KANNUR UNIVERSITY

(Abstract)

B.Sc. Microbiology Programme-Scheme, Syllabus and Pattern of Question Papers of Core, Complementary Elective and Generic Elective Course under Choice Based Credit and Semester System (Outcome Based Education System-OBE) in Affiliated colleges with effect from 2019 Admission-Implemented-Orders issued.

Academic Branch

No.Acad.C2/12726/2019 Civil Station P.O, Dated 25/06/2019

Read:- 1. U.O.No.Acad.C2/429/2017 dated 10-10-2017

2. The Minutes of the Meeting of the Curriculum Restructuring Committee held on 28-12-2018.
3. U.O No. Acad.C2/429/2017 Vol.II dated 03-06-2019
4. The Minutes of the Meeting of the Board of Studies in **Microbiology (Cd)** held on 06/06/2019
5. Syllabus of **B.Sc. Microbiology** Submitted by the Chairperson, Board of Studies in **Microbiology (Cd)** dated 15/06/2019

ORDER

1. A Curriculum Restructuring Committee was constituted in the University vide the paper read (1) above to co-ordinate the activities of the Syllabus Revision of UG programmes in Affiliated colleges of the University.

2. The meeting of the Members of the Curriculum Restructuring Committee and the Chairpersons of different Boards of Studies held, vide the paper read (2) above, proposed the different phases of Syllabus Revision processes, such as conducting the meeting of various Boards of Studies, Workshops, discussion etc.

3. The Revised Regulation for UG Programmes in Affiliated colleges under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) was implemented with effect from 2019 Admission as per paper read (3) above.

4. Subsequently, as per paper read (4) above, the Board of Studies in **Microbiology (Cd)** finalized the Scheme, Syllabus & Pattern of Question Papers for Core, Complementary Elective & Generic Elective Course of **B.Sc. Microbiology** Programme to be implemented with effect from 2019 Admission.

5. As per paper read (5) above, the Chairperson, Board of Studies in **Microbiology (Cd)** has submitted the finalized copy of the Scheme, Syllabus & Pattern of Question Papers of **B.Sc. Microbiology** Programme for implementation with effect from 2019 Admission.

6. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with accorded sanction to implement the Scheme, Syllabus & Pattern of Question Papers (Core/Complementary Elective/Generic Elective Course) of the **B.Sc. Microbiology** Programme under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) in the Affiliated colleges under the University with effect from 2019 Admission, subject to reporting to the Academic Council.

7. The Scheme, Syllabus & Pattern of Question Papers of the **B.Sc. Microbiology** Programme are uploaded in the University website (www.kannuruniversity.ac.in)

Orders are issued accordingly.

Sd/-
DEPUTY REGISTRAR (ACADEMIC)
For REGISTRAR

To

The Principals of Colleges offering **B.Sc. Microbiology** programme

Copy to:-

1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in **Microbiology (Cd)**
3. PS to VC/PA to PVC/PA to Registrar
4. DR/AR-I, Academic
5. The Computer Programmer (for uploading in the website)
6. SF/DF/FC

Forwarded/By Order

KANNUR UNIVERSITY * THAVAKKARA * CIVIL STATION P.O. KANNUR Pin-670 002

SECTION OFFICER

KANNUR UNIVERSITY

SYLLABUS FOR CORE, COMPLEMENTARY ELECTIVE COURSES & GENERIC ELECTIVE COURSES

FOR
B.Sc. MICROBIOLOGY PROGRAMME

CHOICE BASED CREDIT AND SEMESTER SYSTEM
(2019 ADMISSION ONWARDS)

BOARD OF STUDIES IN MICROBIOLOGY

VISION AND MISSION

Vision: To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavors.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

PROGRAMME OUTCOMES (PO)

PO 1. Critical Thinking:

1.1 Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.

1.2 Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.

1.3 Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO 2. Effective Citizenship:

2.1 Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.

2.2 Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalization and the ability to understand and resist various kinds of discriminations.

2.3 Internalise certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO 3. Effective Communication:

3.1 Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language

3.2 Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.

3.3 Generate hypotheses and articulate assent or dissent by employing both reason and creative thinking.

PO 4. Interdisciplinarity:

4.1 Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.

4.2 Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.

4.3 Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

PREFACE

Outcome Based Education (OBE) is an approach to education in which decisions about the curriculum and instructions are driven by the exit learning outcomes or educational purposes that the students should display at the end of a program or a course. OBE has been adopted in various educational systems across the world and now universities in India, regardless of their stage of development, are busy modifying their University curriculum and syllabus in order to increase the students' readiness in facing global competition through OBE.

In tune with this, the syllabus for Microbiology undergraduate programme in Kannur University has been revised based on Kannur University Regulations for Choice Based Credit and Semester System for Under-Graduate Programme 2019 with a view to implement Outcome Based Education (OBE) and Curriculum from 2019-20 academic year on wards.

The courses in this undergraduate program in Microbiology endeavors to incorporate the latest knowledge into the syllabus to keep the student abreast of the growth and developments in the field. The lab courses are also well framed which will give the students an opportunity to get hands-on training on latest techniques in Microbiology. We hope that this syllabus will inspire the students for pursuing higher studies in Microbiology and for becoming an entrepreneur and also enable students to get employed in research Institutes, Industries and other academic Institutes etc.

Prof. (Dr.) K. Sreejith
Chairman
Board of Studies In Microbiology

PROGRAMME SPECIFIC OUTCOME
B.Sc. MICROBIOLOGY

PSO1: **Understand general characteristics and classification of microorganisms**

PSO2: **Understand the physiological and environmental adaptations of microorganisms and the molecular aspects of microbial cells**

PSO3: **Understand the applicability and significance of microorganisms in the field of health, food, industry, agriculture and environment.**

PSO4: **Carry out standard laboratory techniques in the field of environmental, medical, agricultural and industrial microbiology**

KANNUR UNIVERSITY

B.Sc. MICROBIOLOGY PROGRAMME

WORK AND CREDIT DISTRIBUTION STATEMENT

Semester	Course Title*	Credits	Hours per week	Total Credits	Total Hours
I	Common course I English	4	5	19	25
	Common Course II English	3	4		
	Additional common course I	4	4		
	First complementary Elective course	2	4		
	Second complementary Elective course	2	4		
	Core Course I : Fundamentals of Microbiology	4	4		
II	Common Course III English	4	5	19	25
	Common Couse IV English	3	4		
	Additional Common Course II	4	4		
	First complementary Elective Course	2	4		
	Second Complementary Elective Course	2	4		
	Core Course II : Microbial diversity	4	4		
III	General Awareness course I : Biochemistry for Microbiology	4	4	15	25
	General Awareness Course II: Bioinformatics and Bioinstrumentation	4	4		
	First Complementary Elective Course	2	3		
	First Complementary Elective Course Practical	-	2		
	Second Complementary Elective Course	2	3		
	Second Complementary Elective Course Practical	-	2		
	Core Course III: Microbial Physiology and Metabolism	3	3		
	Core Course IV: Microbiology Practical I	-	4		

IV	General Awareness Course III: Molecular Biology	4	4	27	25
	General Awareness Course IV: Microbial Genetics and rDNA Technology	4	4		
	First Complementary Elective Course	2	3		
	First Complementary Elective Course Practical	4	2		
	Second Complementary Elective Course	2	3		
	Second Complementary Elective Course Practical	4	2		
	Core Course V : Basic Immunology	3	3		
	Core Course VI : Microbiology Practical II	4	4		
V	Core Course VII : Microbial Biotechnology	3	3	15	25
	Core Course VIII : Bacterial Diseases	4	4		
	Core Course IX : Environmental Microbiology	3	3		
	Core Course X : Viral, Fungal and Parasitic Diseases	3	3		
	Core Course XI : Microbiology Practical III	-	5		
	Core Course XII: Microbiology Practical IV	-	5		
	Generic Elective Course (for other Departments	2	2		
VI	Core Course XIII : Food Microbiology	5	5	25	25
	Core Course XIV : Sanitation Microbiology	4	4		
	Core Course XV : Agricultural Microbiology and Plant Pathology	4	4		
	Core Course XVI : Microbiology Practical V	5	5		
	Core Course XVII: Microbiology Practical VI	5	5		
	Core Course XVIII : Project work	2	2		
Total				120	150

*First Complementary Elective Course : Chemistry/Biochemistry
**Second Complementary Elective Course :Biotechnology/Zoology/Physiology

