



B.Sc. MICROBIOLOGY

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 Microbiology

School of Life Sciences

VISION OF THE DEPARTMENT OF MICROBIOLOGY

To produce graduates with relevant education descriptors and hands-on skills in microbiology and related areas of life sciences plus holistic development of individuals that makes them responsible citizens of society.

MISSION OF THE DEPARTMENT OF MICROBIOLOGY

- **Imparting relevant knowledge** and creating an atmosphere to develop **innovative and critical thinking**.
- **Skill enhancement** through **hands-on training** and value-added courses plus add on courses.
- Sustained focus on original **high-quality research** encouraging scientific thinking and approach.
- Creating an environment for holistic development of individuals with emphasis on **spirit of integrity, equity, professional ethics and social harmony** through the exposure and participation in **co-curricular, extracurricular and extension activities**.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Programme Educational Objectives of the B.Sc. in Microbiology programme at VISTAS are given below and are numbered from **PEO1** to **PEO5**.

PEO1	To provide the graduates with knowledge in microbiology and an overview of the processes that employ or deal with microbes that enables them to handle the safe and efficient use of microbiological applications with development of competence on par with global standards and helps the graduates for life-long learning.
PEO2	To prepare graduates by imparting skills to use technological developments related to current and advanced areas involving molecular diagnostics, immunotechnology, mass cultivation of microbes, downstream processing and nanotechnology with scope for upskilling in all potential future technologies so as to contribute effectively for Research & Development leading to patenting and publishing.
PEO3	To train graduates to choose a decent career option either as Entrepreneur or having a high degree of employability; or pursue higher education - by empowering students with basic interpersonal skills, ability to handle critical situations allowing them to be good team members as well as training to excel in competitive examinations.
PEO4	To impart a strong sense of social responsibility with awareness of professional and societal ethical values and scope to develop leadership capabilities.
PEO5	To establish an environment that accentuates the requirement to fulfil life-long learning for the overall development of self and society at large.

PROGRAMME OUTCOMES (POs)

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

PO-1	Microbiology knowledge: Graduates will acquire microbiology specific knowledge including molecular biology, immunology and rDNA technology 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 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 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The overall outcome of graduates specific to B.Sc. Microbiology programme at VISTAS can be summarized as:

PSO1	Microbiology skills:	The ability to understand the basic concepts related to the relevant fields of microbiology which will enable them to analyse and develop solutions to microbiology related problems.
PSO2	Microbiology related employability skills:	The ability to use the acquired hands-on skills in microbiology, molecular biology, immunology, medical microbiology and screening for useful biomolecules within employment areas.
PSO3	Successful Career and Entrepreneurship:	The ability to gainfully become an entrepreneur by using microorganisms to produce biofertilizers, mushrooms and pharmaceutically important biomolecules as well as using practical hands-on training to become employed in diagnostic, industrial, pharmaceutical, food and research and development laboratories.

**VISTAS: SCHOOL OF LIFE SCIENCES
DEPARTMENT OF MICROBIOLOGY
LIST OF MEMBERS-THE BOARD OF STUDIES IN B.Sc. MICROBIOLOGY**

S.No	Name & Address	Designation
1	Dr. A.K. Kathiresan Professor and Head Department of Microbiology School of Life Sciences VISTAS, Chennai- 600 117.	Chairperson
2	Dr. G.Gayathri Associate Professor Department of Microbiology School of Life Sciences VISTAS, Chennai- 600 117.	Internal Member
3	Mr. Allen John Henry Assistant Professor Department of Microbiology School of Life Sciences VISTAS, Chennai- 600 117.	Internal Member
5	Dr. M. Elanchezhian Professor and Head Department of Microbiology University of Madras Dr. ALM PGIBMS Taramani Campus Chennai- 600 113.	External Member
6	Dr. Babu Sarangan CEO Mahathi Biotech Ramapuram, Chennai.	External Member
7	Ms. Sanchita Nath Research Scholar Department of Microbiology School of Life Sciences VISTAS Chennai- 600 117.	Alumni (M.Sc., Immunology and Microbiology, 2013 – 2015 Batch)

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED
STUDIES (VISTAS), CHENNAI**

**CHOICE BASED CREDIT SYSTEM (CBCS)
and
LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF)**

BSC MICROBIOLOGY REGULATIONS 2021

(For ALL Arts, Science, Commerce and Humanities 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

Pass in +2, HSC or equivalent with Biology / Math's / Botany / Zoology/ Microbiology
/Biotechnology / Nutrition & Dietetics as a paper or +2 Vocational / Agriculture

3. MEDIUM OF INSTRUCTION

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

4. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

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

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

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

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

Part II – English Language courses (ELC) or special subject designed in lieu of the Language courses and English Language Courses are 4 each / 2 each in number and the LC and ELC are meant to develop the student's communicative skill at the UG level.

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

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

Contact hour per week CREDITS

1 Lecture hour - 1 Credit

1 Tutorial hour - 1 Credit

2 Practical hours - 1 Credit

(Laboratory / Seminar / Project Work / etc.)

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

- 7.1. **Eligibility:** Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed therefor by the Board of Management from time to time.
- 7.2. **Attendance:** All Students must earn 75% and above of attendance for appearing for the University Examination. (Theory/Practical)
- 7.3. **Condonation of shortage of attendance:** If a Student fails to earn the minimum attendance (Percentage stipulated), the HODs shall condone the shortage of attendance on medical grounds up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after paying the prescribed fee towards the condonation of shortage of attendance. The students with attendance of less than 65 and more than 50% shall be condoned by VC on the recommendation of HODs on genuine grounds, will be permitted to appear for the regular examination on payment of the prescribed condonation fee.

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

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

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

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

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

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

8. EXAMINATION AND EVALUATION

8.1. EXAMINATION:

- i) There shall be examinations at the end of each semester, for odd semesters in the month of October / November, for even semesters in April / May. A candidate who does not pass the examination in any course(s) shall be permitted to appear in such failed courses in the subsequent examinations to be held in October / November or April / May.
- ii) A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulations prescribed OR belated joining OR on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the programme.

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

8.2 To Register for all subjects: Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination, except for the shortage of attendance programs. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

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

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

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

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

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

9. Question Paper Pattern for End Semester Examination

SECTION – A 10 questions 10 X 2 = 20 Marks

SECTION – B 5 questions either or pattern X 16 = 80 Marks

Total 100 Marks

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

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

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

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

- 11.1. Re-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 **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

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

14.2. Letter Grade and Class CGPA

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

GPA for a Semester: = $\sum_i C_i G_i \div \sum_i C_i$ 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: = $\frac{\sum n \sum i C_n i G_n}{\sum n \sum i C_n i}$ 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

15. RANKING

- 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.
- 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. Microbiology Courses of Study and Scheme of Assessment

(Minimum Credits to be earned: 140)

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

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Preamble

Microbiology is the study of microorganisms or microbes such as bacteria, viruses, fungi, algae, protozoa and infectious proteins like prions. Microbes are extremely important as their diverse activities range from causing diseases in humans, animals and plants to production of highly useful products like antibiotics, vitamins, enzymes, alcohol, fermented foods, and recycling of nutrients from dead and decaying organic matter in the nature. Thus, the science of microbiology has an important role to play in health, agriculture, environment and industry. Several discoveries in the last two to three decades, which significantly impact these areas of human endeavor have put Microbiology on the centre stage of teaching, research and development all over the globe.

The Choice Based Credit System (CBCS) curriculum for Microbiology at the undergraduate level has now been developed into a new system called Learning Outcome Curriculum Framework (LOCF) under the recommendations and guidance of University Grants Commission (UGC). The LOCF approach first envisions the program learning outcomes of the B.Sc. program in Microbiology as well as the learning outcomes of the courses being taught under this program, keeping in view the graduate attributes of the program. The curriculum was then developed in tune with the learning outcomes. It is envisaged that the students trained under this curriculum will have the required attributes of knowledge, skills, temperament and ethics related to the subject of Microbiology. Besides the contents of the curriculum, the teaching learning processes have also been designed to achieve these attributes. A variety of learning assessment tasks have been included in the curriculum. Besides assessing the knowledge/skills acquired by the students, these tasks would also help to supplement the teaching learning processes.

There are 15 core courses (CC1 - 15) which encompass all important aspects of the discipline of Microbiology and are all compulsory courses. The choice-based Discipline Specific Elective (DSE) courses are designed to enhance the expanse of the subject. DSE also give the students a chance to apply their knowledge of microbiology to study societal problems and suggest solutions in the form of small project under the mentorship of their teachers. These are also designed to expose the students to leaders / innovators in the areas related to microbiology for inspiration. The Generic Elective Courses (GEC) are designed to impart comprehensive understanding of Microbiology to students from other disciplines.

The Microbiology students will have the choice to select courses from other disciplines depending on their interest and passion besides Microbiology. The CC and DSE are either 4 credit courses for theory and 2 credit courses for laboratory work. A number of Skill based Elective Courses (SEC), 2 Credits each would give the students option to develop skills in areas which have direct relevance to employability in diagnostics, health, food and pharmaceutical industries, agriculture and environment-related job opportunities in Microbiology. Generic Elective Courses (GEC) are 2 credit courses designed to provide insights about microbiology to students from other disciplines. The focus of the Ability Enhancement Compulsory Courses (AECC) which are 4 Credits each, is to develop communication skills and awareness about our environment. To comply with the education policy of Govt. of India namely access, equity and quality students are encouraged to complete a minimum of 1 Online Course (OLC) which are available on NPTEL or SWAYAM portals under MOOCS program being developed by MHRD to provide opportunity to the most disadvantaged students and to bridge the digital divide. The online courses would also inculcate the habit of self-study at their own pace by the students and also acclimatize them to future technologies of learning processes.

1. Introduction:

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

2. Learning Outcomes based approach to Curriculum Planning:

Learning Outcome based approach to curriculum planning (LOCF) is almost a paradigm shift in the whole gamut of higher education such that it is based on first and foremost identifying the outcomes of the learning required for a particular subject of study, and then planning all components of higher education so as to achieve these outcomes. The learning outcomes are the focal point of the reference to which all planning and evaluation of the end learning is compared and further modifications are made to fully optimize the education of the individuals in a particular subject. The outcomes for the subject of Microbiology are defined in terms of the understanding and knowledge of the students in microbiology and the practical skills the students are required to have to be competitive microbiologist so that they are able to fulfil their role as microbiologist wherever required in the society such as the diagnosis and monitoring of prognosis of diseases combined with their remedies; the role of microbiologists in the pharmaceutical, food and biotechnology industry and how they may be able to fit the bill in the industry. The students are also trained in such a way that they develop critical thinking and problem solving as related to the field of microbiology. The developed curriculum emphasizes the teaching and evaluation tasks are designed in such a way that the students are able to apply their knowledge and training of microbiology to solve the problems of microbiology as these exist or appear from time to time in the society. The curriculum envisions that the student, once graduate as specialists in microbiology, have an important role to play in the newer developments and innovations in the future in the subject for advancement of the discipline.

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

The undergraduate program in Microbiology is the first level of college or university degree in the country as in several other parts of the world. After obtaining this degree, a microbiologist may enter into the job market or opt for undertaking further higher studies in the subject. After graduation the students may join industry, academia, and public health and fructify their role as microbiologists in a useful manner contributing and completing their role in the development of the welfare society. Thus, the undergraduate level degree in microbiology at VISTAS prepares the students for all these objectives. Thus, the LOCF curriculum developed has a very wide range covering all aspects of Microbiology with

reasonable depth of knowledge and skills so as to diversify graduates in various specialties of

the subject enabling them to complete their role professionally as expected of them. It is also imperative that microbiologists are evaluated in a manner appropriate to assess their proper development as microbiologists. The current LOCF in Microbiology has been designed in keeping all these important points in mind.

2.2 Aims of Bachelor's degree programme in MICROBIOLOGY:

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in a wide- ranging context which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology will be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

3. Graduate Attributes in Microbiology:

As mentioned earlier B.Sc. degree in Microbiology is the first college/university level degree in the country as in several parts of the world. The students graduating in this degree must have through understanding of basic knowledge or understanding of the fundamentals of Microbiology as applicable to wide ranging contexts. They should have the appropriate skills of Microbiology so as to perform their duties as microbiologists. They must be able to analyze the problems related to microbiology and come up with most suitable solutions. As microbiology is an interdisciplinary subject the students might have to take inputs from other areas of expertise. So, the students must develop the spirit of team work. Microbiology is a very dynamic subject and practitioners might have to face several unforeseen problems. To this end, the microbiologists must be trained to be innovative to solve such emerging problems. Several new developments are taking place in microbiology. The students are trained to pick up leads and see the possibility of converting these into products through entrepreneurship. To this end, the students are made to interact with industry experts so that they may able to see the possibility of their transition into entrepreneurs. They are also made aware of the requirements of developing a Microbiology enterprise by having knowledge of patents, copyrights and various regulatory process to make their efforts a success.

Besides attaining the attributes related to the profession of Microbiology, the graduates in this discipline should also develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory, work and ethics followed for scientific publishing of their research work in future. The students graduating in microbiology should also develop excellent communication skills both in the written as well as spoken language which are must for them to pursue higher studies.

4. Qualification Descriptors:

The following are the important qualification descriptors for a UG degree in microbiology:

1. Knowledge of the various fields where microbiology is involved.
2. Understanding of diverse Microbiological processes.
3. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc.
4. Moderately advanced skills in working with microbes such as pilot scale culturing, downstream processes, diagnostics etc.
5. Generation of new knowledge through small research projects
6. Ability to participate in team work through small microbiology projects.
7. Ability to present and articulate their knowledge of Microbiology.
8. Knowledge of recent developments in the area of Microbiology.
9. Analysis of data collected through study and small projects.
10. Ability to innovate so as to generate new knowledge.
11. Awareness how some microbiology leads may be developed into enterprise.
12. Awareness of requirements for fruition of a microbiology-related enterprise.

4. Programme Learning Outcomes of B.Sc. Microbiology

A candidate who is conferred an UG degree i.e. B.Sc. degree in Microbiology needs to have acquired/developed following competencies defined in Programme Employability Outcomes and Programme specific outcomes in conjunction with course outcomes during the programme of the study.

5.1 Programme Employability Outcomes of B.Sc. Microbiology at VISTAS

1. Acquired knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others.
2. Demonstrate key practical skills/competencies in working with microbes for study and use in the laboratory as well as outside, including the use of good microbiological practices.
3. Competent enough to use microbiology knowledge and skills to analyze problems involving microbes, articulate these with peers/ team members/ other stake holders, and undertake remedial measures/ studies etc.
4. Developed a broader perspective of the discipline of Microbiology to enable him to identify challenging societal problems and plan his professional career to develop innovative solutions for such problems.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Same as mentioned above in the begin

6. Structure of B.Sc. Microbiology program

VISTAS COURSES OF STUDY AND SCHEME OF ASSESSMENT - B.Sc. Microbiology (MINIMUM CREDITS TO BE EARNED: 140)

Code No.	Course	Hours/week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 1								
LANG	Tamil I/ Hindi I/ French I	3	0	0	3	40	60	100
ENG	English I	3	0	0	3	40	60	100
CORE1	Basics of Microbiology	3	1	0	4	40	60	100
CORE2	Basic Concepts in Immunology	3	1	0	4	40	60	100
CORE3	Introduction to Microbial Anatomy, Physiology and Microbial Taxonomy	4	0	0	4	40	60	100
CORE	Practical in Basic Microbiological Techniques	0	0	4	2	40	60	100
CORE	Practical in Immunology	0	0	4	2	40	60	100
AECC	Communication Skill	1	0	2	2	40	60	100
SEC	Orientation/Induction programme / Life skills	-	-	-	-	-	-	-
Total		17	2	10	24	320	480	800
SEMESTER 2								
LANG	Tamil II/ Hindi II/ French II	3	0	0	3	40	60	100
ENG	English II	3	0	0	3	40	60	100
CORE 4	Introduction to Microbial Genetics and Molecular Biology	3	1	0	4	40	60	100
CORE 5	Introduction to Industrial Microbiology	3	1	0	4	40	60	100
CORE 6	Basics of Pharmaceutical Microbiology	4	0	0	4	40	60	100
CORE	Practical in Molecular Separation Methods	0	0	4	2	40	60	100
CORE	Practical in Industrial Microbiology	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	-	-	-	-	-	-	-
Total		18	2	8	24	320	480	800

CA – Continuous Assessment; SEE – Semester End Examination; SEC – Skill Enhancement Course; GE – Generic Elective

VISTAS

**COURSES OF STUDY AND SCHEME OF ASSESSMENT - B.Sc. Microbiology
(MINIMUM CREDITS TO BE EARNED: 140)**

Code No.	Course	Hours/week			Credits	Maximum Marks		Total
		Lecture	Tutorial	Practical		CA	SEE	
SEMESTER 3								
LANG	Tamil III/ Hindi III/ French III	3	0	0	3	40	60	100
ENG	English – III	3	0	0	3	40	60	100
CORE 7	Introduction to Environmental Microbiology	4	0	0	4	40	60	100
CORE 8	Basic Food Microbiology	3	0	2	4	40	60	100
CORE 9	Introduction to Virology	4	0	0	4	40	60	100
AECC	Environmental Studies	2	0	0	2	40	60	100
CORE	Practical in Environmental microbiology	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	-	-	-	-	-	-	-
Total		21	0	6	24	320	480	800
SEMESTER 4								
LANG	Tamil IV/ Hindi IV/ French IV	3	0	0	3	40	60	100
ENG	English IV	3	0	0	3	40	60	100
CORE 10	Basic Systematic Bacteriology	4	0	0	4	40	60	100
CORE 11	Introduction to Medical Mycology	3	0	2	4	40	60	100
CORE 12	Introduction to Parasitology	3	0	0	3	40	60	100
CORE	Practical in Medical Bacteriology	0	0	4	2	40	60	100
CORE	Practical in Mycology and Parasitology	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	-	-	-
Total		18	0	12	24	320	480	800

CA – Continuous Assessment; SEE – Semester End Examination; SEC – Skill Enhancement Course; GE – Generic Elective

VISTAS
COURSES OF STUDY AND SCHEME OF ASSESSMENT - B.Sc. Microbiology
(MINIMUM CREDITS TO BE EARNED: 140)

Code No.	Course	Hours/week			Credits	Maximum Marks		Total
		Lecture	Tutorial	Practical		CA	SEE	
SEMESTER 5								
CORE 13	Basics of Recombinant DNA Technology	3	0	0	3	40	60	100
DSE	Basics of Fermentation Technology	3	0	0	3	40	60	100
DSE	Basic concepts of Biofertilizer Technology	3	0	2	4	40	60	100
DSE	Introduction to Biochemistry	3	0	0	3	40	60	100
DSE	Introduction to Immunotechnology	3	0	0	3	40	60	100
DSE	Practical in Biochemistry	0	0	4	2	40	60	100
DSE	Practical in rDNA Technology and Immunotechnology	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	-	-	-	-	-	-	-
Total		15	0	14	22	320	480	800
SEMESTER 6								
DSE	Basic Microbial Biotechnology	4	0	0	4	40	60	100
DSE	Introduction to Mushroom Cultivation Technology	3	1	0	4	40	60	100
DSE	Introduction to Microbial Quality Control and Analysis in Applied Microbiology	3	0	2	4	40	60	100
SEC		3	0	0	3	40	60	100
DE	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
Total		15	1	12	22	320	480	800
CA – Continuous Assessment; SEE – Semester End Examination; SEC – Skill Enhancement Course; GE – Generic Elective								

Marks for Internal and End Semester Examinations for PART I, II, III

Sl. No	Category	Theory	Practical
1	Continuous Internal Assessment	40	40
2	End Semester Examination	60	60

Procedure for Awarding Internal Marks:

Course	Continuous Internal Assessment Components	Marks
Theory	Class Test 1	5
	Class Test 2	5
	Class Test 3	5
	Assignment / Seminar	5
	Assessment by Faculty	5
	Aptitude of the student	5
	Model Exam	5
	Attendance	5
	Total	40
Practical	Assessment by Faculty	5
	Aptitude of the student	5
	Model Practical Exam	10
	Practical Observation	5
	Record work	10
	Attendance	5
	Total	40

Awarding Marks for Attendance:

