



**Learning Outcomes based Curriculum Framework
(LOCF) – Curriculum and Syllabus
for
B.Sc. MICROBIOLOGY
Effective from the academic year
2018 - 2019**

**VELS INSTITUTE OF SCIENCE TECHNOLOGY AND ADVANCED STUDIES
PALLAVARAM, CHENNAI
TAMIL NADU – 600 117**

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 deal with the safe and efficient use and monitoring 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. program (Biochemistry, Biotechnology, Bioinformatics and Microbiology) 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 Scientific knowledge:** Graduates will acquire biochemistry/biotechnology / bioinformatics/ microbiology specific knowledge including recent techniques in the respective fields coupled with hands-on skills and leadership skills for a successful career.
- PO-2 Problem analysis:** Graduates will be able to analyse, solve and troubleshoot problems in implementation of biochemistry/biotechnology/ microbiological protocols.
- PO-3 Design/development of solutions:** Graduates will develop creative thinking and cooperate with each other to solve problems in the field of biochemistry/biotechnology/bioinformatics/ microbiology.
- PO-4 Conduct investigations of complex problems:** Graduates will acquire practical skills – which help in planning and designing protocols to validate hypothesis and execute experimental techniques independently as well as assimilate, analyse and interpret subsequent data.
- PO-5 Modern tool usage and communication:** Graduates will effectively be able to manage resources and time using ICT and computer enabled devices and accomplish ability to understand and communicate all ideas effectively.
- PO-6 Environment sustainability and Ethics:** Graduates will get adequate knowledge to use information and implement solutions for environmental protection and remediation. Graduates will be aware of their role and responsibility in handling and use of microbes including genetically modified microorganisms.
- PO-7 Lifelong learning:** Graduates will carry on to learn and adapt in a world of constantly evolving technology.

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 identification, immunodiagnostics, medical microbiology and screening for useful biomolecules to implement, validate and interpret data in protocols 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. |
| PSO4 Societal responsibility: | The ability to learn and implement environmentally safe and sustainable practices by adhering to good microbiological practices, upholding ethical codes and gainful employability. |
| PSO5 Life-long learning: | The ability to learn, assimilate and update by using MOOC platforms and various digital platforms and knowledge resources as a continuous process of life-long learning and knowledge addition. |

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

Sl.No	Name & Address	Designation
1	Dr. R. Dinakaran Micheal Dean School of Life Sciences VISTAS, Chennai – 600 117.	Chairperson
2	Dr. A.K.Kathiresan Professor and Head 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
4	Dr. G. Gayathri Assistant Professor Department of Microbiology School of Life Sciences VISTAS, Chennai – 600 117	Internal Member
5	Dr. M. Elanchezhiyan Professor and Head Department of Microbiology University of Madras Dr. ALM PGIBMS Taramani Campus Chennai – 600 113.	External Member
6	Dr. Rajkumar Samuel Director Technical HUBERT ENVIRO CARE SYSTEMS Guindy, 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)



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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 endeavour 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 behaviours 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, 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.

5. 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 beginning of the document.

6. Structure of B.Sc. Microbiology program

COURSES OF STUDY AND SCHEME OF ASSESSMENT (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	5	0	0	5	40	60	100
ENG	English I	5	0	0	5	40	60	100
CORE	General Microbiology	5	0	0	5	40	60	100
CORE	Immunology	4	0	0	4	40	60	100
CORE	Basic Techniques of Microbiology Lab	0	0	4	2	40	60	100
CORE	Immunology Lab	0	0	4	2	40	60	100
		19	0	8	23			
SEMESTER 2								
LANG	Tamil II / Hindi II / French II	5	0	0	5	40	60	100
ENG	English II	5	0	0	5	40	60	100
CORE	Microbial genetics and Molecular Biology	5	0	0	5	40	60	100
CORE	Industrial and Pharmaceutical Microbiology	4	0	0	4	40	60	100
CORE	Microbial Genetics & Molecular separation Lab	0	0	4	2	40	60	100
CORE	Industrial Microbiology Lab	0	0	4	2	40	60	100
		19	0	8	23			

CA - Continuous Assessment
 SEE - Semester End Examination
 LANG - Language
 ENG - English

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Programme: B.Sc. Microbiology

Code No.	Course	Hours/Week				Credits	Maximum Marks		
		Lecture	Tutorial	Practical	CA		SEE	Total	
SEMESTER 3									
LANG	Tamil III / Hindi III / French III	5	0	0	5	40	60	100	
ENG	English - III	5	0	0	5	40	60	100	
CORE	Food Microbiology	4	0	0	4	40	60	100	
CORE	Environmental Microbiology	4	0	0	4	40	60	100	
CORE	Food Microbiology Lab	0	0	4	2	40	60	100	
CORE	Environmental Microbiology Lab	0	0	4	2	40	60	100	
SEC	Soft Skills I	2	0	0	2	40	60	100	
		20	0	8	24				

SEMESTER 4

LANG	Tamil IV / Hindi IV/ French IV	5	0	0	5	40	60	100	
ENG	English IV	5	0	0	5	40	60	100	
CORE	Medical Microbiology	4	0	0	4	40	60	100	
CORE	Recombinant DNA Technology	4	0	0	4	40	60	100	
CORE	Medical Microbiology Lab	0	0	4	2	40	60	100	
AECC	Environmental Studies	2	0	0	2	40	60	100	
SEC	Soft Skills II	2	0	0	2	40	60	100	
		22	0	4	24				

CA - Continuous Assessment
 SEE - Semester End Examination
 SEC - Skill Enhancement Course
 AECC - Ability Enhancement Compulsory Course

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Program: B.Sc. Microbiology

Code No.	Course	Hour / Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 5								
DSE	Discipline Specific Elective - I	6	0	0	6	40	60	100
DSE	Discipline Specific Elective - II	5	0	0	5	40	60	100
DSE	Discipline Specific Elective - III	5	0	0	5	40	60	100
DSE	Basic techniques in Biochemistry Lab	0	0	4	2	40	60	100
GE	Generic Elective -I	3	0	0	3	40	60	100
SEC	NSS	2	0	0	2	40	60	100
		21	0	4	23			

SEMESTER 6

DSE	Discipline Specific Elective - IV	6	0	0	6	40	60	100
DSE	Discipline Specific Elective – V	6	0	0	6	40	60	100
GE	Generic Elective -II	3	0	0	3	40	60	100
SEC/ VAC	SEC IV	2	0	0	2	40	60	100
DE	Project Work	0	0	12	6	40	60	100
		17	0	12	23			

- CA - Continuous Assessment
 SEE - Semester End Examination
 DSE - Discipline Specific Elective Course
 GE - Generic Elective Course
 SEC - Skill Enhancement Course
 VAC - Value Added Course

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
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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: General Microbiology
- CC2: Basic Techniques in Microbiology (Practical)
- CC3: Immunology
- CC4: Immunology (Practical)
- CC5: Microbial Genetics and Molecular Biology
- CC6: Microbial Genetics and Molecular Separation (Practical)
- CC7: Industrial Microbiology
- CC8: Industrial Microbiology (Practical)
- CC9: Food Microbiology
- CC10: Practical – Food Microbiology
- CC11: Environmental Microbiology
- CC12: Practical - Environmental Microbiology
- CC13: Medical Microbiology
- CC14: Practical in Medical Microbiology
- CC15: Recombinant DNA Technology

List of Discipline Specific Electives (ANY FIVE)

- DSE1: Fermentation Technology
- DSE2: Biochemistry
- DSE3: Basic Techniques in Biochemistry Lab
- DSE4: Bioinstrumentation
- DSE5: Bioinstrumentation (Practical)
- DSE6: Bioinformatics
- DSE7: Bioinformatics (Practical)
- DSE8: Biofertilizers
- DSE9: Microbial Biotechnology
- DSE10: Environmental Biotechnology
- DSE11: Biostatistics
- DSE 12: Microbial Metabolism
- DSE13: 18DBMB61 - Marine Microbiology

DSE14: 18DBMB6X– Immunotechnology

List of Generic Electives

GE 1: Introduction and Scope of Microbiology

GE 2: Industrial and Food Microbiology

GE 3: Microbes in Environment

GE 4: Genetic Engineering and Biotechnology

GE 5: Microbial Genetics and Molecular Biology

List of Skill Enhancement Courses

SEC 1. NSS-I

SEC 2. NSS-II

SEC 3. NSS-III

SEC 4. NSS-IV

SEC 5. NSS-V

SEC 6. NSS-VI

SEC 7. Personality Development

SEC 8. Soft skills- I

SEC 9. Soft skills- II

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

18CBMB11 CC1: General Microbiology (Theory) 6 0 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 18 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. Major characteristics used in classification; five kingdom, six kingdom and eight kingdom concepts.

UNIT II MICROSCOPY 18 Lecture Hours

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 20 Lecture Hours

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.

UNIT IV ANTIBIOTICS 14 Lecture Hours

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 20 Lecture Hours

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: 75 Lecture Hours

Course Outcome

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

CO1: Gain knowledge on various classes of microorganisms; their structure-extracellular and intracellular components, cultural characteristics and their growth conditions.

CO2: Know about the different parts and working mechanisms of basic light microscope up to electron microscopes with deep knowledge on the sample preparation and staining techniques.

CO3: Acquire knowledge on sterilization techniques with adequate information on sterile, aseptic conditions.

CO4: Know about different classes of antibiotics and their mode of actions, treatment strategies and detection of resistant forms of bacteria from clinical settings.

CO5: Microbial culture media and pure culture techniques for aerobic and anaerobic cultivation methods for bacteria.

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.

18PBMB11**CC2: Basic Techniques In Microbiology (Practical)****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 and microscopy of growth.
11. Cultivation of Algae and Identification of *Spirogyra*, *Chlamydomonas*, *Anabaena* and *Nostoc*.
12. Antibiotic sensitivity test – Kirby Bauer Method.

Total: 60 Lab Hours**Course Outcome**

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

CO1: Perform cleaning & sterilization of glassware

CO2: Competently prepare and cultivate bacteria in different types of media.

CO3: Gain knowledge on filter sterilization techniques

CO4: Know how to grow algae in the lab

CO5: Competently able to identify sensitivity and resistance of bacteria

18CBMB12**CC3: Immunology (Theory)****6 0 0 4**

Course Objectives: The candidate will gain knowledge about immunity, organs of immunity and cells involved. Types of antigens and immunoglobulins. Antigen- antibody reactions and assays. MHC and its significance.

UNIT I IMMUNITY 15 Lecture Hours

Introduction- immunity- types-innate, acquired. Cell mediated immunity and Humoral immunity. Ontogeny and Physiology of immune system- Primary and Secondary lymphoid organs, lymphoid tissues. Immunoreactive cells- structure and functions-macrophages, granulocytes, NK cells, Dendritic cells, T and B lymphocytes. Phagocytosis.

UNIT II ANTIGENS AND IMMUNOGLOBULINS 15 Lecture Hours

Antigens and immunogenicity- terminologies and definition- antigen, immunogen, haptens, adjuvant, super antigen, tolerance, epitope, paratope. Factors associated with antigenicity and immunogenicity. Immunoglobulin- structure, types, distribution, biological and chemical properties. Theories of antibody production- its regulation and diversity. Monoclonal and polyclonal antibodies.

UNIT III ANTIGEN-ANTIBODY REACTIONS 15 Lecture Hours

Antigen-antibody interactions- Primary interactions, *in vitro* reactions-precipitation, agglutination reactions, labelled assays – ELISA, RIA, IFT-*in vivo* reactions- skin tests, immune complex demonstration. Complement system – mode of activation- Classical, Alternate and Lectin pathways, biological functions. CFT.