PART A
B.Sc. MICROBIOLOGY CORE COURSES

B.Sc. MICROBIOLOGY CORE COURSES
WORK AND CREDIT DISTRIBUTION

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HRS
1B01 MCB	Fundamentals of Microbiology	I	4	4	3
2B02 MCB	Microbial Diversity	II	4	4	3
3B03 MCB	Microbial Physiology and Metabolism	III	3	3	3
3B04 MCB	Microbiology Practical I	III	4	-	-
4B05 MCB	Basic Immunology	IV	3	3	3
4B06 MCB	Microbiology Practical II	IV	4	4	3 HRS X 2 DAYS/ BATCH
5B07 MCB	Microbial Biotechnology	V	3	3	3
5B08 MCB	Bacterial Diseases	V	4	4	3
5B09 MCB	Environmental Microbiology	V	3	3	3
5B10 MCB	Viral, Fungal and Parasitic Diseases	V	3	3	3
5B11 MCB	Microbiology Practical III	V	5	-	-
5B12 MCB	Microbiology Practical IV	V	5	-	-
6B13 MCB	Food Microbiology	VI	5	5	3
6B14 MCB	Sanitation Microbiology	VI	4	4	3
6B15 MCB	Agricultural Microbiology and Plant Pathology	VI	4	4	3
6B16 MCB	Microbiology Practical V	VI	5	5	3 HRS X 2 DAYS/ BATCH
6B17 MCB	Microbiology Practical VI	VI	5	5	3 HRS X 2 DAYS/ BATCH
6B18 MCB	Project Work	VI	2	2	-

*Practical Examination of 3B04 MCB Practical I is to be conducted along with 4B06 MCB Practical II with a total credit 4 and 100 marks at the end of IV Semester
The practical examinations of 5B11MCB Microbiology Practical III and 5B12MCB Microbiology Practical IV are to be conducted along with that of 6B16 MCB Microbiology Practical V and 6B17 MCB Microbiology Practical VI with a total credit of 10 and 200 marks at the end of VI semester.

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

CONTINUOUS INTERNAL ASSESSMENT

COMPONENT*	WEIGHTAGE	REMARKS
COMPONENT 1 Written class test	50 %	Minimum two tests, average of the best two shall be taken
COMPONENT 2 Seminar and Assignment	50 %	30 % for Seminar and 20 % for Assignment

*Any two components, Attendance shall not be a component

CORE COURSE I:
FUNDAMENTALS OF MICROBIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1B01MCB	4	4	3

COURSE OUTCOME

CO 1. Understand the history, development & scope of microbiology
CO 2. Understand the principle and procedure of microscopy
CO 3. Understand the detailed structure of bacteria
CO 4. Explain the techniques for visualization of microorganisms
CO 5. Explain various media and components for cultivation of different microorganisms
CO 6. Understand various techniques used for isolation and preservation of bacteria
CO 7. Understand the principle and methods for controlling microorganisms and attain knowledge in controlling microbes in day today life.

Unit I:
History, Development & Scope of Microbiology - Theories & Concepts - Spontaneous generation versus biogenesis, Germ theory of disease. Contributions of Louis Pasteur, Robert Koch, Antony Van Leuven Hoek, Alexander Fleming, Jenner and Joseph Lister. Pure culture concepts. Scope of Microbiology (Brief)

(6 Hrs)

Unit II:
Microscopy – Bright field, Dark field, Phase contrast, Fluorescent, Scanning and Transmission electron microscopy (principle, methodology, specimen preparation and Use)

(10 Hrs)

Unit III:
Ultra structure of Bacterial cell - cell wall and its types, cell membrane, Flagella, Pili, Glycocalyx, Protoplasts and Spheroplast, Internal structures like ribosome, inclusion bodies, vacuoles, nuclear material (Nucleoid and plasmids), mesosome and dormant form – endospore structure & sporulation. Morphological types of bacteria and their arrangements.

(12 Hrs)

Unit IV:
Visualization of Microorganisms - Staining - types of stains used for bacteria with examples. Staining techniques - Simple, Negative, Differential (Gram & Ziehl Neelsen), special (Capsule, flagella & endospore) and fungal staining (LPCB). Wet mount for motility study.

(10 Hrs)

Unit V:

Media for cultivation – definition of culture media, Major ingredients for cultivation of bacteria and fungi, classification- solid, Liquid, semi solid (consistency), defined, semi defined and complex (ingredients), enriched, enrichment, differential, transport, indicator and anaerobic media (special). Media for cultivation of other microorganisms - viruses, algae and protozoans (Briefly mention)

(10 Hrs)

Unit VI:

Pure culture Isolation & cultivation and preservation techniques – Streak plate – quadrant (briefly mention radiant, continuous & T streak), Spread plate, serial dilution technique, Pour plate – for enumeration (CFU), stab culture, stroke culture, lawn culture, sweep plate method. Preservation of microorganisms – Refrigeration, sub culture, deep freezing, and Lyophilization (mention principle and procedure briefly)

(12 Hrs)

Unit VII:

Fundamentals of Microbial control - Principles and techniques – Definition of sterilization, disinfection, antisepsis and sanitization. Microbistatic & Microbicidal, pattern of death, factors affecting antimicrobial agents, mechanism of cell damage. Classification of antimicrobial agents – physical (heat – dry heat and moist heat, filtration and types of filters, and irradiation – ionizing and non ionizing and examples of radiations used) and chemical (alcohols, Aldehydes, phenols, halogens, surface active agents, dyes, and gases). Evaluation of antimicrobial potency – Phenol coefficient (Rideal Walker method). Major groups of antibiotics and their mode of action.

(12 Hrs)

Books for Study

1) Text book of Microbiology – Prescott
2) Text book of Microbiology – J. Black
3) Microbiology an introduction – Gerard J. Tortora

Books for Reference

1) Concepts and applications – Pelczar
2) Fundamentals of microbiology – Jeffrey Pommerville
3) Brock biology of Microorganisms – Michael T Madigan

Marks including choice:

Unit	Marks
I	5
II	8
III	10
IV	10
V	9
VI	8
VII	10

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)
Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)
Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)
Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE II:
MICROBIAL DIVERSITY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
2	2B02 MCB	4	4	3

COURSE OUTCOME

CO 1. Understand the basics and tools in Microbial taxonomy
CO 2. Explain classification and diversity of bacteria
CO 3. Understand general characteristics and taxonomy of viruses
CO 4. Understand general characteristics and taxonomy of fungi
CO 5. Understand general characteristics and taxonomy of microscopic algae & protozoa

Unit I:
Basics understanding of systematics - Objectives and Practical value of taxonomy. Major systems of biological classification. Three kingdom & five kingdom classification, Scientific Nomenclature, Taxonomic hierarchy, Domains and current classification systems. Numerical Taxonomy. Various criteria used in bacterial classification, Morphological characteristics, staining characters, cultural characters, Biochemical characters, Serotyping and Molecular techniques (DNA hybridization, DNA sequencing - in brief)

(16 Hrs)

Unit II:

Taxonomy of bacteria**-** Bergey's manual of systematic bacteriology - an international reference. Eubacteria and Archebacteria. Comparative account on important groups of Archebacteria. Brief account on Eubacterial groups- names with examples only

(18 Hrs)

Unit III:

Taxonomy and general characteristics of Fungi -Structure and Morphology of Fungi, Classification - flagellated lower fungi, slime molds, Terrestrial fungi - brief account of divisions with examples.

(14 Hrs)

Unit IV:

Taxonomy and general characteristics of virus - Structure and Morphology of animal, plant and bacterial viruses. Classification of plant and animal viruses with representing examples, Classification of Bacteriophages - names of family with examples.

(12 Hrs)

Unit V:

Classification of microscopic algae - Green Algae, Diatoms and Golden brown Algae, Dinoflagellates, euglenoids - brief account with examples. Classification of Protozoa - Flagellates, Ciliates, Amoeba and Sporozoa - names with examples.

(12 Hrs)

Books for Study

1) Text book of Microbiology – Prescott
2) Text book of Microbiology – J. Black

Books for Reference

1) Concepts and applications – Pelczar
2) Fundamentals of microbiology – Jeffrey Pommerville
3) Brock biology of Microorganisms – Michael T Madigan
4) Microbiology an introduction – Gerard J. Tortora

Marks including choice:

Unit	Marks
I	15
II	15
III	10
IV	10
V	10

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)
Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)
Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)
Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)
Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE III:
MICROBIAL PHYSIOLOGY AND METABOLISM

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3B03 MCB	3	3	3

COURSE OUTCOME

CO 1. Understand the nutritional diversity among microorganisms, the different macro and micronutrients required for microbial growth and understand the physical factors affecting microbial growth.
CO 2. Describe the pattern of growth, reproduction, death and growth kinetics of microbes and measure population growth by different methods.
CO 3. Understand the phototrophic nutrition in microorganisms, different mechanisms seen in different microbial groups and their ecological importance.
CO 4. Understand the unique nutritional type among microorganisms- the chemolithotrophs-, their types, use of different inorganic sources for energy production, ecological importance and role in biogeochemical cycles.
CO 5. Understand how carbohydrates, proteins and fats are metabolized in the microbial cells and the diverse metabolic pathways leading to energy production.

