome:**

- CO-1: Learn about synthesis of nanoparticle
- CO-2: Understand the concept of silver nano particle synthesis
- CO-3: Applying knowledge in nanoparticle for antibacterial activity
- CO-4: Analysing antioxidant property for nanoparticle
- CO-5: Determine the nano particle size using characterization

**TEXT AND REFERENCE BOOKS:**

1. Rao,C.N.R., 2006. The Chemistry of Nanomaterial: Synthesis, Properties and Applications. Vol I and III, Springer on line book.
2. Krishnamoorti R. and R.A. Vaia – Polymer nanocomposites: Synthesis characterization and modeling ,Americal Chemical Society, 2002.
3. Pinnavaia T.J. and Beall G.W. – Polymer –clay Nanocomposites, John Wiley, 2000.
4. Rao C. N. R., A. Muller, A. K. Cheetham The Chemistry of Nanomaterials: Synthesis, Properties and Applications. (Eds.), WILEY-VCH Verlag GmbH & Co., Weinheim, 2004.
5. Jackie Yi-Ru Ying, Nanostructured Materials, Academamic press, 2001.
6. Philippe Knauth and Joop Schoonman, Nanostructured materials, Springer, 2002.



**Course Objective: (Skill development)**

Students will understand the importance of Statistics in Biological Sciences, Intellectual Property Rights (IPR), and Bioethics

**UNIT- I 12**

**Statistical methods:** Introduction – Scope and Limitations of Statistical methods- Diagrammatic and Graphical representation of data- Measures of Central tendency: Mean, Median, Mode– Measures of Dispersion- Range, Quartile Deviation, Standard Deviation and Coefficient of variation.

**UNIT- II 12**

**Tests of significance:** Concept of Sampling and Sampling Distribution –Parameter and Statistics- Standard error – Tests of Significance for small samples: t-test for Single mean - Difference of means, F-test (variance –Ratio test), Chi-Square tests for goodness of fit and test for independence of attributes in contingency table.

**UNIT- III 13**

**IPR – Types:** Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret

**UNIT-IV 11**

**IPR – Laws and Application:** Laws of IPR, Patent Law, WHO, WIPO, TRIPS agreement, copyrights, IP protection. Impact of IP technology transfer contracts & agreements.

**UNIT-V 12**

**Bioethics:** Introduction to bioethics, ethical issues in preclinical (animal) studies, & clinical studies- Ethical principles, Ethical guidelines-ICMR, Institutional Ethics. The ethics of clinical research in developing countries. Biosafety - Release of GMOs.

**Total : 60 hrs**

**Course Outcome:**

CO-1: Learn about the types of data and collection of data

CO-2: Understand statistics like mean, mode and median. Measuring central tendency, Kurtosis will also be learnt.

CO-3: Analysing the importance of IPR, Copyright and other Intellectual Property

CO-4: Differentiate Copyright, Patent, GI, Design and Traditional Knowledge

CO-5: Identify the institutional Ethics committees, Institutional review board, SOPs in ethics.

**TEXT AND REFERENCE BOOKS:**

1. Gupta S.C. and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons, 3rd Edition, 2001.
2. Neeraj, P and Khusdeep, D. Intellectual Property Rights. India, IN: PHI learning Private Limited. 2014.
3. Nithyananda, K V. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited. 2019.
4. Tom L Beauchamp. Jeffrey Khan, LeRoy Walters, Anna C Mastroanni. Contemporary issues in Bioethics. 2013.
5. Edmund D Pellegrino, David C Thomasa. The virtues in medical practice. 1994
6. Leon Kass. President's Council on Bioethics. Being human. Core readings in the humanities. 2003.
7. Vital P.R., Business Statistics, Margham Publications, Second Edition, 2012.
8. Beri. G, Business Statistics, Tata McGraw Hill Publishing Company Limited, 2009.
9. Tom L Beauchamp, James F Childress. Principles of Biomedical Ethics. 2008

**Course Objective: (Employability)**

The paper designed to introduce and provide basics in medical coding, Human Anatomy and Clinical Research to students.

**UNIT- I 13**

**Coding Procedures:** Introduction to Medical coding: Professional Overview; Specific Responsibilities, Medical Diagnosis, Standardization in Coding. Relative Value Units (RVUs); HIPAA Background and Explanation. History of the ICD; Origins and Revisions of the ICD.