Percentage of Attendance	Marks
Below 65	00
65-74	03
75-90	04
91 - 100	05

Question Paper Pattern for End Semester (University) Examination

SECTION – A

(30 words) Answer All the questions $10 * 3 \text{ marks} = 30 \text{ marks}$

SECTION – B

(200 words) 5 questions out of 8 questions $5 * 8 \text{ marks} = 40 \text{ marks}$

SECTION – C

(500 words) 2 questions out of 4 questions $2 * 15 \text{ marks} = 30 \text{ marks}$

TOTAL = 100 marks

Details of courses

List of core courses

- CC1: Basics of Microbiology
- CC2: Basic Concepts in Immunology
- CC3: Introduction to Microbial Anatomy, Physiology and Microbial Taxonomy
- CC4: Practical in Basic Microbiological Techniques
- CC5: Practical in Immunology
- CC6: Introduction to Microbial Genetics and Molecular Biology
- CC7: Introduction to Industrial Microbiology
- CC8: Basics of Pharmaceutical Microbiology
- CC9: Practical in Molecular Separation Methods
- CC10: Practical in Industrial and Pharmaceutical Microbiology
- CC11: Introduction to Environmental Microbiology
- CC12: Basic Food Microbiology and Practical in Food Microbiology
- CC13: Introduction to Virology
- CC14: Practical in Environmental Microbiology
- CC15: Basic Systemic Bacteriology
- CC16: Introduction to Medical Mycology
- CC17: Introduction to Parasitology
- CC18: Practical in Medical Bacteriology
- CC19: Practical in Parasitology
- CC20: Basics of Recombinant DNA Technology

List of Discipline Specific Electives(ANYFIVE)

- DSE1: Introduction to Immunotechnology
- DSE2: Basic concepts of Biofertilizer Technology
- DSE3: Basics of Fermentation Technology
- DSE4: Practical in rDNA Technology and Immunotechnology
- DSE5: Basic Microbial Biotechnology
- DSE6: Introduction to Mushroom Cultivation Technology
- DSE7: Introduction to Microbial Quality Control and Analysis in Applied Microbiology
- DSE8: Biochemistry
- DSE9: Practical in Basic Techniques in Biochemistry
- DSE10: Introduction to Bioinstrumentation
- DSE11: Practical in Bioinstrumentation
- DSE12: Introduction to Research Methodology
- DSE13: Introduction to Bioinformatics
- DSE14: Practical Bioinformatics
- DSE15: Introduction to Environmental Biotechnology
- DSE16: Basic Biostatistics
- DSE17: Introduction to Microbial Metabolism
- DSE18: Introduction to Biochemistry
- DSE19: Practical in Biochemistry

List of Generic Electives

- GE1: Introduction and Scope of Microbiology
- GE2: Industrial and Food Microbiology
- GE3: Microbes in Environment
- GE4: Genetic Engineering and Biotechnology
- GE5: Microbial Genetics and Molecular Biology

List of Skill Enhancement Courses

- SEC1. NSS-I
- SEC 2.NSS-II
- SEC3. NSS-III
- SEC4. NSS-IV
- SEC 5. NSS-V
- SEC 6. NSS-VI
- SEC 7. Personality Development
- SEC 8. Communication Skill
- SEC 9. Soft skills-I
- SEC 10: Soft skills II
- SEC 11: Soft skills III
- SEC 12. Entrepreneurship Development

Course learning outcomes and contents of the courses
CORE COURSES (CC)

பாடக்குறியீட்டுஎண்: 21LTA001

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

தாள்-1

இக்காலக்கவிதைகள் - உரைநடை - பண்பாடு - மொழித்திறன்
அலகு 1: மரபுக்கவிதை 9

மணிநேரம்

1. பாரதியார் - பாரததேசமென்னும் தலைப்பில் ஆறுபாடல்கள்.
(பாடல்எண்கள் 1, 6, 7, 9, 12, 13)
2. பாரதிதாசன் -
தமிழுக்கும் அமுதென்று பேர்என்னும் தலைப்பிலான கவிதை.
3. தேசிகவிநாயகம்பிள்ளை -
உடல்நலம்பேணல்என்னும் தலைப்பிலான கவிதை
4. முடியரசன் - காவியப்பாவை - "புண்படுமா" என்னும் கவிதை.

அலகு 2: புதுக்கவிதை 9

மணிநேரம்

1. நா. காமராசன் -
கறுப்புமலர்கள் தொகுப்பில் காகிதப்பூக்கள்என்னும் தலைப்பிலான
கவிதை.
2. அப்துல்ரகுமான் -
ஆலாபனை தொகுப்பில் போட்டிஎன்னும் தலைப்பிலான கவிதை
3. ஈரோடு தமிழன்பன் -
ஒருவண்டி சென்றியு தொகுப்பில் தேர்ந்தெடுக்கப்பட்ட சென்றியு கவி
தைகள்
4. ஆண்டாள் பிரியதர்ஷினி -
முத்தங்கள் தீர்ந்து விட்டன தொகுப்பில் 'இங்கே வரும் போது'
என்னும் தலைப்பிலான கவிதை

அலகு 3: உரைநடை 9

மணிநேரம்

1. மாணாக்கரும் தாய்மொழியும் - திரு. வி. க.,
2. மனவலிமைவேண்டும்- மு. வரதராசனார்
3. செம்மொழித்தமிழின் சிறப்புகள்

4. பண்டைத்தமிழரின் சாதனைச் சுவடுகள்

அலகு 4: தமிழர் வாழ்வும் பண்பாடும்

9

மணிநேரம்

பண்பாடு - வாழ்வியல்முறை - அகம், புறம் - உணவுமுறை - விருந்தோம்பல் - நம்பிக்கைகள் - விழாவும் வழிபாடும் - கலைகள் - கட்டடம் - சிற்பம் - ஓவியம் - இசை - கூத்து - தொழிலும் வணிகமும் - அறிவியல்நோக்கு.

அலகு 5: மொழித்திறன், இலக்கியவரலாறு, இலக்கணம்

9 மணிநேரம்

1. எழுத்துப்பிழை, தொடர்பிழைகள்
2. வேற்றுமை இலக்கணம்
3. செய்யுள்நலம்பாராட்டல்
4. பாடம்தழுவிய இலக்கியவரலாறு (மரபுக்கவிதை, புதுக்கவிதை, உரைநடை)

மொத்தம்: 45 மணிநேரம்

பார்வைநூல்கள்

1. தமிழர்நாகரிகமும் பண்பாடும், டாக்டர் அ.தட்சிணாமூர்த்தி, ஐந்திணைப்பதிப்பகம்
2. தவறின்றித்தமிழ்எழுதுவோம், மா. நன்னன், ஏகம்பதிப்பகம்
3. தவறின்றித்தமிழ்எழுத-மருதூர் அரங்கராசன், ஐந்திணைப்பதிப்பகம்
4. தமிழ்இலக்கியவரலாறு, வரதராசன், மு., புதுதில்லி : சாகித்திய அக்காடெமி ,
5. புதியதமிழ்இலக்கியவரலாறு, நீல. பத்மநாபன், சிற்பிபாலசுப்ரமணியம், சாகித்திய அக்காடெமி
6. செம்மொழிதமிழின் சிறப்பியல்புகள் - முனைவர் மறைமலை இலக்குவனார்; <https://www.youtube.com/watch?v=HHZnmJb4jSY>

பாடநூல்தேடலுக்கான இணையம் - <https://archive.org/>

HINDI I
I year-I Sem (Prose, Letter writing & Technical words)

3 0 0 3

Course Objective:

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

Unit I	‘ Ek atuut kadi’ ,letter writing, Technical words.	9
Unit II	‘Devi singh’ , letter writing, Technical words.	9
Unit III	‘ kabiraa ki kaashi ’, letter writing, Technical words.	9
Unit IV	‘ kabiraa ki kaashi ‘, letter writing, Technical words.	9

Unit V ' bharathiya vigyan ki kahaani '- 'hamne diyaa ,hamne liyaa', letter writing, **9**

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

21LFR001

FRENCH I

3 00 3

a. COURSE OBJECTIVE:

To introduce French language.

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

b. UNIT I - INTRODUCTION

9

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.

c. UNIT II-LECON1-3**9**

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

d. UNIT III-LECON4-6**9**

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 tirées 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

e. UNIT IV-LECON7-9**9**

Leçon 7.Trois visages de l'aventure , 8. A moi Auvergne 9.Recit de voyage-Réponses aux questions tirées de la leçon- Grammaire : Adjectif possessif- Les phrases au présent de l'indicatif-Les phrases avec les verbes pronominaux au présent.

f. UNIT V-COMPOSITION :**9**

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.

g. TEXTBOOK:

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

h. REFERENCE BOOKS:

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

Credit Hours**UNIT I****09**

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

UNIT II**09**

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

UNIT III**09**

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

UNIT IV**09**

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

UNIT V**09**

9. Vocabulary and Exercises under the Lessons

Total: 45 Hours

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

Course 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.

21CBMB11**Basics of Microbiology (Theory)****3 1 0 4**

Course Objectives: The candidate will gain knowledge about the structure of bacteria, fungi, algae, protozoa and viruses along with the basic principles of microscopy. Control of microbial growth by physical and chemical methods plus the use of antibiotics and their efficacy testing are emphasized. Cultivation of microbes is discussed.

UNIT I INTRODUCTION 12 Lecture Hours

Evolution and scope of microbiology. Description of various groups of microorganisms with typical example. Cell cycle and reproduction of bacteria. Bacterial cell structure and components.

UNIT II MICROSCOPY 12

Microscopy—principles of microscopy—bright-field microscopy—Simple microscope, Compound microscope, PCM, FM, DFM, TEM, SEM and STEM—description, principle and use.

UNIT III STERILIZATION 12

Sterilization— Principle, use and quality control of: High temperature -Dry Heat- Hot air oven, incineration, moist heat- Tyndallization, Pasteurization, inspissation, moist heat under pressure; low temperature—preservation; filtration—membrane filters, depth filters; centrifugation; radiation. Disinfection—Mode of action and Evaluation – RW test, KS Test, Use-Dilution method.

UNIT IV ANTIBIOTICS 12

Antibiotics—Classification, Mode of Action, mechanism of resistance, Evaluation—Disc Diffusion; MIC— Broth dilution, agar dilution; MBC; E-test with Quality control for each method.

UNIT V MICROBIAL GROWTH 12

Growth requirements of Bacteria. Microbial culture media and pure culture techniques. Anaerobic cultivation methods. Preservation of cultures. Quantitation of microbial growth and bacterial growth curve in batch culture. Structure of *Paramecium*, *Amoeba*, *Euglena*, *Giardia*.

Total: 60 Lecture Hours

Course Outcome:

At the end of the course, learners will be able to:

- CO1:** Evaluate the outcomes of various antibiotic sensitivity tests.
- CO2:** Decide the optimum media for growth of microbes.
- CO3:** Assess the outcome of sterilization and disinfection protocol.
- CO4:** Judge the suitability of microscopes to microbial cytology.
- CO5:** Choose appropriate methods for cultivation of microorganisms.

TEXTBOOKS:

Michael J. Pelczar, E.C.S. Chan, Noel R. Krieg; Microbiology, Tata-McGraw Hill. Ed. 5; 2006.

REFERENCE BOOKS:

1. Ananthanarayanan R & C.K. Jeyaram Paniker; Textbook of Microbiology; Orient Longman. Ed. 7; 2005.
2. Michael T. Madigan, John M Martinko; Brock's Biology of Microorganisms, Pearson-Prentice Hall. Ed. 11; 2006
3. Ronald M. Atlas; Principles of Microbiology, WCB Publishers. Ed. 2; 1997
4. Roger Y. Stanier, John L. Ingraham, Mark L. Wheelis, Page R. Painter, General Microbiology, MacMillan Press. Ed. 5; 2004.
5. Topley & Wilson's: Principles of Bacteriology, Virology & Immunology, Edward Arnold. Ed. 9; 2002.
6. Lansing M. Prescott, John P Harley, Donald A. Klein; Microbiology, McGraw Hill. Ed. 6; 2005.

21PBMB11 Practical in Basic Microbiological Techniques 0 0 4 2

Course Objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to sterilize media and to prepare, inoculate observe and distinguish the growth patterns in different media.

1. Cleaning and Sterilization of Glassware.
2. Preparation and growth of Bacteria in Basal Media– Nutrient Broth, Peptone Water, Nutrient Agar.
3. Preparation and growth of Bacteria in – MacConkey Agar and Cetrimide Agar.
4. Preparation and growth of Bacteria in Carbohydrate Fermentation Media.
5. Filter sterilization of Serum.
6. Simple staining– positive and negative staining.
7. Gram staining of Bacteria.
8. Capsule staining.
9. Spore staining.
10. Cultivation of fungi in SDA and LPCB mount of fungi.
11. Cultivation of Algae and Identification of *Spirogyra*, *Chlamydomonas*, *Anabaena* and *Nostoc*.
12. Antibiotic sensitivity test – KirbyBauer Method.

Total: 60 Lab Hours

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Develop skills to observe microbes using microscopes.
- CO2:** Competently prepare and cultivate bacteria in different types of media.
- CO3:** Judge the accuracy of sterilization
- CO4:** Prepare media and grow fungi and algae in the lab
- CO5:** Evaluate the sensitivity and resistance of bacteria to antimicrobials

21CBMB12**Basic Concepts in Immunology (Theory)****31 0 4**

Course Objectives: The candidate will gain knowledge about the basic concepts of immunology. The course introduces students to a wide range of topics in immunology starting from cells of immune system, innate and adaptive immune systems, humoral immunity, antibody structure and function, basic immunological techniques, hypersensitivity and vaccine production

UNIT I IMMUNITY 12

Introduction- Immunity-Innate-anatomical barriers, chemical defenses. Adaptive Immunity- Active and Passive. Ontogeny and Physiology of immune system-Primary and Secondary lymphoid organs Immune reactive cells-structure and functions-Macrophages, Phagocytosis, Dendritic cells, Granulocytes, NK cells, T and B lymphocytes.

UNIT II ANTIGENS AND IMMUNOGLOBULINS 12

Antigens and immunogenicity-terminologies and definition-antigen, Immunogen, Haptens, Adjuvant, Epitope, Paratope, Autoimmunity. Factors influencing immunogenicity. Immunoglobulin- structure, types and properties. Monoclonal and polyclonal antibodies.

UNIT III ANTIGEN-ANTIBODY REACTIONS 12

Antigen-antibody interactions-Affinity- avidity, cross reactivity, Precipitation reaction-SRID, Ouchterlony double diffusion. Agglutination reactions- Active, Passive agglutination and Hemagglutination. Complement system-Classical, Alternate and Lectin pathways.

UNIT IV MAJOR HISTOCOMPATIBILITY COMPLEX, HUMORAL AND CELL MEDIATED IMMUNE RESPONSES.

12

MHC- Structure of MHC I and MHC II. Humoral immunity- Development of B-cells-B cell receptor- Activation and Production of Antibodies. Cell mediated immunity- Development of T-cell- T-cell receptors-types of T-lymphocytes-Activation of T-cell. Cytokines- General Properties, functional categories.

UNIT V HYPERSENSITIVITY AND VACCINES**12**

Hypersensitivity—Type I, Type II, Type III and Type IV. Vaccines -Introduction to Vaccines and Adjuvants - Types of vaccines – Killed and Live Attenuated vaccines. Sub-unit vaccines, conjugate vaccines, Toxoids. Recombinant vector vaccines. Immunization: Passive and active immunization.

Total: 60 Lecture Hours**Course Outcome**

At the end of the course, learners will be able to:

- CO1:** Analyze a model of Immunoglobulins
- CO2:** Evaluate the reasons for immunization and aware of different vaccination
- CO3:** Compare and contrast innate and adaptive immune systems.
- CO4:** Apply basic techniques for identifying antigen antibody interactions.
- CO5:** Analyze cell types and organs present in the immune response.

TEXTBOOK:

Richard Coico , Geoffrey Sunshine ,Eli Benjamini. Immunology—A Short Course. Wiley-Liss, New York. 5th ed., 2003.

REFERENCE BOOKS:

1. Ivan M. Roitt ,J. Brostoff and D.K .Male, Immunology, Gower Medical Publishing, London.1993.
2. Clark W R, The experimental foundations of modern immunology. John Wiley and sons Inc. New York. 1991.
3. Janis Kuby, Immunology, II edition. W. H.Freeman and Company, New York.1993.
4. Janeway Travers, Immunobiology-the immune system in health and disease. Current Biology Ltd. London, New York. 3rded., 1997.
5. Peter J. Delves, Ivan M. Roitt, Encyclopedia of Immunology; Academic Press .2ndEd. 1998.
6. Chapel H and Halbey M, Essentials of Clinical Immunology. ELBS. 1986.
7. Leslie Hudson and Frank C. Hay. Practical Immunology. Blackwell Scientific Publication. 3rd ed., 1989.
8. Pravash Sen. Gupta, Clinical Immunology. Oxford University Press.2003.

21PBMB12**Practical in Immunology****0 0 4 2**

Course Objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to identify lymphocytes, various agglutination and precipitation reactions. Perform and interpret ELISA tests, Immuno-electrophoresis and purify immunoglobulins.

1. Identification of various immune cells by morphology.
2. Latex Agglutination reactions-RF, ASO, CRP.
3. Hemagglutination Reactions-Blood Grouping, Rh Typing,
4. Ouchterlony double immunodiffusion (ODD)
5. Mancini's single radial immunodiffusion (SRID)
6. Immunoelectrophoresis-Counter Current Immunoelectrophoresis.
7. ELISA for HBs antigen detection.

Total:60 Lab hours**Course Outcome**

At the end of the course, learners will be able to:

CO1: Evaluate and correlate test results with associated diseases or conditions.

CO2 Analyze and quantify the antigens/antibodies

CO3: Describe the principals involved in the immune response

CO4: Analyze serological diagnostic tests such as RF, ASO, CRP.

CO5: Discriminate various immune cells and enumerate them

REFERENCE BOOKS:

1. Leslie Hudson and Frank C. Hay. Practical Immunology. Blackwell Scientific Publication. 3rd ed., 1989.
2. Clark WR, The experimental foundations of modern immunology. John Wiley and Sons Inc. New York. 1991.
3. Hay FC and Westwood OMR. 2002. Practical Immunology. 4th Edition. Blackwell Science.

**21CBMB13 Introduction to Microbial Anatomy, Physiology and Microbial Taxonomy
4 0 0 4**

Course Objective: The candidate will gain knowledge about the structure of algae. Basis of taxonomy – characteristics, kingdom. Outlines of classification of bacteria, protozoa, fungi and algae. Basic insights into few unique physiological activities in microbes.

UNIT I Introduction 12

Introduction to taxonomy; Taxonomical hierarchy, Binomial Nomenclature; concept of species; Major characteristics used in classification; five kingdom, six kingdom and eight kingdom concepts.

UNIT II Classification of Bacteria, Algae, Virus 12

Basis for Classification of bacteria according to Bergey's Manual of Systematic Bacteriology. Classification of Algae. Classification of animal viruses.

UNIT III Classification of Protozoa, Fungi 12

Classification of protozoa- 1980 official system and Cavalier- Smith system. Classification of fungi according to Einsworth. Characteristics of each division.

UNIT IV Life Cycle and Reproduction 12

Structure of algal cell with example; Life-cycle patterns of Algae. Reproduction in algae. Structure of Fungi - unicellular and multicellular forms. Structure of Virus – Adenovirus, Retrovirus, TMV and T- phage.

UNIT V Physiology in Bacteria 12

Photosynthesis in Bacteria – Oxygenic and Anoxygenic. Nitrogen Fixation. Glycolysis, HMP, TCA, ED pathways, Glyoxylate cycle. Respiration – Aerobic and Anaerobic. ATP synthesis.

Total: 60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Design a dichotomous key to identify bacteria

CO2: Discriminate algae into genera based on exhibited characteristics.

CO3: Discriminate fungi into genera based on exhibited characteristics.

CO4: Discriminate bacteria into genera based on exhibited characteristics.

CO5: Analyze the basic physiological processes in bacterial cells.

TEXTBOOK:

Roger Y. Stanier, John L. Ingraham, Mark L. Wheelis, Page R. Painter; General Microbiology, MacMillan Press. Ed. 5; 2004.