Unit I:
Nutritional types of microorganisms. Nutritional requirements for microbial growth - Carbon, Nitrogen. Sulfur, Oxygen, Phosphorus, Hydrogen, microelements and energy sources; Vitamins and growth factors. Factors influencing microbial growth - temperature, gaseous atmosphere, pH, osmotic pressure and hydrostatic pressure.

(8 Hrs)

Unit II:
Reproduction and growth of microorganisms, kinetics of growth -multiplication, and death of microbial cell. Growth curve in a closed system, continuous culture and synchronous culture. Measurement of population growth**.**

(10 Hrs)

Unit III:
Phototrophic metabolism - Microbial photosynthesis- oxygenic and anoxygenic photosynthesis – photosynthesis in algae. Diversity of phototrophic bacteria - photosynthetic pigments. Light reaction- cyclic and non- cyclic photophosphorylation. Carbon dioxide fixation - Calvin cycle, reverse TCA cycle.

(10 Hrs)

Unit IV:
Chemolithotrophy- (energy from oxidation of inorganic electron donors) Hydrogen oxidizing bacteria, Sulfur bacteria, Iron-oxidizing bacteria, Ammonium and Nitrite oxidizing bacteria. ATP production by chemolithotrophs. Anaerobic respiration, nitrate reduction and denitrification process, sulfate reduction, methanogenesis and acetogenesis.

(12 Hrs)

Unit V:
Microbial energetics : Concepts of aerobic metabolism, anaerobic metabolism and fermentation. Central metabolic pathways- EMP pathway, ED pathway, PP pathway, TCA cycle. ETC, oxidative phosphorylation and ATP synthesis. Brief account on amino acid degradation- transamination, deamination, decarboxylation. Fat and phospholipid hydrolysis, β- oxidation.

(14 Hrs)

Books for study:

1) Prescott, Harley and Kleins Microbiology- Prescott
2) Microbiology: Concepts & Applications -M J Pelczar, E.C.S Chan, Noel R Krieg

Books for reference:

1) Principles of Microbiology: Atlas R M
2) Brock Biology of Microoganisms: Madigan M T and Martinko J M
3) Microbiology - Principles and explorations: Jacquelyn G Black, Laura J black
4) Microbiology: An introduction- Tortora GJ, Funke BR, Case CL

Marks including choice:

Unit	Marks
I	10
II	10
III	10
IV	15
V	15

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE IV:
MICROBIOLOGY PRACTICAL I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3B04 MCB	4	-	-

COURSE OUTCOME

CO 1. Understand the basic rules and regulations in Microbiology lab and the procedure of cleaning & preparation of materials for lab experiments
CO 2. Understand the working and understand how to operate major microbiology lab instruments
CO 3. Understand and carry out the preparation of various media for cultivation of microorganisms
CO 4. Carry out the techniques for isolation and cultivation of bacteria
CO 5. Understand the procedure of comparing the efficiency of disinfectants commonly used

List of Experiments

1. General rules and regulations in microbiology lab
2. Cleaning and Preparation of glassware for lab experiments
3. Principle, applications and working procedure of lab instruments - autoclave, hot air oven, incubator, colony counter, laminar air flow cabinet/ Biosafety cabinet.
4. Preparation of Media for Microbes – Peptone broth, Nutrient Broth, Nutrient Agar and Fungal media (SDA / PDA), special media (Mac Conkey / MSA/ Blood agar)
5. Pure Culture isolation - Streak plate (quadrant streak), Spread plate technique
6. Pour plate for isolation and enumeration
7. Phenol Coefficient test

Books for Study

1) Practical Microbiology – Cappuccino
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi

Books for Reference

1) Microbiological applications – Harold Benson
2) Manual of Microbiology – Tools and Techniques – Kanika Sharma
3) Practical Microbiology – T.J. Mackie and J. E. Mc Cartney

CORE COURSE V:
BASIC IMMUNOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B05 MCB	3	3	3

COURSE OUTCOME

CO 1. Understand various immune mechanisms
CO 2. Describe various immune cells and organs involved in immunity
CO 3. Understand different immunological techniques used and serological diagnosis of infectious diseases
CO 4. Understand the basis of allergy reactions, auto immune mechanisms, transplantation and cancer immunity.

Unit I:

Immunity – types – Innate and acquired, active and passive immune response, organs and cells of immune system- central and peripheral lymphoid organs, leucocytes, lymphocytes, macrophages, plasma cells, Immune responses- primary and secondary. Mechanism of immunity – barriers, phagocytosis and inflammation

(15 Hrs)

Unit II:

Antigens – types, antigenic determinants. Immunoglobulins - basic structure and classes (IgA, IgG, IgM, IgD, and IgE) and functions. Theories of antibody synthesis - instructive and selection theory, clonal selection theory. Monoclonal antibodies.

(12 Hrs)

Unit III:

Antigen – Antibody reactions - Precipitation, agglutination, complement fixation, Enzyme Linked immuno Sorbent Assay (ELISA), Immuno Fluorescence, Radio Immuno Assay (RIA), Clinical application – Widal, VDRL, CFT, RA, ELISA – HIV, Western blot – HIV

(12 Hrs)

Unit IV:

Hypersensitivity reactions – types and mechanism. Auto immunity and auto immune diseases (Pernicious anemia and Rheumatoid arthritis as example) - Transplantation immunity – types of transplants, allograft reactions – allograft rejection – primary and secondary rejection reactions, Graft versus Host (GVH) reactions. Tumor immunity – tumor antigens and mechanism of immune response to tumors

(15Hrs)

Books for Study

1) Text book of immunology – Janis Kubi
2) Text book of Microbiology – Anantha Narayanan and Panicker

Books for Reference:

1) Text book of Microbiology – Prescott
2) Concepts and applications – Benjamin
3) Essential Immunology – Ivan M Roitt
4) Immunology – Ivan Roitt, Jonathan Brostoff, David male

Marks including choice:

Unit	Marks
I	10
II	15
III	15
IV	20

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE VI:
MICROBIOLOGY PRACTICAL II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B06 MCB	4	4	3 HRSX 2 DAYS/ BATCH

COURSE OUTCOME

CO 1. Understand the principle, parts of Compound light microscope and carry out the procedure of using Microscope
CO 2. Carry out the techniques of visualizing bacteria
CO 3. Understand and carry out the procedure of differentiating bacterial populations
CO 4. Carry out the techniques for visualizing different parts of bacteria
CO 5. Understand the procedure of separating compounds by using chromatography

List of Experiments

1. Microscopy
   a. Working Principle & parts of Microscope.
   b. Use and care of Microscope
2. Visualization of Microorganisms
   a. Preparation of bacterial smears
   b. Negative staining for unfixed smears (using India ink/ Nigrosin)
   c. Simple staining for morphology & arrangement (Methylene blue / Crystal violet)
3. Differential staining
   a. Gram staining
   b. Acid fast Staining
4. Special staining for
   a. Endospore
   b. Capsule
5. Chromatography – paper chromatography

Books for Study

1) Practical Microbiology – Cappuccino
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi

Books for Reference

1) Microbiological applications – Harold Benson
2) Manual of Microbiology – Tools and Techniques – Kanika Sharma
3) Practical Microbiology – T.J. Mackie and J. E. Mc Cartney
4) Modern experimental biochemistry - Boyer. Rodney, F Benjamin & Cummins

CORE COURSE VII:
MICROBIAL BIOTECHNOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B07 MCB	3	3	3

COURSE OUTCOME

CO 1. Describe about fermenter and fermentation technology.
CO 2. Understand microbial products by fermentation process.
CO 3. Understand enzyme technology and its application

Unit I

Introduction to fermentation processes- media for industrial fermentation-submerged and solid state fermentation. sterilization, development of inoculum for fermentation. Screening techniques-primary and secondary, strain improvement of industrially important microorganisms. fermentor- design and components of fermentor- agitation, aeration, pH, temperature, dissolved oxygen- control and monitoring. Different types of fermenter

(15 Hrs)

Unit II

Techniques of Downstream processes - recovery and purification- filtration, centrifugation. Purification of intracellular and extra cellular products- Chromatography and Distillation.

(10 Hrs)

Unit III

Brief account of industrial production of beer, bread, industrial alcohol, Acetone- butanol, vinegar and citric acid by microorganisms. Production of aminoacids- glutamic acid production

(15 Hrs)

Unit IV

Production of microbial enzymes and its importance- protease, alpha- amylase - brief account of enzyme technology. Immobilization of cells and enzymes- their applications- Biosensor.

(8 Hrs)

Unit V

Industrial production of pharmaceutical products- production of Penicillin G. Production of vitamin- B 12. Brief account on Bio insecticides- *Bacillus thuringiensis*.