**UNIT- II 11**

**Coding Rules:** Introduction to ICD-9-CM Coding and structure of ICD-9-CM, ICD-9-CM: Basic Operating Guidelines; V Codes; and E Codes; ICD-9-CM versus ICD-10-CM.

**UNIT- III 11**

**CPT coding:** CPT Medical Coding: History; Structure CPT Codes. Three Categories of CPT Codes; CPT Codes: Reimbursement: Overview. Top Ten Coding and Billing Errors; Step to Avoid Coding Billing Errors. Introduction; Basic E/M Coding

**UNIT- IV 14**

**Human Anatomy:** Introduction to Human Anatomy : Musculoskeletal System, Respiratory system, Cardiovascular System, Digestive and Excretory System, Urinary System, Reproductive System, Nervous system, Endocrine System, Hemic and Lymphatic System

**UNIT- V 11**

**Basics in Clinical Research:** Introduction to clinical research, history of clinical research and an over view. Scope of clinical research. Preclinical Toxicology and Different phases of clinical research. GCP and ICH. Ethics to be followed in Clinical research trails.

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Understand the transcription and ICD principles.
- CO-2: Identify medical coding guidelines and understand the coding rule
- CO-3: Adapt the CPT Code stepping and Reimbursement
- CO-4: Importance of Human Anatomy for giving Coding.
- CO-5: Determine about drug developmental process and clinical research

**TEXT AND REFERENCE BOOKS:**

1. Karen Smiley, “Medical Coding And Billing for Dummies”, Second Edition, 2012.

2. Beth A.Rich, “Medical Coding: A Journey”, Prentice Hall, 2013. ISBN – 13: 9780132541770
3. Martini and Nath. Fundamentals of Anatomy and Physiology Modified Mastering A&P Access Code. Pearson, San Francisco, CA. 11th ed.,2018.
4. Perez. Anatomy (Flash Cards). Bar Charts Publishing, Boca Raton, FL,2008.
5. Kapit and Elson. Anatomy Coloring Book 12th ed. Pearson Education, Boston, MA,2013.
6. Guyton AC. Text book of Medical Physiology, Prism books (pvt), Bangalore, India. TATA McGraw-hill publishing Company, 8th Edition. 1991.
7. Chatterjee C.C., Human Physiology (Vol. I & Vol. II), Medical Allied Agency, Calcutta, 11thedition,1985.

**Course Objective: (Employability)**

- To provide the basic knowledge in Environmental Biotechnology

**List of Experiments:**

1. Isolation of microorganisms from different waste (Effluent, Solid waste etc.,)
2. Estimation of dissolved and suspended total solid in industrial waste
3. Estimation of chromium from soil
4. Screening of industrially important enzyme
5. Isolation of soil microbes Rhizobium sp., Acetobacter, Micorhizye
6. Isolation and enumeration of phyllosphere Bacteria and Fungi
7. Water Quality Analysis-MPN Test
8. Determination of Biological Oxygen Demand (BOD) of sewage sample
9. Determination of Chemical Oxygen Demand (COD) of sewage sample
10. Production of Biogas from Cow dung

**Total : 30 hrs**

**Course Outcome:**

- CO-1: Knowledge about microbes present in waste materials
- CO-2: Understand the water analysis and types of contamination
- CO-3: Distinguish between BOD and COD for sewage sample analysis.
- CO-4: Determine the knowledge and methods MPN test
- CO-5: Imagine about Biogas production and their utilization.

**TEXT AND REFERENCE BOOKS:**

1. Aneja, K.R., Experiments in Microbiology, Plant Pathology and Biotechnology, IV Ed., New Age International Pvt. Ltd. Publishers, New Delhi, India. 2004.
2. Sharma, B.K and H. Kaur, Environmental Chemistry, H. Goel Publishing House, Meerut. 1991.
3. Dubey, R.C. and E. Maheshwari, Practical Microbiology, S.Chand & Co. Publishers, New Delhi, India. 2004.
4. Grant, W.D. and P.E.Long, Environmental Microbiology. Blakie publications, Glasgow. 2001.
5. Reddy, G. M., M.N. Reddy, D.V.R. Saigopal and K.V. Mallaiah, Laboratory Experiments in Microbiology, II Edition. Himalaya Publishing House, Mumbai. 2007.