UNIT IV IMMUNE CELLS 15 Lecture Hours

Ontogeny of B cell lymphocytes, B-cell receptors; Thymic selection of T-cells; Activation and function of T and B cells. Cytokines – General properties, functional categories.

UNIT V MHC, HYPERSENSITIVITY AND VACCINES 15 Lecture Hours

MHC – structure of MHC I and MHC II, Role of MHC in antigen processing and presentation. Hypersensitivity – types and mechanisms. Vaccines- types, Toxoids- bacterial and viral. Passive immunization, Immunotherapy- functions and applications of antibodies, Development of antibodies in animals and plants. Current understanding of possible vaccine development as therapeutic agents.

Total: 75 Lecture Hours

Course Outcome

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

CO1: Understand the fundamental concepts of immunity, contributions of the organs and cells in immune responses.

CO2: Understand the antigens & their characters; the different types antibodies & their properties

CO3: Understand the mechanisms involved in antigen-antibody reactions

CO4: Differentiate the humoral and cell mediated immune mechanisms

CO5: Comprehend the overall reaction by our immune system leading to hypersensitive conditions and its consequences. Know how MHC functions in the immune system; Gain knowledge on vaccines, toxoids and immunotherapy

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 WR, 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. 3rd ed.,1997.
5. Peter J. Delves, Ivan M. Roitt, Encyclopedia of Immunology; Academic Press. 2nd Ed., 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.
9. Noel R. Rose, Herman Friedman, John L. Fahey. Manual of Clinical Laboratory Immunology. ASM. 3rd ed., 1986.

18PBMB12**CC4: Immunology (Practical)****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 and Immuno-electrophoresis as well as purify immunoglobulins.

1. Identification of various immune cells by morphology.
2. Latex Agglutination reactions- RF, ASO, CRP.
3. Hemagglutination Reactions- Blood Grouping, Rh Typing, TPHA.
4. Precipitation reactions in gels – SRID, ODD.
5. Immuno-electrophoresis and staining of precipitation lines.
6. ELISA for HBs antigen detection.
7. Preparation of lymphocytes from peripheral blood by density gradient centrifugation.
8. Purification of immunoglobulin - Ammonium sulphate precipitation.
9. Separation of IgG by chromatography.
10. Titration of IgG.

Total: 60 Lab hours

Course Outcome

The students will be able to

CO1: Identify various immune cells and enumerate them

CO2: Competently perform serological diagnostic tests such as RF, ASO, CRP.

CO3: Identify blood groups and types

CO4: Diagnose syphilis by performing TPHA test

CO5: Analyze and quantify the antigens / Abs by performing immuno-electrophoresis, chromatography techniques & ELISA

18CBMB21 CC5: Microbial Genetics and Molecular Biology (Theory) 5 0 0 4

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 16 Lecture hours

Nucleic acids as genetic material – DNA and RNA structure. Properties of nucleic acids. DNA replication – general principles, modes of replication, Mechanism. Superhelicity in DNA, topology and topoisomerases.

UNIT II REPLICATION 16 Lecture hours

Replication of ssDNA, retroviral replication. DNA damage and repair – Types of DNA damage, mechanism of repair (methyl directed, excision, recombinational, SOS). Recombination – Generalized and Site- specific.

UNIT III TRANSCRIPTION 17 Lecture hours

Transcription – general principles, basic apparatus, RNA polymerases and steps involved. Monocistronic and polycistronic mRNAs. Processing of RNA. Regulation of transcription – attenuation & antitermination, heat shock proteins. Translation –post translational modifications; operon concept – *lac*, *trp*, *ara* operon.

UNIT IV GENE TRANSFER 13 Lecture hours

Genetic code. Gene transfer mechanisms – conjugation, transformation and transduction. Plasmids - structure of F1, Col E1. pSC 101, Ti plasmid, incompatibility. Transposons – structure, types and functions.

UNIT V MUTATION 13 Lecture hours

Gene as a unit of mutation and recombination – mutagens, mutagenesis – biochemical basis of mutations – spontaneous and induced. Reversion, suppression, genetic analysis of mutants. Genetic mapping of *E. coli* and yeast.

Total 75 Lecture hours

Course Outcome

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

CO1: Understand the flow of information from DNA to Protein. Know in detail the structure of DNA & RNA and replication of DNA.

CO2: Grasp the replication of single-stranded DNA molecules and the various features of retrovirus replication.

CO3: Appreciate the various cellular mechanisms involved in the control of transcription.

CO4: Basic understanding of control methods for gene expression. Understanding the language for communication in cells.

CO5: Molecular basis of heritable changes in cells along with insights about evolutionary methods to overcome change. Firm grasp of *E.coli* gene mapping methods as well as those of yeast

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. Blackwell Scientific Publishers, Oxford. 1985.

18PBMB21 CC6: Microbial Genetics and Molecular Separation (Practical) 0 0 4 2

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: Understand the concept of plasmid isolation and characterization

CO2: Know how to purify bacterial chromosomal DNA

CO3: Gain knowledge on methods of DNA & RNA estimation

CO4: Acquire technical knowledge on paper & thin layer chromatography

18CBMB32**CC7: Industrial Microbiology (Theory)****4 0 0 4****UNIT I Introduction to industrial microbiology 6 Lecture Hours**

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

UNIT II Industrially important microbial strains and fermentation media 12 Lecture Hours

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 Lecture Hours

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 Lecture Hours

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 Lecture Hours

Microbial production of chemotherapeutic agents-penicillin, streptomycin, tetracycline. Organic acids- Citric acid, gluconic acid. Aminoacids- L-Glutamic acid, L- Tryptophan, L- Lysine. Enzymes-amylase, protease, lipase. Production of Wine, beer, ethanol and Vitamin B12. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes

TOTAL HOURS: 60 Lecture Hours**Course Outcome**

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

CO1: Realize the importance of microbial products over chemically synthesized products

CO2: Gain knowledge on important microbial strains and fermentation media

CO3: Understand fermenters and fermentation processes.

CO4: Gain knowledge in downstream processing and industrial production of various products.

CO5: Gain knowledge on 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 Higton 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,

18PBMB32**CC8: Industrial Microbiology (Practical)****0 0 4 2**

1. Study different parts of fermenter
2. Primary screening of 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:
 - (b) Amino acid: Glutamic acid
 - (c) Organic acid: Citric acid
 - (d) Alcohol: Ethanol
 - (e) Wine
6. A visit to any educational institute/industry to see an industrial fermenter, and other downstream processing operations.

Total: 60 Lab hours

18CBMB31**CC9: Food Microbiology (Theory)****4 0 0 4**

Course Objectives: The candidate will gain knowledge about food preservation, spoilage. Sanitation requirements and in-plant mechanism with documentation – GMP, HACCP. Dairy microbiology – cheese, Yogurt. Food-borne diseases and its control.

UNIT I INTRODUCTION**12 Lecture Hours**

Scope of food microbiology. Microorganisms important in food microbiology- molds, yeasts and bacteria. Factors influencing microbial growth and survival in foods – intrinsic and extrinsic factors. Common spoilage organisms in food.

UNIT II FOOD PRESERVATION METHODS**12 Lecture Hours**

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**12 Lecture Hours**

Spoilage of foods – Meat, Eggs, Sea foods, Fruits, Vegetables and Grains. Food Sanitation- Controlling microbiological quality of foods- sampling schemes, control at source, GMPs, HACCP, Personal Hygiene. Quality Systems – BS 5750, ISO 9000 series.

UNIT IV MICROBIOLOGY OF MILK AND DAIRY PRODUCTS 12 Lecture Hours

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

UNIT V FOOD-BORNE DISEASES**12 Lecture Hours**

Food microbiology and public health. Food hazards, Significance of food-borne diseases, Incidence and Risk factors. Bacterial and non-bacterial food borne infections and intoxications. Methods of microbiological examination of foods- indicator organisms, direct examination, cultural techniques. Packing of foods.

Total: 60 Lecture Hours

Course Outcome

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

CO1: Gain knowledge on various interactions between food and microorganisms.

CO2: Know about the different methods of food preservation.

CO3: Acquire knowledge on spoilage of foods.

CO4: Explain about the microbial 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.

18PBMB31**CC10: Food Microbiology (Practical)****0 0 4 2**

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

1. Dye Reduction Tests for milk – MBRT test.
2. Evaluation of quality of curd by SPC.
3. Enumeration of bacteria in spoiled foods.
4. Production of Wine
5. Enumeration of microbes in air- settle plate method, air sampling methods.
6. Physical, chemical and microbial assessment of water- color, pH, alkalinity, acidity, BOD, COD, anions, cations.
7. MPN for water.
8. Enumeration of microbes using membrane filter.
9. Isolation of fecal coliform from water.
10. Field trip to sewage treatment plants, coastal area, salt pans, coral reef.

Total: 60 Lab hours

18CBMB32**CC11: Environmental Microbiology (Theory)****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 Lecture Hours

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

UNIT II AQUATIC MICROBIOLOGY 13 Lecture Hours

Aquatic Microbiology- aquatic ecosystems- fresh water (ponds, lakes, streams), marine ecosystem (estuaries, mangroves, deep sea, salt pan, coral reef); Eutrophication. Potability of water, assessment of water quality, purification of drinking water. Water borne diseases- pathogenesis, prevention and control.

UNIT III WASTE WATER MICROBIOLOGY 12 Lecture Hours

Waste water Microbiology- types and characteristics of waste, BOD, COD. Liquid waste treatment- primary, secondary, tertiary treatment, disinfection and disposal, Solid waste treatment- composting, saccharification and gasification, pyrolysis, incineration.

UNIT IV MICROBES IN ECOSYSTEM 12 Lecture Hours

Microbial communities and role of microbes in ecosystem (primary producer and decomposer). Adaptations of microbes in extreme environment- thermophile, psychrophile, halophile, acidophile, alkalophile, barophile, osmophile.

UNIT V RECALCITRANCE AND BIOREMEDIATION 12 Lecture Hours

Recalcitrance and biodegradation of recalcitrant compounds. Biodegradation of xenobiotic compounds. Bioaccumulation of heavy metals, biomagnification, biocorrosion, bioleaching and biomining. Bioremediation.

Total: 60 Lecture Hours

Course Outcome

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

CO1: Gain knowledge on the role and infections caused by microbes in air.

CO2: Obtain detailed information on aquatic ecosystems and Assimilate knowledge on Water borne diseases.

CO3: Get detailed knowledge on Waste water treatment and its different methods.

CO4: Basic understanding on different types of microbes present in the environment and its uses.

CO5: Acquire knowledge on Biodegradation, of xenobiotic compounds and Understand of Biomagnification and Bioremediation.

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. Vijaya Ramesh, Environmental Microbiology, MJP 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 KH and Herson OS, Bioremediation, Mc Graw Hill, NY. 1994.
8. R. C. Dubey and D. K. Maheswari, Practical Microbiology, S, Chand & Co Ltd, New Delhi. 1st ed, 2008.

18PBMB32**CC12: Environmental Microbiology (Practical)****0 0 4 2**

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

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. Physical, and chemical assessment of water- color, pH, alkalinity, acidity, BOD, COD, anions, cations.
4. Estimation of BOD.
5. Estimation of BOD.
6. MPN for coliforms in water as per - BAM, APHA, IS Standards.
7. Enumeration of microbes in water using membrane filter.
8. Isolation of faecal coliform from water.
9. Field trip to sewage treatment plants, coastal area, salt pans, coral reef.