(6 Hrs)

Books for study

1) Microbial Biotechnology: Fundamentals of Applied microbiology - Hiroshi Nikaido, Alexander N Glazer
2) Industrial microbiology - L E Casida

Books for Reference

1) Prescott and Dunn's Industrial microbiology -Prescott
2) Brocks Biology of Micro organisms - Michael T Madigan, John M Martinko

Marks including choice:

Unit	Marks
I	15
II	10
III	15
IV	10
V	10

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course – 40

CORE COURSE VIII:
BACTERIAL DISEASES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B08 MCB	4	4	3

COURSE OUTCOME

CO 1. Describe about infection, its types, transmission of infection & virulence factors
CO 2. Understand the details of causative agent of major human bacterial infection
CO 3. Understand the diagnostic & treatment methods of various bacterial infections
CO 4. Understand prophylactic measures of different bacterial diseases
CO 5. Understand epidemiological aspects of bacterial diseases

Unit I

Different types of infection – primary, secondary, re infection, cross infection, Nosocomial infection, iatrogenic infection, exogenous and endogenous, atypical and in apparent infections. Classification based on spread – Endemic, Epidemic and pandemic. Sources of infection to humans – humans (patients and carrier and carrier types), animals (reservoirs), insect vectors (Biological and mechanical) Methods of disease transmission, mode of transmission, Factors predisposing infection (Virulence factors of Microorganisms). MID, MLD, LD 50 and ID 50, bacteremia and septicemia.

(8 Hrs)

Unit II

Staphylococcus aureus, Streptococcus pyogenes, Streptococcus pneumoniae, *Bacillus anthracis, Corynebacterium diphtheriae, Clostridium tetani*- Morphology, culture, biochemical characters and resistance of these organisms. Pathogenicity (virulence factors and mechanism), clinical features, epidemiology, diagnosis, treatment and prophylaxis of the diseases caused by these organisms.

(20 Hrs)

Unit III

Neisseria gonorrhea, Salmonella typhi, Vibrio cholerae, Escherichia coli, Hemophilus influenzae, Bordetella Pertussis, Yesinia pestis - Morphology, culture, biochemical characters and resistance of these organisms. Pathogenicity (virulence factors and mechanism), clinical features, epidemiology, diagnosis, treatment and prophylaxis of the diseases caused by these organisms.

(20 Hrs)

Unit IV

Mycobacterium tuberculosis and *Mycobacterium leprae* - Morphology, culture, biochemical characters and resistance of these organisms. Pathogenicity (virulence factors and mechanism), clinical features, epidemiology, diagnosis, treatment and prophylaxis of the diseases caused by these organisms.

(10 Hrs)

Unit V:

Treponema pallidum, *Borrelia burgdorferri, Leptospira icterohaemorragiae,* Rickettssia and Chlamydia - Morphology, culture, biochemical characters and resistance of these organisms. Pathogenicity (virulence factors and mechanism), clinical features, epidemiology, diagnosis, treatment and prophylaxis of the diseases caused by these organisms.

(14 Hrs)

Books for Study

1) Text book of Microbiology – Ananthanarayanan and Panicker
2) Text book of Microbiology – Green Wood

Books for Reference

1) Text book of Microbiology – Prescott
2) Text book of Microbiology – J. Black
3) Microbiology an introduction – Gerard J. Tortora
4) Practical medical microbiology – Mackie and Mc. Cartney
5) Text book of microbiology – Robert. W. Bauman
6) Medical Microbiology – Jawetz, Melnick

Marks including choice:

Unit	Marks
I	7
II	18
III	15
IV	10
V	10

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE IX :
ENVIRONMENTAL MICROBIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B09 MCB	3	3	3

COURSE OUTCOME

CO 1. Understand the concept of ecosystem and its components and concept of biogeochemical cycles and N, S and P cycles.
CO 2. Explain the principles of microbial interactions and its importance with suitable examples.
CO 3. Describe microorganisms in air, methods by which they reach and remain in air and its medical importance. Air sampling methods and its use in agriculture.
CO 4. Describe microorganisms in aquatic environment, various factors that can influence their survival and distribution in different aquatic systems. Their role in aquatic eco system as biotic factor- producer, consumer and decomposer.
CO 5. Understand the concept of xenobiotics, xenobiotics as pollutants of environment, concept of biomagnification, concept of persistence and recalcitrance of various xenobiotics. Concept of bioremediation of environment and microbial degradation of various xenobiotics.
CO 6. Understand the concepts of leaching, corrosion and microbial biofilms. Involvement of microorganisms in metal leaching and corrosion.

Unit I

Brief account of Ecosystem - energy flow in ecosystem. Biogeochemical cycles- brief account with its importance- Nitrogen, Sulfur and Phosphorus cycles.

(7 Hrs)

Unit II

Interaction between microorganisms in soil- Mutualism, commensalisms, ammensalism, synergism, parasitism, predation, competition, antibiosis- their significance.

(14 Hrs)

Unit III

Microbiology of air- micro flora of air, aerosols, droplet nuclei, infectious dust, microbiological sampling of air. Aquatic microbiology- Aquatic environment, physical factors affecting aquatic life, distribution of microorganisms in aquatic environment- fresh water, estuarine and marine water systems.

(12 Hrs)

Unit IV

Microbiology of xenobiotics - novel pollutants, persistence and biomagnification. Recalcitrant halocarbons, nitro aromatic compounds, poly chlorinated biphenyls and dioxins, synthetic polymers, alkyl benzyl sulfonates. Petroleum hydrocarbons - their microbial degradation. Bio remediation of soil and water

(15 Hrs)

Unit V

Microbial leaching. Corrosion of metals due to microbial growth and biofilms

(6 Hrs)

Books for study

1) Microbiology: Concepts and Applications- Michael J Pelczar, E C S Chan, Noel R Krieg
2) Microbial Ecology : Fundamentals & Applications- Richard Bartha, Ronald M Atlas

Books for Reference

1) Environmental Microbiology-Ian Pepper, Raina M Maier, Charles P Gerba
2) Prescott, Harley,and Kleins Microbiology- Prescott

Marks including choice:

Unit	Marks
I	10
II	15
III	15
IV	15
V	5

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE X:
VIRAL, FUNGAL AND PARASITIC DISEASES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B10 MCB	3	3	3

COURSE OUTCOME

CO 1. Understand the architecture of animal viruses, its classification, methods for studying viruses and the multiplication strategies of animal viruses
CO 2. Understand the most prevalent viral diseases of human beings including the emerging viral diseases and to understand the preventive measures to be taken by studying the pathogenesis and mechanism of survival of pathogens.
CO 3. Describe overview of fungal infections affecting human beings and the treatment strategies against fungal infections
CO 4. Understand important protozoan and helminthic infections of human beings

Unit I

General characteristics of animal viruses- classification based on genetic material- viral multiplication- cultivation of animal viruses- embryonated eggs, experimental animals, tissue culture- methods of detection of viral growth, antiviral agents- brief account

(5 Hrs)

Unit II

Causative agent, pathogenesis, clinical features, methods of transmission, laboratory diagnosis, prophylaxis and control of the following viral disease: Polio, herpes simplex, influenza, mumps, measles, rubella, hepatitis, rabies, HIV

(12 Hrs)

Unit III

Causative agent, vectors, pathogenesis, clinical symptoms, laboratory diagnosis, prophylaxis and control of important arboviruses - Dengue and KFD. Oncogenic viruses- viral oncogenes- emerging viral diseases- Nipah, SARS, Avian flu, West Nile fever- brief account.

(12 Hrs)

Unit IV

Fungal infections of medical importance- superficial mycoses: Pityriasis versicolor, cutaneous Dermatophytoses, Subcutaneous: Mycotic mycetoma, Deep mycoses of human beings :Cryptococcosis – Opportunistic systemic mycoses: Aspergillosis.

(10 Hrs)

Unit V

Parasitic diseases of medical importance- protozoan diseases: Amoebiasis, malaria, toxoplasmosis, Leishmaniasis. Helminth disease: filariasis - brief study on etiology, vectors if any, life cycle, symptoms and preventive measures.

(15 Hrs)

Books for Study

1) Ananthanarayanan R and Panicker CKJ. Text Book of Microbiology
2) Medical Microbiology by Greenwood
3) Text Book of Medical Mycology by Jagadish Chander, Interprint, New Delhi
4) Text Book of Medical Parasitology by Jayaram Panicker

Books for Reference

1) Madigan MT, Martinto J M, Dunlap P V and Clark D P. Brock Biology of Microorganisms – Pearson International Edition
2) White and Fenner. Medical Virology. New York Academic Press
3) Text Book of Medical Parasitology by P Chakraborty.