REFERENCE BOOKS:

1. Ananthanarayanan R & C.K. Jeyaram Paniker, Textbook of Microbiology, Orient Longman. Ed. 7; 2005.
2. Michael T. Madigan, John M Martinko,; Brock's Biology of Microorganisms, Pearson-Prentice Hall. Ed. 11; 2006.
3. Ronald M. Atlas,; Principles of Microbiology, WCB Publishers. Ed. 2; 1997.
4. Topley & Wilson's : Principles of Bacteriology, Virology & Immunology,; Edward Arnold. Ed. 9; 2002.
5. Lansing M. Prescott, John P Harley, Donald A. Klein; Microbiology,; Mc Graw Hill. Ed. 6; 2005.

பாடக்குறியீட்டுஎண்: 21LTA002

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 - நாடு 87, 88 பாடல்கள்

2. தமிழ்விடுதூது - முதல் 20 கண்ணிகள்
3. திருக்குற்றாலக்குறவஞ்சி - மலைவளம்கூறுதல் - முதல் 5 பாடல்கள்
4. முக்கூடற்பள்ளு - முத்தபள்ளிநாட்டுவளம்கூறுதல் 3 பாடல்கள், இளையபள்ளிநாட்டுவளம்கூறுதல் 3 பாடல்கள்.
5. கலிங்கத்துப்பரணி - பாலைபாடியது - முதல் 5 பாடல்கள்

அலகு 3: சிறுகதை

9

மணிநேரம்

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 – பேச்சுத்திறனின் அடிப்படைகள் – வகைகள்
– மேடைப்பேச்சு – உடையாடல் - பயிற்சிகள்

அலகு 5: எழுத்துத்தமிழ், இலக்கியவரலாறு, இலக்கணம் 8
மணிநேரம்

1. கலைச்சொல்லாக்கம் - தேவைகள் - கலைச்சொற்களின் பண்புகள் - அறிவியல்கலைச்சொற்கள் - கடிதம் - வகைகள் - அலுவலகக்கடிதங்கள் - உறவுமுறைக்கடிதங்கள்.
2. பாடம்தழுவிய இலக்கியவரலாறு (அறஇலக்கியம், சிற்றிலக்கியம், சிறுகதை)
3. அணிஇலக்கணம்
4. விண்ணப்பக்கடிதம் எழுதுதல்

மொத்தம்: 45 மணிநேரம்

பார்வைநூல்கள்

1. பேசும் கலை, முனைவர்கு. ஞானசம்பந்தன் விஜயாபதிப்பகம்
2. தமிழ் இலக்கியவரலாறு, வரதராசன், மு., சாகித்திய அக்காடெமி, புதுதில்லி
3. தமிழ்நடைக்கையேடு, மொழி அறக்கட்டளை
4. பயன்பாட்டுத்தமிழ், முனைவர் அரங்க இராமலிங்கம், முனைவர் ஒப்பிலாமதிவாணன், சென்னை பல்கலைக்கழகம், 2007
5. மொழிபெயர்ப்பியல் அடிப்படைகள், கா.பட்டாபிராமன், யமுனைப்பதிப்பகம், திருவண்ணாமலை

6 பாடநூல்தேடலுக்கான இணையம்

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

Hindi II**3 0 0 3****I year-II Sem (kahani , Natak & Translation)****Course Objective:**

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

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

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 Hindi literature
 CO 5 will acquire knowledge in Hindi sahithya

Text book: Gadya khosh

21LFR002

FRENCH II

3 0 0 3

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

12

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

12

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

UNIT III-LECON 14-15

12

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

12

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

UNIT :V- COMPOSITION :**12**

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

TEXTBOOK :

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

REFERENCE BOOKS:

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

Nithya Vijayakumar get ready French grammar-Elementary Goyal publications, New Delhi Edition 2014.

ENGLISH II – POETRY**3 0 0 3**

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

Credit Hours**UNIT I****09**

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

UNIT II**09**

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

UNIT III**09**

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

UNIT IV**09**

7. If - Rudyard Kipling

8. The Drowned Children - Louise Glück

UNIT V

09

9. Australia - A.D.Hope

10. A Far Cry from Africa - Derek Walcott

Total : 45 Hours

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.

21CBMB21 Introduction to Microbial Genetics and Molecular Biology 4004

Course Objectives: The candidate will gain knowledge about the structure, shape and significance of DNA, RNA. Synthesis of RNA and proteins along with its control. Role of genes as basic units of expression.

UNIT I NUCLEIC ACIDS 12

Nucleic acids as genetic material–DNA and RNA structure. Gene transfer mechanisms– conjugation, transformation and transduction. Properties of nucleic acids. Super helicity in DNA, topology and topoisomerases.

UNIT II REPLICATION 12

DNA replication – general principles, modes of replication, Mechanism. Replication of ssDNA, retroviral replication. DNA damage and repair. Types of DNA damage (deamination, oxidative damage, alkylation, pyridine dimers) and repair (BER, NER and MMR).

UNIT III TRANSCRIPTION 12

Transcription–general principles, basic apparatus, RNA polymerases and steps involved. Monocistronic and polycistronic mRNAs. Processing of RNA. Genetic code. Translation overview – Prokaryotes and Eukaryotes. Post translational modifications.

UNIT IV GENE TRANSFER 12

Operon concept – *lac*, *trp*, *ara* operon. Plasmids – Types and properties, Ti plasmid structure, Plasmid incompatibility. Transposons – structure, types (IS, Tn3, Mu and Ty) and functions.

UNIT V MUTATION 12

Mutation and genetic analysis of mutants: Mutation and its types – insertion, deletion, addition, rearrangement. Genetic analysis. Mutagenesis: Types: Site directed mutagenesis, base analogue mutants, tautomerization. Physical and chemical mutagens.

Total 60 Lecture hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Develop a fairly good knowledge on the flow of information from DNA to Protein and the three well known mechanisms by which the genetic material is transferred among the microorganisms

CO2: Explain different types of DNA replication and grasp the replication of single-stranded DNA molecules and the various features of retrovirus replication.

CO3: Summarize and compare the various cellular mechanisms involved in the control of prokaryotic and eukaryotic transcription.

CO4: Formulate an idea about different types of the extra chromosomal elements; the nature of the transposable elements in the prokaryotic and eukaryotic cells.

CO5: Analyze the various mechanisms of genetic exchange, mutations and their implications along with insights about evolutionary methods to overcome change.

TEXT BOOK:

1. Freifelder, D; Molecular Biology. Narosa Publishing House, New Delhi. 2008.

REFERENCE BOOKS:

1. Maloy S.R, Cronan JR, JE. Freifelder, D; Microbial Genetics. Jones and Barlette publishers. 1994.
2. Lodish H, Baltimore O, Berk A, Zipursky SL, Matsudaira P, Darnell, J.; Molecular Cell Biology. Scientific American Books. 1995.
3. Lewin B; Genes VIII. Oxford University Press. 2004.
4. William Haynes; The Genetics of Bacteria and Their Viruses. Black well Scientific Publishers, Oxford. 1985.

21PBMB21 CC9: Practical in Molecular Separation Methods**00 42**

Course Objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to separate and observe chromosomal DNA, RNA, amino acids, lipids as well as estimate nucleic acids.

1. Isolation of plasmid DNA and its demonstration by agarose gel electrophoresis.
2. Isolation of bacterial chromosomal DNA and demonstration.
3. Estimation of DNA by chemical method.
4. Estimation of DNA by spectroscopy.
5. Estimation of RNA by chemical method.
6. Separation of amino acids by paper chromatography.
7. Separation of lipids by TLC.

Total: 60 Lab hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Develop a hands on skills of isolation of plasmid DNA from bacterial cells and characterization.

CO2: Evaluation of methods to purify bacterial chromosomal DNA

CO3: Estimate the amount of DNA and RNA present in the given samples

CO4: Analyze and acquire technical knowledge on paper & thin layer chromatography and learn to interpret the results of chromatographic analysis.

21CBMB22 Introduction to Industrial Microbiology**4 0 0 4**

Course Objectives: The candidate will gain knowledge of the role of microbes in production of industrially important products through the use of fermentation media. They will also learn about types of bioreactors and product separation technologies.

UNIT I Introduction to industrial microbiology 6

Brief history and developments in industrial microbiology. Importance of microbial products over chemically synthesized products – ill effects of chemicals

UNIT II Screening and fermentation media 12

Sources of industrially important microbes and methods for their isolation, preservation and maintenance of industrial strains, strain improvement, Crude and synthetic media; molasses, corn steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates

UNIT III Fermentation processes 12

Concept of Fermentation technology. Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (eg. baker's yeast) and continuous fermentations Components of a typical bio-reactor, Types of bioreactors- Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters, Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration

UNIT IV Down-stream processing 12

Cell disruption, filtration, centrifugation, solvent extraction, precipitation, lyophilization and spray drying, Enzyme immobilization- Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

UNIT V Microbial production of industrial products 18

Microbial production of: chemotherapeutic agents - penicillin, streptomycin, tetracycline; Organic acids- Citric acid, gluconic acid; Amino acids- L-Glutamic acid, L- Tryptophan, L- Lysine; Enzymes-amylase, protease, lipase. Production of Wine, beer, ethanol and Vitamin B12

Total Hours: 60 Lecture Hours**Course Outcome**

At the end of the course, learners will be able to:

CO1: To formulate the methods of immobilization, advantages and applications of Immobilization, large scale applications of immobilized enzymes

CO2: To create the importance of microbial strains and fermentation media

CO3: To construct the chemotherapeutic agents

CO4: To evaluate the Concept of Fermentation technology.

CO5: To estimate the Microbial production of industrial products

TEXTBOOK:

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited

REFERENCE BOOK:

1. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
2. Waites M.J., Morgan N.L., Rockey J.S. and Highton G. (2001). Industrial Microbiology: An Introduction. 1st edition. Wiley – Blackwell
3. Glaze A.N. and Nikaido H. (1995). Microbial Biotechnology: Fundamentals of Applied Microbiology. 1st edition. W.H. Freeman and Company
4. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
5. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
6. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Wiley-Eastern.

21CBMB23 Basics of Pharmaceutical Microbiology**4 0 0 4**

Course Objectives: The candidates will understand the need and knowledge of microbes in pharmaceutical industries and be familiar with the various technologies and variables associated in the pharmaceutical application of microorganisms. The candidates will also have knowledge in the biological aspect of microbial utilization for production of metabolites.

Unit - I INTRODUCTION 12

Ecology of microorganisms and pharmaceutical products – air, water, raw materials, packaging, buildings, equipment, cleaning equipment and utensils.

Unit – II STERILIZATION 12

Microbial contamination and spoilage of pharmaceutical products – infection risk and contamination control - and their sterilization. Sterility testing methods – specific inactivation, dilution, and membrane filtration.

Unit – III ANTIMICROBIAL AGENTS 12

Antibiotics - Natural and synthetic - antifungal agents, antitumor substances. Peptide antibiotics, Laboratory evaluation of antimicrobial agents- Mechanism of action of antibiotics and synthetic anti-infective agents. Clinical uses of antimicrobial drugs.

Unit – IV VACCINES 12

Manufacturing procedures in process control of pharmaceuticals. Other pharmaceuticals produced by microbial fermentations. New vaccine technology, DNA, synthetic peptide, multivalent subunit vaccines. Regulatory aspects of quality control.

Unit-V BIOASSAYS 12

Bioassay of antibacterial agents in liquid media and in agar media using standard guidelines (e.g. (NCCLS) / (CLSI)). Methodologies for testing of antimycobacterial, antifungal, antiparasitic and antiviral drugs (in vivo and in vitro infectivity models). Clinical studies: Phase I, phase II, phase III and phase IV of clinical trials – Objectives, Conduct of trials, Outcome of trials.

Total Hours: 45 Lecture Hours

Course Outcomes:

CO1: Develop all the type of drugs and its effects

CO2: Compare the mode of action and mechanism behind antibiotic resistance will be Studied.

CO3: Design manufacturing procedures in process control of pharmaceuticals

CO4: Recommend regulatory aspects of quality control.

CO5: Develop new vaccine technology

References

1. Stephen P Denyer, Norman A Hodges, Sean P Gorman, Brendan F Gilmore (2011). Hugo and Russell's Pharmaceutical Microbiology, John Wiley and Sons, 8th edn.
2. Frederick Kavanagh (2014). Analytical Microbiology, Elsevier.
3. Vyas SP and Dixit VK (2010). Pharmaceutical Biotechnology, CBS Publishers & Distributors, New Delhi.
4. Joseph D Nally (2016). Good Manufacturing Practices for Pharmaceuticals, CRC Press, 6th edn.
5. Chakrabarty AM, Omenn and Gilbert S (1990). Biopharmaceuticals in Transition: Advances in Applied Biotechnology, Portfolio publisher, Vol. 10.
6. Hill RG (2012). Drug Discovery and Development-E-Book: Technology in Transition, Elsevier Health Sciences.
7. Tille P (2015). Bailey & Scott's Diagnostic Microbiology-E-Book, Elsevier Health Sciences.
8. Saravanamuthu R (2010). Industrial Exploitation of Microorganisms, IK International Pvt Ltd.
9. Kim SK (2012). Marine pharmacognosy: Trends and applications, CRC Press.
10. Dhanasekaran D, Thajuddin N and Panneerselvam A. eds., (2015). Antimicrobials: synthetic and natural compounds, CRC Press.
11. Denyer S, Russell A (2004). Non- Antibiotic Antibacterial Agents: Mode of Action and Resistance, Hugo and Russell's: Pharmaceutical Microbiology, 7th Edn, 306- 22.
12. Denyer SP, Hodges NA and Gorman SP eds., (2008). Hugo and Russell's pharmaceutical microbiology, John Wiley & Sons.
13. Zhang R et al., (2018). Mxra8 is a receptor for multiple arthritogenic alphaviruses, Nature

21PBMB22 CC10: Practical in Industrial and Pharmaceutical Microbiology 004 2

1. Study of the different parts of fermenter
2. Primary screening for amylase producing bacteria from soil
3. Production and assaying of microbial proteases
4. Production and assaying of microbial lipases
5. Microbial fermentations for the production and estimation (qualitative and quantitative) of:
 - (a) Amino acid: Glutamic acid
 - (b) Organic acid: Citric acid
 - (c) Wine
6. A visit to any industry to see an industrial fermenter, and other downstream processing operations.
7. Standardization of antibacterial testing of any available antibiotic– MIC
8. Standardization of antifungal testing of plant extract

Total: 60 Lab hours

Course Outcome

At the end of the course, learners will be able to:

CO1: To formulate the methods of large-scale applications of enzymes

CO2: To create the importance of microbial strains and fermentation media

CO3: To construct the methods of industrial fermenter

CO4: To evaluate the Concept of Fermentation technology.

CO5: To estimate the Microbial production of industrial products.

பாடக்குறியீட்டுஎண்: 21LTA003

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

தாள்-3

பக்திஇலக்கியம் - காப்பியம் - புதினம் - மொழிபெயர்ப்பு

அலகு 1: பக்திஇலக்கியம்

10

மணிநேரம்

1. மாணிக்கவாசகர் - திருவாசகம் - மூன்றுபாடல்கள்
 - ✓ புல்லாகிபூடாகி(சிவபுராணம்)
 - ✓ எல்லாப்பிறப்பும்(சிவபுராணம்)
 - ✓ உற்றாரையான்வேண்டேன்(திருப்பலம்பல்)
2. ஆண்டாள் - திருப்பாவை - மூன்றுபாடல்கள் (1, 3, 4)
 - ✓ மார்கழித்திங்கள் ... (பாசுரம் 1)
 - ✓ 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

9 மணிநேரம்

1. சிலப்பதிகாரம் - அடைக்கலக்காதை

(தெரிவுசெய்யப்பட்ட பாடல் அடிகள் 120-199)

2. சீவகசிந்தாமணி – விமலையார் இலம்பகம்
(தெரிவுசெய்யப்பட்ட பாடல்கள்)

அலகு 3: காப்பியம்-2

9 மணிநேரம்

1. கம்பராமாயணம் – மந்தரைசூழ்ச்சிப்படலம்
(தெரிவுசெய்யப்பட்ட பாடல்கள்)
2. பெரியபுராணம் – பூசலார்நாயனார்புராணம்
(தெரிவுசெய்யப்பட்ட பாடல்கள்)

அலகு 4: புதினம்

8

மணிநேரம்

1. கல்மரம் - கோ. திலகவதி

அலகு 5: மொழிபெயர்ப்பு, இலக்கணம், இலக்கியவரலாறு

9 மணிநேரம்

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

மொத்தம்: 45 மணிநேரம்

பார்வைநூல்கள்

1. தமிழ்இலக்கியவரலாறு, வரதராசன், மு., சாகித்திய அக்காடெமி, புதுதில்லி
2. தமிழ்நடைக்கையேடு, மொழிஅறக்கட்டளை
3. பயன்பாட்டுத்தமிழ், முனைவர் அரங்கிராமலிங்கம் முனைவர் ஒப்பிலாமதிவாணன், சென்னை பல்கலைக்கழகம், 2007
4. மொழிபெயர்ப்பியல் அடிப்படைகள், கா.பட்டாபிராமன், யமுனைப்பதிப்பகம், திருவண்ணாமலை

5 பாடநூல்தேடலுக்கான இணையம்

- <http://www.tamilvu.org/library>
- <https://www.tamildigitalibrary.in/book>

Hindi III**3 0 0 3****II year-III SEM (Ancient poetry,Hindi sahitya ka Ithihas)****Course Objective:**

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

Unit I	-	‘Thirukkural’, Hindi Sahitya ka ithihas (aadikal)	9
Unit II	-	‘Kabir ke pad’, Hindi Sahitya ka ithihas (aadikal)	9
Unit III	-	‘Sur ke pad’, Hindi Sahitya ka ithihas (bhakthi kal)	9
Unit IV	-	Thulsi ke pad,Hindi Sahitya ka ithihas (bhakthi kal)	9
Unit V	-	Thulsi ke pad, <u>Hindi Sahitya ka</u> ithihas (Rithikal)	9

Total Hours: 45**Course Outcome**

At the end of this course

- CO 1 Students will know the valuable messages in Thirukkural
 CO 2 will create interest in knowing ancient poems.
 CO 3 Gain knowledge in Hindi literature
 CO 4 will know the difference between Hindi & the languages used by Ancient poets
 CO 5 will be familiar with different styles of poetry writing

Reference books

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

21LFR003

FRENCH III

3 0 0 3

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 1

9

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

UNIT II-

LECON 12-13

9

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

UNIT III-

LECON 14-15

9

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

UNIT :IV-

LECON 16-18

9

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

UNIT :V- COMPOSITION : 9
 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.

TEXTBOOK :

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

REFERENCE BOOKS:

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

ENGLISH III DRAMA AND COMPOSITION

3 0 0 3

Course Objective:

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

Credit Hours

UNIT I	09
<input type="checkbox"/> Introduction to Drama .	
UNIT II	09
<input type="checkbox"/> Shakespeare: Funeral Oration (Act III Scene II Julius Caesar) &	
<input type="checkbox"/> Monkey's Paw - W.W.Jacobs	
UNIT III	09

- Comprehension

UNIT IV **09**

- Precis -Writing and Note Taking

UNIT V **09**

- General Essay on Current Topics

Total **45 Hours**

Course 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.

21CBMB31 **Introduction to Environmental Microbiology** **4 0 0 4**

Course Objectives: The candidate will gain knowledge about microbes in air, air sanitation and quality assessment. Types of water ecosystems and water-borne diseases. Effluent treatment and parameters– BOD, COD. Extremophiles in the environment.

UNIT I **INTRODUCTION** **11**

Microbiology of air; droplet, droplet nuclei, aerosol, infectious dust. Assessment of air quality. Laboratory hazards of air microbes, airborne diseases, air sanitation. Aero mycology.

UNIT II **AQUATIC MICROBIOLOGY** **13**

Aquatic Microbiology- aquatic ecosystems- freshwater (ponds, lakes, streams), marine ecosystem (estuaries, mangroves, deep sea, coral reef); Eutrophication. Assessment of water quality - Physical (TSS, TDS); Chemical (BOD, COD, salinity, pH); Biological (Fecal coliform). Water borne diseases- pathogenesis, prevention and control.