Total: 60 Lab hours

18CBMB41**CC13: Medical Microbiology (Theory)****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. They will also gain knowledge on fungal and parasitic pathogens, fungal infections and parasitic diseases and their diagnosis and treatment.

UNIT I: VIROLOGY 12 Lecture Hours

General properties of viruses Structure, cultivation, pathogenesis and various diagnosis techniques. Antiviral agents, chemotherapy and vaccines. Viroids, prions, virusoids and satellite RNA. General properties, antigenic structure, pathogenesis, clinical findings, lab diagnosis, prevention, control and treatment of - HIV, HBV, Rabies, Influenza, Dengue, Polio, Oncogenic, Pox Viruses.

UNIT II: BACTERIOLOGY 12 Lecture Hours

Normal flora of human body. General attributes and virulence factors of bacteria causing infections – invasiveness and toxigenicity. Pathogens, pathogenesis, clinical manifestations, lab diagnosis, epidemiology, chemotherapy and prevention of diseases caused by – *Staphylococcus aureus*, *Streptococcus pneumoniae*, *C. diphtheriae*, *C. tetani*, *M. tuberculosis*, *N. gonorrhoeae*, *E. coli*, *S. typhi*, *V. cholerae*, *Klebsiella pneumoniae*, *Pseudomonas sp.*

UNIT III: INFECTIONS 12 Lecture Hours

Epidemiology and control of community infections. Nosocomial infections – factors that influence hospital infection, routes of transmission, investigation, prevention and control. Hospital waste management.

UNIT IV: MYCOLOGY 12 Lecture Hours

Detection and recovery of fungi from clinical specimens. Antifungal agents- testing methods and quality control. Yeasts of medical importance – *Candida*, *Cryptococcus sp.* Fungi of medical importance – Dermatophytes and agents causing Superficial mycoses - Piedra, systemic mycoses - Histoplasmosis, opportunistic mycoses.

UNIT V: PARASITOLOGY 12 Lecture Hours

Introduction to parasitology, Host–parasite relationship, mechanism of pathogenesis, transmission and life cycle of the Protozoan – *Entamoeba*, *Leishmania*, *Cryptosporidium* and *Plasmodium*. Helminthes – Cestodes – *Taenia solium* and *T. saginata*, *Echinococcus*. Trematodes – *Fasciola hepatica*, *Paragonium*, *Schistosomes*. Nematodes – *Ascaris*, *Ankylostoma*, *Enterobius*, *Wuchereria*.

Total: 75 Lecture Hours

Course Outcome

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

CO1: Study about the properties, pathogenicity, lab diagnosis of pathogenic viruses.

CO2: Know about the normal microbial flora of human and Learn about the characters, pathogenicity, lab diagnosis of bacteria pathogens.

CO3: Get knowledge on nosocomial infections. Gain knowledge hospital waste management

CO4: Get in-depth knowledge on fungal pathogens.

CO5: Learn about pathogenic protozoans and helminths

TEXTBOOK:

1. Ananthnarayanan. R & C. K. Jeyaram Panicker, 2006; Textbook of Microbiology, 8th Ed., Orient Longman.
2. Subhas Chandra Parija, 1993; Medical Parasitology, Ed.2; Chand & Co.

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 EJ, Fine Gold S.M, 1995; Diagnostic Microbiology; Blackwell Scientific Systems.
4. J.G. Colle, 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 Arolla, London.
8. Jagadish Chandar, 1996; A Textbook of Medical Mycology; Interprint, New Delhi.
9. Alexopoulos C.J, 1992; Introductory Mycology; John Wiley & Sons Inc, N.Y.
10. H.C. Dube , 2005; Introduction to Fungi, Ed.3; Vikas Publishing House.
11. D.R. Arora & B.R. Arora, 2002; Medical Parasitology, Ed.1; CBS Publishers & Distributors, New Delhi.
12. Chatterjee, 1986; Medical Parasitology; Tata McGraw Hill.
13. Jayaram Panicker, 1998; Textbook of Parasitology; C.K. Jaypee Brothers, New Delhi.
14. S.L. Fleck., A. H. Moody, 1987; Diagnostic Techniques in Medical Parasitology, Ed.1; ELBS.

18PBMB41**CC14: Medical Microbiology (Practical)****0 0 4 2**

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.

1. Collection & transport of specimens- Sputum / throat / ear / nasal swabs
2. Cultivation, transport, isolation and biochemical identification of pathogenic bacteria.
3. Identification of medically important pathogenic bacteria- *Staphylococci*, *Streptococci*, *E. coli*, *Klebsiella*, *Pseudomonas* species
4. KOH examination of skin, hair and nail infections.
5. LPCB examination of fungi.
6. Isolation & identification of fungi- *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, Dermatophytes & Yeasts – SDA / Corn meal agar - Slide culture technique - Germ tube test.
7. Examination of parasites in clinical specimens- Ova/ cyst in faeces by Lugol's iodine wet mount method.
8. Concentration methods- Formol ether and Zinc sulphate methods, Salt saturation methods.
9. Blood smear examination for malarial parasites.
10. Cultivation of viruses by egg inoculation methods
11. Observation and interpretation of CPE.

Total: 75 Lab Hours

18CBMB42**CC15: Recombinant DNA Technology (Theory)****5 0 0 4**

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****12 Lecture Hours**

An overview of Genetic engineering - Isolation & purification of DNA from cells – Total, plasmid and phage DNA. Isolation & purification of RNA from cells. PCR – types and applications, Pulse field electrophoresis for large DNA. Blotting techniques – Northern, Southern, Western blotting and its applications. Restriction enzymes, DNA ligases, DNA modifying enzymes,

UNIT II**VECTORS****12 Lecture Hours**

Eukaryotic and Prokaryotic hosts for cloning. Characteristics of an ideal vector, cloning vectors – Plasmids, phages, Cosmids, Phagemids, Artificial chromosomal vectors, Shuttle vectors; choice of vectors for *E. coli*, fungi, higher plants and mammalian cells. Agarose gel electrophoresis and SDS – PAGE.

UNIT III**GENE TRANSFER****12 Lecture Hours**

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****12 Lecture Hours**

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**NANOMICROBIOLOGY****12 Lecture Hours**

Basics of Nanomicrobiology- introduction, landmarks in nanomicrobiology- Techniques: microarrays- nanoarrays- protein nanoarray. Atomic force microscopy- operation- advantages of AFM, Magnetic resonance force microscopy. Nanoparticles- Quantum dots, Gold nanoparticles, Silica nanoparticles, Fluorescent nanoparticles, cubosomes, Dendrimers, nanoparticle synthesis. Nanomicrobiology in drug delivery- viruses as

nanomaterials for drug delivery- Bacteria mediated drug delivery-Dendrimers- Cubosomes- Gold nanoparticles- cyclodextrin.

Total: 60 Lecture Hours

Course Outcome

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

CO1: Identify the aspects of various techniques for manipulation of nucleic acids.

CO2: Infer the details about hosts and vectors in gene cloning.

CO3: Apply the knowledge on gene transfer and screening of recombinants.

CO4: List out the characteristics of clone selection and ethical issues of cloning.

CO5: Identify the process and characters 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.
7. M.Ratner and D.Ratner, Nanotechnology –A Gentle Introduction to The Next Big Idea, Pearson Education. 2007.
8. L.E.Foster, Nanotechnology-Science, Innovation and Opportunity, Person education Inc., 2007.
9. Charles P. Poole, Jr. and Frank J. Owens, Introduction to Nanotechnology; Wiley – Interscience. 2003.
10. Guozhong Cao, Nanostructures & Nanomaterials: Synthesis, Properties and Applications; Imperial College Press. 2004.

11. David S. Goodsell, *Bionanotechnology: Lessons from Nature*; Wiley-Liss, Inc. Hoboken, New Jersey. 2004.

ENGLISH- I**5 0 0 5****COURSE OBJECTIVE:**

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

UNIT I	Preparatory Lesson	12 Lecture Hours
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1. Competition Matters
Suzanne Sievert
2. A Personal Crisis May Change History
Dr. A.P.J. Abdul Kalam
3. Why Preserve Biodiversity
Prof. D. Balasubramanian

UNIT II	Prose	12 Lecture Hours
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1. The Unexpected
Robert Lynd
2. My Greatest Olympic Prize
Jesse Owens
3. If You are wrong, admit it
Dale Carnegie

UNIT III	Poetry	12 Lecture Hours
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1. The Night of the Scorpion
Nissim Ezekiel
2. Pulley or The Gift of God
George Herbert
3. La Bella Dame Sans Merci
John Keats

UNIT IV	Short Story	12 Lecture Hours
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1. The Gift of Magi
O Henry
2. Three Questions
Leo Tolstoy

UNIT V

One Act Play

12 Lecture Hours

1. The Shirt

Francis Dilion

2. The Pie and the Tart

Hugh Chesterman

Total: 60 Hours

Books Prescribed:

Confluence - Anu Chithra Publications

ENGLISH- II**5 0 0 5****COURSE OBJECTIVE:**

- To enable students to develop their communication skills effectively
- To make students familiar with various sentence patterns of the English Language
- To enrich their vocabulary in English
- To develop communicative competency

UNIT	I Prose	12 Lecture Hours
1. The Words of Wisdom Chetan Bhagat		
2. Forgetting Robert Lynd		
3. My Early Days Dr. A.P.J. Abdul Kalam		
UNIT II	Poetry	12 Lecture Hours
1. Ozymandias Percy Bysshe Shelley		
2. Mending Wall Robert Frost		
3. Where the Mind is Without Fear Rabindranath Tagore		
UNIT III	Short Story	12 Lecture Hours
1. Am I Blue? Alice Walker		
2. The Last Leaf O' Henry		
3. The Selfish Giant Oscar Wilde		
UNIT IV	One Act Play	12 Lecture Hours
1. Soul Gone Home Langston Hughes		

UNIT V

12 Lecture Hours

1. Lexical Skills
2. Vocabulary
3. Communication and Grammar at the end of all lessons

Total: 60 Hours

Books Prescribed:

Radiance - Emerald Publications

ENGLISH – III**5 0 0 5****COURSE OBJECTIVE:**

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

UNIT – I Prose 12 Lecture Hours

1. Two Gentleman of Verona - A.J. Cronin
2. Judas Iscariot - Bonnie Chamberlain
3. Dangers of Drug Abuse - J. V. S. Henbane

UNIT II Short Stories 12 Lecture Hours

1. Journey by Night - Norah Burke
2. The 2000-Mile Turtle - Henry Edward Fox
3. Fools Paradise - Isaac Bashevis Singer

UNIT III Fiction 12 Lecture Hours

R. L. Stevenson - Dr. Jekyll & Mr. Hyde (Retold by Kennet) –
S. Chand & company Ltd.

UNIT IV Functional English 12 Lecture Hours

1. Paragraph Writing
2. Comprehension
- 1.** Letter Writing
- 2.** Report writing
 - a) News Paper Report
 - b) Reports for Government Official Attention
 - c) Definition

UNIT V Conversation In Situations & Conversation Practice 12 Lecture Hours**1. Conversation in Situations**

- a) At the Airport
- b) In a Bank
- c) On the Beach
- d) At the Customs

- e) At the Doctors'
- f) In a Flight
- g) In a Hotel
- h) In a Restaurant
- i) In a Shop
- j) Tea Time
- k) On the Telephone
- l) In a Travel Agency
- m) On a Country Walk
- n) At the theatre
- o) In a Street

2. Conversation Practice

- a) Daily Activities
- b) Asking Directions
- c) Travel plans
- d) Living in an Apartment
- e) Money Problems
- f) Weather Conditions
- g) Dinner Conversations
- h) Common Health Problems
- i) Tag Questions
- j) Office Conversations

3. Expansion of Hints

Total: 60 Hours

Books Prescribed:

1. Effective English Communications for You – V. Syamala, Emerald Publishers, Chennai.
2. English Conversation Practice by D. H. Spencer, Oxford University Press
3. English Conversation Practice by Grant Taylor, Tata McCraw-Hill, Publishing Company Limited, New Delhi.