Marks including choice:

Unit	Marks
I	8
II	15
III	12
IV	10
V	15

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)
Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE XI:
MICROBIOLOGY PRACTICAL III

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B11 MCB	5	-	-

COURSE OUTCOME

CO 1. Perform basic laboratory techniques in Microbiology to detect bacterial motility and use of special media in order to differentiate pathogenic microorganisms
CO 2. Understand the isolation and identification of normal flora
CO 3. Determine the effect of environmental factors influencing the growth of microorganisms
CO 4. Perform basic laboratory experiments in Biochemistry, Genetics and bioinformatics

List of Experiments

1. Bacterial motility testing by Hanging Drop method
2. Use of differential and selective media
3. Examination of normal flora of skin and mouth
4. Effect of temperature on growth of microorganisms
5. Effect of pH on growth of microorganisms
6. Demonstration of mitosis
7. Pairwise & multiple sequence alignment using Bioinformatics tools (BLAST/FASTA)

Books for Study

1) Microbiology Laboratory Manual- Capuccino, Sherman, Pearson Education.
2) Practical Microbiology- R.C Dubey, D.K Maheshawari,
3) Manual of Microbiology: Tools and Techniques, Kanika Sharma,
4) Practical Biochemistry by Pattambiraman
5) Bioinformatics: A Practical Approach. K. Mani and Vijayaraj,

Books for Reference

1) Microbiology : Concepts & Applications- Pelzer Jr, Chang Kreig,
2) Microbiological Applications : Harold T Benson

CORE COURSE XII:
MICROBIOLOGY PRACTICAL IV

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B12 MCB	5	-	-

COURSE OUTCOME

CO 1. Determine the microbial load and diversity in soil
CO 2. Determine the microbiological quality of drinking water and air
CO 3. Understand the laboratory procedure for the growth of fungi and identify the fungi by macroscopic and microscopic examination
CO 4. Isolate microorganisms with special metabolic capacities from the environment

List of Experiments

1. Detection of viable count of bacteria by pour plate method
2. Isolation and enumeration of soil microflora (bacteria and fungi)
3. Determination of water quality
   i. Presumptive test- MPN determination
   ii. Confirmed test
   iii. Completed test
4. Demonstration of Winogradsky column
5. Air sampling by open plate method
6. Isolation of cellulose digesting bacteria
7. Fungal cultivation by slide culture method
8. Fungal staining by LPCB method

Books for Study

1) Microbiology Laboratory Manual- Capuccino, Sherman, Pearson Education.
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi
3) Manual of Microbiology: Tools and Techniques, Kanika Sharma, Ane Books Pvt Ltd
4) Practical Biochemistry by Pattambiraman
5) Bioinformatics: A Practical Approach. K. Mani and Vijayaraj, Aparna publications

Books for Reference:

1) Microbiology : Concepts and Applications- Pelzer Jr, Chang Kreig, Mc Graw, Hill Inc
2) Microbiological Applications : Harold T Benson

CORE COURSE XIII:
FOOD MICROBIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B13 MCB	5	5	3

COURSE OUTCOME

CO 1. Understand the role of microorganisms in food fermentation, food processing, food spoilage and food borne diseases
CO 2. Understand the significance of microbes in spoilage of different varieties of food and the role of intrinsic and extrinsic factors affecting the growth and survival of microbes in food.
CO 3. Describe ways to control the growth of microbes in foods and know the principles involved in methods of food preservation.
CO 4. Understand the beneficial role of microbes in fermented foods and the microbiology of fermented dairy products and other indigenous fermented foods and understand the basis of food safety regulations.
CO 5. Understand the role of microbes in food borne illnesses and their characteristics and their preventive measures

Unit I

History and scope of food microbiology- beneficial role of microbes in food industry and in fermented foods- role of microbes in food spoilage and food borne diseases-microbes important in food microbiology-bacteria, yeasts and molds- sources of contaminants of foods- animals, plants , soil, air, sewage.

(12 Hrs)

Unit II

Intrinsic and extrinsic factors affecting growth and survival of microorganisms in food- nutrient content, pH, buffering capacity, redox potential, inhibitory substances and antimicrobial barriers, water activity, environmental factors- relative humidity, temperature, gaseous atmosphere. Food spoilage, food as a substrate for microbes- general principles of spoilage, causes, classification of food by ease of spoilage, factors affecting spoilage, spoilage of milk, meat, fish, eggs, fruits and vegetables.

(20 Hrs)

Unit III

General principles of food preservation- asepsis, removal of microorganism, maintenance of anaerobic conditions, high temperature processing, and low temperature storage, drying, additives and chemicals, irradiation, Pascalisation, preservation of milk, meat, fish, fruits and vegetables.

(20 Hrs)

Unit IV

Foodborne illnesses- foodborne intoxications and infections- causative agents, foods involved, symptoms and preventive measures of important foodborne illnesses : *Clostridium botulinum , Clostridium perfringens, , Brucella, Shigella*. Mycotoxins and mycetismus

(20 Hrs)

Unit V

Fermented foods- fermented milk products- yoghurt, kefir, acidophilus milk, , cheese. Other fermented foods – wine, idli, soy sauce, sauerkraut. SCP – Spirulina , prebiotics and probiotics. Food sanitation, good manufacturing practices, food sanitation indices HACCP, Indian standards : AGMARK, fssai .

(18 Hrs)

Books for study

1) Frazier W C . Food Microbiology, McGraw Hill
2) Modern Food Microbiology. James M Jay, Martin J Lossner, David A Golden
3) Food Microbiology Adams M R & Moss. The Royal Society of Chemistry, Cambridge.

Books for Reference

1) Industrial Microbiology Samuel C Presscott
2) Dairy Microbiology Parihar and Parihar
3) Dairy Microbiology . Robinson P K. Elsevier Applied Science , London.

Marks including choice:

Unit	Marks
I	8
II	15
III	12
IV	13
V	12

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE XIV:
SANITATION MICROBIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B14 MCB	4	4	3

COURSE OUTCOME

CO 1. Understand the concept of Sanitation and its importance in public health and UN actions
CO 2. Describe the importance of water quality, methods of water quality analysis, water quality standards & the basic principles of water purification and disinfection.
CO 3. Understand the concept of sewage and its microbiology, methods and steps involved in waste water treatment.
CO 4. Explain the principles of solid waste management and methods.
CO 5. Explain sanitary land filling, Composting and biogas plants.
CO 6. Describe principles of air sanitation, methods of air sanitation and air quality standards.

Unit I

Introduction to sanitation and its microbiological aspects. Importance of sanitation in public health and its global perspectives- United nations sustainable development Goals, detailed perspective of Goal 6

(8 Hrs)

Unit II

Sources of drinking water, single dwelling and municipal water supplies, water purification procedures, indicator microorganisms and their importance, microbiological examination of water, total count, MPN, presumptive, confirmed and completed tests, membrane filter method , and water quality standards. Water purification methods- Different methods of disinfection of drinking water - Chlorination, ozonisation, UV treatment.

(20 Hrs)

Unit III

Microbiology of sewage - Characteristics of sewage - physical, chemical and microbiological. BOD and organic content. Sewage treatment - need and importance. Treatment processes - primary treatment, secondary treatment and tertiary treatment - trickling filters, activated sludge process, rotating bio disks, oxidation ponds and anaerobic sludge digester.

(20 Hrs)

Unit IV

Solid waste management - sources and kinds of solid waste, need and importance of solid waste management. Biodegradable and non-degradable solid wastes. Sanitary landfill and composting (aerobic and anaerobic), vermi composting, anaerobic digesters.

Methanogenesis and production of Biogas. Design and management of biogas plant. Biomedical waste management

(14 Hrs)

Unit V

Air sanitation methods. Laminar air flow, sterilization of air in hospitals, surgical theatres, virus inoculation rooms. Air quality standards - indoor and outdoor. Air quality index

(10 Hrs)

Books for Study

1. Environmental Microbiology- Ian L Pepper , Raina M Maier, Charles P Gerba
2. Microbiology : Michael.J.Pelczar, E.C.S Chan, Noel.R.Krieg
3. Hand book of Environmental Microbiology -Volume I, II and III- S C Bhatia

Books for Reference

1) Microbial Ecology : Fundamentals & Applications- Richard Bartha, Ronald M Atlas
2) Prescott, Harley,and Kleins Microbiology- Prescott

Marks including choice:

Unit	Marks
I	5
II	20
III	15
IV	15
V	5

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE XV:
AGRICULTURAL MICROBIOLOGY AND PLANT PATHOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B15 MCB	4	4	3

COURSE OUCOME

CO 1. Understand the role of microbes in agriculture
CO 2. Explain the production and application of biofertilizers
CO 3. Understand plant disease mechanism and how to control plant diseases and also to get awareness on the impact of chemical fertilizer
CO 4. Understand various plant diseases commonly found.

Unit I

Developmental history of agricultural microbiology & plant pathology (Brief). Microflora of soil – bacteria, fungi, viruses, protozoans and algae (Brief account) - Rhizosphere & its significance, Importance of humus. Plant – microbe interactions and their importance in agriculture.