UNIT III: WASTEWATER MICROBIOLOGY 12

Wastewater Microbiology- types and characteristics of waste. Liquid waste treatment- primary, secondary, tertiary treatment, disinfection and disposal, Solid waste treatment- Incineration, landfill, composting,

UNIT IV: MICROBES IN ECOSYSTEM 12

Microbial communities and role of microbes in the ecosystem (primary producers, consumers, decomposers, autotrophs and heterotrophs). Adaptations of microbes in extreme environments- thermophile, psychrophile, halophile, acidophile, alkalophile, barophile, osmophile.

UNIT V RECALCITRANCE AND BIOREMEDIATION 12

Recalcitrance and biodegradation of xenobiotic compounds. Bioremediation – In situ and Ex situ. Bioaccumulation of heavy metals.

Total:60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: To recognize the ecological problems caused by air pollution and design methods to evaluate the human impacts as well as environmental protection.

CO2: Obtain detailed information on aquatic ecosystems and assess the water quality by various methods.

CO3: Analysis of current wastewater treatment methods.

CO4: Summarize the correct understanding of microbial interactions with environment.

CO5: Acquire knowledge on biodegradation, its types and learn to design the protocols for optimization of degradable parameters.

TEXTBOOK:

Ronald.M.Atlas, Richard Bartha, Microbial Ecology. Fundamental and application, An imprint of Addison Wesley Longman Inc. 4th ed, 1998.

REFERENCE BOOKS:

1. Joseph. C. Daniel, Environmental Aspects of Microbiology, Brightsun

- Publications. 2nd. Ed., 2006.
2. Dr.K.VijayaRamesh, Environmental Microbiology, MJ Publishers. 1st Ed, 2004.
 3. A.J.Salle, Fundamental Principles of Bacteriology, Tata McGraw Hill Publishing Company. 7th Ed, 1990
 4. Paul Singleton, Diana Sainsbury, Dictionary of Microbiology and Molecular Biology, John Wiley and Sons. 2nd ed, 1997.
 5. P.D.Sharma, Environmental Microbiology, Narosa Publications Limited. 1st Ed, 2005.
 6. Edowrly.S, Hardman OJ and Wait S, Pollution: Ecology and Biotreatment, Longman Scientific Technical. 1993.
 7. Baker K Hand Herson OS, Bioremediation, McGraw Hill, NY. 1994.
 8. R.C.Dubey and D.K.Maheswari, Practical Microbiology, S, Chand & Co Ltd, New Delhi. 1st ed, 2008.

21CBMB32**CC12: Basic Food Microbiology****3 0 2 4**

Course Objectives: The candidate will gain knowledge about food preservation, spoilage. Students will be able to explain the importance of food sanitation and concepts-HACCP, GMPs and microbial production of foods. Students will also be able to elaborate on Food-borne diseases and their control.

UNIT I INTRODUCTION**9**

Scope of food microbiology. Microorganisms important in food microbiology- molds, yeasts and bacteria. Probiotics, Prebiotics and Functional Foods. Factors influencing microbial growth and survival in foods – intrinsic and extrinsic factors.

UNIT II FOOD PRESERVATION METHODS**9**

Principles of food preservation – Asepsis, Removal of microbes, maintenance of anaerobic conditions. Methods – physical- heat-processing, canning process, low temperature-chilling, freezing, high pressure, controlled and modified atmosphere, drying, irradiation. Chemical methods- use of preservatives, food additives. Hurdle Concept.

UNIT III MICROBIAL SPOILAGE AND CONTROL**9**

Spoilage of foods – Meat, Eggs, Sea foods, Fruits, Vegetables and Grains. Food Sanitation- Controlling microbiological quality of foods- Concepts of Total Quality Management (TQM), GMPs, GHPs. Quality Systems – Overview of Global Food Safety Initiative (GFSI), Hazard Analysis and Critical Control Point system (HACCP), International Food Standard (IFS), British Retail Consortium (BRC), Safe Quality Food (SQF) 2000 and International Organization for Standardization ISO 22000:2018.

UNIT IV MICROBIOLOGY OF FOOD PRODUCTS**9**

Microbiology of milk and dairy products- contamination, spoilage and preservation of dairy products. Fermented dairy products – cheese and its types, butter milk, acidophilus milk, kefir, koumiss. Microbes as foods - Mushrooms, Spirulina. Non-dairy products – Bread, wine, sauerkraut and vinegar. Milk- borne diseases.

UNIT V FOOD-BORNE DISEASES**9**

Bacterial and non-bacterial food borne infections and intoxications. Methods of microbiological examination of foods- indicator organisms, direct examination, culture dependent and culture independent techniques. Packaging of foods.

Total: 45 Lecture Hours**Course Outcome**

At the end of the course, learners will be able to:

- CO1:** Validate the interactions between foods and microorganisms.
- CO2:** Explain the different methods of food preservation and types of spoilage in foods.
- CO3:** Discuss about food sanitation and quality systems adopted in food industries.
- CO4:** Identify the role of microbes in the production of dairy and non-dairy products
- CO5:** Classify bacterial and non-bacterial food borne diseases

TEXTBOOKS:

Adams MR and Moss MO, Food Microbiology. New Age International Publishers. 2005.

REFERENCE BOOKS:

1. Frazier WC and Westhoff DC, Food Microbiology. Tata McGraw Hill Publishing Company Limited. New Delhi. 1988.
2. Sivasankar, B. Food Processing and Preservation, Prentice Hall of India Pvt. Ltd. 2002.
3. James M. Jay, Modern Food Microbiology, CBS Publishers and Distributors. New

Delhi. 1996.

4. Board, RC. A Modern Introduction to Food Microbiology. Blackwell Scientific Publications, Oxford. 1983.
5. Ananthkrishnan CP, Singh RB, Padmanabhan PN, Dairy Microbiology, Sri Lakshmi Publications, Chennai. 1994.
6. Robinson RK. Dairy Microbiology, Wiley and Sons. New York. 2002.
7. Salle, A.J. Fundamental Principles of Bacteriology. Tata McGraw Hill Publishing Company Ltd. 7th Ed., 2001.
8. Samuel C. Prescott, Cecil G. Dunn. Industrial Microbiology, Agro Bios India. 2005.
9. Michael P. Doyle, Larry R. Beuchat, Thomas J. Montville. Food Microbiology- Fundamentals and Frontiers. ASM Press. 2nd Edition. 2001.

21PBMB32

CC12: Practical in Food Microbiology

0 0 2 1

Course Objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to evaluate the quality of milk, curd and spoilage organisms.

1. Dye Reduction Tests for milk – MBRT test.
2. Evaluation of quality of curd by SPC.
3. Enumeration of bacteria in spoiled foods.
4. Isolation of fungi from spoiled vegetables – Slide Culture Technique
5. Identification of fungi – LPCB staining
6. Production of Wine
7. Production of Sauerkraut

Total: 30 Lab hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Evaluate the bacteriological quality of milk

CO2: Evaluate the quality of curd

CO3: Estimate the amount of bacterial growth in spoiled foods

CO4: Produce fermented food products using microbes.

CO5: Identify the fungi from spoiled vegetables

REFERENCES:

1. Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Govt. of India, New Delhi. 2021. Lab. Manual 14. In: Manual of Methods of Analysis of Foods. Microbiology Testing.
2. Nielsen SS. 2017. Food Analysis Laboratory Manual. 3rd Edition. Springer International Publishing. ISBN 978-3-319-44127-6 (eBook).
3. Varghese N and Joy PP. 2014. Microbiology Laboratory Manual. Edition: 1. Publisher: Aromatic and Medicinal Plants Research Station, Odakkali, Asamannoor P.O., Ernakulam District, Kerala, India.

21PBMB31

CC14: Practical in Environmental Microbiology

0 0 4 2

Course Objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to evaluate the quality of water and air.

1. Enumeration of microbes in air- settle plate method
2. Enumeration of microbes in air- Reuters Air sampler as per - BAM, APHA, IS Standards.
3. Estimation of BOD.
4. Estimation of COD.
5. MPN for coliforms in water as per - BAM, APHA, IS Standards.
6. Enumeration of microbes in water using membrane filter.
7. Isolation of faecal coliform from water.
8. Field trip to sewage treatment plants, coastal area, salt pans, coral reef.

Total: 60 Lab hours

Course Outcome

At the end of the course, learners will be able to:

CO1: To evaluate the microbial quality of water

CO2: To evaluate the physical and chemical quality of water

CO3: To estimate the number of microbes in air

CO4: To evaluate the Cultivation of SCP.

CO5: To estimate the Microbial production of acids.

21CBMB33 INTRODUCTION TO VIROLOGY 4004

Course Objectives: The candidates will understand the structure, classification, diagnosis of disease, treatment and prevention of viral infections. Successful completion of the course will give a solid understanding of basic concepts in the field of Virology.

UNIT I INTRODUCTION 12

General properties of viruses, Structure of TMV, Adenovirus, Influenza virus, HIV, HBV, Ebolavirus; Electron Microscopic techniques for detection of virus.

UNIT II CLASSIFICATION 12

Classification of Animal viruses. Classification of plant viruses. Classification of bacteriophages.

UNIT III PATHOGENIC VIRUSES 12

General properties, antigenic structure, pathogenesis, clinical findings, prevention, control and treatment of following viruses HIV, HAV, HBV, Rabies, Influenza, Dengue, Corona virus Rubella, Polio, and Oncogenic Virus.

UNIT IV LIFE CYCLES 12

Antiviral agents, chemotherapy and vaccines. Viroids, Prions, Virusoids and Satellite RNA. Bacteriophage –life cycle lytic and lysogeny with control mechanism.

UNIT V CULTIVATION AND DIAGNOSTIC TECHNIQUES 12

Cultivation of virus – Egg inoculation, Cell culture methods. Viral diagnosis techniques – Immunological, cytopathic effect, molecular diagnostic methods.

Total Hours: 60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Able to write the Pathogenesis of viral infections

CO2: Evaluate the classification of viruses.

CO3: Explain the Able to write the Pathogenesis of viral infections

CO4: Explain vaccine strategies and mechanisms of antiviral drugs

CO5: Understand about the viral diagnosis techniques.

TEXTBOOK:

Saravanan.P, Virology, MJP Publishers. 2006.

REFERENCE BOOKS:

1. S.B.Biswas, Amita Biswas, An Introduction To Viruses, Vikas Publishing House. 2003.
2. Douglas D. Richman, Richard J.Whitley, Frederick G.Hayden, Clinical Virology; Churchill-Livingstone. 1997.
3. S.j.Flint, L.W.Enquist, R.M.krug, V.R.Racanielo, A.M.Skalka, Principles of Virology, Molecular Biology, pathogenesis And Control, ASM Press. 2000.
4. Topley & Wilson's Principles of Bacteriology, Virology & Immunity, Vol. 4, 9th Ed.1998.
5. Roger Hull, Matthew's Plant Virology, Academic Press. 2002.
6. Ananthnarayanan. R & C. K. Jeyaram Panicker; TEXTBOOKS of Microbiology, Orient Longman. 2006.
7. Baron EJ, Fine Gold S.M; Diagnostic Microbiology. Blackwell Scientific Systems. 1995.
8. Jawetz. E, Melnick J.L, Adelberg E.A; Review of Medical Microbiology, Lange Medical Publications, ELBS, London. 19th Edn.,1998.

21EVSXXX ENVIRONMENTAL STUDIES 2002**UNIT I INTRODUCTION 6**

The multidisciplinary nature of Environment of studies – Definition - Scope and Importance
- Need for Public Awareness.

UNIT II NATURAL RESOURCES 6

Natural resources and associated problem - Renewable and Non- Renewable resources. Role of an individual in conservation of natural resources.

UNIT III ECO SYSTEM 6

Concepts of an Ecosystem - Structure and Functions of an Ecosystem - Producers, Consumers and Decomposers - Energy flow in the ecosystem - Food chains, Food webs and ecological pyramids - Introduction, types, Characteristics features - Structures and functions of the following ecosystem: Forest ecosystem, Grass land ecosystem, Aquatic ecosystem.

UNIT IV BIODIVERSITY AND ITS CONSERVATION 6

Introduction - Definition, genetic, species and ecosystem diversity - Value of Bio-diversity - Bio-diversity at global, National and Local levels - India s a mega-diversity nation - Hot-Spots of diversity-Threats to diversity. Endangered and Endemic species of India. Conservation of Bio-diversity.

UNIT V ENVIRONMENTAL POLLUTION AND HUMAN RIGHTS 6

Definition - Causes, effects and control measures of : Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution - Role of an individual in prevention of pollution - Disaster Management – Flood, earthquakes, cyclone of landslides - Environment and human health - Human rights - Value education - HIV/AIDS - Role of information technology in Environment and Human health - Case study.

Total: 30hrs

TEXTBOOK:

Dr. N. Arumugam, Prof.V. Kumaresan, Environmental studies. 2010. MJP Publishers.

பாடக்குறியீட்டுஎண்: 21LTA004

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

தாள்-4

சங்கஇலக்கியம் - நாடகம் - வளர்தமிழ் - பொதுக்கட்டுரை

அலகு 1:சங்கஇலக்கியம் - 1

10

மணிநேரம்

1. புறநானூறு (மூன்றுபாடல்கள் - 183, 184, 192)
2. பதிற்றுப்பத்து (இரண்டுபாடல்கள் - 14, 69)
3. பட்டினப்பாலை (காவிரியின்சிறப்புபாடல்அடிகள் 01-07,சோழநாட்டுவளம்பாடல்அடிகள்20-28,பல்பொருள்வளம்பாடல்அடிகள் 183-193)
4. மதுரைக்காஞ்சி (பாண்டியர்பரம்பரைபாடல்அடிகள் 01-23, மன்னர்க்குமன்னன்பாடல்அடிகள் 64-74, பாண்டியன்புகழ்பாடல்அடிகள் 197-209).

அலகு 2: சங்கஇலக்கியம் - 2

9

மணிநேரம்

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

8

மணிநேரம்

1. ஆட்டனத்திஆதிமந்தி - கவிஞர்கண்ணதாசன்

அலகு 4:வளர்தமிழ்

9 மணிநேரம்

1. ஊடகத்தமிழ் - கணினித்தமிழ்அறிமுகம்

ஊடகத்தமிழ்:அச்சுக்கலை - இதழியல் - ஊடகவகைகள் -
அச்சஊடகங்கள் - மின்னணுஊடகம் -இதழியல்முன்னோடிகள் -
அச்சஊடகங்களில்தமிழ் -கருத்துப்பரிமாற்றம் -
மொழிநடையின்தன்மை - நாளிதழ்கள் - வார, மாதஇதழ்கள் -

மின்னணுஊடகங்களில் தமிழ் - வானொலி- தொலைக்காட்சி- திரைப்படம்.

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

அலகு 5: பொதுக்கட்டுரை, இலக்கியவரலாறு, இலக்கணம்
9 மணிநேரம்

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

மொத்தம்: 45 மணிநேரம்

பார்வைநூல்கள்

1. கணினித்தமிழ், முனைவர் இல. சுந்தரம், விகடன் பிரசுரம்
2. கணிப்பொறியில் தமிழ், த. பிரகாஷ், பெரிகாம்
3. தமிழ்க்கணினி இணையப்பயன்பாடுகள், முனைவர்துரை. மணிகண்டன், மணிவானதிபதிப்பகம்
4. இதழியல்கலை, டாக்டர் மா. பா. குருசாமி, குரு - தேமொழிபதிப்பகம், திண்டுக்கல்
5. அச்சுக்கலைவழிகாட்டி, பாலசுப்பிரமணியன், ஆ., சென்னை : தனசுபதிப்பகம், 1966
6. தொலைக்காட்சிக்கலை, முனைவர் வெ. நல்லதம்பி, மங்கைப்பதிப்பகம், சென்னை 42

8 பாடநூல்தேடலுக்கான இணையம்

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

Hindi IV

3 0 0 3

**II year-IV SEM (Modern Poetry, Hindi sahithya ka ithihas
-Adhunik kal, Journalism, Advertisement writing)**

Course Objective:

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

Unit I	- ‘Adhunik kavitha(Sansar), Journalism	9
Unit II	- ‘Adhunik kavitha (Mouun nimanthran), Journalism	9

Unit III	- Adhunik kavitha ('rah rahkar Tuutthaa rab kaa kahar), Journalism	9
Unit IV	- ' Adhunik kavitha ('samarpan'), Advertisement writing	9
Unit V	- 'Adhunik kavitha ('panthrah agasth kii pukaar '), Advertisement writing	9

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

21LFR004

FRENCH IV

3 0 0 3

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

12

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.

UNIT :II

12

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

UNIT :III **12**

Leçon :56 A Biarritz la page-Grammaire le future antérieure. Leçon :57 Dans les Pyrénées-Grammaire le future antérieure suite.

UNIT :IV **12**

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

UNIT :V **12**

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

TEXTBOOK :

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

REFERENCE BOOKS:

DONDO Mathurin, “Modern French Course”, Oxford University Press, New Delhi Edition 2014.

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

Course Objective:

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

Credit Hours

UNIT I

09

i. At the Airport ii. In a Bank

iii. On a Bus

UNIT II **09**

iv. In Flight

v. In a Hotel vi. In a Library

UNIT III **09**

vii. Tea Time viii. On a Train

ix. In a Restaurant

UNIT IV **09**

x. On a Picnic

xi. In a Police station xii. In a Post office

UNIT V **09**

xiii. In a travel agency xiv. Asking the way xv. At the theatre

Total hours: 45

Books Recommended:

English Conversation Practice, D.H.Spencer, Oxford

Course Outcome

At the end of the course, learners 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.

21CBMB41**Basic Systemic Bacteriology****4 0 0 4**

Course Objectives: The candidates will acquire knowledge about viruses of medical importance, their classification and characteristics. They will also learn in detail about the infections and their treatments. They will also study about the medically important bacteria and infections caused by them and their therapeutic options.

UNIT I INTRODUCTION**12**

Normal flora of human body. General attributes and virulence factors of bacteria causing infections – invasiveness and toxigenicity. Host – Parasite relationships – non specific host immune mechanism.

UNIT II PATHOGENESIS, DIAGNOSIS AND PREVENTION**12**

Pathogens, pathogenesis, clinical manifestations, lab diagnosis, epidemiology, chemotherapy and prevention of following diseases based on portal of entry: *Via* respiratory tract – Pneumonia, bronchitis, diphtheria, whooping cough, tuberculosis, meningitis. *Via* gastrointestinal tract – gastroenteritis, enterocolitis, typhoid, cholera,. *Via* genitourinary tract – Urinary tract infections, gonorrhoea, syphilis, non – gonococcal urethritis.

UNIT III MODE OF TRANSMISSION**12**

Plague, relapsing fever, Leprosy, Leptospirosis, glomerulonephritis – Wounds and Burns: Gas gangrene, tetanus. Infection of eye: Trachoma, conjunctivitis; Infections of oral cavity.

UNIT IV INFECTIONS AND DISEASES**12**

Miscellaneous bacteria – *Campylobacter*, *Helicobacter*, *Legionella*, etc. Prevention and treatment of human bacterial diseases. Antibiotics and chemotherapeutic agents – drug resistance and antibiotic policy. Epidemiology and control of community infections. Nosocomial infections and their control.

UNIT V COLLECTION, TRANSPORT AND DIAGNOSIS**12**

Rules for collection and dispatch of clinical specimens for microbiological diagnosis; Recommendations for the collection, transport and isolation of bacteria from clinical specimens. General principles, media and isolation techniques involved for anaerobic bacteria.

Total: 60 Lecture Hours**Course Outcome**

At the end of the course, learners will be able to:

CO1: Explain about the general properties of pathogens

CO2: Assess about the characters, pathogenicity, and lab diagnosis of bacterial pathogens that enter through respiratory, GI and genitourinary tract.

CO3: Elaborate about the characters, pathogenicity, and lab diagnosis of bacterial pathogens that enter through other routes of transmission.

CO4: Highlight the importance and significance of antimicrobial resistance and control measures.

CO5: Select appropriate procedures for specimen collection and isolation of pathogens.