ENGLISH – IV

5 0 0 5

COURSE OBJECTIVE

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

UNIT I **Prose** **12 Lecture Hours**

1. Walking Tours - R. L. Stevenson
2. All About a Dog - A. G. Gardinar
3. No Man is an Island - Minno Masani

UNIT II **Short Stories** **12 Lecture Hours**

1. The Man Who Likes Dickens - Evelyn Waugh
2. Lamb to the Slaughter - Roald Dahl
3. Buck Hears the Call - Jack London

UNIT III **Drama** **12 Lecture Hours**

1. Selected Scenes from Shakespeare's Plays – Book I, Emerald Publishers
 - a) Funeral Oration (Julius Caesar)
 - b) Trial for a Pound of Flesh (The Merchant of Venice)
 - c) Patterns of Love (As You Like It)

UNIT IV **12 Lecture Hours**

1. General Essay Writing & Group Discussion
2. Persuasive Writing and Role Play

UNIT V **12 Lecture Hours**

1. Notice, Agenda, Minutes.

Total: 60 Hours**Books Prescribed:**

1. Invitation to English Prose – A. E. Varadarajan & S. Jagadisan, Orient Black Swan, Chennai

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தமிழ் மொழி, இலக்கிய வரலாறு – அறிமுகம்

நொக்கம்: தமிழ்மொழி மற்றும் இலக்கியத்தின் வரலாற்றை அறிமுகம் செய்யும் நொக்கில் இப்பொடம் வடவிவறக்கப்பட்டுள்ளது. தமிழ்மொழியின் வரலாற்றை அறிவியல் கண்டுநொட்டத்துடனும் மொழிக்குடும்பங்களின் அடிப்பறடயிலும் விளக்குகிடைது. ஂங்க இலக்கியம் மதொடங்கி, இக்கொல இலக்கியம் வறறயிலொன தமிழிலக்கிய வரலாற்றை இலக்கிய வரலாறு அறிமுகப்பட்டுத்துகிடைது. அரசு நவறலவொய்ப்பிற்கொன நபொட்டித் நதர்வகளுக்குப் பயன்படும் வறகயிலும் இப்பொடம் அறந்துள்ளது.

அலகு 1
15

தமிழ் மொழி வரலாறு

மொழிக்குடும்பம் - இந்திய மொழிக்குடும்பங்கள் - இந்திய ஆட்சி மொழிகள் - திரொவலிட மொழிக்குடும்பங்கள் - திரொவலிட மொழிகளின் வறககள் - திரொவலிட மொழிகளின் சிைப்புகள் - திரொவலிட மொழிகளின் வழங்கிடங்கள் - திரொவலிட மொழிகளுள் தமிழின் இடம் - தமிழ்மொழியின் சிைப்புகள் - தமிழ் பிமை மொழித் மதொடர்புகள்.

அலகு 2
15

சங்க இலக்கியம்

ஂங்க இலக்கியம் - எட்டுத்தொறக - ற்றிற - கறாநம்தொறக - ஐங்குறாநறறு - பதிற்றாப்பத்து - பரிபொடல் - கலிதம்தொறக - அக ஂறறு - பஂ ஂறறு - பத்துப்பொட்டு - திரமஂருகொற்றுப்பறட - சிறஂபொ ஂற்றாப்பறட - மபருமஂபொ ஂற்றாப்பறட - மபொரு ரொற்றுப்பறட - றலபடுகடொம் - குறிஞ்சிப்பொட்டு, மஂலறலப்பொட்டு, படட்டிணப்பொறல - மடுல்வொறட - துறரக்கொஞ்சி.

அலகு 3

அற இலக்கியங்களும் கொப்பியங்களும்

15 களப்பிரர் கொலம் விளக்கம் - நீதி இலக்கியத்தின் மொகத்தறவ -

பதிமண்கீழ்க்க க்கு நல்கள் அறிமுகம் - திருக்குள்ளு, லடியலர்.

கலப்பியங்கள் - ஐம்மபருங்கலப்பியங்கள் ற்றும் ஐஞ்சிறுங்கலப்பியங்கள் அறிமுகம்-கலப்பிய இலக்கம் - சிலப்பதிகலரம் - ணிந கறல - சீவகசிந்தா ணி - வறளயபதி - குண்டலநகசி.

அலகு 4 பக்தி இலக்கியங்களும் சிறிலக்கியங்களும்
15 தமிழகப் பக்தி இயக்கங்கள் - பக்தி இலக்கியங்கள் - றவ இலக்கியம் - லயன் லர்கள் அறுபத்து ழுவர் - ல யக்கூரவர் லலவர் - றவ வ இலக்கியம் - பன்னிரு ஆழ்வலர்கள் - மூதல் ழுன்று ஆழ்வலர்கள்.

சிற்றிலக்கியக் கொலம் - சிற்றிலக்கியங்கள் - வறககள் - பரணி -
கலிங்கத்துப்பரணி - குவைஞ்சி

- குறையொக குவைஞ்சி - பிள்ளைத்தமிழ் - மீனொட்சியமற்ற ப்

பிள்ளைத்தமிழ் - துது - தமிழ்விடு துது - கலம்பகம் - ந்தகிக்கலம்பகம்

- பள்ளு - மாகுக்கூடற்பள்ளு.

அலகு 5

இக்கொல இலக்கியங்கள்

15

வீன கொலம் - வீன இலக்கியம் - உள்ளடக்கம் - புதாக்கவிறத -
நதொற்றைமும் வளர்ச்சியும்-

ொவல் - மாதல் மூன்று றொவல்கள் - ஶ்வலின் வறககள் - மபொழுது
நபொகக்கு றொவல்கள் - வரலொற்று றொவல்கள் - ெழக றொவல்கள் -
இக்கொல றொவல்கள் - ம றொழிமபயர்ப்பு ஶ்வல்கள் - சிறுகறத -
வறககளும் வளர்ச்சியும் - றொடகம் -கொலந்நதொறும்

ொடகங்கள் - புரொ இதிகொொ

ொடகங்கள் - ெழக றொடகங்கள் - வரலொற்று றொடகங்கள் - ம
றொழிமபயர்ப்பு றொடகங்கள் -
றகச்சுறவ றொடகங்கள்.

ம றொத்தம்: 75 ணி ந ரம்

பொர்வவ றூல்கள்:

1. அகத்தியலிங்கம். ெ., மதொக 1", ணிவொொகர்
மாதற்பதிப்பு, 1978.
2. ெக்திநவல. சூ., "தமிழ்ம றொழி வரலொறு", ணிவொொகர் பதிப்பகம்,
மாதற்பதிப்பு 1998.
3. பஸவண் ண், "தமிழ் இலக்கிய வரலொறு", றவொசித்தொந்த
நூற்பதிப்புக் கழகம், மாதற்பதிப்பு,
1998.
4. வரதரொனென். மூ., "இலக்கிய வரலொறு", ெொகித்ய அகொமதமி,
ஶன்பதொம் பதிப்பு, 1994.
5. வி லொனந்தம். து.ெ., "இலக்கிய வரலொறு", பொறி நிறலயம்,
றாபதிப்பு, 2008.

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தமிழிலக்கியம்

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0 0 4 ந ாக்கம்: ஁ங்க கலம் மதொடங்கி தற்கலம்
 வறரயிலும் தமிழில் உள்ள பறடப்பிலக்கியங்கறள இப்பொடம்
 அறிமுகம் மெய்கின்து. தமிழ் இலக்கியத்தில்
 நதர்ந்மதடுக்கப்பட்ட மிக மூக்கிய ஁ன மெய்யுட்கள்,
 கவிறதகள், கறதகள், உறர றட ஆகியவற்றைக்மகொண்டு
 இப்பொடம் கட்டற க்கப்பட்டுள்ளத஁. ஁ ஁கக்கரிடம் இலக்கியத்
 நதடறல உருவொக்குவதும், தற்஁஁ர்ப்புறடய அறிறவ ந
 ம்பட஁த்துவதும் இப்பொடத்தின் ந ஁க்க ஁கும்.

அலகு 1

மசவ்வியல் இலக்கியங்கள்

15 திருக்குள்- அன்புறடற , ஁ழுக்கம஁றடற , மபரியொறர்த்துற
 க்நகலல் -மூன்று அதிகலொங்ுகள் ம஁ழுற யுடம்.

ப஁ ஁஁஁஁- ஁டல் ஁ண்: 18, 55, 182, 183, 192 -
 ஁ந்து ஁டல்கள்.

கு஁ந்மதொறக- ஁டல் ஁ண்: 2, 167, 27, 202, 184 -
 ஁ந்து ஁டல்கள்.

அலகு 2

கொப்பியங்கள்

16

சிலப்பதிகலொரம்- கனலத்தி஁ம் உறரத்தக்
 கலொறத ம஁ழுவதும்.

ணிற கறல- பவத்தி஁ம் அ஁க ஁னப் ஁லொறவ ந ஁஁஁ கலொறத
 ம஁ழுவதும்.

கம்பர஁ ஁ய ம் - ந்தறரச் சூழ்ச்சிப்படலம்

(நதர்ந்மதடுக்கப்பட்ட ஁ன்பது ஁டல்கள்). அலகு 3

கவிவதயும் ப஁஁க்கவிவதயும்

14

பலொரதல்தொ஁஁஁ன் 'தமிழியக்கம்' -(i) ம ஁க பறதக்க஁ம் நிறல - (ii)

஁ருப்பறதவிட ஁஁஁஁஁஁ - ஁ரண்டு கவிறதகள்.

஁஁஁஁஁஁ தமிழனப்ப஁஁஁, "அந்த ந்தறன ஁ரித்த ம ஁ப்பின்

மிச்செம்" ஁ன்னும் மதொக஁தலில் ஁டமம்மபற்ற஁஁ள் 'விடிகலி஁து'

஁ன்னும் ப஁துக்கவிறத.

அலகு 4

சிறுகவதகள்

15

த. ஜொனகிரிஸ்னி 'கெக்தி
றவத்தியம்'

கி. ரொஜ ரொய னினி 'கதவு' -
இரண்டு கறதகள்

அலகு 5
15

உவர வை

றவரமத்து எழுதிய 'சிற்பிநய உன்றனச்
மெதுக்குகிறைன்' மூழுவதும்

ம லத்தம்: 75 னி
ந ரம்

பொை

நூல்கள்:

1. இரவிசெந்திரன். சூ. (ப.ஆ), "மெய்யுள் திரட்டம்", நவலஸ்
பல்கறலக்கழகம், மூதற்பதிப்பு,
2008.

2. றவரமஸ்து. இரஊ., “஑ற்பிநய ஁னறனசு ம஑ு஑ு஑ுகினைன்”, திரு ஑ள் நிறலயம், பதிநனழ஑ம் பதிப்பு, 2007.