(15 Hrs)

Unit II

Nitrogen fixation – Different nitrogen fixers, symbiotic & non symbiotic, mechanism of nitrogen fixation, nitrogenase enzyme complex, nif genes. Microbial inoculants - definition & importance (PGPR - Azospirillum, Azotobacter, Pseudomonas, Azolla–anabaena) production and applications of microbial inoculants (Rhizobium only) Mycorrhiza – types – Endo, Ecto, Ectendo, AM, VAM and their significance in agriculture.

(20 Hrs)

Unit III

Plant pathogenesis – Mechanism, methods of disease transmission, mode of entry of pathogens, symptoms, plant disease resistance mechanisms (Morphological, functional and protoplasmic resistance), variation in disease resistance, factors affecting disease incidence. Plant disease control measures –chemical (Copper, sulphur etc) and biological (Trichoderma, Pseudomonas, bacillus etc) in brief. Adverse effect of chemical agents. Advantages of bio control agents. Briefly mention organic farming and its importance.

(20 Hrs)

Unit IV

Important Microbial disease of plants – Bacterial, fungal, viral - Rice blast, wheat black rust, Citrus canker, quick wilt of pepper, Bud rot of coconut, abnormal leaf fall of rubber, bud rot of areca nut, coffee rust (name of pathogen, symptoms, occurrence, mode of spread, control measures)

(17 Hrs)

Books for Study

1) Advances in agricultural microbiology – N.S. Subba Rao
2) Agricultural Microbiology – Rangaswamy

Books for Reference

1) Objectives in agricultural microbiology – Deepak Kumar Varma
2) Agricultural microbiology and microbial applications – P.C.Trivedi
3) Soil and agricultural microbiology – Umesh Kumar

Marks including choice:

Unit	Marks
I	10
II	20
III	20
IV	10

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

CORE COURSE XVI:
MICROBIOLOGY PRACTICAL V

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B16 MCB	5	5	3HRSX 2DAYS/ BATCH

COURSE OUTCOME

CO 1. Perform Antigen – Antibody reactions for the Serodiagnosis of infectious Diseases
CO 2. Identify bacterial species from clinical samples by microscopy, Cultural characteristics and biochemical reactions
CO 3. Determine the antimicrobial spectrum of the given bacterial species

List of Experiments

1. Differential count of WBCs
2. Blood grouping
3. Widal Tube Agglutination Test
4. Latex agglutination Test (ASO/RA/HBsAg)
5. VDRL or RPR test
6. Biochemical reactions for the identification of bacteria
   i. IMViC test
   ii. TSI
   iii. Sugar fermentation test (GLSM)
   iv. Catalase
   v. Urease
   vi. H_2S production test
   vii. Nitrate reduction test
7. Identification of any three of the following bacterial species – *S.aureus, E.coli, Klebsiella spp, Proteus vulgaris, Pseudomonas spp.* from clinical samples.
8. Antibiotic Sensitivity Testing

Books for Study

1) Microbiology Laboratory Manual- Capuccino, Sherman, Pearson Education.
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi
3) Manual of Microbiology: Tools and Techniques, Kanika Sharma, Ane Books Pvt Ltd
4) Practical Medical Microbiology by Mackie & Mc Cartney
5) Handbook of Experimental Immunology by D.M Veir

Books for Reference

1) Microbiology : Concepts and Applications- Pelzer Jr, Chang Kreig, Mc Graw, Hill Inc
2) Microbiological Applications : Harold T Benson
3) Bailey & Scott's Diagnostic Microbiology

CORE COURSE XVII:
MICROBIOLOGY PRACTICAL VI

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B17 MCB	5	5	3HRSX2DAY S/ BATCH

COURSE OUTCOME

CO 1. Determine the microbial count of fish, milk and fermented milk samples
CO 2. Understand the production of wine using yeast
CO 3. Analyze the microbiological quality of milk sample
CO 4. Perform experiments for the isolation of nitrogen fixing bacteria

List of Experiments

1. Isolation of constituent flora of fermented milk
2. Aerobic mesophilic count of fish samples
3. Aerobic mesophilic count of milk samples
4. Production of wine
5. Methylene blue reductase test for milk quality analysis
6. Study of antibiosis by soil microorganisms and determination of antimicrobial spectrum
7. Isolation of Rhizobium and Azotobacter

Books for Study

1) Microbiology Laboratory Manual- Capuccino, Sherman, Pearson Education.
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi
3) Manual of Microbiology: Tools and Techniques, Kanika Sharma, Ane Books Pvt Ltd
4) Methods in Food Microbiology W. F Harrigan

Books for Reference

1) Microbiology : Concepts and Applications- Pelzer Jr, Chang Kreig, Mc Graw, Hill Inc
2) Microbiological Applications : Harold T Benson

INTERNAL ASSESSMENT OF PRACTICAL COURSES

COMPONENT	WEIGHTAGE	REMARKS
Lab involvement	25 %	Involvement in preparatory session, safety precautions, disposal and completion of all experiments
Record	25 %	
Lab examination/ viva	50 %	

CORE COURSE XVIII:
PROJECT WORK

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B18 MCB	2	2	-

A group of 5 to 8 students shall do a combined project and submit the report individually. There will be a presentation and viva as part of continuous and end semester evaluation. The project work report must be submitted to the Head of the Dept. as per the regulations.

PROJECT EVALUATION

EXTERNAL ASSESSMENT:

COMPONENT	WEIGHTAGE
Relevance of the topic, Objectives, Methodology and Review of Literature	20 %
Presentation, Quality of Analysis, Findings	30 %
Viva	50 %

INTERNAL ASSESSMENT:

COMPONENT	WEIGHTAGE	REMARKS
Involvement	30 %	Include sample collection, preparatory session, punctuality, disposal etc
Scheme/ organization	20 %	
Presentation	25 %	
Viva	25 %	

PART B
COMPLEMENTARY ELECTIVE COURSES

B.Sc. MICROBIOLOGY COMPLEMENTARY ELECTIVE COURSES [FOR B.Sc. BIOCHEMISTRY & B.Sc. BIOTECHNOLOGY PROGRAMME(S)]

WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS
1CO1 MCB	Basic Microbiology I	I	4	2	3
2 C02 MCB	Basic Microbiology II	II	4	2	3
3CO3 MCB	Applied Microbiology I	III	3	2	3
3C04 MCB	Microbiology (Complementary) Practical I	III	2	-	-
4C05 MCB	Applied Microbiology II	IV	3	2	3
4C06 MCB	Microbiology (Complementary) Practical II	IV	2	4	3 HRS X 2 DAYS/ BATCH

Microbiology (complementary) practical examination of 3C04MCB Microbiology (complementary) practical I is to be conducted at the end of semester IV along with 4C06 MCB Microbiology (complementary) practical II with a total credit of 4 and 40 marks. The examination duration is 3 hours x 2 consecutive days per batch. 2hrs/week in the four semesters shall be utilized for practicals

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT*	WEIGHTAGE	REMARKS
COMPONENT1 Written class test	50 %	Minimum two test, average of the best two shall be taken
COMPONENT 2 Seminar and Assignment	50 %	30 % for seminar and 20 % for assignment

*Any two components, Attendance shall not be a component

COMPLEMENTARY ELECTIVE COURSE I: BASIC MICROBIOLOGY I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1C01 MCB	4	2	3

COURSE OUTCOME

CO 1. Understand the history and developments in Microbiology
CO 2. Explain Microbiological techniques

Unit I

Introductory Microbiology: History- biogenesis versus abiogenesis, Germ theory of diseases, contributions of Louis Pasteur and Robert Koch, antisepsis, immunization and chemotherapy. The concept of sterilization, (dry heat, moist heat, radiation, chemical methods, Filtration)

(14 Hrs)

Unit II

Microscopy: Light microscopy - bright field and dark field, phase contrast, fluorescent electron microscope - TEM and SEM. Staining methods -simple, Gram, Negative, AFB, endospore, capsule and Fungal staining-LPCB

(20 Hrs)

Unit III

Prokaryotic cell versus Eukaryotic cells. The ultra structure of bacterial cell -Gram positive and Gram negative. Bacterial endospore and sporulation

(18 Hrs)

Unit IV

Microbial Nutrition: Nutritional types. Macro and micro nutrients and their role. Nutrient uptake - imbibition, diffusion, osmosis, facilitated diffusion, role of carrier proteins, active transport, group translocation, uniport, symport and antiport.