**Course Objective:** (Employability)

To train the students on enzyme characterization, immobilization and medium optimization methods.

**List of Experiment:**

1. Isolation and secondary screening of industrially important microorganisms
2. Determine the growth patterns and specific growth rate of *E. coli*
3. Calculation of thermal death point of a microbial sample
4. Estimation of Biomass production
5. Cell Disruption using chemical and enzymatic method and estimation of protein
6. Production of amylase from *Bacillus subtilis* and Assaying for its activity
7. Immobilization of amylase enzyme by entrapment method
8. Production of Alcohol using *Saccharomyces cerevisiae*
9. Determination of Alcohol using potassium dichromate Method
10. Production of Citric acid by solid state fermentation
11. Fermentor parts and design

**Total : 30 hrs**

**Course Outcome:**

CO-1: Learning of industrial important microorganism isolation

CO-2: Understand the methods to investigate the growth of microorganisms in different systems under different conditions.

CO-3: Evaluate the growth kinetics of microorganism and become adept with medium optimization technique

Students gain the knowledge about industrial important enzyme production

CO-4: Determine the knowledge about alcohol production

CO-5: Formulate fermentation process and fermentor design

**TEXT AND REFERENCE BOOKS:**

1. Palvannan, T., S. Shanmugam and T. Sathishkumar, Laboratory Manual on Biochemistry, Bioprocess and Microbiology. SciTech Publications (India) Pvt. Ltd, Chennai. 2005.
2. Stanbury, P.F., A. Whitaker and Hall, Principles of Fermentation Technology, Pergamon Press, Oxford. 1997.
3. Bailey and Ollis, "Biochemical Engineering Fundamentals", McGraw Hill , 2<sup>nd</sup> edition, 1986.
4. Shuler and Kargi, "Bioprocess Engineering ", Prentice Hall, 1992.
5. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications. 1995

**Course Objective:** (Entrepreneurship)

- To learn and understand the marine environment, microbes in marine environment, marine organism, aquaculture, feed formulation, artificial fish and shrimp cultivation

**UNIT- I****13**

**Introduction:** History of Oceanography - Major divisions of marine environment – Physical and Chemical Properties of Ocean. Composition of sea, estuarine and brackish waters. Marine Ecology: Classification of marine environment. General characteristics of primary biotic divisions-Plankton, Nekton and Benthos.

**UNIT- II****10**

**Biofouling and Control technology:** Biofouling organisms - Problems by biofouling Biotechnological approach to biofouling control. Algal bioenergy technology - Bioenergy from marine algae (biofuel) – biorefinery - Omics approach for product discovery in marine algae.

**UNIT- III****12**

**Aqua Farming:** Criteria for site selection for aqua farm-topography, Aqua farm construction, types of aquaculture - brackish water aquaculture - Shellfish - Laws pertaining to aquaculture and exploitation of living resources. Breeding - fish farming - shrimp farming- Brood stock management – breeding of ornamental fishes - farm and hatchery - Sea food processing.

**UNIT- IV****12**

**Marine pollution:** GESAMP definition and its role – major marine pollutants and types – classification – nature, sources and transportation pathways. Conservative and non-conservative pollutants. Law pertaining to marine pollution. Ocean management – IMO, IUCN, FAO, UNEP, MoEF&CC and MOES.

**UNIT- V****13**

**Important Marine Products:** Seaweeds, Bioactive compounds from marine organisms, antibiotics, antifouling agents,  $\beta$  –carotene, agar agar and perls, Green mussel adhesive protein, Chitosan and its applications - GFP, RFP characteristics and their applications. Remote sensing applications in coastal zone management-Territorial water, contiguous zone and exclusive economic zone.

**Total : 60 hrs****Course Outcomes:**

CO-1: Understand the basics of marine biology and oceanography

CO-2: Gain the Knowledge about algal importance and its application

CO-3: Make use of aquaculture importance and improvement

CO-4: Validating ideas of marine contaminants and marine pollution

CO-5: Adapt importance of marine products and remote sensing.