TEXTBOOK:

1. Ananthnarayanan. R & C. K. Jeyaram Panicker, 2006; Textbook of Microbiology, 8th Ed., Orient Longman.

References:

1. Jawetz, E., Melnick, J. L., & Adelberg, E. A., 1998; Review of Medical Microbiology, Ed. 19; Lange Medical Publications, ELBS, London.
2. David Greenwood, Richard B. Slack, John F. Peutherer, 2002; Medical Microbiology, Ed. 16; Churchill Livingstone, London.
3. Baron, E. J., & Tenover, F. C., 1995; Diagnostic Microbiology; Blackwell Scientific Systems.
4. J. G. Collee, A. Simmons, A. G. Fraser, B. P. Marmion, 2006; Mackie & McCartney Practical Medical Microbiology, Ed. 14; Elsevier.
5. Cowan & Steel, 1995; Cowan & Steel's Manual for Identification of Medical Bacteria, Ed. 4; Cambridge University Press, London
6. Wolfgang, Joklik & David J. Smith, 1990; Zinsser's Microbiology, Ed. 11; Appleton Century Crafts, N.Y.
7. Topley & Wilson, 1990; Topley & Wilson's Principles of Bacteriology, Virology & Immunity, Vol III; Bacterial Diseases, Ed. 8; Edward Arnold, London.

21PBMB41**Practical in Medical Bacteriology****0042**

Course Objectives: The candidate will gain knowledge about collection and transport of specimens from patients to Microbiology lab and the processing of collected samples. The students will also gain hands-on skills related to diagnosis of bacterial pathogens.

1. Collection and transport of specimens- Sputum / throat / ear / nasal swabs
2. Cultivation, transport, isolation and biochemical identification of pathogenic bacteria from samples.
3. Identification of medically important pathogenic *Staphylococci*
4. Identification of medically important pathogenic *Streptococci*

5. Identification of medically important pathogenic *E.coli*
6. Identification of medically important pathogenic , *Klebsiella* species
7. Identification of medically important pathogenic *Pseudomonas* species
8. Identification of medically important pathogenic *Proteus* species

Total Hours: 60 Lab Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Determine the methods for collection and processing of clinical specimens.

CO2: Analyze the methods of lab diagnosis of pathogenic bacteria.

CO3: Differentiate the characteristics of enterobacteriaceae

CO4: Correlate the results of various identification methods of enterobacteriaceae

CO5: Correlate the results of antibiogram analysis of pathogens.

REFERENCES:

1. James H Jorgensen; Michael A Pfaller; Karen C Carroll. 2015. Manual of clinical microbiology. 11th Edition. ASM Press. Washington DC.
2. Forbes BA, Sahra DF, Weissfeld AS. 2001. Bailey and Scott's Diagnostic Microbiology. 12th Edition. Mosby, Elsevier.

21CBMB42

Introduction to Medical Mycology

3 0 2 4

Course Objective: The candidate will gain knowledge about the structure of fungi, life-cycle patterns, pathogenesis, identification, and treatment of fungal infections.

UNIT I INTRODUCTION

9

Introduction to Mycology, Structure and cell differentiation- unicellular and multicellular forms. Modes of reproduction – sexual, asexual and para sexual, life cycle patterns. Growth requirements and cultivation. Virulence factors.

UNIT II LAB DIAGNOSIS AND CONTROL 9

Detection and recovery of fungi from clinical specimens. Advances in diagnostic mycology. Antifungal agents- type and mode of action, testing methods and quality control. Immunity to fungal infection.

UNIT III SUPERFICIAL AND SUBCUTANEOUS MYCOSES 9

Superficial Mycoses- Dermatophytosis, Piedra, Pityriasis versicolor, Tinea nigra.
Subcutaneous Mycoses- Mycetoma, Sporotrichosis, Chromoblastomycosis,
Phaeohyphomycosis, Rhinosporidiosis

UNIT IV SYSTEMIC MYCOSES 9

Histoplasmosis, Blastomycosis, Coccidioidomycosis and Paracoccidioidomycosis.

UNIT V OPPORTUNISTIC MYCOSES AND MYCOTOXICOSES 9

Opportunistic mycoses-Candidiasis, Cryptococcosis, Aspergillosis, Zygomycosis, Dematiaceous fungi. Mycotoxicoses and Mycetismus.

Total: 45 Lecture Hours

Course outcomes (CO)

At the end of the course, learners will be able to:

CO1: Formulate protocol to detect and recover fungi from clinical specimen

CO2: Differentiate fungi based on morphological characters

CO3: Summarize the mode of action and assess the activity of different antifungal agents

CO4: Summarize the Pathogenesis, Clinical manifestation, Laboratory diagnosis and treatment of various fungal diseases

CO5: Summarize the Mode of action, clinical manifestation of Mycotoxins

TEXTBOOK:

Jagadish Chandar; A textbook of Medical Mycology. Jaypee Brothers Medical Publishers. 4th Edn, 2018.

REFERENCE BOOKS:

1. Alexopoulos C.J; Introductory Mycology. Wiley, 4th Edn 2007.
2. H.C. Dube, An introduction to Fungi, Scientific Publishers. 4rd Edn., 2012.
3. Alexopoulos C.J. & H.C. Bold. Algae & Fungi. MacMillan & Co Ltd, London. 2001.
4. Ainsworth G.C; A Dictionary of the Fungi. Commonwealth Mycological Institute, Kew. Surrey. 1971.
5. Bilgrami K.S., Verma R.N; Physiology of Fungi, Scientific Publishers. 3rd Edn., 2011.

21PBMB43

Practical in Medical Mycology

0 0 2 1

Course Objectives: The student will be able to learn the isolation and identification of medically important fungi and their detection in samples. They will also learn the cultivation and identification of opportunistic fungi.

1. KOH mount of skin and nail samples.
2. LPCB examination of fungi
3. Gram's staining of yeast
4. Cultivation and identification of dermatophytes
5. Isolation and Identification of *Aspergillus*

6. Isolation and Identification of *Mucor*
7. Isolation and Identification of *Rhizopus*
8. Isolation and Identification of *Penicillium*.
9. Germ tube test for *Candida*
10. Slide culture technique

Total Hours: 30 Lab Hours

Course outcomes (CO)

At the end of the course, learners will be able to:

CO1: Choose appropriate media for cultivation of fungi

CO2: Differentiate fungi based on morphological characters

CO3: Differentiate fungi based on growth characters

CO4: Differentiate *Candida albicans* based on Germ tube production

CO5: Decide appropriate technique for identification of fungi

21CBMB43

Introduction to Parasitology

3 0 0 3

Course Objective: The candidate will gain knowledge about the structure of protozoa and helminths; life-cycle patterns, pathogenesis, identification, and treatment.

UNIT I INTRODUCTION

9

Introduction to parasitology, Classification, Host – parasite relationship, Lab diagnosis of parasitic infections.

UNIT II PROTOZOLOGY

9

Pathogenic mechanism, transmission, life cycle, lab diagnosis of Protozoa – *Entamoeba*, *Giardia*, *Trichomonas*, *Balantidium*.

UNIT III HAEMOFLAGELLATES 9

Trypanosomes- *Leishmania*, *Trypanosoma* and Sporozoites-*Plasmodium*. Coccidia- *Toxoplasma*, *Cryptosporidium*.

UNIT IV HELMINTHS - CESTODES 9

Taenia solium and *T. saginata*, *Echinococcus*. Trematodes – *Fasciola hepatica*, *Fasciolopsis buski*, *Paragonimus*, *Schistosoma*.

UNIT V HELMINTHS - NEMATODES 9

Nematodes – *Ascaris*, *Ancylostoma*, *Trichinella*, *Trichuris*, *Strongyloides*, *Enterobius*, Filarial worms- *Wuchereria*, *Brugia*, *Loa Loa*, *Dracunculus*, *Onchocerca*; and other parasitic infections in immunocompromised hosts and AIDS associated parasites.

Total: 45 Lecture hours

Course outcomes (CO)

At the end of the course, learners will be able to:

CO1: Formulate protocol to detect and recover parasites from clinical specimen

CO2: Differentiate parasites based on morphological characters

CO3: Summarize the Pathogenesis, Clinical manifestation, Laboratory diagnosis and treatment of various protozoans

CO4: Summarize the Pathogenesis, Clinical manifestation, Laboratory diagnosis and treatment of various helminths

CO5: Summarize the interactions between the host and the parasite

TEXTBOOK:

Chatterjee; Medical Parasitology. CBS Publishers. 13th Edn 2019.

REFERENCE BOOKS:

1. D.R. Arora & B.R. Arora Medical Parasitology, CBS Publishers 5th Edn., 2018.
2. Subhas Chandra Parija, Medical Parasitology, 4th Edn., 2013.
3. Jayaram Panicker, Textbook of Parasitology, C.K. Jaypee Brothers, 8th Edn 2018.

4. Gerald D. Schmidt & Larry S. Roberts. Foundations of Parasitology, 6th Edn., 2008.

21PBMB42

Practical in Parasitology

0 0 4 2

Course objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to identify parasites based on morphology.

1. Examination of parasites in clinical specimens- Ova/ cyst in faeces by Lugol's iodine wet mount method.
2. Concentration methods for stool samples - Salt saturation methods.
3. Blood smear examination for malarial parasites.

4. Blood smear examination for microfilariae.

Total: 60 Lab Hours**Course outcomes (CO)**

At the end of the course, learners will be able to:

CO1: Formulate protocol to detect and recover parasites from clinical specimen

CO2: Differentiate protozoans based on morphological characters

CO3: Distinguish *Plasmodium* species

CO4: Differentiate helminths based on morphological characters

CO5: Identify parasites in blood smears

21CBMB51**Basics of Recombinant DNA Technology****3 0 0 3**

Course Objectives: The candidates will understand rDNA technology and strategies involved in genetic manipulations. The candidates will also gain knowledge on ethical issues involved in the system. Studying nanomicrobiology, the students will get necessary background information on nanotechnology in microbiological perspective and gain knowledge on nanoprocesses.

UNIT I:**INTRODUCTION****9**

An overview of Genetic engineering- Isolation & purification of DNA from cells. Restriction enzymes, DNA ligases, DNA modifying enzymes. Agarose gel electrophoresis and SDS – PAGE. Pulse field electrophoresis for large DNA

UNIT II: VECTORS 9

Characteristics of an ideal vector, cloning vectors – Plasmids, phages, Cosmids, Phagemids, Artificial chromosome vectors, Shuttle vectors; choice of vectors for *E. coli*, fungi, higher plants and mammalian cells.

UNIT III: GENE TRANSFER 9

Methods of gene transfer- Electroporation, transduction, and liposome mediated gene transfer. Direct transfer of DNA- Microinjection, particle bombardment. Screening of recombinants- Insertional inactivation and complementation, blue-white screening, immunodetection and radioactive probes.

UNIT IV: SELECTION OF RECOMBINANTS 9

Strategies for obtaining the clone of choice- Direct selection – selection from gene library. Construction of cDNA libraries. Uses of cloning in medicine, agriculture, forensic science and industries. Socio-economic ethics of cloning, GEO, GMF.

UNIT V: APPLICATIONS AND TECHNIQUES OF GENE CLONING 9

PCR – types and applications. Blotting techniques – Northern, Southern, Western blotting and its applications. DNA Sequencing. DNA Fingerprinting. Reporter gene assays.

Total Hours: 45 Lecture Hours

Course Outcomes:

At the end of the course, learners will be able to:

- CO1:** Create a manual for manipulation of nucleic acids.
- CO2:** Develop the methods on gene transfer and screening of recombinants.
- CO3:** Assess the characteristics of clone selection and ethical issues of cloning.
- CO4:** Evaluate about the hosts and vectors in gene cloning.
- CO5:** Evaluate the process, characters and applications of nanoparticles.

TEXTBOOK:

T.A. Brown, Gene Cloning and DNA Analysis- An Introduction, Blackwell Science Publishers.Ed.4; 2001.

REFERENCE BOOKS:

1. Old, R.S and Primrose SB, Principles of Gene manipulation: An Introduction to Genetic engineering , Blackwell Scientific publications.Ed.5;1995.
2. Glick B.R and Pasternak JJ, Molecular Biotechnology. ASM Press, Washington DC.1994.
3. Clover D.M , DNA cloning series (Vol I-IV); IRL Press, Oxford.1987.
4. Winnacker E L, From Genes to clones: Introduction to Gene technology; VCH Weinheim.1987.
5. Satyanarayana. U, Biotechnology; Uppala- Author Publishers Linkers.2005.
6. Tuan R.S , Recombinant Gene Expression Protocols; Humana Press.1997.

DISCIPLINE SPECIFIC ELECTIVES

21DBMB51 INTRODUCTION TO IMMUNOTECHNOLOGY 3 0 0 3

Course Objectives: The candidates will understand basic principles in immunology and immunological methods. The course will help the students to learn the concepts of immunoengineering of antigens and antibodies.

UNIT I ANTIGEN-ANTIBODY REACTIONS

9

Antigen-Antibody reactions- Precipitation reaction, Immunodiffusion methods-SRID, ODD. Agglutination reaction- Principle, types and application. Labeled immunoassays- Immunofluorescence assay, Radio immunoassay, ELISA. Immunoelectrophoresis- Rocket and Counter current electrophoresis.

UNIT II ANTIGENS AND IMMUNOGLOBULIN PURIFICATION TECHNIQUES 9

Preparation of antigens-bacterial, fungal, viral pathogens. Standardization and quantification of antigens. Raising of polyclonal antibodies in animals-different routes of inoculation-immunization protocol. Purification of immunoglobulin- Salting out, Chromatography techniques

UNIT III MOLECULAR ENGINEERING METHODS 9

Molecular engineering methods - Antigen engineering for better immunogenicity and use for vaccine development. Antibody engineering-Production of monoclonal antibodies-Hybridoma Technology and their applications.

UNIT IV SEPARATION OF IMMUNE CELLS 9

Separation of immune cells-T cells, B cells- E Rosette method, Nylon wool separation method, Panning, Immunomagnetic separation. Mononuclear cells from whole blood by density gradient centrifugation.

UNIT V IMMUNOHAEMATOLOGY 9

Immunohaematology-blood groups- methods of blood grouping- forward grouping and reverse grouping. Transfusion Reactions. Coombs test-direct and Indirect Coombs tests.

Total Hours: 45 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Write about the basic principles in immunology and immunological methods.

CO2: Analyze the preparation of antigens from pathogens

CO3: Apply molecular engineering methods to improve the specificities of immunology reactions.

CO4: Discuss the polyclonal, monoclonal and humanized antibodies

CO5: Analyze the principles of immune haematology methods

TEXTBOOK:

B. Annadurai, Textbooks of Immunology & Immunotechnology; Chand & Co., 2008.

REFERENCE BOOKS:

1. D.P. Stites, JD Stobo, H.H. Fudenberg, J.V. Wells, Basic and Clinical Immunology. Lange Medical Publications. Ed.8; 2006.
2. Pravash Sen. Gupta, 2003; Clinical Immunology; Oxford University Press.
3. Noel R. Rose, Herman Friedman, John L. Fahey, Manual of Clinical Laboratory Immunology. III edition; ASM. 1986.
4. Leslie Hudson and Frank C. Hay, Practical Immunology, Ed.3; Blackwell Scientific Publication. 1989.
5. Goding J.W., Monoclonal Antibodies: Principle and Practice; Academic Press. 2001.
6. Carl A. K. Borreback, Antibody Engineering, Ed.2; Oxford University Press. 1995.
7. Leonore A. Herzenberg, Donald M. Weir, Leonard A. Herzenberg, Caroline Blackwell, Weir's Handbook of Experimental Immunology, Vol. I – IV; Blackwell Science. 1996;
8. Stefan H.E. Kaufmann and Dieter Kabelitz, Immunology of Infection. Methods in Microbiology. Vol. 25; Academic Press. 1998.
9. Sringer, T.A, Hybridoma Technology in the Biosciences and Medicine; Plenum Press. New York. 2004.
10. Garrison Fathman. C., Fitch, F.W., Isolation, Characterization and Utilization of T lymphocyte clones; Academic Press. 2003.
11. G.P. Talwar and S.K. Gupta., A Handbook of Practical and Clinical Immunology, Vol. I-II; CBS Publishers & Distributors. Delhi. 1993.

21PBMB52 Practical in rDNA Technology and Immunotechnology

0 0 4 2

Course Objective: The candidate will study the basic principle behind recombinant DNA technique gain, and acquire adequate skill required to separate and observe chromosomal DNA in rDNA Technology and will gain hands-on knowledge and acquire adequate skill required to perform precipitation reactions, Immunoelectrophoresis, and purify immunoglobulins in immunotechnology.

1. Isolation of bacterial chromosomal DNA and demonstration.

2. Isolation of plasmid DNA and its demonstration by agarose gel electrophoresis.
3. Restriction analysis of DNA.
4. Competent cell preparation, Transformation and selection of clones.
5. Precipitation reactions in gels – SRID, ODD.
6. Immunoelectrophoresis - Rocket and counter current immunoelectrophoresis.
7. Preparation of lymphocytes from peripheral blood by density gradient centrifugation.

Total Hours: 60 Lab Hours

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Develop method for isolating genomic DNA and plasmid DNA
- CO2:** Appraise restriction analysis of DNA
- CO3:** Analyze the outcome of transformation.
- CO4:** Evaluate the Antigen-antibody interactions in gels.
- CO5:** Distinguish Lymphocytes and immunoglobulins from blood.

References

1. Molecular Cloning: A Laboratory Manual (*Fourth Edition*) - Michael R. Green, Joseph Sambrook, *Peter MacCallum* COLD SPRING HARBOR LABORATORY PRESS Cold Spring Harbor, New York.
2. Leslie Hudson and Frank C. Hay. Practical Immunology. Blackwell Scientific Publication. 3rd ed., 1989.

21DBMB52 Basic concepts of Biofertilizer Technology

3 0 0 3

Course Objectives: The candidates will understand the potentials of microbes as fertilizers, important microbes as biofertilizers and their beneficial impacts on the soil and agriculture.

UNIT I INTRODUCTION

9

General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

UNIT II AZOSPIRILLUM 9

Isolation and mass multiplication – carrier based inoculant, associative, effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

UNIT III CYANOBACTERIA AND AZOLLA 9

Cyanobacteria (blue green algae) *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

UNIT IV MYCORRIZA 9

Mycorrhizal association: Types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

UNIT V ORGANIC FARMING 9

Green manuring and organic fertilizers, Recycling of biodegradable, municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field application.

Total: 45 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Create a protocol for production of *Rhizobium* biofertilizer.

CO2: Create a protocol for production of *Azotobacter* biofertilizer.

CO3: Evaluate the application of nitrogen fixing biofertilizers.

CO4: Assess the quality of finished biofertilizers.

CO5: Decide the ecofriendly method for recycling and degradation of biodegradable waste.

TEXTBOOK:

P.C.Trivedi, Biofertilizers; Neha Publishers. 2008.

REFERENCE BOOKS:

- 1.Dubey, R.C., A Text book of Biotechnology S.Chand & Co, New Delhi.2005.
- 2.Kumaresan, V., Biotechnology, Saras Publications, New Delhi.2005.
- 3.John Jothi Prakash, E., Outlines of Plant Biotechnology. Emkay Publication, New Delhi.2004.
- 4.Sathe, T.V., Vermiculture and Organic Farming. Daya Publishers.2004.
- 5.Subba Rao, N.S. Soil Microbiology, Oxford & IBH Publishers, New Delhi.2000.
- 6.Vayas,S.C, Vayas, S. and Modi, H.A. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.1998.
7. H.C.Lakshmi, Biofertilizers & Biopesticides; Neha Publishers. 2014.

21DBMB52 Practical in Biofertilizer Technology**0 0 2 1**

Course Objectives: The candidate will gain hands-on knowledge and acquire adequate skill required to separate and observe chromosomal DNA, RNA, aminoacids, lipids as well as estimate nucleic acids.

1. Enumeration of soil bacteria by plate count method.
2. Isolation of Actinobacteria from soil.

3. Isolation of Phosphate Solubilizing Bacteria and Determination of Phosphate Solubilizing Index (SI).
4. Isolation and enumeration of *Azospirillum* from paddy.
5. Demonstration of mycorrhizal colonization by trypan blue staining.
6. Isolation of blue green algae (BGA) from soil.
7. Isolation of *Rhizobium* from root nodules.
8. Enrichment and isolation of *Azotobacter*.
9. Seed inoculation with *Rhizobium* biofertilizer.

Course Outcome

At the end of the course, learners will be able to:

CO1: Develop method for isolating Rhizobacteria

CO2: Appraise Soil microflora

CO3: Analyze Mycorrhizal interaction

CO4: Evaluate associative N₂ fixers

CO5: Distinguish N₂ fixers.

21DBMB53

Introduction to Biochemistry

3 0 0 3

Course Objectives: The candidate will gain knowledge about the structure, properties and functions of carbohydrates, proteins, lipids and nucleic acids. Basic biochemical techniques are also dealt with.