(20 Hrs)

Books for Study

1) Microbiology : Concepts and Applications -Michael J Pelczar, E.C.S Chan, Noel R Krieg
2) Text Book of Microbiology- R Ananthanarayan, C.K.J Paniker
3) Prescott, Harley, and Kleins MIcrobiology –Prescott

Books for Reference

1) Principles of Microbiology: Atlas R M
2) Microbiology - Principles and explorations: Jacquelyn G Black, Laura J black
3) Microbiology: An introduction- Tortora GJ, Funke BR, Case CL
4) Brock's Biology of Microorganisms

Marks including choice:

Unit	Marks
I	10
II	15
III	13
IV	12

About the Pattern of Questions:

Part A - Short answer (5 questions x Mark 1each = 5)
Answer all questions (5 questions x Mark 1each = 5)

Part B - Short Essay (5 questions x Marks 2 each = 10)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (5 questions x Marks 3 each = 15)
Answer any 3 questions (3 questions x Marks 3 each = 9)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 50
Maximum marks of the course - 32

COMPLEMENTARY ELECTIVE COURSE II:
BASIC MICROBIOLOGY II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2C02 MCB	4	2	3

COURSE OUTCOME

CO 1. Explain microbial growth and metabolism.
CO 2. Understand diversity of microbial nutrition
CO 3. Understand general characteristics and life cycle of bacterial viruses
CO 4. Understand gene transfer methods in microorganisms.

Unit I

Microbial Growth: Growth curve, Measurement of growth - total count, viable count, Turbidimetric techniques to determine growth, Factors affecting growth. Culture media - nutrient agar, Mac Conkey Agar, PDA, EMB. Isolation of pure cultures-culture methods-streak, pour plate. Preservation of cultures.

(15 Hrs)

Unit II

Bacterial heterotrophism, Bacterial photosynthesis: light reaction- reaction centres, pigments. Sulphur assimilation in microbes.

(20 Hrs)

Unit III

Bacteriophages: DNA and RNA phages, T4 phage, lytic and lysogenic cycles – Host cell adsorption and penetration, synthesis phage nucleic acid. Cultivation of phages.

(20 Hrs)

Unit IV

Gene transfer in micro organisms- transformation ,transduction -generalised and specialised, conjugation- F+ x F-, Hfr x F-, F' x F-

(17 Hrs)

Books for study

1) Microbiology : Concepts and Applications -Michael J Pelczar, E.C.S Chan, Noel R Krieg
2) Prescott, Harley, and Kleins MIcrobiology –Prescott
3) Microbial Genetics- David Freifelder
4) Text book of Microbiology-R C Dubey

Books for reference

1) Text book of Microbiology – J. Black
2) Fundamentals of microbiology – Jeffrey Pommerville
3) Brock biology of Microorganisms – Michael T Madigan
4) Microbiology an Introduction – Gerard J. Tortora

Marks including choice:

Unit	Marks
I	15
II	8
III	15
IV	12

About the Pattern of Questions:

Part A - Short answer (5 questions x Mark 1each = 5)
Answer all questions (5 questions x Mark 1each = 5)

Part B - Short Essay (5 questions x Marks 2 each = 10)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (5 questions x Marks 3 each = 15)
Answer any 3 questions (3 questions x Marks 3 each = 9)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 50
Maximum marks of the course – 32

COMPLEMENTARY ELECTIVE COURSE III: APPLIED MICROBIOLOGY I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3C03 MCB	3	2	3

COURSE OUTCOME

CO 1. Understand the role of microbes in Food fermentation, spoilage, foodborne illnesses
CO 2. Explain food and water borne diseases and the microbial pathogens.
CO 3. Describe food preservation techniques and industrial production of foods

Unit I

Microorganism important in food- yeast - Saccharomyces, Schizosacharomyces, mold- Aspergillus, Penicillium, Rhizopus , bacteria- Lactobacillus, Leuconostoc, Clostridium, Pseudomonas, . Sources of contamination of food- animals, plants, soil, air, sewage, contamination during handling and processing

(8 Hrs)

Unit II

Food spoilage: Chemical changes caused by microorganisms - Causes of spoilage - Factors affecting the growth of microorganisms in food-

(8 Hrs)

Unit III:

Food preservation - General principles - Asepsis, removal, anaerobic conditions. Methods of preservation : (i) Preservation by use of High temperature -Pasteurisation- Heating at 100°C, Canning. (ii) Preservation by use of low temperature - chilling or cold storage - Freezing or Frozen storage- (iii) Preservation by Drying - Sun drying - Drying by mechanical dryers – Freeze drying - Smoking - (iv) Preservation by food additives - Organic acids and their salts - Benzoates, Sorbates, Acetates, Nitrites and Nitrates, Alcohol and antibiotics.

(16 Hrs)

Unit IV:

Food and water-borne diseases – Food infections and intoxication- Viral- Gastroenteritis – rota, noro, adeno, Infectious hepatitis, Polio myelitis. Bacterial- Cholera, Typhoid fever, Listeriosis – symptoms, and preventive measures commonly employed.

(14 Hrs)

Unit V:

Microbial production of bread, Beer, vinegar, yoghurt, cheese, industrial alcohol.

(8 Hrs)

Books for Study

1) Food Microbiology- William C Frazier, Dennis C Westhoff
2) Industrial Microbiology-L E Casieda
3) Introduction to Food Biotechnology- Sinosh Skariyachan, Abhil

Books for Reference

1) Text book of Microbiology – J. Black
2) Fundamentals of microbiology – Jeffrey Pommerville
3) Brock biology of Microorganisms – Michael T Madigan
4) Microbiology an Introduction – Gerard J. Tortora

Marks including choice:

Unit	Marks
I	8
II	7
III	15
IV	10
V	10

About the Pattern of Questions:

Part A - Short answer (5 questions x Mark 1each = 5)
Answer all questions (5 questions x Mark 1each = 5)

Part B - Short Essay (5 questions x Marks 2 each = 10)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (5 questions x Marks 3 each = 15)
Answer any 3 questions (3 questions x Marks 3 each = 9)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 50
Maximum marks of the course - 32

COMPLEMENTARY ELECTIVE COURSE IV:
MICROBIOLOGY (COMPLEMENTARY) PRACTICAL I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3C04 MCB	2	-	-

COURSE OUTCOME

CO 1. Understand the principle and working of bright field microscopy
CO 2. Understand the working principle and procedure of laboratory equipments
CO 3. Understand the structural basis of prokaryotic cells through microscopic analysis.
CO 4. Understand the growth requirements of bacteria through media formulations.
CO 5. Perform pure culture isolation techniques

List of Experiments

1. Use and care of microscopes
2. Microscopy-Staining-Simple, Negative, Gram staining, Hanging drop motility, Fungal staining-LPCB.
3. Cleaning and sterilization of glasswares
4. Use of Hot Air Oven, Autoclave, Incubator, Water bath, Colony counter, Laminar air flow
5. Preparation of culture media - Simple , Selective, Differential.
6. Isolation of bacteria by Streak plate method.
7. Personal hygiene-Microbes from hands, tooth scum, other body parts.
8. Isolation of microorganisms from soil samples.(serial dilution and pour plating)

Books for Study

1) Microbiology Laboratory Manual- Capuccino, Sherman, Pearson Education.
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi
3) Manual of Microbiology: Tools and Techniques, Kanika Sharma, Ane Books Pvt Ltd

Books for Reference

1) Microbiology : Concepts and Applications- Pelzer Jr, Chang Kreig, Mc Graw, Hill Inc
2) Microbiological Applications : Harold T Benson

COMPLEMENTARY ELECTIVE COURSE V: APPLIED MICROBIOLOGY II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C05 MCB	3	2	3

COURSE OUTCOME

CO 1. Understand the role of soil Microbes.
CO 2. Understand biological management of sewage and solid waste
CO 3. To develop interest in waste management through microorganisms

Unit I

Nitrogen fixation-Microbes as Biofertilizers:, *Rhizobium*. Mycorrhiza - types, *Azolla-Anabaena* system its benefits. Production of microbial inoculants and application-Rhizobium

(12 Hrs)

Unit II

Microbiology of Municipal sewage: sewage treatment- primary, secondary and tertiary treatments - septic tank , - trickling filters - Imhoff tank - activated sludge process - oxidation ponds -, rotating bio discs-anaerobic sludge digestion.

(16 Hrs)

Unit III

Solid waste disposal: Sanitary landfills - composting – Vermicompost - Biogas - Gobar gas plant technology –common models. Microbiology of Methane production.

(16 Hrs)

Unit IV:

Soil micro organisms and pesticide degradation - microbial decomposition of herbicides, insecticides and fungicides - Effect of pesticides on soil micro organisms.