**TEXT AND REFERENCE BOOKS:**

1. Reddy, M.P.M., Descriptive Physical Oceanography. Oxford & IBM 2001.
2. Santhanam, P., A. R. Thirunavukkarasu and P. Perumal., Advances in Marine and Brackishwater Aquaculture. Springer Publications (ISBN 978-81-322-2270-5). 2015.
3. Jayaraman, K. C., Fundamentals of fish taxonomy. Publication. 2002.
4. Carl J. Sindermann, Coastal pollution: Effects on living resources and humans (Marine Science Series). 2005.
5. Churchill, R. R and A.V. Lowe, The Law of the Sea, ,Manchester: Manchester University Press , 3<sup>rd</sup> edition. 1983.
6. Clark, R. B. Marine pollution, Fifth edition. Oxford University press, New York Inc., 2001.
7. Marshall, J. and R.A. Plumb, Atmosphere, ocean and climate dynamics. NIO. Collected reprints. Vol.1 to 27, 2008.
8. Richard B. Primack., Essentials of conservation biology –Sinauer Assoc. Inc. Pub., USA. 3<sup>rd</sup> edition, 2002.



**Course Objective:** (Entrepreneurship)

The course objective to expose students to the basic scientific evidence and technical aspects of the different disciplines of agricultural biotechnologies. It clarifies major scientific, ecological and sociological aspects of biotechnology in agriculture and food production.

**UNIT- I** **11**

**Agronomy:** Agronomy and its scope, seeds and sowing, tillage and tith, crop density and geometry, Crop nutrition, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, types of irrigation, irrigation- scheduling criteria and methods, quality of irrigation water, crop rotation and its principles

**UNIT- II** **12**

**Soil:** Physical, chemical properties and importance in agriculture - Soil survey - humus formation and its importance in soil fertility management- humic substances - nature and properties. Seed and seed technology: characters of good quality seed – Phases of seed germination – different classes of seed- principles of seed production – post harvest handling of seed- threshing methods methods of seed drying- seed processing-seed certification –seed storage: factors affecting, pest and disease control, godown sanitation.

**UNIT- III** **13**

**Fertilizers & Insecticides:** Fertilizers- classification, composition, types and importance. Pesticides: classification, importance and beneficial effects of Insecticides - Herbicides, Rodenticides, Bactericides, Fungicides, Larvicides, Nematicide. Biopesticides Importance, scope and potential of biopesticide, Bio-insect repellent. Importance of plant diseases, scope and objective of Plant Pathology

**UNIT- IV** **13**

**Horticulture:** Horticulture - branches, importance and scope; horticultural and botanical classification; Plant propagation-methods and propagating structures, Importance of vegetables & spices in human nutrition, Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Characteristics of weeds their harmful and beneficial effects on ecosystem, Hydroponics.

**UNIT- V** **11**

**Organic farming:** Classification, types, Scope and importance: compost, vermicompost and green manure - Organic farming and their importance. Green house technology: Introduction, Types of Green Houses - Cultivation of economically important vegetables, fruits, medicinal and aromatic plants. Drying/ Dehydration of fruits and vegetables - Concept and methods, osmotic drying. Canning - Concepts and Standards, packaging of products

**Total : 60 hrs**

**Course Outcome:**

- CO-1: Learn about agronomy and crop nutrition
- CO-2: Understand the various methods of seed harvesting and drying
- CO-3: Analyse the fertilizers and insecticides importance
- CO-4: Gain knowledge about the horticulture and nursery management
- CO-5: Creating new patterns for farmers make use of organic farming

**TEXT AND REFERENCE BOOKS:**

1. Kumar . H.D, Agricultural Biotechnology, Daya Publishing House, 2005 2.Rajmohan Joshi, Agricultural Biotechnology, Gyan Publishing House, 2006.
2. Reddy. S.R, Principles of Agronomy, Kalyani Publishers, 4<sup>th</sup> Edition. 2011
3. Nirmal De, AmitavaRakshit, PriyankarRaha, Manures, Fertilizers and Pesticides, CBS Publishers And Distributors, 1<sup>st</sup> edition, 2015
4. Arie Altman, Agricultural biotechnology, Rita Rossi Colwell, New York, NY : Dekker, cop. 1998
5. David Castle, Peter W. B. Phillips, Stuart Smyth, Handbook on Agriculture, Biotechnology and Development, Edward Elgar Publication, 2014
6. Ahindra Nag, Textbook of Agricultural Biotechnology, PHL Learning Publication, 2008
7. Chris Bird, The Fundamentals of Horticulture, Cambridge university Press, 2014
8. Adams. C.R, Bamford. K.M, Early. M.P, Principles of Horticulture, Elsevier Science, 2013
9. Nyle C. Brady, Ray R. Weil, The Nature and Properties of Soils, 14th Edition , Pearson Publisher, 2017
10. Biswas. T and Muherjee,Textbook of Soil Science, McGraw-Hill Education – Europe, 2nd Edition, 2017