UNIT I

CARBOHYDATES

9

CO5: Gain the knowledge on different chromatographic method

TEXTBOOK:

J.L. Jain, Fundamentals of Biochemistry; Chand Publications. 2006.

REFERENCE BOOKS:

1. Harper's Biochemistry; Robert K. Murray Lance International Publication, 26th edition, 2005.
2. M.N. Chatterjee, Text Book of Medical Biochemistry; Jaypee Publication. 6th edition, 2006
3. U. Sathyanarayana, Biochemistry; Books and Allied (P) Ltd. 2006. 3rd edition

21PBMB51

DSE3: Basic Techniques in Biochemistry Lab

0 0 4 2

Course Objectives: The candidate will gain knowledge and skills required detecting carbohydrates, amino acids, and also estimating the amount on biomolecules in the given solutions.

1. Qualitative analysis of monosaccharides – Aldose.

2. Qualitative analysis of monosaccharides– Ketose.
3. Qualitative analysis of disaccharides.
4. Qualitative analysis of polysaccharides.
5. Qualitative analysis of aromatic amino acids.
6. Qualitative analysis of sulphur containing amino acids.
7. Qualitative analysis of basic amino acids.
8. Estimation of glycine by Sorrenson's Formol Titration.
9. Estimation of ascorbic acid by 2,3 DichlorophenolIndophenol.
10. Estimation of glucose by Ortho Toluidine Method.
11. Estimation of protein by Lowry's method.
12. Separation of amino acids by thin layer chromatography.

Total: 60Lab hours

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Analyze carbohydrates
- CO2:** Appraise amino acids
- CO3:** Evaluate glucose levels
- CO4:** Evaluate protein content
- CO5:** Distinguish amino acids.

21DBMB54

Basics of Fermentation Technology

3 0 0 3

Course Objectives: The candidates will understand the essentials of fermentation technology and be familiar with the various technologies and variables associated in the industrial application of microorganisms. The candidates will also have knowledge in the biological aspect of microbial utilization for production of metabolites.

UNIT I: INTRODUCTION TO FERMENTATION TECHNOLOGY 9

History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms – primary and secondary screening; Maintenance of Strains; Strain improvement.

UNIT II: FERMENTATION MEDIA 9

Natural and Synthetic media; Basic components of a media (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Role of buffers in media; Process of aeration, and agitation.

UNIT III: STERILIZATION 9

Sterilization-Types of sterilization, batch and continuous, Insitu and exsitu. Sterilisation of media. Sterilization kinetics – del factor, TDT, 12 D concepts

UNIT IV: FERMENTOR DESIGN 9

Basic designs of Fermentor; Type of fermentors: column, Packed tower and airlift fermenter; Scale up study and Product development; Down-stream processing and Product recovery; Regulation and safety.

UNIT V: PRODUCTION OF MICROBIAL PRODUCTS 9

Production of alcohol; Organic acid – Citric acid; Antibiotic – Penicillin, Amino acid – Glutamic acid; Vitamin – B1; Single Cell Protein (SCP).

Total Hours: 45 Lecture Hours

Course Outcomes:

At the end of the course, learners will be able to:

CO1: Develop the methods for screening of industrially important microbes.

CO2: Design the fermentation media for microbial growth.

CO3: Apply the knowledge on various sterilization methods.

CO4: Analyse the characteristics and design of various bioreactors.

CO5: Choose the process for products obtained using microbes.

Textbook:

1. Mukhopadhyay S., Process Biotechnology Fundamentals (2nd edn). 2004. Viva books Pvt Ltd.

Reference:

2. Stanbury PF, Whitaker A, Hall SJ, 1995; Principles of Fermentation Technology .Pergamon press.
3. Cruegar and Crueger, 1988; Biotechnology – Industrial Microbiology
4. Patel, AH, 2004; Industrial Microbiology. Mc. Millan pvt. Ltd.
5. Anton Moser, 1988; Bioprocess Technology – Kinetics and Reaction. Springer Verlag, New York.
6. El-Mansi, 2005; EMT. Fermentation Microbiology and Biotechnology. Taylor and Francis Publishers
7. Balasubramanian, D., Bryce CFA, Dharmalingam, K., green J., Kunthala Jayaraman, 2004; Concepts of Biotechnology .University press.

Course Objectives: The candidates will understand fermentation process and types of fermentations. They will also be familiar with knowledge about GMP and other regulatory principles as well as be able to solve the scale-up problem.

UNIT I INTRODUCTION 9

Brief history of fermentation; Fermentation- general concepts, Applications of fermentation; Range of fermentation process- Microbial biomass, enzymes, metabolites, recombinant products, transformation process; Component parts of a fermentation process..

UNIT II FERMENTATION PROCESS 9

Types of fermentations- Aerobic and anaerobic fermentation, Submerged and solid state fermentation; Factors affecting submerged and solid state fermentation; Substrates used in SSF and its advantages; Culture media- types, components and formulations. Sterilization: Batch and continuous sterilization.

UNIT III STERILIZATION 9

Sterilization-Types of sterilization, batch and continuous, In situ and ex situ. Sterilisation of media, bioreactor and accessories. Sterilisation kinetics – del factor, TDT, 12 D concepts, asepsis and containment – GMP, GILSP, HACCP, IPR, TRIPS, GATT.

UNIT IV SCALE UP PROCESS 9

Screening and selection of industrially important cultures. Inoculum development, strain development, scale up process and downstream processing.

UNIT V COMMERCIAL FERMENTATION PRODUCTS 9

Commercial fermentation products – enzymes – protease, amylase, lipase. Organic solvents – ethanol, butanol, Acids-Acetic acid and lactic acid, SCP-BGA, Vitamins – Vit. B12, Vit. C. Amino acids- glutamic acid and threonine. Non microbial products produced through microbes – Hormones – GH, IFN, TPA, B-cell growth factor.

Total Hours: 45 Lecture Hours

Course Outcome:

At the end of the course, learners will be able to:

CO1: Create knowledge about fermentation processes.

CO2: Choose the appropriate fermentations process needed.

CO3: Recommend the asepsis and containment protocols in fermentation industry

CO4: Design the scale-up in fermentations.

CO5: Demonstrate microbial products and the production.

Textbook:

1. Mukhopadhyay S., Process Biotechnology Fundamentals (2nd edn). 2004. Viva books Pvt Ltd.

Reference:

1. Stanbury PF, Whitaker A, Hall SJ, 1995; Principles of Fermentation Technology .Pergamon press.
2. Cruegar and Crueger, 1988; Biotechnology – Industrial Microbiology
3. Patel, AH, 2004; Industrial Microbiology. Mc. Millan pvt. Ltd.
4. Anton Moser, 1988; Bioprocess Technology – Kinetics and Reaction. Springer Verlag, New York.
5. El-Mansi, 2005; EMT. Fermentation Microbiology and Biotechnology. Taylor and Francis Publishers
6. Balasubramanian, D., Bryce CFA, Dharmalingam, K., green J., Kunthala Jayaraman, 2004; Concepts of Biotechnology .University press.

21DBMB62 INTRODUCTION TO MUSHROOM CULTIVATION TECHNOLOGY

3 1 0 4

Course Objectives: The candidate will gain knowledge and skills to identify edible and poisonous mushrooms and establish a mushroom cultivation enterprise. The students will be

able to access the experiences of experts and functioning mushroom farms which will help them to learn a means of self-employment and income generation.

UNIT I: INTRODUCTION TO MUSHROOMS 9

Mushrooms -Taxonomic rank -History and Scope of mushroom cultivation - Edible and Poisonous Mushrooms-Vegetative characters

UNIT II: MUSHROOM ECOLOGY 9

Based on occurrence- Epigynous & Hypogeous, Natural Habitats-Humicolous, Lignicolous & Coprophilous, Color of spores- white, yellow, pink, purple brown & black, Morphology- fruiting layers exposed to air, fruiting layers not exposed to air

UNIT III: MUSHROOM CULTIVATION 9

Structure and construction of mushroom house. Sterilization of substrates. Spawn production - culture media preparation- production of pure culture, mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation. Spawning, spawn running, cropping and harvesting, marketing . Cultivation of oyster and button mushroom.

UNIT IV: BENEFITS OF MUSHROOMS 9

Nutritional and medicinal values of mushrooms. Therapeutic aspects- antitumor effect, Antiviral value, antibacterial effect, antifungal effect.

UNIT V: POST HARVEST TECHNOLOGY 9

Preservation of mushrooms - freezing, dry freezing, drying, canning, quality assurance and entrepreneurship. Training/ Workshop/ Field visit (Any one per semester)

Total Hours: 45 Lecture Hours

Course Outcome:

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

CO 1: Design cultivation of different types of edible mushrooms and spawn production

CO2: Create self-employment and income generation

CO3: Compare different types of edible and non edible mushrooms.

CO4: Analyze knowledge on the nutritional benefits of edible mushrooms

CO5: Analyze the methods of commercialization of edible mushrooms

Text Book:

V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi (2000)

References

1. Marimuthu, T. et al. (1991). Oyster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
2. Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3. Pandey R.K, S. K Ghosh, 1996. A Handbook on Mushroom Cultivation. Emkey Publications.
4. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
6. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi.

Course Objectives: The candidate will gain knowledge about good laboratory practices and quality control of microbiological procedures. They will also be familiar with quality assurance protocols, GMP, GILSP and regulatory requirements.

UNIT I GOOD MICROBIOLOGICAL LABORATORY PRACTICES 9

Good microbiological laboratory practices – Determination of hazards and hazard groups, groups at risk of exposure and multiple exposure. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3. Discarding biohazardous waste – Methodology of Disinfection, Autoclaving and Incineration.

UNIT II MICROBIOLOGICAL METHODS 9

Quality control of Microbial techniques - Culture and microscopic methods - Standard plate count, Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Mannitol salt agar, EMB agar, MacConkey Agar, Sabouraud Agar, Biochemical and immunological methods, gel diffusion. sterility testing for pharmaceutical products.

UNIT III QUALITY ASSURANCE 9

Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centers. Molecular methods - Nucleic acid probes, PCR based detection, biosensors. Microbial quality of water and air – MPN method and air sampling. Total quality control – goals and requirements. Statistical quality control – charts, interpretation and significance.

UNIT IV GMP 9

Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations
Microbial Standards for Different Foods and Water – BIS and FSSAI standards for common foods and drinking water. GMP – guidelines, regulations and preambles, audit resources. Quality improvement plans – focusing on microsystems, understanding and implementing the improvement cycle. Quality control circles – roles, significance.

UNIT V GILSP 9

rDNA GILSP – microorganisms and cell cultures. Good Manufacturing and environmental safety for processes using genetically modified organisms. Good developmental principles – design of experiments and assumptions involving GMOs, key factors. Applications of GM – microbes, plants and animals. Governmental regulations involving GMOs.

Total Hours: 45 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: To formulate SOP for the use of Biosafety cabinets.

CO2: To create a manual for QC in microbiology.

CO3: To compile the data for National standards.

CO4: To write about GMOs.

CO5: To evaluate the GMP.

Text Book:

Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.

References:

1. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press
2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer
4. Abishek Chauhan and Tanu Jindal (2020). Microbiological Methods for Environment, Food and Pharmaceutical Analysis. Springer Publishers.
5. Philip, A.C. (2001). Reconceptualizing quality. New Age International Publishers, Bangalore.
6. Bhatia, R. and Ichhpujan, R.L. (2004). Quality assurance in Microbiology. CBS Publishers and Distributors, New Delhi.
7. Kher, C.P. (2000). Quality control for the food industry. ITC Publishers, Geneva. 2000.

21PBMB61 DSE8: Practical in Microbial Quality Control and Analysis in Applied Microbiology **0 0 2 1**

Course Objective: The candidate will gain knowledge of sterility and quality control in microbiology.

1. MPN method for water.
2. Sterility control of autoclaves.
3. Detection of Bacterial sterility for sterile water for injection.
4. Detection of Fungal sterility of sterile water for injection.
5. Quality control of Microbiological media.
6. Quality control of Gram's Staining.

Total hours: 30

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Develop method for QC for media
- CO2:** Appraise Sterility
- CO3:** Develop method for QC for staining
- CO4:** Evaluate sterile water
- CO5:** Estimate coliforms.

electrophoresis-western blotting. Electrophoresis of Nucleic acids-Agarose gel- Pulse-field gel and Capillary electrophoresis. Chromatographic techniques- principles-materials and applications. Column-TLC-Low pressure column chromatography-HPLC- Adsorption- Partition and affinity chromatography-GLC.

Total:60 Lecture Hours

Course outcomes (CO)

At the end of the course, learners will be able to:

CO 1: Formulate hypothesis for conduct of research

CO 2: Design experiments for conduct of research

CO 3: Develop new techniques for conduct of research

CO 4: Prepare protocols for experiments

CO 5: Choose appropriate technique for proper conduct of research

TEXTBOOK:

Kothari CR; Research Methodology; NewAge International Publishers, NewDelhi. 2ndEdition; 2005.

REFERENCE BOOKS:

1. KeithWilsonandJohnWalker;PracticalBiochemistry-principles and techniques, CambridgeUniversity Press. 5thEdition, 2003.
2. JohnG.Webster;Bioinstrumentation.StudentEdition,JohnWileyandSonsLtd.2004.
3. Palanivel, P; Analytical Biochemistry and Separation Techniques- A laboratory manual, 2ndEdition. 2001.
4. Asokan P; Analytical Biochemistry (Biochemical Techniques), 2001.
- 5.GurumaniN;ResearchMethodologyforBiologicalsciences,MJPpublishers,Chennai.200
6. WayneWDaniel;Biostatistics-Afoundationforanalysisinthehealthsciences.7thEdition, John Wiley and Sons Ltd. 2000.

At the end of the course, learners will be able to:

CO1: To formulate the principle and working of various laboratory equipment and can able to use them with theoretical knowledge.

CO2: To create the theory, principles and applications of different chromatographic techniques like paper, thin layer, gel filtration, ion exchange, affinity, gas liquid, high pressure/ performance liquid chromatography (HPLC)

CO3: To construct the different techniques of gel electrophoresis where they can separate DNA, proteins and compounds.

CO4: To evaluate the usage of spectroscopic techniques with UV, Visible, IR, NMR, Fluorescence, Atomic Absorption, Mass, Raman Spectroscopy.

CO5: : To estimate the principle & will have a wide knowledge to use the radioisotopes in life sciences and radioactive labeling.

TEXTBOOK:

Chatwal And Anand, S. ; Instrumental Methods of Chemical Analysis. Himalaya Publishing House, Mumbai. 1989.

REFERENCE BOOKS:

1. H.H. Willard, L.L. Merritt Jr. ; Instrumental Methods of Analysis. CBS Publishers and Distributors. 6th Edition, 1986.
2. Williams, B.L. and Wilson, K.; A Biologists Guide to Principles and Techniques of Practical Biochemistry. Wiley. 2000.
3. B.B. Straughan and S. Walker.; Spectroscopy. Volume 1. Chapman and Hall Ltd. 1999.
4. James Miller. Chromatography: Concepts and Contrasts; John Wiley and Sons. Inc., New York. 1988.
6. R. J. Hamilton and P. A. Sewell. Introduction To High Performance Liquid Chromatography, Chand Co. 2010.
7. Gordon M. Message, Practical aspects of Gas Chromatography and Mass Spectrometry; John Wiley and Sons, New York. 1984.
8. Tibor Kremmery. Gel Chromatography. Wiley Publications. 2000.
9. C.C. Thorburn, Isotopes and radiations in Biology, Butterworth and Co. Ltd., London. 1999.

21PBMBXX**Bioinstrumentation (Practical)****0 0 4 2**

Course Objectives: The candidate will gain knowledge and skills required to separate amino acids, serum, haemoglobin.

1. Separation of amino acids by Paper Chromatography.
2. Separation of amino acids by TLC.
3. Separation of serum protein by horizontal submerged gel electrophoresis.
4. Study of UV absorption spectra of macromolecules - protein, nucleic acid.
5. Demonstration of PCR.
6. Separation of haemoglobin or blue dextran by gel filtration.
7. Paper electrophoresis.
8. Demonstration of Fermenter.
9. Determination of pH of various solutions.

Total: 60 Lab hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Develop chromatograms

CO2: Appraise amino acids based on chromatography

CO3: Analyze the quality of DNA

CO4: Evaluate biomolecules using UV spectrophotometer

CO5: Estimate pH of solutions.

21DBMBXX**Basic Bioinformatics****4 0 0 4**

Course Objectives: The candidate will gain knowledge about the computerization of biological information – data analysis and retrieval systems: NCBI, DDBJJan, EMBL, SGD, TIGR and ACeDB.

UNIT I COMPUTER, LANGUAGE, DEVICES 12

Computer and Programming Languages. Introduction to Computers: Introduction – Types of Computers – Characteristics of Computers. Generations of Computers - Classification of Computers – Programming Languages: Machine Language – Assembly Language – High level languages. Input Devices- Keyboard – Mouse - Types of mice – Connections – Mouse Pad - Trackball – Joystick - Output Devices – Dot Matrix Printer – Inkjet – Laser Printer – LCD and LED Printers– Line Printer Auxiliary Storage Devices : Hard Disk – CD –DVD
– primary memory

UNIT II BIOINFORMATICS 12

Bioinformatics - Definition, History, Scope and Applications. Opportunities in Bioinformatics. Emerging areas of Bioinformatics

UNIT III MOLECULAR BIOLOGY 12

Introduction to Molecular Biology and genetics. Central dogma of life: DNA – RNA - Protein. Role of Bioinformatics in Human Genome Project

UNIT IV NUCLEIC ACID DATABASES 12

Biological databases, Importance of databases, Nucleic acid sequence databases (NCBI, DDBJJan, EMBL). Protein databases (primary, secondary and composite)

UNIT V PROTEIN DATABASES 12

Specialized genome databases (SGD, TIGR and ACeDB) and Structure databases (CATH, SCOP and PDBsum)

Total: 60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Basic understanding of Computers & programming languages

CO2: Grasp the information on input & output devices of a computer

CO3: Gain basic knowledge on Bioinformatics

CO4: Obtain knowledge on biomolecules

CO5: Obtaining in-depth information on biological databases and assimilate knowledge on genome and structure database

TEXTBOOK:

S. Ignacimuthu; Basic Bioinformatics; Narosa Publishing House. 2005.

REFERENCE BOOKS:

1. K. Mani and Vijayaraj; Bioinformatics for Beginners; Kalaikathir Achagam. 2002.

Irfan Ali Khan, Atiya Khanum; Fundamentals of Bioinformatics; Ukaaz publications. 2003.

21PBMBXX**Practical Bioinformatics****0 0 4 2**

Course Objectives: The candidate will gain knowledge and skills required to compare, retrieve and gain accurate 3D structure predictions using various softwares.

1. Handling of computer and listing specifications and characteristics of all parts of computer system available in the laboratory
2. Learning the intranet system in the laboratory and getting its characteristics.
3. Retrieval of the sequence information from NCBI.
4. Retrieve the sequence information and file format of Nucleotide using EMBL.
5. Accessing the information of Nucleotide sequence using DDBJ
6. Protein sequence information using Swissprot.
7. Secondary information of a protein using SCOP
8. Motif analysis of a protein sequence using Motif search
9. Analysis - the family of protein sequence using Pfam.
10. 3D structure of protein from PDB

Total: 60 hours

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Develop computing skills
- CO2:** Appraise protein sequence
- CO3:** Develop proficiency for sequence analysis
- CO4:** Evaluate protein structure
- CO5:** Analyze proteins using online tools.

21DBMBXX**Introduction to Environmental Biotechnology****4 0 0 4**

Course Objectives: The candidates will understand microbial interactions with environment and their association with diseases. The students will also appreciate the role of microbes in waste treatment and biodeterioration.

UNIT I MICROBIAL ECOLOGY 12

Concepts of microbial ecology: Relationship between microorganism and different environments land, water and air. Microorganisms inhabiting extreme environments. Microbiology of air – organisms in air, distribution and sources. Droplet nuclei, aerosol, assessment of air quality, solid – liquid – impingement methods. Brief account of air borne transmission of harmful microbes.