ப஑஑்வவ நூல஑ள்:

1. ப஑லசு஑ு஑்஑ிரனு்.஑., “இல஑஑ியத் தி஑்஑஑஑்வ஑”, நிய஑ ம஑ு஑ு஑ுகினைன் புக஑ ஹவ஑ஸ், பத்த஑ம் பதிப்பு, 2007.
2. ஑஑றதயன்.மப., “தம஑ிழ஑்சு ம஑்வ஑்வியல் ப஑டப஑்ப஑஑ள்”, நிய஑ ம஑ு஑ு஑ுகினைன் புக஑ ஹவ஑ஸ், ம஑ுதல் பதிப்பு, 2009.
3. வரத஑஑஑஑ன்.ம஑., “஑ு஑஑்஑஑஑்ட஑ம் ஑஑஑ல஑ர்”, ப஑றி நிறலயம், ஑஑பதிப்பு, 2005.

18LTAM31

பயன்பாட்டுத் தமிழ்

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நொக்கம்: தற்கொல அனெண்டைத்நதறவக்குரிய வறகயில்
 தமிழம் தொழிறயச் மெம்ற யொகப் பயன்படாத்த நவண்டும்
 எனனும் நொக்கில் இப்பொடம் உருவொக்கப்பட்டுள்ளதா. தொ
 தொக்கரின் நவறலவொய்ப்பு ந ர்கொ ல்கள் ற்றும் குழா
 உறரயொடல்கறள எதிரம்கொள்வதற்நகறை நபச்சுத்தின் ந
 ம்பொடா, மெய்தித்தொள்கறள நுட்ப கொ அணுகுமவிதம்,
 சினைந்த கடிதங்கறள எழுதுவதற்கொன பயிற்சி நபொனெ
 பயன்பொடு தொரைந்த ம தொழிப்பயிற்சிறய இப்பொடம்
 அளிக்கின்றதா.

அலகு 1

ம தொழி

14 பிறழ நீக்கி எழுதுதல் - ஒற்றாப்பிறழ நீக்கி எழுதுதல் -
 மதொடர்பிறழ நீக்கி எழுதுதல் - ஒற்று மிகும் இடங்கள் - ஒற்று மிகொ
 இடங்கள் - பிணை ம தொழிச் மெற்றொறகறள நீக்கி எழுதுதல் -
 பயிற்சிகள.

அலகு 2

நபச்சு

16 நபச்சுத்தின் - விளக்கம் - நபச்சுத்தின் அடிப்பறடகள் -
 வறககள் - ந றடப்நபச்சு - உறரயொடல் - குழுவொக உறரயொடல் -
 பயிற்சிகள.

தறலவரர்களின் ந றடப் நபச்சுகள் - மபறியொர் -
 அண் தொ - கறலஞர்.

அலகு 3

எழுதுதுதறன்

15 கறலச்சுமெல்லொக்கம் - நதறவகள் - கறலச்சுமெற்றொறகளின்
 பண்புகள் - கறலச்சுமெல்லொக்கத்தில் தவிர்க்க நவண்டியறவ -
 அறிவியல் கறலச்சுமெற்றொறகள்.

கடிதம் - வறககள் - அலுவலகக் கடிதங்கள் - பயிற்சி - அறிஞர்களின்
 கடிதங்கள் - கடிதங்களின் வழி கற்பித்தல் - சில அறிஞர்களின்
 கடிதங்கள் - ந ரு...,

அலகு 4

ம லொழிமபயர்ப்பு

16 ம லொழிமபயர்ப்பு அட்ப்பறடக் நகொட்ப்பொசுகள் - ம லொழிமபயர்ப்பு மொறகைகள் - ம லொழிமபயர்ப்பொளரின் தகூதிகள்த். ம லொழிமபயர்ப்பு வறகுகள் - மொலலுக்குச் மொல ம லொழிமபயர்த்தல் - தழுவல் - கட்டறை ம லொழிமபயர்ப்பு - ம லொழியொக்ப்பறடப்பு - இயந்திர ம லொழிமபயர்ப்பு - கருத்துப்பயர்ப்பு - ம லொழிமபயர்ப்பு றட - ம லொழிமபயர்ப்பு சிக்கல்களும் தீர்வுகளும்.

பயிற்சி: அலுவலகக் கட்டுதங்கறள ம லொழிமபயர்த்தல் (ஆங்கிலத்திலிருந்து தமிழுக்கூ).

அலகு 5

இதழியல் பயிற்சி

14

இதழ்களுக்குத் தறலயங்கம் எழுதுதல் - நூல் திப்பொற எழுதுதல் - தொறனயொளறர ந ர்கொ ல் - நிகழ்ச்சிறயச் மயெத்தியொக லொற்றுதல்.

ம லொத்தம்: 75

ந

ணி
ரம்

பொருள்வவ

நூல்கள்:

1. ஈஸ்வரன்.ஓ., பெபொபதி.இரா., “இதழியல்”, பொறவ
பப்ளிநகஷன்ஸ், மஊதற்பதிப்பு, 2004.
2. ஈஸ்வரன்.ஓ., “மொழிமபயர்ப்பியல்”, பொறவ
பப்ளிநகஷன்ஸ், மஊதற்பதிப்பு, 2005.
3. எட்கர் தார்ப், நஷொவிக் தார்ப், “நர்மஊகத் நதர்வில்
மவற்றிமபை”, கிழக்குப் பதிப்பகம்,

இரண்டொம்

பதிப்பு, 2009.

4. சுப்பிரணியன்.பொ.ரா., ஞானகந்தரம்.வ., (ப.ஆ)“தமிழ்
றடக் றகநயடு”, இந்தியமொழிகளின் டுவண் நிறுவனம், ற சூர்
மொழி அக்கட்டறள ற்றஊம் தஞ்றத்தமிழ்ப்
பல்கறலக்கழகம் - மவளியீடு, ஞான்கொம் மீள்பதிப்பு, 2010.
5. சுப்பமரட்டியொர்., “தமிழ் பயிற்றஊம் மஊறஊ”, மய்யப்பன்
பதிப்பகம், ஐந்தொம் பதிப்பு,
2006.

18LTAM41

தமிழர் லொகரிகமும் பண்பொடும்

5 0 0 4

ந லொக்கம்: பண்பொடத் தமிழரின் வொழ்வியல் ம றிகள்
 இயல்பொனதும் இயற்றகநயொடு இ ங்கிச் மெல்வது லொகமம்; மிகவாம்
 பழற யொனதும் பண்பொட்து லொகமம். அன்பொன அக
 வொழ்க்கறயக்கூட மெம்த யொகத் திட்டமிட்டொள்ளனர்.
 மபொழொதுநபொக்கொ, நபொர்மொறகைகள், கறல, லெ யம், அரசியல்,
 அறலியல் என அறனத்திலும் தமிழர் சிலந்து விளங்குவறத விளக்கும்
 பொட லொக இது அற ந்துள்ளது. அரசு நவறல வொய்ப்பொற்கொன
 நபொட்தித் நதர்வொகளுக்குப் பயன்பொடும் வறகயிலும் இப்பொடம் அற
 ந்தொள்ளது.

அலகு 1

லொகரிகம், பண்பொடு

15 மெல்வொற்றமபொருள் விளக்கம் - பண்பொடத் தமிழர் வொழ்வியல் - அகம் -

கொவு - கற்பு - குடும்பம் - விருந்தொம்பல் - லெவு மொறகைகள் -

லெங்குகள் - ம்பிகற்றகுகள் - மபொழொதுநபொகொக்கு - பொகைம் - நபொர்

மொறகைகள் - டுகல் வழிபொடு - மகொறடப்பண்பு.

அலகு 2

கவலகள்

15

சிற்பம் - லெவியம் - இறெ - கூத்து - லெப்பறன - ஆறட அணிகலன்கள்.

அலகு 3 ச யம்

15

றெவம் - றவ வம் - லெ ம், மபொளத்தம் மவளிப்பொடத்தொம்
 பண்பொடு.

அலகு 4 அரசியல்

15

அரசு அற ப்பு - ஆட்சி மொறை - லெள் லொட்டு வணிகம் - மவளி லொட்டு

வணிகம் - வரலி வறகுகள்

- லெ யங்கள் - நீதி மொறை.

அலகு 5 அறலியல்

15

கல்வி - நவளொண்த - வொனலியல் அறிவொ - ருத்துவம் -

கடட்டிக்கறல.

ம லொத்தம்: 75 ணி ந ரம்

பொருள்வள நூல்கள்:

1. நக.நக. பிள்ளை, “தமிழக வரலாறு: க்களும் பண்பொடும்”, உலகத் தமிழ்நெய்ச்சி நிறுவனம், மீள்பதிப்பு, 2009.
2. பக்தவத்சல பொரதர், “தமிழர் லாண்டவியல்”, அறையாளம், இரண்டாம் பதிப்பு, 2008.
3. தட்சி லாழர்த்தி. அ., “தமிழர் லாகரிகமும் பண்பொடும்”, யாழ் மலையீடு, லாபதிப்பு, 2011.
4. நதவந யப்பொவலர். லா., “பழந்தமிழர் லாகரிகமும் பண்பொடும்”, தமிழ் லாண்பதிப்பகம், மலையீடு.
5. வலா லா லா. லா., “தமிழர் வரலாறும் பண்பொடும்”, நியலா மலையீடு புக் லாவலாஸ், ஆலாலா பதிப்பு, 2007.

18LHIN11**HINDI I****5 0 0 4**

Course Objective: To train the students in the use of Karyalayin Basha. To enable the students to develop the communication skill in Hindi language.

Unit I GADYA AUR KARYALAYIN BASHA 15 Lecture hours

Mamata, -Yogyatha evam vyavasay kaa Chunaav Paribashik shabdavalil prashasanik vakyansh, padanam

Unit II GADYA AUR SARKARI PATRA 15 Lecture hours

Rajneethi kaa Bhandwara, , Samanya sarkari patra, gyapan, karyalay gyapan

Unit III GADYA AUR SARKARI PATRA 15 Lecture hours

Computer nayi krantee kee dastak, , Karyalay aadesh, Ardha sarkari patra paripatra, Adhisoochana

Unit IV GADYA AUR SAMANYA PATRA 15 Lecture hours

Raspriya, Samanya patra- chutti patra, sampadak ke naam patra, shikayati patra, pustak vikretha ke naam patra

Unit V VYAVASAAYIK PATRA 15 Lecture hours

Bankon mein bach khaata kholne ke liye – chek buk ke liye, run lene hetu, chek buk gum ho jane hetu, kitaabon kaa krayadesh

Total : 75hours

TEXT BOOK:

Gadya Aur Prayojanmulak Hindi ed by Dr.N.Lavanya Mayura Publishers, 2008.

18LHIN21**HINDI II****5 0 0 4**

Course Objective: To enable the students to have the knowledge in contemporary literature of the modern era. It also provides an idea how translation to be effected.

UNIT I **KAHANI AUR EKANKI** **15 Lecture hours**

Poos Kee Raat., - **Duzhazar**

UNIT II **EKANKI AUR KAHANI** **15 Lecture hours**

.Vaapasi, Akeli, . Akbhari vigyapan

UNIT III : **KAHANI AUR ANUVAD** **15 Lecture hours**

Sharandatha - Anuvad anuched angreji se hindi me karne ke liye.

UNIT IV **EKANKI AUR ANUVAD** **15 Lecture hours**

Raat ke Raahi Main Bhi Maanav hoon Anuvad anuched angreji se hindi me karne ke liye.

UNIT V **KAHANI ,EKANKI AUR ANUVAD** **15 Lecture hours**

Parda - Yeh Meri Janma Bhoomi Hai -anuvad anuched angreji se hindi me karne ke liye.

Total: 75hours

TEXT BOOK:

Sankalan Kahani evam Ekankied by Dr.N.Lavanya, Mayura Publishers, 2010.