**Course Objective: (Employability)**

To provide knowledge on principles of drug development, manufacturing, design and its importance in Pharmaceutical industry.

**UNIT- I** **10**

**Basics of Pharmacology, Drug Action & Metabolism:** History and Principle of pharmacology. Drug names and Classification systems. Route of drug administration, pharmacodynamics, pharmacokinetics – Absorption, Distribution, Metabolism and Excretion of drugs / metabolites, prodrugs, protein binding of drugs

**UNIT- II** **8**

**Drug and Its Treatments:** Chemo therapeutic drugs- Protein synthesis inhibitors, Anti mycobacterial, anti-fungal, anti-protozoal, antiviral, anticancer, anti-inflammatory drugs, Production of Ergot alkaloids, Probiotics.

**UNIT- III** **8**

**Drug Development Process:** Discovery of biopharmaceuticals –armacogenetics - Pre-clinical studies - Toxicity studies – reproductive toxicity and teratogenicity, mutagenicity, carcinogenicity and other tests, clinical trials, clinical trial design, trial size design and study population. Drug development and delivery - drug carrier -Recombinant drugs.

**UNIT- IV** **10**

**Principles of Drug Manufacture:** Solid dosage forms – introduction to types of tablets, excipients, granulation techniques, compression machinery, processing problems, Coated tablets - types – enteric coated tablets, film coated tablets and sugar coated tablets. Evaluation of coated tablets. Production of hard and soft gelatine capsules, liquid dosage form – suspension and emulsion. Semisolid dosage form – ointment, GMP

**UNIT- V** **9**

**Biopharmaceuticals and Bioactivity:** Various categories of therapeutics like Laxatives, Analgesics, Contraceptives, Antibiotics and Hormones. Biochips, Biofilms, Biosurfactants. Applications of Nano-biotechnology in drug development and delivery

**Total : 45 hrs**

**Course Outcomes:**

- CO-1: Learn about basics of pharmacology and their metabolism
- CO-2: Knowledge about drugs and its treatment for various organisms.
- CO-3: Apply the drug development process and its application in production of therapeutic proteins.
- CO-4: Formulate new drug formation and principles of manufacturing.
- CO-5: Determine the current regulatory acts and safety norms of the modern pharmaceutical industries.

**TEXT AND REFERENCE BOOKS:**

1. Jay P Rho, Stan G Louie, Hand book of Pharmaceutical Biotechnology, Pharmaceutical products press, New york. 2003.
2. Ajay K. Banga,.Therapeutic Peptides and Proteins: Formulation, Processing, and Delivery Systems, 2<sup>nd</sup> Ed. Mercer University, Macon, Georgia, USA. 2004
3. Satoskar, R. S., S. D. Bhandhakan and S. S. Alinaoure, Pharmacology and Pharmacotheraoeutics. 17<sup>th</sup> Edition, Popular Prakashan Publishers, Mumbai. 2000.
4. Harvey,R.E., Lipin and W. C. Walters, Pharmocology. Kluwer Company, New York. 4<sup>th</sup> ED. 2002.
5. Daan, J. A., Crommelin and R. D. Sindelar, Pharmaceutical Biotechnology. Routledge Taylor and Francis Inc, New York. III Edition, 2002.
6. Sethi, P.D., Quantitative Analysis of Drugs in Pharmaceutical Formulations. III Edition, CBS Publishers and Distributers. New Delhi. 2005.
7. Manfred E. Wolff. Burger's Medicinal Chemistry and Drug Discovery. Wiley and Sons, USA. 5<sup>th</sup> Ed. 2000.