UNIT II AQUATIC ECOSYSTEMS 12

Types of aquatic ecosystems: fresh water – ponds, lakes, streams. Marine habitats – estuaries, mangroves, deepsea, hydrothermal vents, salt pans, coral reefs. Zonations – upwelling – eutrophication – food chain. Potability of water – microbial assessment of water quality – water purification – brief account of water – borne diseases.

UNIT III SOLID AND LIQUID WASTES 12

Types of wastes – characterization of solid and liquid wastes. Solid waste treatment – saccharification – gasification – composting, Utilization of solid wastes – food (SCP, mushroom, yeast); fuel (ethanol, methane, hydrogen); fertilizers

UNIT IV LIQUID WASTE TREATMENT 12

Liquid waste treatment. Treatment methods – primary –secondary (anaerobic – methanogenesis; aerobic- tricking activated sludge – oxidation pond – tertiary treatment. Utilization of liquid wastes – food (SCP, Yeast) – fuel (methane), fertilizers

UNIT V BIODETERIORATION 12

Biodeterioration: Deterioration of paper, leather, wood, textiles, metal corrosion, mode of deterioration, organisms involved, its disadvantages and mode of prevention.

Total: 60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Develop the information about the role of microbes in environments.

CO2: Point out the microorganism inhabiting extreme environments.

CO3: Compose knowledge on aquatic ecosystems and Water borne diseases

CO4: Design different methods on solid and liquid waste treatment,

CO5: Apply information on Biodeterioration.

TEXTBOOK:

Pradipta Kumar Mohapatra; TEXTBOOKS of Environmental Biotechnology; I.K.International. 2007.

REFERENCE BOOKS:

1. Baker, W.C. and Herson, D.S.1994. Bioremediations – McGraw Hill Inc., New York
2. W.Nybakken, 1982. Marine Biology – An Ecological Approach. Ames Harper and Row Publisher, New York.
3. K.C.Marshall, 1985. Advances in Microbial Ecology. Vol-8. Plenum press.
4. Burns, R.C. and Slater, J.H. 1982. Experimental Microbial Ecology – Blackwell Scientific Publications, Oxford, London.
5. Gareth M. Evans, Judith C. Furlong; Environmental Biotechnology: Theory and Application, Wiley. 2ed. 2010.

21DBMBXX**Basic Biostatistics****4 0 0 4**

Course Objectives: The candidates will gain knowledge in the statistical approach of scientific methods. The students will develop analytical and problem solving skills in addition to the design of experiments.

UNIT I INTRODUCTION TO BIOSTATISTICS 12

Introduction to biostatistics – Definition, statistical methods, biological measurement, kinds of biological data, functions of statistics and limitation of statistics.

UNIT II DATA COLLECTION 12

Collection of data, sampling and sampling design, classification and tabulation, types of representations, graphic – bar diagrams, pie diagrams and curves.

UNIT III METHODS OF CORRELATION 12

Correlation – different types of correlation – positive, negative, simple, partial, multiple, linear and non linear correlation. Methods of studying correlations.

UNIT IV REGRESSION AND ITS TYPES 12

Regression, types and methods of analysis. Regression line, Regression equations, Deviation taken from arithmetic mean of X on Y, Deviation taken from the assumed mean.

UNIT V MEASURES OF DEVIATIONS 12

Measures of dispersion and variability, changes. Deviations – Quartile deviation, mean deviation, standard deviation, coefficient of variation, Lorenzen's curve.

Total: 60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

CO1: To formulate Basic understanding of Biostatistics.

CO2: To create and grasp the information on kinds of biological data and collection of data

CO3: To access and obtain knowledge on sampling, sampling design and in-depth information on Correlation

CO4: To Choose and assimilate knowledge on Regression its types and Deviations

CO5: To predict and gain the knowledge on graphic representations

TEXTBOOK:

Khan, Fundamentals of Biostatistics, Uhaaz Publications, 1994.

REFERENCE BOOKS:

1. Palanisamy. S. and Manoharan, M. Statistical methods for Biologists (Biostatistics).
Palani Paramount Publications, TamilNadu. 1994.
2. Arora, P.N. and Malhan, P.K. Biostatistics. Himalaya Publishing House, Mumbai. 1996.
3. Stanton. A.Clantz. Primer of Biostatistics – The McGraw Hill Inc. New York.1997.
4. Sokal and Rohlf. Introduction to Biostatistics – Toppan Co. Japan. 1973.
5. A. K. Vashisth. Encyclopedia of Biostatistics; Neha Publishers & Distributors. 2007.
6. Suresh Kumar, Satya veeri, Basic Biostatistics; Neha Publishers & Distributors. 2010.

21DBMBXX**Introduction to Microbial Metabolism****4 0 0 4**

Course Objectives: The candidates will understand the basic bioprocesses and the potentials of biomolecules in cell stability and survival. Students will gain knowledge on metabolic pathways of microbes with emphasis on prokaryotic photosynthesis.

UNIT I TYPES OF LINKAGES IN BIOMOLECULES 12

Types of Linkages in Biomolecules: configuration and forms of sugars, amino acids (biologically active forms) Glycolysis, HMP, TCA, ED pathways, Glyoxylate cycle

UNIT II MEMBRANE POTENTIAL 12

Membrane Potential – Generation, Maintenance, use: High energy Molecules- ATP/NTP, ATP synthesis ATP are substrate level phosphorylation, Reducing power – Generation and use Amino acid biosynthesis

UNIT III LIPID METABOLISM 12

Lipid metabolism – Beta oxidation, omega oxidation, phospholipids biosynthesis, Biosynthesis of purines & pyrimidines.

UNIT IV BIOSYNTHESIS AND FERMENTATION 12

Biosynthesis of CW of bacteria C1 metabolism – carbon dioxide, methane, methanol & methanolamine metabolism fermentation- Butyrate, lactate, propionate , Acetate, Formate, Mixed – Acid & Butanediol.

UNIT V PHOTOSYNTHESIS IN PROKARYOTE 12

Photosynthesis – Prokaryotes- purple bacteria, green bacteria, cyanobacteria, respiration - aerobic & anaerobic Assimilation & dissimilation of nitrate and sulphate: nitrogen fixation.

Total: 60 Lecture hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Discriminate and evaluate biomolecules based on their structure and linkages.

CO2: Compare the various pathways for carbohydrate breakdown.

CO3: Distinguish various types of lipid metabolism and nucleic acid biosynthesis.

CO4: Explain the processes of energy production in cells.

CO5: Discriminate metabolic pathways.

TEXTBOOK:

Albert G. Moat, John W. Foster, Michael P. Spector, *Microbial Physiology*, John Wiley & Sons. Ed. 4; 2006.

REFERENCE BOOKS:

1. David White, *The Physiology and Biochemistry of Prokaryotes*; Oxford University Press. 1995.
2. Michael T. Madigan, John M Martinko, *Brock's Biology of Microorganisms*, Pearson-Prentice Hall. Ed. 11; 2006.
3. Albert G. Moat, John W. Foster, Michael P. Spector, *Microbial Physiology*, John Wiley & Sons. Ed. 4; 2006.
4. Ronald M. Atlas, *Principles of Microbiology*, WCB Publishers. Ed. 2; 1997.
5. Alberts B. Dray, J Lewis, M Raff, K Roberts, JD Watson, *Molecular Biology of The Cell*, Garland Publishing. Ed. 3; 1994.
6. Neidhart FC, JL Ingraham, M Schaecter, *Physiology of the Bacterial Cell: A Molecular Approach*; Sinauer-Sunderland. 1990.
7. Dawes EA, IW Sutherland, 1992; *Microbial Physiology*, Ed. 2; Blackwell Scientific.
8. Gottschalk G, *Bacterial Metabolism*, Springer-Verlag. Ed. 2; 1996.
9. Kates M, D Kushner, AT Matthews, *The Biochemistry of Archaea*; Elseiver. 1993.
10. Topley & Wilson's: *Principles of Bacteriology, Virology, & Immunology*; Edward Arnold. Ed. 9; 2002.

21DBMBXX**Basic Marine Microbiology****4 0 0 4**

Course Objectives: The candidates will understand the ecological role of microbes in the marine environment, marine symbiosis. The paper also instills in students the influence of marine microbes in human health and the biosphere.

UNIT I**MICROBIAL ECOSYSTEMS****12**

Microbial communities in the aquatic environment, kinetics of microbial population, biofilms, microbial interactions – symbiosis, antagonism and commensalisms, biogeochemical cycles. Types of water ecosystem: fresh water (ponds, lakes, streams, springs) marine habitats: (estuaries, mangroove, deep sea etc.); zonation of water ecosystems; lacustrine and thermal; microbial composition of water. Assessment of water quality: physical, chemical and microbiological basis.

UNIT II**BIOLOGICAL POLLUTION****12**

Pollution – nature and types, their effects on living organisms. Water pollution microbial changes induced by inorganic and organic pollutants, industrial effluents and domestic sewage. Water-borne pathogens – faecal contamination; enteroviruses. Standards for various types of water, conventional wastes and their treatment – Biological pollution – algal blooms and their effect on fish production, biological and chemical control of algal bloom.

UNIT III MICROBIOLOGY OF FRESH WATER AND WASTEWATER 12

Microbiology of fresh water and wastewater (sewage), BOD, COD (definitions), Types of waste water, Characteristics of waste water, Analysis of wastewater (Physical, Chemical, biological), Effect of wastewater on environment, Monitoring bodies (small and large scale), Treatment of small and large scale wastewater: septic tank, sedimentation Activated sludge and trickling filter process and disposal of treated water. Important water borne human diseases and their prevention– cholera, typhoid, (name of pathogen, preventive measures).

UNIT IV**MICROBIOLOGY OF POTABLE WATER****12**

Microbiology of potable water: Definition of potable water, standards for potability, Municipal water purification process, Microorganisms as bio-indicators of fecal pollution,

routine analysis of water. Outlines of method for detection of microorganisms in drinking water (presumptive, confirmatory and completed tests). Distinction between fecal and non-fecal coliforms, IMVIC tests. Ecotoxicology - toxicants and toxicity - factors influencing toxicity, effects, acute, chronic, concentration response relationships, test organisms, toxicity testing bioconcentration - bioaccumulation - biomagnification - bioassay - biomonitoring.

UNIT V 12 **EUTROPHICATION**

Eutrophication: Definition, causes of eutrophication, and microbial changes in eutrophic bodies of water induced by various inorganic pollutants. Effects of eutrophication on the quality of water environment, factors influencing eutrophication. Qualitative characteristics and properties of eutrophic lakes. Algae in eutrophication, algal blooms, their effects and toxicity, coloured waters, red tides, and cultural eutrophication. Physico-chemical and biological measures to control eutrophication.

Total: 60 Lecture Hours

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Discriminate marine microflora.
- CO2:** Compare water treatment outcomes.
- CO3:** Distinguish inorganic and organic pollutants
- CO4:** Explain the role of Aquatic ecosystem
- CO5:** Explain the impact of algal bloom

TEXTBOOK:

Jeffery S Livinton; Marine Microbiology. Oxford university Press. 3rd ed., 2009.

REFERENCE BOOKS:

1. Rheinmer, G. Microbial Ecology of Brackish Water environment: Ecological Studies – Vol-25, Springer – Verlag Nerlin – Heidelberg New York. 1977.
2. William M., Lewis Jr. James. F. Saunders. David W. Crumpacker. Sr. and Charles Brebdecke., Ecologica Studies – Vol 46. Wiley Science. 1994.
3. Bernt Zeitzschel, Sebastian A. Gerlach The Biology of Indian Ocean. Ecological studies. Vol.III. Blackwell Scientific Publications, 1973.
4. W. Nybakken, Marine Biology – An Ecological Approach. Ames Harper and Row Publisher, New York. 1982.

5. K.C. Marshall, *Advances in Microbial Ecology*. Vol-8. Plenum press. 1985.
6. Burns, R.C. and Slater, J.H. *Experimental Microbial Ecology* – Blackwell Scientific Publications, Oxford, London. 1982.
7. Anand Kumar; *Ecology of Polluted Water* – Vol. II , Aph Pub. Co. New Delhi. 1990.
8. Colin Munn; *Marine Microbiology*; Taylor and Francis. 2011.

21UGGEXX GE1: Introduction and Scope of Microbiology (Theory) 2 0 0 2

Course Objectives: The candidates will understand the development of microbiology, diversity of microorganisms, Microscopy and other microbiological concepts.

UNIT I HISTORY OF DEVELOPMENT OF MICROBIOLOGY 6

Development of microbiology as a discipline, Spontaneous generation *vs.* Biogenesis. Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming. Role of microorganisms in fermentation, Germ theory of disease.

UNIT II DIVERSITY OF MICROORGANISMS 6

Systems of classification: Binomial nomenclature, Whittaker's five kingdoms and Carl Woese's three kingdom classification systems and their utility. General characteristics of different groups: Acellular microorganisms and Cellular microorganisms giving definitions and citing examples.

UNIT III MICROSCOPY 6

Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Transmission Electron Microscope, Scanning Electron Microscope.

Unit IV STERILIZATION 6

Moist Heat, Autoclave, Dry Heat, Hot Air Oven, Tyndallization, Filtration. Microorganisms as food (SCP), microorganisms in food fermentations (dairy and non dairy based fermented food products) and probiotics.

Unit V MICROBES IN HUMAN HEALTH AND ENVIRONMENT 6

Medical microbiology and immunology: List of important human diseases and their causative agents of various human systems. **Environmental microbiology:** Definitions and examples of important microbial interactions – mutualism, commensalism- parasitism

Total: 30hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Learn basics of microbiology

CO2: Learn about the significance of classification and features of microbes.

CO3: Able to suitably address the ways to view microbes and the role of fermentations in human activity.

CO4: Gain knowledge regarding control of microbes, uses and impact of microorganisms regarding food.

CO5: Comprehend the role of microorganisms in health and environment.

TEXTBOOK:

Ananthanarayanan. R & C. K. Jeyaram Panicker; Textbook of Microbiology, Orient Longman. 2010.

REFERENCE BOOKS:

1. Tortora GJ, Funke BR and Case CL., Microbiology: An Introduction; Pearson Education. 9th edition.,2008.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP., Brock Biology of Microorganisms. Pearson International Edition. 14th edition. 2014.
3. Cappucino J and Sherman N., Microbiology: A Laboratory Manual. Pearson Education Limited. 9th edition. 2010.
4. Wiley JM, Sherwood LM and Woolverton CJ. Prescott's Microbiology. McGrawHill International. 9th Edition. 2013.
5. Atlas RM., Principles of Microbiology. 2nd edition. W.M.T.Brown Publishers. 1997.
6. Pelczar MJ, Chan ECS and Krieg NR., Microbiology. McGraw Hill Book Company. 5th edition. 1993.
7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR., General Microbiology. McMillan. 5th edition. 2005.

21UGGEXX GE2: Industrial and Food Microbiology (Theory) 2002

Course Objectives: The candidates will understand the development of food microbiology, microbial fermentation processes, food preservation and food-borne diseases.

UNIT I INTRODUCTION 6

Brief history and developments in industrial microbiology. Types of fermentation processes

- solid state, liquid state, batch, fed-batch and continuous. Types of fermenters – laboratory, pilot-scale and production fermenters.

UNIT II MICROBIAL FERMENTATION PROCESSES 6

Ingredients used in fermentation medium - molasses, corn steep liquor, whey & Yeast extract. Downstream processing - filtration, centrifugation, cell disruption, solvent extraction. Microbial production of industrial products - citric acid, ethanol and penicillin. Industrial production and uses of the enzymes - amylases, proteases, lipases and cellulases

UNIT III FOOD AS A SUBSTRATE FOR MICROBIAL GROWTH 6

Intrinsic and extrinsic parameters that affect microbial growth in food. Microbial spoilage of food – seafoods, fruits and vegetables, milk, egg, bread and canned foods

UNIT IV METHODS OF FOOD PRESERVATION 6

Physical methods - high temperature, low temperature, irradiation, aseptic packaging

Chemical methods - salt, sugar, benzoates, citric acid, ethylene oxide, nitrate and nitrite.

Food sanitation and control – HACCP

UNIT V DAIRY PRODUCTS, PROBIOTICS AND FOOD-BORNE DISEASES 6

Fermented dairy products - yogurt, acidophilus milk, kefir, dahi and cheese. Probiotics definition, examples and benefits Food intoxication by *Clostridium botulinum* and *Staphylococcus aureus*, Food infection by *Salmonella* and *E.coli*.

**Total: 30
hours**

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Explain the importance of microbes in the production of many useful products
- CO2:** Explain fermenters and fermentation processes.
- CO3:** Discuss downstream processing and industrial production of various products.
- CO4:** Relate foods and microbes and its impact on human health
- CO5:** Summarize the microbial production of foods and food sanitation

TEXTBOOK:

Frazier WC and Westhoff DC., Food Microbiology. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India. 3rd edition. 1992.

REFERENCE BOOKS:

1. Crueger W and Crueger A., Biotechnology: A TEXTBOOKS of Industrial Microbiology. Panima Publishing Company, New Delhi. 2nd Edition. 2000.
2. Patel AH., Industrial Microbiology . MacMillan India Limited Publishing Company Ltd. New Delhi, India. 1996.
3. Tortora GJ, Funke BR, and Case CL., Microbiology: An introduction. Pearson Education. 9th Edition. 2008.
4. Willey JM, Sherwood LM AND Woolverton CJ, Prescott, Harley and Klein's Microbiology. McGraw Hill Higher education. 9th Edition. 2013.
5. Casida LE., Industrial Microbiology. Wiley Eastern Limited. 1991.
6. Stanbury PF, Whitaker A and Hall SJ., Principles of Fermentation Technology. Elsevier Science Ltd. 2nd edition, 2006.
7. Adams MR and Moss MO., Food Microbiology; New Age International (P) Limited Publishers, New Delhi, India. . 4th edition, 1995.
8. Banwart JM. Basic Food Microbiology. CBS Publishers and Distributors, Delhi, India. 1987.
9. Jay JM, Loessner MJ and Golden DA., Modern Food Microbiology. CBS Publishers and Distributors, Delhi, India. 7th edition, 2005.

21UGGEXX**GE3: Microbes in Environment (Theory)****2002**

Course Objectives: The candidates will understand the microorganisms and their habitats, microbial interactions, biogeochemical cycling and waste management.

UNIT I MICROORGANISMS AND THEIR HABITATS 6

Structure and function of ecosystems. Terrestrial Environment: Soil profile and soil microflora. Aquatic Environment: Microflora of fresh water and marine habitats
Atmosphere: Aeromicroflora and dispersal of microbes.

UNIT II MICROBIAL INTERACTIONS 6

Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbe-Plant interaction: Symbiotic and non symbiotic interactions. Microbe-animal interaction: Microbes in ruminants, nematophagous fungi and symbiotic luminescent bacteria.

UNIT III BIOGEOCHEMICAL CYCLING 6

Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin
Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction. Phosphorus cycle: Phosphate immobilization and solubilisation
Sulphur cycle: Microbes involved in sulphur cycle. Other elemental cycles: Iron and manganese.

UNIT IV WASTE MANAGEMENT 6

Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill). Liquid waste management: Composition and strength of sewage (BOD and COD).

UNIT V MICROBIAL BIOREMEDIATION 6

Principles and degradation of common pesticides, hydrocarbons (oil spills). Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests.

Total: 30 hours

Course Outcome

At the end of the course, learners will be able to:

CO1: To formulate and learn about the structure and functions of ecosystem and role of microbes in the environment.

CO2: To create and obtain knowledge about microbial interactions – symbiosis, antagonism, synergism, commensalism, amensalism, parasitism, and predation.

CO3: To construct the importance of biogeochemical cycling in the ecosystems.

CO4: To evaluate the knowledge on microbiological aspects and management of waste water.

CO5: To estimate about the microbial bioremediation of pesticides, hydrocarbons, oil spills

TEXTBOOK:

Pradipta.K.M., TEXTBOOK of Environmental Microbiology; I.K.Publishing House; 2008.

REFERENCE BOOKS:

1. Atlas RM and Bartha R. Microbial Ecology: Fundamentals & Applications. Benjamin/Cummings Science Publishing, USA. 4th edition. 2000.
2. Madigan MT, Martinko JM and Parker J. Brock Biology of Microorganisms. Pearson/ Benjamin Cummings. 14th edition. 2014.
3. Maier RM, Pepper IL and Gerba CP., Environmental Microbiology. Academic Press. 2nd edition, 2009.
4. Okafor, N, Environmental Microbiology of Aquatic & Waste systems. Springer, New York. 2011.
5. Singh A, Kuhad, RC & Ward OP, Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg. 2009.
6. Barton LL & Northup DE, Microbial Ecology. Wiley Blackwell, USA2011.