18LHIN31**HINDI III****5 0 0 4**

Course Objective: To help the students to have in depth knowledge of Literature. It makes the students to acquire more about the medieval period through the literary works.

UNIT I PRACHIN KAVYA HINDI SAHITYA KA ITIHAS 15 Lecture hours

Kabir- Hindi bash aka vikas – Hindi sahitya kaa aavirbahv

UNIT II PRACHIN KAVYA HINDI SAHITYA KA ITIHAS 15 Lecture hours

Surdaas, Tulsidass. Hindi sahitya kaa kaal vibhajan, aadikal, kaa Parichay

UNIT III PRACHIN KAVYA HINDI SAHITYA KA ITIHAS 15 Lecture hours

Rahim, aadikaal kaa namkran, paristhitiyan, racha evam rachnaakar

UNIT IV BHAKTI KAAL, REETHI KAA 15 Lecture hours

Bhakti kal kaa vibhajan paristhitiyan- racha evam rachnaakar - Reethikal ke prakaar, rachna evam rachnakar

UNIT V PRACHIN KAVYA EVAM RACHNAKARON KAA PARICHAY

15 Lecture hours

Bihari - Chandbardayee, Ameerkhusaro, Kabir, Surdas, Tulsidas Jaayasi, Kesahv das Bhushan,

Total: 75hours

TEXT BOOK:

Prachin evam Aadhunik Kavya Sankalan ed by Dr.N.Lavanya, Mayura Publishers, 2011.

REFERENCE BOOK:

Hindi Sahitya kaa Itihas, By Dr.Nagendra, Raj kamal Prakashan, 1997.

18LHIN41**HINDI IV****5 0 0 4**

Course Objective: To enable the students to acquire knowledge in journalism so as to enhance his skill in effective communication pertaining to Hindi language.

UNIT I AADHUNIK KAVITHA AUR RACHNAAKAR 15 Lecture hours

Mythili Sharan Gupta - Apna Sansar, Aadhunik Rachnakar Hazaari prasad Diwedi,
Mahaveer Prasad Diwedi,

Unit II AADHUNIK KAVITHA AUR RACHNAAKAR 15 Lecture hours

Jayashankar Prasad Kamayani - Chinta, Aadhunik Hindi Rachanakar Premchand,
Jainendra

Unit III AADHUNIK KAVITHA AUR PATRAKARITHA 15 Lecture hours

Mahadeviverma, Murjaya PhoolBhavani Prasad Mishra Patrakarita – paribhasha,, arth,
prakar, swaroop

Unit IV AADHUNIK KAVITHA , PATRAKARITHA AUR RACHNAKAR 15 Lecture hours

Mukthibodh Tum Logoan se door,Shamsher Bhadur Singh – Bharat kee aarathi,
Vigyapan- sampadan kala,-Nirala, -Pant- Mohan Rakesh

Unit V AADHUNIK KAVITHA , PATRAKARITHA AUR RACHNAKAR 15 Lecture hours

Prabhakar Machve Nimna Mdhya varg, **Patrakaritha-** samachar sankalan - Peeth
patrakarita, Rachnakaar - Fanishwaranath renu -Mannu bhandari,Bhagawaticharan Verma,
Yashpal

Total: 75hours

TEXT BOOK:

Prachin evam Aadhunik Kavya Sankalan ed by Dr.N.Lavanya, Mayura Publishers, 2011.

REFERENCE BOOK:

Patrakaritha Ek Paricahy by Dr.Madhu Dhawan, Bodh Prakashan,1997.

18LFRE11**FRENCH I****5 0 0 4**

Course Objective: To introduce French Language. To enable the students to understand and to acquire the basic knowledge of French Language with the elementary grammar.

UNIT I INTRODUCTION**15 Lecture hours**

Introduction - Alphabet – Comment prononcer, écrire et lire les mots- Base : Les prénoms personnel de 1^{er}, 2^{ème} et 3^{ème} personnes – Conjugaisons les verbes être et avoir en forme affirmative, négative et interrogative

UNIT II LEÇONS 1- 3**15 Lecture hours**

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

UNIT III LEÇONS 4- 6**15 Lecture hours**

Leçons 4. L'heure, C'est 1 ;heure,- 5. Elle va revoir sa Normandie,- 6 .Mettez –vous d'accord groupe de nom - Réponses aux questions tirés de la leçon - Grammaire : A placer et accorder l'adjectif en groupe de nom- Préposition de lieu –A écrire les nombres et l'heure en français

UNIT VI LEÇONS 7- 9**15 Lecture hours**

Leçons7. Trois visage de l'aventure,- 8. A moi, Auvergne,- 9. Recit de voyage - Réponses aux questions tirés de la leçon - Grammaire : Adjectif possessif – Les Phrases au Présent de l'indicatif - Les phrases avec les verbes pronominaux au présent

UNIT V COMPOSITION :**15 Lecture hours**

A écrire une lettre à un ami l'invitant à une célébration différente ex : mariage – A faire le dialogue - A lire le passage et répondre aux questions

Total: 75hours**TEXT BOOK :**

Jacky GIRARDER & Jean Marie GRIDLIG, « Méthode de Français PANORAMA », Clé Internationale , Goyal Publication, New Delhi., Edition 2004

REFERENCE BOOKS:

1. Dondo Mathurin , “ Modern French Course”, Oxford University Press., New Delhi., Edition 1997

2. Nitya Vijayakumar, “Get Ready French Grammar – Elementary”, Goyal Publications, New Delhi., Edition 2010

18LFRE21**FRENCH II****5 0 0 4**

Course Objective: To fortify the grammar and vocabulary skills of the students. Enable the students have an idea of the French Culture and Civilization

UNIT I LEÇONS 10 – 11**15 Lecture hours**

Leçons : 10. Les affaires marchent,- 11. Un après midi à problèmes- Réponses aux questions tirés de la leçon - Grammaire : Présent progressif, passé récent ou future proche - Complément d'objet directe - Complément d'objet indirecte.

UNIT II LEÇONS 12 – 13**15 Lecture hours**

Leçons : 12. Tout est bien qui fini bien,- 13. Aux armes citoyens – Réponses aux questions tirés de la leçon - Grammaire : Les pronoms « en ou y » rapporter des paroles - Les pronoms relatifs que, qui, ou où ,

UNIT III LEÇONS 14 – 15**15 Lecture hours**

Leçons 14. Qui ne risqué rien n'a rien,- 15. La fortune sourit aux audacieux – Réponses aux questions tirés de la leçon - Grammaire : Comparaison – Les phrases au passé composé

UNIT IV LEÇONS 16 – 18**15 Lecture hours**

Leçons 16 La publicite et nos rêves 17 La France le monde 18 Campagne publicitaire Réponses aux questions tirés de la leçon - Grammaire :- Les phrases à l' Imparfait - Les phrases au Future

UNIT V COMPOSITION :**15 Lecture hours**

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

Total: 75hours**TEXT BOOK :**

Jacky GIRARDER & Jean Marie GRIDLIG, « Méthode de Français PANORAMA », Clé Internationale , Goyal Publication, New Delhi., Edition 2004

REFERENCE BOOKS:

1. Dondo Mathurin, “Modern French Course”, Oxford University Press, New Delhi., Edition 1997
2. Paul Chinnappane “Grammaire Française Facile”, Saraswathi House Pvt Ltd, New Delhi, Edition 2010

18LFRE31**FRENCH III****5 0 0 4****Objective :**

To strengthen the Grammar and Composition in French language.

To train the students to enhance his skill in French language for communication

UNIT I LEÇON 16 & 29 12 Lecture hours

La famille Vincent (Page 44) - Grammaire : Passé composé

Vers l'hôtel (page 80) Grammaire : Impératif, A mettre les phrases
du singulier au pluriel

UNIT II LEÇON 40 & 44 12 Lecture hours

L'épicerie, les légumes et les fruits (page 112) – Grammaire : Présent

de l'indicatif a poste (page 124) – 1 Grammaire : A mettre les phrases
à l'imparfait

UNIT III LEÇON 51 & 58 12 Lecture hours

Le café et tabac (page 142) - Grammaire : A changer les phrases en Interrogatif

La Chasse et la pêche (160) - Grammaire : Le plus que parfait

UNIT IV LEÇON 61 12 Lecture hours

Un mariage à la campagne (page 170) - Grammaire – A changer au participe
présent

UNIT V COMPOSITION 12 Lecture hours

A écrire une lettre à un ami l'invitant à une celebration differente ex : mariage
– A faire un essaie sur un sujet générale - A lire le passage et répondre aux questions

TOTAL : 60 Hours**TEXTBOOK**

Les leçons ont été choisi et tiré de I & II degré de G .MAUGER « Cours de
Langue et de Civilisation Française » The Millenium, Publication Hachette,
Edition 2002

REFERENCE BOOKS

1.DONDO Mathurin, “ Modern French Course”, Oxford
University Press, New
Delhi., Edition 1997

2. Paul Chinnapan, « Saraswati Grammaire Française facile », Saraswathi House Pvt. Ltd., New Delhi., Edition 2010
3. Larouse, “Larouse French Grammar”, Goyal Publication, New Delhi., Edition 1995

18LFRE41**FRENCH IV****5 0 0 4****Objective:**

To enable the students to strengthen their knowledge of grammar/composition

To make the students to develop their skills of communication in French language

UNIT I LEÇON 20 & 46**12 Lecture hours**

Une grande Nouvelle (page 56) – Grammaire : A mettre les phrases au Future

Le métro ; l'autobus (page 130) - Grammaire : A former ou à changer

l'adjectif masculin ou féminin à l'adverbe - A trouver les noms qui correspondent aux verbes.

UNIT II LEÇON 48 & 63**12 Lecture hours**

A la Préfecture de police (page 132) - Grammaire : Les Pronoms relatifs

Les sports (page 174) Grammaire : Le conditionnel présent

UNIT III LEÇON 56 & 57**12 Lecture hours**

A Biarritz, la plage (page 156) - Grammaire : Le future antérieure

Dans les Pyrénées (page 158) - Grammaire : Le future antérieure suite)

UNIT IV LEÇON 65**12 Lecture hours**

A fin des vacances (page 178) Grammaire : A changer les phrases du pluriel au singulier - Le présent du subjonctif

UNIT V COMPOSITION**12 Lecture hours**

A écrire une lettre de regret / refus à un ami concernant l'invitation d'une célébration

reçue- A écrire un essai sur un sujet générale - A lire le passage et répondre aux questions

TOTAL : 60 Hours**TEXTBOOK**

Les leçons ont été choisis et tirés de I & II degré de G .MAUGER « Cours de Langue et de Civilisation Française » The Millennium, Publication Hachette, Edition 2002

REFERENCE BOOKS

1. DONDO Mathurin, “ Modern French Course”, Oxford University Press, New Delhi., Edition 1997
2. Paul Chinnapan, « Saraswati Grammaire Française facile », Saraswathi House Pvt. Ltd., New Delhi., Edition 2010
3. Larouse, “Larouse French Grammar”, Goyal Publication, New Delhi., Edition

DISCIPLINE SPECIFIC ELECTIVES (DSE)

18DBMB52 DSE1: Fermentation Technology 5 0 0 5

Course Objectives: The candidate will gain knowledge about fermentation technology and requirements; various fermenter systems; production of commercially important microbial products

UNIT I INTRODUCTION 15 Lecture Hours

General consideration of fermentation process. Types of fermentation-submerged, solid state, batch, fed batch, continuous, single, dual, multiple. Design of fermenter. Types of fermenter-Air lift, cylindro-conical, fluidized bed, stirred, Tower fermentor, growth kinetics of batch and continuous culture-chemostat and turbidostat. Primary and secondary metabolites-product fermentation kinetics.