**COURSE OBJECTIVES:** (Employability)

To learn and understand the principles behind the qualitative and quantitative estimation of phytochemicals Synthesis of drugs, isolation of bioactive components from natural products and laboratory analysis of the body fluids.

**List of Experiments:**

1. Qualitative analysis of Phytochemicals.
2. Quantitative Estimation of total phenols.
3. Quantitative Estimation of tannins.
4. Quantitative Estimation of alkaloids
5. Separation and Identification of Phytochemicals using TLC & Column.
6. Preparation of Acetyl salicylic acid
7. Identification of organic compound: Carbohydrate, alcohols, Phenols, Aldehydes and ketones.
8. Isolation of pectin from orange peel and lemon peel
9. Isolation of citric from lemon fruits
10. Determination of iodine, Acid and Peroxide and Saponification values.

**Total : 15 hrs**

**COURSE OUTCOMES:**

- CO-1: Understand the basic principles of phytochemical identification and estimations
- CO-2: Experiment knowledge in synthesis and identification of drugs.
- CO-3: Choose expertise in isolation of bioactive constituents from natural products.
- CO-4: Knowledge about isolation of pectin and citric acid from natural source.
- CO-5: Determine of different oil value for identification good product

**TEXT AND REFERENCE BOOKS:**

1. Palanivelu, P., Analytical Biochemistry and Separation Techniques, Kalaimani Printers, Madurai. 2001.
2. Sadasivam. S. and A. Manickam, Biochemical Methods, New Age International Pvt. Ltd. Publishers, New Delhi. 2002.
3. Harris, D.C. Quantitative Chemical Analysis. W. H. Freeman, New York. VI Edition, 2003.
4. Work.W., Laboratory Techniques in Biochemistry and Molecular Biology, American Elsevier, New York. Vol 5. 1976.
5. Sethi, P.D., Quantitative Analysis of Drugs in Pharmaceutical Formulations. III Edition, CBS Publishers and Distributers. New Delhi. 2005.

## **PROJECT**

**0084**

- 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 the project 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

2002

### Course Objective: (Skill development)

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

**Credit Hours**

### **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 Outcome:

- 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

- Raman, M. & Sangeeta Sharma. Technical Communication.OUP.2008
- Taylor, Grant.English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd. 2005
- 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

2002

### **Course Objective:** (Skill development)

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

**Credit Hours**

### **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 Outcome:**

- 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**

- English for Competitive Examinations by R.P.Bhatnagar & Rajul Bhargava Macmillan India Ltd. Delhi.
- Carnegie, Dale. The Quick and Easy Way to Effective Speaking. New York: Pocket Books, 1977.
- 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

2002

### **Course Objective:** (Skill development)

- 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

**Credit Hours**

### **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 Outcome:**

- 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**

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

**Course Objectives:** (Skill development)

- For the benefit of the students, it has been mandatory to attend a minimum of one internship/ Mini project during semester vacation
- Student should go for Internship/ Mini project in any biotechnological industry or laboratories and learn their laboratory techniques by hands on training.
- After the Internship/ Mini project, student should submit detailed reports about the Internship/ Mini project 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.

**Course Objective:** (Skill development)

- 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.

**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.

**UNIT I****6**

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

**UNIT II****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****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****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**

**6**

**Entrepreneurship 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**

### **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

**SEMESTER-1****COMMUNICATION SKILLS****1 0 2 2****Course Objective:** (Skill development)

- 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.

**UNIT I**

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

**Credit Hours  
06****UNIT II**

- Short Essay Writing

**06****UNIT III**

- Explaining Proverbs

**06****UNIT IV**

- Use of Prepositions

**06****UNIT V**

- Synonymous Words

**06****Total****30 Hours****Course Outcome:**

- 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**

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

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 resources 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. India as a mega-diversity nation. Hot-spots 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-II 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. Disaster 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 rehabilitation 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**

- To understand the nature and facts about environment.
- To find and implement scientific, technological, economic solutions to environmental problems.
- To know about the interrelationship between living organisms and environment.
- To understand the integrated themes and biodiversity, natural resources, pollution control and waste management.
- 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 link and we source**

<https://easyengineering.net/ge6351-environmental-science-and/>  
<https://learnengineering.in/ge8291-environmental-science-and-engineerin>