21UGGEXX GE4: Genetic Engineering and Biotechnology (Theory) 2002

Course Objectives: The candidates will understand the development of genetic engineering, vectors, DNA amplification and DNA sequencing, application of genetic engineering and biotechnology.

UNIT I INTRODUCTION TO GENETIC ENGINEERING 6

Milestones in genetic engineering and biotechnology. Restriction modification systems: Mode of action, applications of Type II restriction enzymes in genetic engineering. DNA modifying enzymes and their applications: DNA polymerases.

UNIT II VECTORS 6

Cloning Vectors: Definition and Properties - Plasmid vectors: pBR and pUC series Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs. Expression vectors: *E.coli* lac and T7 promoter-based vectors, yeast YIp, YEp and YCp vectors, Baculovirus based vectors, mammalian SV40-based expression vectors.

UNIT III DNA AMPLIFICATION AND DNA SEQUENCING 6

PCR: Basics of PCR, RT-PCR, Real-Time PCR, Genomic and cDNA libraries: Preparation and uses, Genome sequencing - Sanger's method of DNA Sequencing: traditional and automated sequencing

UNIT IV APPLICATION OF GENETIC ENGINEERING 8

Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery, *Agrobacterium* - mediated delivery. Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal, flavo savo tomato, Gene therapy, recombinant vaccine, protein engineering

UNIT V INTELLECTUAL PROPERTY RIGHTS 4

Patents, Copyrights, Trademarks.

Total: 30hours

Course Outcome

At the end of the course, learners will be able to:

- CO1:** Write about the genetic engineering and enzymology.
- CO2:** Construct the cloning vectors used in genetic engineering.
- CO3:** Analyse DNA amplification and sequencing methods.
- CO4:** Explain gene transfer methods in genetic engineering.
- CO5:** Interpret the intellectual property rights, patent, copyrights and Trademarks.

TEXTBOOK:

Primrose SB and Twyman RM. Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K. 2008.

REFERENCE BOOKS:

1. Brown TA., Gene Cloning and DNA Analysis Blackwell Publishing, Oxford, U.K. 6th edition. 2010.
2. Clark DP and Pasternik NJ. Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA. 2009.
3. Primrose SB and Twyman RM., Principles of Gene Manipulation and Genomics, Blackwell Publishing, Oxford, U.K. 7th edition. 2006.
4. Brown TA., Genomes-3. Garland Science Publishers. 2007.

21UGGEXX GE5: Microbial Genetics and Molecular Biology (Theory) 2 0 0 2

Course Objectives: The candidates will understand the structures of DNA and RNA, replication of DNA and transcription, translation, gene regulation, mutations and genetic exchange.

UNIT I STRUCTURES OF DNA AND RNA 6

DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, topoisomerases; Organization of DNA Prokaryotes, Viruses, Eukaryotes. RNA Structure.

UNIT II REPLICATION OF DNA AND TRANSCRIPTION 6

Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication. Mechanism of DNA replication: Enzymes and proteins involved in DNA replication – DNA polymerases, DNA ligase, primase, telomerase. Transcription: Definition, promoter - concept and strength of promoter.

UNIT III TRANSLATION AND GENE REGULATION 6

Genetic code, Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides.

UNIT IV MUTATIONS AND GENETIC EXCHANGE 6

Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens; Uses of mutations, DNA repair mechanisms. Transformation - Discovery, mechanism of natural competence. Conjugation - Discovery, mechanism, Hfr and F' strains. Transduction - Generalized transduction, specialized transduction.

UNIT V PLASMIDS AND TRANSPOSABLE ELEMENTS 6

Property and function of plasmids, Types of plasmids. Prokaryotic transposable elements – Insertion. Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Uses of transposons and transposition.

Total: 30hours

Course Outcome

At the end of the course, learners will be able to:

CO1: Attain knowledge about the structure of Nucleic acid.

CO2: Know about the mechanism of DNA replication, transcription and translation processes in organisms.

CO3: Gain knowledge in the mechanisms of gene expression and its regulations in organisms.

CO4: Achieve knowledge about the mutations and DNA repair mechanisms in organisms.

CO5: Realize knowledge about the transposable elements, types of plasmids and its applications.

TEXTBOOK:

Russell PJ. Genetics- A Molecular Approach. Benjamin Cummings. 3rd Ed, 2009.

REFERENCE BOOKS:

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R, Molecular Biology of the Gene, Cold Spring Harbour Lab. Press, Pearson Publication. 6th edition, 2008.
2. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP, The World of the Cell, Pearson Benjamin Cummings Publishing, San Francisco. 7th edition, 2009.
3. De Robertis EDP and De Robertis EMF Cell and Molecular Biology, Lippincott Williams and Wilkins, Philadelphia. 8th edition, 2006.
4. Karp G, Cell and Molecular Biology: Concepts and Experiments, John Wiley & Sons. Inc. 6th edition, 2010.
5. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, Jones and Bartlett Learning
6. Gardner EJ, Simmons MJ, Snustad DP, Principles of Genetics. 8th Ed. Wiley-India. 3rd Ed., 2008.
7. Klug WS, Cummings MR, Spencer, C, Palladino, M, Concepts of Genetics, Benjamin Cummings. 10th Ed., 2011.

SKILL ENHANCEMENT COURSES (SEC)**SEC1: NSS-I**

UNIT - 01: INTRODUCTION AND BASIC CONCEPTS OF NSS	4
a) History, philosophy, aims & objectives of NSS	
b) Emblem, flag, motto, song, badge etc.	
c) Organizational structure, roles and responsibilities of various NSS functionaries	
UNIT — 02: NSS PROGRAMMES AND ACTIVITIES	10
a) Concept of Regular activities, special camping, Day Camps	
b) Basis of adoption of village/slums, Methodology of conducting Survey	
c) Financial pattern of the scheme	
d) Other youth prog./schemes of GOI	
e) Coordination with different agencies	
f) Maintenance of the Diary	
UNIT — 03: UNDERSTANDING YOUTH	5
a) Definition, profile of youth, categories of youth	
b) Issues, challenges and opportunities for youth	
c) Youth as an agent of social change	
UNIT - 04: COMMUNITY MOBILISATION	9
a) Mapping of community stakeholders	
b) Designing the message in the context of the problem and the culture of the community	
c) Identifying methods of mobilization	
d) Youth-adult partnership	
UNIT - 05: VOLUNTEERISM AND SHRAMDAN	7
a) Indian Tradition of volunteerism	
b) Needs & importance of volunteerism	
c) Motivation and Constraints of Volunteerism	
d) Shramdan as a part of volunteerism	

SEC2: NSS-II

UNIT — 01: IMPORTANCE AND ROLE OF YOUTH LEADERSHIP	6
a) Meaning and types of leadership	
b) Qualities of good leaders; traits of leadership	
c) Importance and role of youth leadership	
UNIT - 02: LIFE COMPETENCIES	11
a) definition and importance of life competencies	
b) Communication	
c) Inter Personal	
d) Problem-solving and decision-making	
UNIT - 03: SOCIAL HARMONY AND NATIONAL INTEGRATION	9
a) Indian history and culture	
b) Role of youth in peace-building and conflict resolution	
c) Role of youth in Nation building	
UNIT — 04: YOUTH DEVELOPMENT PROGRAMMES IN INDIA	9
a) National Youth Policy	
b) Youth development programmes at the National Level, State Level and voluntary sector	
c) Youth-focused and Youth-led organisations	

SEC3: NSS-III**UNIT - 01: CITIZENSHIP****7**

- a) Basic Features of Constitution of India
- b) Fundamental Rights and Duties Human Rights
- c) Consumer awareness and the legal rights of the consumer
- d) RTI

UNIT - 02 : FAMILY AND SOCIETY**6**

- a) Concept of family, community, (PRIs and other community-based organisations) and society
- b) Growing up in the family — dynamics and impact
- c) Human values
- d) Gender justice

UNIT – 03: HEALTH, HYGIENE & SANITATION**7**

- a) Definition, needs and scope of health education
- b) Food and Nutrition
- c) Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan)
- d) National Health Programme
- e) Reproductive health

UNIT - 04: YOUTH HEALTH**6**

- a) Healthy Lifestyles
- b) HIV AIDS, Drugs and Substance abuse
- c) Home Nursing
- d) First Aid

UNIT - 05: YOUTH AND YOGA**9**

- a) History, philosophy and concept of Yoga
- b) Myths and misconceptions about yoga
- c) Different Yoga traditions and their Impacts
- d) Yoga as a preventive, promotive, and curative method
- e) Yoga as a tool for healthy lifestyle

SEC4: NSS-IV

UNIT — 01: ENVIRONMENT ISSUES	11
a. Environment conservation, enrichment and Sustainability	
b. Climate change	
c. Waste management	
d. Natural resources management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation)	
UNIT -02: DISASTER MANAGEMENT	7
a. Introduction to Disaster Management, classification of disasters	
b. Role of youth in Disaster Management	
UNIT-03: PROJECT CYCLE MANAGEMENT	10
a) Project planning	
b) Project implementation	
c) Project monitoring	
d) Project evaluation: Impact assessment	
UNIT - 04: DOCUMENTATION AND REPORTING	7
a) Collection and analysis of data	
b) Preparation of documents/ reports	
c) Dissemination of documents/ reports	

SEC5: NSS-V**Unit - 1: Vocational Skill Development****20**

This unit aims to enhance the employment potential of the NSS volunteers or, alternately, to help them to set up small business enterprises. For this purpose, a list of 12 to 15 vocational skills will be drawn up, based on the local conditions and opportunities. Each volunteer will have the option to select skill-areas out of this list - one such skill in each semester. The education institution (or the university) will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.

Unit - 02: Entrepreneurship Development**8**

- a) Definition & Meaning
- b) Qualities of good entrepreneur
- c) Steps/ways in opening an enterprise
- d) Role of financial and support service Institutions

Unit - 03: Youth and crime**7**

- a) Sociological and Psychological Factors influencing Youth Crime
- b) Peer Mentoring in preventing crimes
- c) Awareness about Anti-Ragging
- d) Cyber Crime and its Prevention
- e) Juvenile justice

SEC6: NSS VI**UNIT - 1: VOCATIONAL SKILL DEVELOPMENT 20**

This Unit will aim to enhance the employment potential of the NSS volunteers or, alternately, to help them to set up small business enterprises. For this purpose, a list of 12 to 15 vocational skills will be drawn up, based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list - one such skill in each semester. The education institution (or the university) will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.

UNIT - 02: CIVIL/SELF DEFENSE 5

- a) Civil defense services, aims and Objectives of civil defense
- b) Needs for Self-defense training

UNIT-03: RESOURCE MOBILISATION 3

- a) Writing a Project Proposal
- b) Establishment of SFUs

UNIT-04: ADDITIONAL LIFE SKILLS 7

- a) Positive Thinking
- b) Self Confidence and Self Esteem
- c) Setting Life Goals and working to achieve them
- d) Management of Stress including Time Management

21SEEDXX**SEC7: Personality Development****2002**

Course Objective: To Make Aware About The Importance Of Personality And Development In The Business World. To Make The Students Follow The Good Personality And Create A Good Relationship With Others.

UNIT I PERSONALITY DEVELOPMENT-INTRODUCTION 6

The Concept Personality - Dimensions of Personality - Term Personality Development - Significance. The Concept of Success And Failure What Is Success? - Hurdles In Achieving Success - Overcoming Hurdles - Factors Responsible For Success – What Is Failure - Causes Of Failure - Do's And Don'ts Regarding Success And Failure.

UNIT II ATTITUDES AND VALUES 6

Attitude - Concept - Significance - Factors Affecting Attitudes - Positive Attitude - Advantages -Negative Attitude - Disadvantages - Ways To Develop Positive Attitude – Difference between Personalities Having Positive And Negative Attitude.

UNIT III MOTIVATION 6

Concept Of Motivation - Significance - Internal And External Motives - Importance Of Self- Motivation- Factors Leading To Demotivation -Theories To Motivation

UNIT IV SELF ESTEEM AND SMART 6

Term Self-Esteem - Symptoms - Advantages - Do's And Don'ts To Develop Positive Self-Esteem – Low Self-Esteem - Symptoms - Personality Having Low Self Esteem - Positive And Negative Self-Esteem. Interpersonal Relationships - Teaming - Developing Positive Personality - Analysis of Strengths and Weaknesses. Concept of Goal-Setting - Importance of Goals - Dream Vs Goal - Why Goal-Setting Fails? – Smart (Specific, Measurable, Achievable, Realistic, Time-Bound) Goals - Art of Prioritization - Do's And Don'ts About goals.

UNIT V BODY LANGUAGE, STRESS MANAGEMENT**6**

Body Language - Assertiveness - Problem-Solving - Conflict And Stress Management - Decision-Making Skills - Positive And Creative Thinking - Leadership And Qualities Of A Successful Leader - Character-Building - Team-Work - Lateral Thinking - Time. Management - Work Ethics – Management Of Change - Good Manners And Etiquettes (Concept, Significance And Skills To Achieve Should Be Studied.)

Topics Prescribed For Workshop/Skill Lab: 12

- A) Group Discussion
- B) Presentation Skill
- C) Problem-Solving
- D) Decision-Making
- E) Creativity
- F) Leadership
- G) Time Management
- H) Body Language

Total: 30hrs**Course Outcome**

At the end of the course, learners will be able to:

- CO1:** Realize importance of personality development.
- CO2:** Learn about the hurdles in achieving success
- CO3:** Understand the importance of failure.
- CO4:** Obtain information on positive and negative attitudes.
- CO5:** Understand the concept of motivation.

TEXT BOOKS:

1. Organisational Behaviour - S. P. Robbins - Prentice-Hall Of India Pvt. Ltd., New Delhi-15th edition, 2013
2. Communicate To Win - Richard Denny - Kogan Page India Private Limited, New Delhi-2009
3. Essentials Of Business Communication - Rajendra Pal And J. S. Korlhalli - Sultan Chand & Sons, New Delhi, 1st edition, 2012

REFERENCE BOOKS:

- 1) Business Communication - K. K. Sinha - Galgotia Publishing Company, New Delhi.-4th edition,2012
- 2) Media And Communication Management - C. S. Rayudu - Himalaya Publishing House,Bombay.2011
- 3) Business Communication - Dr. S.V. Kadvekar, Prin. Dr. C. N. Rawal And Prof. Ravindra Kothavade-Diamond Publications, Pune.2009
- 4) You Can Win - Shiv Khera - Macmillan India Limited.2012
- 5) Group Discussion And Public Speaking - K. Sankaran And Mahendra Kumar - M.I. Publications, Agra .2000
- 6) Basic Managerial Skills For All - Prentice-Hall Of India Pvt. Ltd., New Delhi-2011- E.H.mcgrath
- 7) 8 Habits - Stephen Covey-simon&schusker publisher-2007 edition.
- 8) Management Thoughts - Pramod Batra-HPB publisher-1st edition-2006
- 9) Produced By Prof. Rooshikumar Pandya - Creative Communication And Management Center, Bombay-R&E publisher kindle edition-2012. A) Assertive Training:Four Cassettes-hannah Richards-2012
B) Self Hypnosis For Goal Achievement: Four Cassettes-kindle edition-ryan cooper-2012

Course Objective:

This course is to subject the students to practise the components in various units.

To make students ready for placement interviews within campus.

To infuse confidence to face job situations.

	Credit Hours
UNIT I	06
<ul style="list-style-type: none">● Resume and CV Writing● Complaint Letter● Social Correspondence● Letter of Enquiry	
UNIT II	06
<ul style="list-style-type: none">● Short Essay Writing	
UNIT III	06
<ul style="list-style-type: none">● Explaining Proverbs	
UNIT IV	06
<ul style="list-style-type: none">● Use of Prepositions	
UNIT V	06
<ul style="list-style-type: none">● Synonymous Words	
Total : 30 Hours	

Books Prescribed

- For Unit I – V Effective Communication For You – V. Syamala, Emerald Publishers, Chennai - 600 008.

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.

Course objectives

- 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

- 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

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 |

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

UNIT I: SKILL ENHANCEMENT **06**

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

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

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

UNIT III: INTERVIEW SKILLS **06**

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

UNIT IV: QUANTITATIVE ABILITY **06**

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

UNIT V: REVISIONARY MODULES **06**

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

Total: 30 Hours

Course Outcome:

- | | |
|-----|---------------------------------------------------------|
| CO1 | To develop participant's 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 |

COURSE OBJECTIVE:

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

UNIT I ENTREPRENEURSHIP 6

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

UNIT II BUSINESS 6

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

UNIT III BUSINESS PLAN PREPARATION 6

Sources of product for business – Pre-feasibility study – Criteria for selection of product – Ownership – Capital – Budgeting project profile preparation – Matching entrepreneur with the project – Feasibility report preparation and evaluation criteria.

UNIT IV SUPPORT TO ENTREPRENEURS 6

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 ENTREPRENEURSHIP DEVELOPMENT PROGRAMME 6

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

Total 30 hrs


COURSE OUTCOMES:

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

CO 1: Define the need and importance of entrepreneurship concepts.

CO 2: Understand the concept of Entrepreneurship

CO 3: Explain the meaning, importance and functions of an entrepreneur.

CO 4: Evaluate the role of mentoring in small industries development industries.

CO 5: Identify, create and analyze entrepreneurial opportunities.

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 & Aditya Dhobale, “Entrepreneurship Development”, Kindle Edition, Jatayu Publication; 1 edition ,2018.
3. Sangeeta Sharma, “Entrepreneurship Development”, 10th Edition, Kindle Edition
PHI Learning, 2018

TEACHING-LEARNING PROCESSES

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

1. **Classroom Teaching** for topics which are intensely information-based. This a very regular feature of all the courses in Microbiology
2. **PowerPoint slides** for topics which involve information related to intricate biological pathways such as metabolic pathways in bacteria and other microorganisms. Use of PowerPoint presentations are also made whenever the lectures are to be summarized in a crisp and pointwise manner to highlight salient / important conclusions from the topics.
3. **Classroom Discussions** are a regular feature while teaching. The students are drawn into impromptu discussions by the teacher during the process of teaching.
4. **Video Displaying**, both real-time and animations, are used for topics which require 3D dimensional viewing of the biological mechanisms to drive the point home. These have proved to be very helpful while teaching concepts of molecular biology like DNA replication, transcription and translation. These are also used to convey complexities of antigen-antibody interactions and generation of antibody diversity during the teaching of Immunology.
5. **Model Making** is also used especially for understanding and building a perception of the students for the structures of viruses which cannot be seen by a light microscope and can be seen only under expensive equipment like electron microscopes.
6. **Laboratory Practical** are an integral part of every course included in UG programme in Microbiology. The is also a daily affair for UG students of Microbiology.
7. **Problem Solving** is encouraged during the laboratory work.
8. **Group Activity** as well as discussions with the laboratory supervisor/ among the students themselves/ Mentor is also encouraged during laboratory work.
9. **Project Work** is included in the programme where students work individually or in groups to design experiments to solve/answer a problem suggested by the Mentor or identified by the students in consultation with the Mentor. The students are mentored regularly during the duration the project is in progress.



10. **Presentations by the Students** are regularly done. The students are mentored in presentation of data, interpretation of data and articulation with the students/teachers/Research Scholars during their presentation.

11. **Presentation by Experts** in different specialties of Microbiology are arranged to broaden the horizons of the students.

12. **Interaction with Experts** is also encouraged during/after presentations to satisfy/ignite curiosities of the students related to developments in the different areas of Microbiology.


13. **Visit to Industries/Laboratories** related to Microbiology like fermentation, food, diagnostics etc. are organized to acquaint the students with real-life working environments of the professional microbiologists with a view to broaden their perspective of the subject of Microbiology.

ASSESSMENT TASKS:

It is important that the students of UG Microbiology 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 Microbiology 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.

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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 mid- term 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.

Keywords:

Microbiology, Teaching, Learning outcomes, Curriculum, Curriculum Framework, Programme outcomes, Course outcomes, UG Programme, Undergraduate programme, Teaching learning processes, Assessment Tasks, Evaluation Tasks, Online Courses, MOOCS, NPTEL, SWAYAM, UGC, India, Higher Education Institutions, HE