UNIT II FACTORS INFLUENCING FERMENTATION 15 Lecture Hours

Media formulation- Strategy involved, aeration and agitation. Factors affecting oxygen transfer – Determination of K_{LA} Values-Newtonian and non-Newtonian fluids. Physical and chemical environmental sensors, fermentation control systems-manual and automatic.

UNIT III STERILIZATION 15 Lecture Hours

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

UNIT IV INDUSTRIALLY IMPORTANT MICROORGANISMS 15 Lecture Hours

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

UNIT V COMMERCIAL PRODUCTION 15 Lecture Hours

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

Total: 75 Lecture Hours

Course Outcome

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

CO1: Basic understanding of fermentation process and types.

CO2: Grasp the information on design of fermenter and its types

CO3: Gain knowledge on factors influencing fermentation process

CO4: Obtain knowledge on sterilization processes and their kinetics

CO5: Obtaining in-depth information on scale-up process and Assimilate knowledge on industrially important microbes

TEXT BOOKS:

1. Stanbury PF, Whitaker A, Hall SJ; Principles of fermentation technology Pergamon press. 1995.
2. Mukhopadhyay S., process Biotechnology fundamentals Viva books Pvt Ltd. 2nd edn., 2004.

REFERENCE BOOKS:

1. Cruegar and Cruegar. Biotechnology – Industrial Microbiology (1st edn). 1988.
2. Patel, AH. Industrial Microbiology; Mc. Millan pvt. Ltd. 1st edn., 2004.
3. Anton Moser, Bioprocess technology – Kinetics and reaction; Springer Verlag, New York wein. 1st edn., 1988
4. El-Mansi, EMT. Fermentation Microbiology and Biotechnology; Taylor and Francis Publishers. 2005.
5. Balasubramanian, D., Bryce CFA, Dharmalingam, K., green J., Kunthala Jayaraman. Concepts of Biotechnology; University press. Revised edn., 2004

18DBMB51

DSE2: Biochemistry**6 0 0 6**

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 15 Lecture Hours

Carbohydrates – Classification, structure of mono, oligo and polysaccharides. Glycolysis, TCA cycle, HMP shunt, Oxidative Phosphorylation and its inhibitors.

UNIT II PROTEINS 20 Lecture Hours

Protein – Classification, amino acid – structure and classification. Biological role of proteins and structural organization of protein. Transamination, deamination and urea cycle and its regulation.

UNIT III LIPIDS 15 Lecture Hours

Lipids – Classification, Saturated and Unsaturated fatty acids. Biological functions of lipids. Biosynthesis and oxidation of fatty acids, structure, function and metabolism of cholesterol.

UNIT IV NUCLEIC ACIDS 20 Lecture Hours

Nucleic acid – Nucleosides, Nucleotides, Structure of DNA and RNA – various types of RNA. Biosynthesis and degradation of purine and pyrimidine.

UNIT V CHROMATOGRAPHY 20 Lecture Hours

Chromatography – gel filtration, affinity, HPLC. Centrifugation – differential centrifugation. Electrophoresis – SDS-PAGE, Agarose gel electrophoresis.

Total: 90 Lecture Hours

Course Outcome

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

CO1: Basic understanding of carbohydrates and its metabolism

CO2: Obtain knowledge on structure, classification & biological roles of proteins

CO3: Obtaining in-depth information on lipids and their classification.

CO4: Assimilate knowledge on biosynthesis and metabolism of lipids

CO5: Gain the knowledge on different chromatographic methods.

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

18PBMB51**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 Formal Titration.
9. Estimation of ascorbic acid by 2,3 Dichlorophenol Indophenol.
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: 60 Lab hours

18DBMB5X**DSE4: Bioinstrumentation****6 0 0 6**

Course Objectives: The candidate will gain knowledge about the principles, uses, advantages and disadvantages of devices and instruments routinely used in biological labs such as LAF cabinets, Centrifuges, HPLC, GC, Spectroscopy – NMR, UV–Vis, IR. Significance and use of radioisotopes.

UNIT I**BASIC INSTRUMENTS****15 Lecture Hours**

Principle and working of pH meter, Laminar-air flow. Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges, differential centrifugation, sedimentation velocity, sedimentation equilibrium, density gradient methods and their applications.

UNIT II**CHROMATOGRAPHY****15 Lecture Hours**

Theory, principles and applications of paper, thin layer, gel filtration, ion exchange, affinity, gas liquid, high pressure/ performance liquid chromatography (HPLC)

UNIT III**ELECTROPHORESIS****15 Lecture Hours**

Basic principles of electrophoresis, theory and application of paper, starch gel, agarose, native and denaturing PAGE, isoelectric focusing.

UNIT IV**SPECTROSCOPY****15 Lecture Hours**

Spectroscopic techniques, theory and applications of UV, Visible, IR, NMR, Fluorescence, Atomic Absorption, Mass, Raman Spectroscopy.

UNIT V**RADIOISOTOPES****15 Lecture Hours**

Use of radioisotopes in life sciences, radioactive labeling, principle and application of tracer techniques, detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger- Muller and Scintillation counters, autoradiography and its applications.

Total: 75 Lecture Hours**Course Outcome**

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

CO1: Gain knowledge on principle and working of various laboratory equipment and can able to use them with theoretical knowledge.

CO2: Learn on 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: Learn the different techniques of gel electrophoresis where they can separate DNA, proteins and compounds.

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

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

TEXTBOOK:

Chatwal G 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. Thornburn, Isotopes and radiations in Biology, Butterworth and Co. Ltd., London. 1999.

18PBMB5X**DSE5: 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

18DBMB6X**DSE6: Bioinformatics****6 0 0 6**

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

UNIT I COMPUTER, LANGUAGE, DEVICES 18 Lecture Hours

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 Lecture Hours

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

UNIT III MOLECULAR BIOLOGY 15 Lecture Hours

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 15 Lecture Hours

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

UNIT V PROTEIN DATABASES 15 Lecture Hours

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

Total: 75 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.

18PBMB5X**DSE7: Bioinformatics (Practical)****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

18DBMB53**DSE8: Biofertilizers (Theory)****5 0 0 5**

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 15 Lecture Hours

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

UNIT II AZOSPIRILLUM 15 Lecture Hours

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 15 Lecture Hours

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

UNIT IV MYCHORRIZA 15 Lecture Hours

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 15 Lecture Hours

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

Total: 75 Lecture Hours

Course Outcome

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

CO1: Acquire knowledge about the role and importance and significance of biofertilizers and in-depth awareness about mass production and applications of Rhizobium bio fertilizer and their impact on plant growth.

CO2: Gain knowledge about formulating Azospirillum and Azotobacter biofertilizers.

CO3: Obtain in-depth information on the mycorrhizal taxonomy, occurrence, distribution and Learn about the types of mycorrhizal associations.

CO4: Know-how in isolation of VAM and also its influence on growth and yield of crop plants.

CO5: Assimilate knowledge on green manuring. Understand recycling of biodegradable municipal, agricultural and industrial wastes. Learn about the method of vermicompost preparation and its field applications.

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.Subha Rao, N.S. Soil Microbiology, Oxford & IBH Publishers, New Delhi.2000.
- 6.Vayas,S.C, Vayas, S. and Modi, H.A. Bio-fertilizers and or ganic Farming Akta Prakashan, Nadiad.1998.
7. H.C.Lakshmi, Biofertilizers & Biopesticides; Neha Publishers. 2014.

18DBMB6X DSE9: Microbial Biotechnology (Theory) 6 0 0 6

Course Objectives: The candidates will be aware of the wide applications of microorganisms in industries, appreciate the use of microbes in biotransformation processes and production of industrially important products, and understand the potentials of microbes in rDNA technology to manufacture genetically engineered therapeutics.

UNIT I INDUSTRIALLY IMPORTANT MICROBES 20 Lecture Hours

Biology & Genetics of industrially important microbes- *Streptomyces*. Non Streptomyces Actinomycetes, *E.coli*, *Corynebacterium*, *Bacillus*, Filamentous fungi, *Saccharomyces*, Non Saccharomyces industrial yeasts, Algae- *Spirulina*, *Chlorella* & *Scenedesmus*.

UNIT II BIOTRANSFORMATION 20 Lecture Hours

Types of Biotransformation reactions. Biotransformation of steroids, antibiotics, arachidonic acid, glycerol, Biotransformation for production of ascorbic acid & indigo. Microbial production of Organic solvents- ethanol, acetone, butanol & glycerol. Microbial production of Organic acids- acetic acid & citric acid.

UNIT III MICROBIAL PRODUCTION OF ANTIBIOTICS AND VITAMINS**20 Lecture Hours**

Applications & Microbial production of Antibiotics- Penicillin, Cephalosporins. Streptomycin, Tetracyclines & Griseofulvin. Microbial production of Amino acids- L- glutamic acid & L- lysine. Microbial production of Vitamins- Vit B12, Riboflavin & Vit C.

UNIT IV FERMENTATION PRODUCTS 15 Lecture Hours

Microbial production of Foods. Fermented foods- cheese, yoghurt, sauerkraut, bread, sweeteners, flavor enhancers. Oriental fermented foods- soya sauce, koji & miso. Microbial production of Alcoholic beverages- beer, wine & whisky. SCP & Mushrooms. Biofertilizers & Biopesticides.

UNIT V rDNA TECHNOLOGY 15 Lecture Hours

Applications of Genetic Engineering & rDNA technology. Recombinant vaccines- subunit, DNA & vector vaccines. Hormones- insulin & human growth hormone. Blood proteins- tissue plasminogen activator, interferons & erythropoietin. Monoclonal antibodies.

Total: 75 Lecture Hours

Course Outcome

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

CO1: Gain knowledge on Industrially important microbes and its applications in Industries

CO2: Obtain detailed knowledge on Biotransformation reactions

CO3: Acquire clear view about Microbial production of Organic solvents, Vitamins, Foods, Applications & Microbial production of Antibiotics and Alcoholic beverages

CO4: Conquer knowledge on Applications of Genetic Engineering & rDNA technology

CO5: Accomplish knowledge on production of vaccines, Hormones and Blood proteins.

TEXTBOOK:

U.Sathyanarayana, Biotechnology; Books and Allied Ltd. 2008.

REFERENCE BOOKS:

1. Arnold .L, Demain and Davis. J. E., Manual of Industrial Microbiology and Biotechnology; ASM Press. Washington DC. 1999.
2. Stanbury. P .F, Whitaker. A. Hall. S. J, Principles of Fermentation Technology; Pergamon Press. 1995.
3. Reed. G, Prescott and Dunn's Industrial Microbiology; Macmillan Publishers. 1982.
4. W.B. Hugo and A. D. Russell, Pharmaceutical microbiology, Ed. 6; Blackwell scientific publications. 2002.
5. S.P.Vyas, V.K. Dixit, Pharmaceutical Biotechnology; CBS publishers and Distributors, New Delhi. 2004.
6. Rajesh Bhatia, Ratanlal Ihhpunjani, Quality assurance in Microbiology; CBS publishers and distributors, New Delhi. 2005.

18DBMB6X DSE10: Environmental Biotechnology (Theory) 6 0 0 6

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 20 Lecture Hours

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

UNIT II AQUATIC ECOSYSTEMS 20 Lecture Hours

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 20 Lecture Hours

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 15 Lecture Hours

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 15 Lecture Hours

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

Total: 75 Lecture Hours

Course Outcome

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

CO1: Gain knowledge about the role and infections caused in air.

CO2: Obtain complete knowledge on Microorganism inhabiting extreme environments.

CO3: Gain detailed knowledge on aquatic ecosystems and Water borne diseases

CO4: Acquire detailed knowledge on solid and liquid wastes, Solid waste treatment, Utilization of solid wastes, Waste water treatment and its different methods.

CO5: Attain 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.

18DBMB6X**DSE11: Biostatistics (Theory)****6 0 0 6**

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 20 Lecture Hours

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

UNIT II DATA COLLECTION 20 Lecture Hours

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 20 Lecture Hours

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 15 Lecture Hours

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 15 Lecture Hours

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

Total: 90 Lecture Hours

Course Outcome

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

CO1: Basic understanding of Biostatistics.

CO2: Grasp the information on kinds of biological data and collection of data

CO3: Obtain knowledge on sampling, sampling design and in-depth information on Correlation

CO4: Assimilate knowledge on Regression its types and Deviations

CO5: 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.

18DBMB5X**DSE12: Microbial Metabolism****5 0 0 5**

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 15 Lecture Hours

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 15 Lecture Hours

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 15 Lecture Hours

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

UNIT IV BIOSYNTHESIS AND FERMENTATION 15 Lecture Hours

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

UNIT V PHOTOSYNTHESIS IN PROKARYOTE 15 Lecture Hours

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

Total: 75 Lecture hours

Course Outcome

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

CO1: Gain knowledge about the basic bioprocesses and the potentials of bio molecules in cell stability.

CO2: Learn about the generation and maintenance of membrane potential.

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

CO4: Gain knowledge in the biosynthesis of various bio molecules and fermentation

CO5: Learn about the photosynthesis in prokaryotic system

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 Archae; Elseiver. 1993.
10. Topley & Wilson's: Principles of Bacteriology, Virology, & Immunology; Edward Arnold. Ed. 9; 2002.

18DBMB61**DSE13: Marine Microbiology****6 0 0 6**

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

UNIT I**MICROBIAL ECOSYSTEMS****20 Lecture Hours**

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****20 Lecture Hours**

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; entroviruses. 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**20 Lecture Hours**

Microbiology of fresh water and wastewater (sewage), BOD, COD (definitions), Types of waste water, Characteristics of waste water, Analysis of waste water (Physical, Chemical, biological), Effect of waste water on environment, Monitoring bodies (small and large scale), Treatment of small and large scale waste water: 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****15 Lecture Hours**

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 organismns,

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.

18DBMB6X**DSE14: Immunotechnology****6 0 0 6**

Course Objectives: The candidates will understand basic principles in immunology and immunological methods. The paper instills in the students the concepts of immunoengineering of antigens and antibodies.

UNIT I ANTIGEN-ANTIBODY REACTIONS 20 Lecture Hours

Antigen-Antibody reactions- Precipitation- types-immunodiffusion methods- Agglutination-types-immunofluorescent techniques-principles- typical protocol -types-RIA-principles-typical protocol-ELISA-different types-Ag coating-Ab coating-linking of enzymes to Abs-substrates. Immunoelectrophoresis-immunoblotting.

UNIT II PREPARATION OF ANTIGENS 20 Lecture Hours

Preparation of antigens-bacterial, fungal, viral pathogens-different methods. Standardization of antigens-quantification. Raising of polyclonal antibodies in animals-different routes of inoculation- immunization protocol- purification of immunoglobulins of different classes-quantification.

UNIT III MOLECULAR ENGINEERING METHODS 20 Lecture Hours

Molecular engineering methods – improve and modify immunological specificities and reactions. Antigen engineering for better immunogenicity and use for vaccine development. Antibody engineering – development of monoclonal antibodies and fragments using cellular and molecular technologies- cloning methods, production, purification and characterization of mAbs. Production of human monoclonal antibodies and their applications. Antibodies for diagnosis and therapy.

UNIT IV SEPARATION OF IMMUNE CELLS 15 Lecture Hours

Separation of immune cells-T cells- B cells- Macrophages- density gradient-lymphocyte stimulation test- flow cytometry-T cell subset analysis- B cell analysis. Delayed Type Hypersensitivity estimation methods- macrophage migration inhibition assays- purification and assay of interleukins.

UNIT V IMMUNOHAEMATOLOGY 15 Lecture Hours

Immunohaematology-blood groups- methods of blood grouping- reverse grouping- uses in forensic science-coombs test- blood banking. HLA typing- Tissue typing.

Total: 75 Lecture Hours

Course Outcome

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

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

CO2: Learn about the preparation of antigens from pathogens and polyclonal, monoclonal and humanized antibodies

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

CO4: Understand the evaluating effect of immune cells.

CO5: Understanding of the principles of immunohaematology methods and their use in scientific research.

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.

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:

Ananthnarayanan. R & C. K. Jeyaram Panicker; TEXTBOOKS 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. WM.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.

15BMI154**GE2: Industrial and Food Microbiology (Theory)****2 0 0 2**

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

UNIT I INTRODUCTION 6 Lecture hours

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 Lecture hours

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 Lecture hours

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 PRINCIPLES AND METHODS OF FOOD PRESERVATION 6 Lecture hours

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 Lecture hours

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: 30hours

Course Outcome

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

CO1: Realize the importance of microbes in the production of many useful products

CO2: Understand fermenters and fermentation processes.

CO3: Gain knowledge in downstream processing and industrial production of various products.

CO4: Understand the relationship between foods and microbes and its impact on human health

CO5: Assimilate information on 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.

15BMI155**GE3: Microbes in Environment (Theory)****2 0 0 2**

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 Lecture hours

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 Lecture hours

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

UNIT III BIOGEOCHEMICAL CYCLING 6 Lecture hours

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 Lecture hours

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 Lecture hours

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: 30hours

Course Outcome

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

CO1: Learn about the structure and functions of ecosystem and role of microbes in the environment.

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

CO3: Gain knowledge in the importance of biogeochemical cycling in the ecosystems.

CO4: Obtain knowledge on microbiological aspects and management of waste water.

CO5: Learn 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.

15BMI157 GE4: Genetic Engineering and Biotechnology (Theory) 2 0 0 2

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

UNIT I INTRODUCTION TO GENETIC ENGINEERING 6 Lecture hours

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 Lecture hours

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 Lecture hours

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 Lecture hours

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 Lecture hours

Patents, Copyrights, Trademarks.

Total: 30hours

Course Outcome

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

CO1: Gain knowledge about genetic engineering and enzymology.

CO2 Study about the various types of cloning vectors used in genetic engineering.

CO3: Learn about the DNA amplification and sequencing methods.

CO4: Acquire knowledge in gene transfer methods and also the applications of biotechnology.

CO5: Achieve knowledge about 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.

15BMI158 GE5: Microbial Genetics and Molecular Biology (Theory) 2002

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 Lecture hours

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 Lecture hours

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 Lecture hours

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 Lecture hours

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 Lecture hours

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 EMFCell 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 Lecture hours**
- History, philosophy, aims & objectives of NSS
 - Emblem, flag, motto, song, badge etc.
 - Organizational structure, roles and responsibilities of various NSS functionaries
- Unit — 02: NSS Programmes and Activities** **10 Lecture hours**
- Concept of Regular activities, special camping, Day Camps
 - Basis of adoption of village/slums, Methodology of conducting Survey
 - Financial pattern of the scheme
 - Other youth prog./schemes of GOI
 - Coordination with different agencies
 - Maintenance of the Diary
- Unit — 03: Understanding Youth** **5 Lecture hours**
- Definition, profile of youth, categories of youth
 - Issues, challenges and opportunities for youth
 - Youth as an agent of social change
- Unit - 04: Community Mobilisation** **9 Lecture hours**
- Mapping of community stakeholders
 - Designing the message in the context of the problem and the culture of the community
 - Identifying methods of mobilization
 - Youth-adult partnership
- Unit - 05: Volunteerism and Shramdan** **7 Lecture hours**
- Indian Tradition of volunteerism
 - Needs & importance of volunteerism
 - Motivation and Constraints of Volunteerism
 - Shramdan as a part of volunteerism

SEC2: NSS-II

- Unit — 01: Importance and Role of Youth Leadership** **6 Lecture hours**
- 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 Lecture hours**
- 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 Lecture hours**
- 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 Lecture hours**
- 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 Lecture hours**
- a) Basic Features of Constitution of India
 - b) Fundamental Rights and Duties Human Rights
 - d) Consumer awareness and the legal rights of the consumer
 - e) RTI
- Unit - 02 : Family and Society** **6 Lecture hours**
- 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 Lecture hours**
- 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 Lecture hours**
- a) Healthy Lifestyles
 - b) HIV AIDS, Drugs and Substance abuse
 - c) Home Nursing
 - d) First Aid
- Unit - 05: Youth and Yoga** **9 Lecture hours**
- 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 Lecture hours**

- 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 Lecture hours**

- a. Introduction to Disaster Management, classification of disasters
- b. Role of youth in Disaster Management

Unit-03: Project Cycle Management**10 Lecture hours**

- a) Project planning
- b) Project implementation
- c) Project monitoring
- d) Project evaluation: Impact assessment

Unit - 04: Documentation and Reporting**7 Lecture hours**

- 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 Lecture hours**

This unit 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 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 Lecture hours**

- 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 Lecture hours**

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

SEC6: NSS VI**Unit - 1: Vocational Skill Development****20 Lecture hours**

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 Lecture hours**

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

Unit-03: Resource Mobilisation**3 Lecture hours**

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

Unit-04: Additional Life Skills**7 Lecture hours**

- 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

15BPD251**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 Lecture hours

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 Lecture hours

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 Lecture hours

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 Lecture hours

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 Lecture hours

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.

CO6: Learn the significance of self esteem and smartness.

CO7: Acquire information on body language, character building and team work.

CO8: Learn about the stress management.

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

SEC8: SOFTSKILLS – I**1. Reading Comprehension and Vocabulary**

Filling the blanks – Cloze Exercise – Vocabulary building – Reading and answering Questions.

2. Listening and Answering Questions.

Listening and writing – Listening and sequencing sentences – Filling in the blanks – Listening and answering questions.

3. Group Discussions

Why GD part of a selection process – Structure of a GD – strategies in GD – Team Work – Body Language

4. Conversation.

Face to face Conversation and Telephone conversation.

5. Self- Introduction and Role Play**BOOKS RECOMMENDED**

Barun K. Mitra. Personality Development and Soft Skills. Oxford University Press. New Delhi.2011.

S.P. Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.

Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

SEC9: SOFT SKILLS – II

1. Presentation Skills

Elements of an effective presentation – structure of presentation – voice modulation – Audience analysis – Body language

2. Soft Skills

Time Management – Articulateness – Assertiveness – Stress management

3. Resume / Report preparation / Letter Writing

Structuring the resume / Report – Business letters – E-Mail Communication

4. Interview Skills

Kinds of Interviews – Required by Skills – Corporate Culture – Mock Interviews

5. 30 Frequently asked questions

BOOKS RECOMMENDED

Barun K.Mitra. Personality Development and soft skills. Oxford University Press. New Delhi. 2011.

S P Sharma. Personality Development. Pustaq Mahal. New Delhi. 2010.

Meenakshi Raman and Sangeetha Sharma. Technical Communication. Oxford University Press. New Delhi. 2009.

7. 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. **Power Point slides** for topics which involve information related to intricate biological pathways such as metabolic pathways in bacteria and other microorganisms.

Use of Power Point presentations are also made whenever the lectures are to be summarized in a crisp and pointwise manner to highlight salient / important conclusions from the topics.

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

8. 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.
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.

9. Key Words:

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