(10 Hrs)

Books for Study

1) Microbial Ecology: Fundamentals & Applications- Richard Bartha, Ronald M Atlas
2) Agricultural Microbiology - G. Rangaswami, D.N Bagyaraj
3) Soil Microorganisms and Plant Growth - N S Subba Rao

4) Microbiology: Concepts and Applications -Michael J Pelczar, E.C.S Chan, Noel R Krieg

Books for reference

1) Text book of Microbiology – J. Black
2) Fundamentals of microbiology – Jeffrey Pommerville
3) Brock biology of Microorganisms – Michael T Madigan
4) Microbiology an Introduction – Gerard J. Tortora

Marks including choice:

Unit	Marks
I	15
II	15
III	13
IV	7

About the Pattern of Questions:

Part A - Short answer (5 questions x Mark 1each = 5)
Answer all questions (5 questions x Mark 1each = 5)

Part B - Short Essay (5 questions x Marks 2 each = 10)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (5 questions x Marks 3 each = 15)
Answer any 3 questions (3 questions x Marks 3 each = 9)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 50
Maximum marks of the course – 32

COMPLEMENTARY ELECTIVE COURSE VI:
MICROBIOLOGY (COMPLEMENTARY) PRACTICAL II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4C06 MCB	2	4	3HRSX 2DAYS / BATC

COURSE OUTCOME

CO 1. Determine the count of actively growing organisms in a sample
CO 2. Perform the biochemical characteristics of bacteria useful for its identification
CO 3. Determine the antimicrobial spectrum of the given bacterial species
CO 4. Determine the role of microorganisms in the post harvest decay of fruits and vegetables.

List of Experiments

1. Quantitative estimation of viable microorganisms through Serial dilution and spread plate technique
2. Metabolic characterization of bacteria(IMViC test)
3. Antibiotic sensitivity test-use of antibiotic disc diffusion method(Kirby Bauer Technique)
4. Identification of important fungi associated with post harvest rot of fruits and vegetables through microscopy(LPCB staining)

Books for Study:

1) Microbiology Laboratory Manual- Capuccino, Sherman, Pearson Education.
2) Practical Microbiology- R.C Dubey, D.K Maheshawari, S. Chand & Company, New Delhi
3) Manual of Microbiology: Tools and Techniques, Kanika Sharma, Ane Books Pvt Ltd

Books for Reference:

1) Microbiology : Concepts and Applications- Pelzer Jr, Chang Kreig, Mc Graw, Hill Inc
2) Microbiological Applications : Harold T Benson

INTERNAL ASSESSMENT OF PRACTICAL COURSES

COMPONENT	WEIGHTAGE	REMARKS
Lab involvement	25 %	Involvement in preparatory session, safety precautions, disposal and completion of all experiments
Record	25 %	
Lab examination/ viva	50 %	

PART C
GENERIC ELECTIVE COURSES

B.Sc. MICROBIOLOGY GENERIC ELECTIVE COURSES WORK AND CREDIT DISTRIBUTION (2019 ADMISSION ONWARDS)

EACH DEPARTMENT SHALL OFFER A POOL OF FIVE GENERIC ELECTIVE COURSE **AT A TIME, TRANSACTION THROUGH GUIDANCE MODE**. STUDENTS OF OTHER DEPARTMENTS CAN CHOOSE **ANY ONE OF THE GENERIC ELECTIVE COURSE FROM THE POOL OF FIVE COURSES.** ALL DEPARTMENTS (WHETHER IT IS A CORE DEPARTMENT OR COMPLEMENTARY DEPARTMENT CAN OFFER THE COURSE IN SEMESTER V)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS /WEEK	CREDIT	EXAM HOURS
5D01MCB	Foodborne Diseases	**V**	2	2	2
5D02MCB	Microbes and Environment	**V**	2	2	2
5D03MCB	Solid Waste Management	**V**	2	2	2
5D04MCB	Mushroom Cultivation & Processing	**V**	2	2	2
5D05MCB	Fermented Foods and Beverages	**V**	2	2	2

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT*	WEIGHTAGE	REMARKS
Component 1 Written class test	**50 %**	**Minimum two test, average of the best two shall be taken**
Component 2 Seminar and Assignment	**50 %**	**30 % for seminar and 20 % for assignment**

*Any two components, Attendance shall not be a component

GENERIC ELECTIVE COURSE I:
FOODBORNE DISEASES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 01 MCB	2	2	2

COURSE OUTCOME

CO 1. Understand etiological agents of important foodborne infections and intoxications
CO 2. Explain the sources, symptoms and preventive measures of foodborne illnesses
CO 3. Understand the preventive and prophylactic measures of foodborne diseases.

Unit I

Significance of food borne diseases. Types of food borne illnesses- Food infections and intoxications-differences. Causative agents of food infections : bacteria , viruses and protozoa with examples of diseases. Food intoxications- reasons-algal, fungal and bacterial toxins- a brief account.

(6 Hrs)

Unit II

Food infections-Source, symptoms and prevention of diarrheal diseases by bacteria. Salmonella (different species) Shigella (different species*), Escherichia coli, Vibrio cholerae,*
Cl. perfringens as examples of food borne pathogens. Amoebic dysentery- *Entamoeba histolytica* clinical symptoms and complications.

(15 Hrs)

Unit III

Food intoxications by bacteria- Botulism and Staphylococcal food poisoning. *Clostridium botulinum, Staphylococcus aureus* –clinical manifestations. Fungal food poisoning-mycotoxicoses - mycotoxins - Aflatoxin, ergo toxin as examples. Mycetismus-mushroom food poisoning-symptoms

(10 Hrs)

Unit IV

Food safety: Control and prevention of food borne illnesses- general measures-environmental sanitation and personal hygiene. Immuno prophylactic measures-Vaccines against typhoid and cholera (names only). Treatment for diarrheal diseases-Rehydration therapy- ORS and IV fluids. HACCP definition

(5 Hrs)

Books for study

1) Text book of Microbiology – R Ananthanarayan and C K J Paniker.
2) Textbook of Medical Parasitology- C K Jayaram Panicker.
3) Introduction to Food Biotechnology-Sinosh Scariachan and Abhilash M

Books for Reference

1) Food Microbiology- William C Frazier, Dennis C Westhoff

Marks including choice:

Unit	Marks
I	5
II	10
III	10
IV	5

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (6 questions x Marks 2 each = 12)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (2 questions x Marks 6 each = 12)
Answer any 1 questions (1 questions x Marks 6 each = 6)

Total marks including choice - 30
Maximum marks of the course - 20

GENERIC ELECTIVE COURSE II:
MICROBES AND ENVIRONMENT

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 02 MCB	2	2	2

COURSE OUTCOME

CO 1. Understand the basic concept of Ecology and factors influencing the growth of microorganisms in the environment
CO 2. Understand biogeochemical cycling in the environment and microbial interactions in the soil
CO 3. Explain the role of microorganisms causing diseases transmitted through water and the importance of indicator organisms in determining the microbiological quality of drinking water
CO 4. Understand steps involved in waste water treatment
CO 5. Explain the methods to resolve important global environmental problems

Unit I

Basic concepts of Ecology and Environment. Ecosystem- concept and components-food chains, food webs and trophic levels. Environmental factors influencing the growth and survival of microbes-physical-temperature, light, osmotic pressure and hydrostatic pressure. Chemical- pH, oxygen and carbon dioxide. Biological factors.

(6 Hrs)

Unit II

Biogeochemical cycles- C cycle, water cycle, N cycle- Nitrogen fixation, nitrification, denitrification. Rhizosphere and microbial interactions in soil: positive and negative. (brief account).

(8 Hrs)

Unit III

Faecal pollution of water, water borne diseases, indicator organisms, sanitary examination of water. Drinking water purification methods.

(8 Hrs)

Unit IV

Dispersal of air borne micro organisms. Micro organisms and sewage treatment. BOD and DO. Trickling filters, activated sludge process, oxidation ponds.

(8 Hrs)

Unit V

Global environmental problems-ozone depletion, Green house effect and acid rain. Xenobiotics and Biomagnification. Release of GMO to environment and their impact-Ethical issues.

(6 Hrs)

Books for Study

1) Microbial Ecology : Fundamentals & Applications- Richard Bartha, Ronald M Atlas
2) Microbiology- Michael J Pelczar, E C S Chan, Noel R Krieg

Books for Reference

1) Environmental Microbiology-Ian Pepper, Raina M Maier, Charles P Gerba
2) Prescott, Harley,and Kleins Microbiology- Prescott

Marks including choice:

Unit	Marks
I	6
II	6
III	6
IV	6
V	6

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (6 questions x Marks 2 each = 12)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (2 questions x Marks 6 each = 12)
Answer any 1 questions (1 questions x Marks 6 each = 6)

Total marks including choice - 30
Maximum marks of the course - 20

GENERIC ELECTIVE COURSE III:
SOLID WASTE MANAGEMENT

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 03 MCB	2	2	2

COURSE OUTCOME

CO 1. Understand the magnitude of health risk and other socio economic problems of solid waste.
CO 2. Explain methods of disposal of solid waste , hazardous solid waste and e waste
CO 3. Understand the methods for reduction of solid waste

Unit 1

Solid waste- Definition- sources and types- Municipal solid waste-biodegradable and non-biodegradable solid waste- nature and characteristics of solid waste- potential risk of diseases , nuisance, environmental and socio economic problems associated with solid waste- hazardous solid waste

(10 Hrs)

Unit II

Solid waste disposal – collection – transfer- transportation- processing and disposal- physical and chemical treatment methods- stabilization and solidification- thermal treatment- incineration- pyrolysis- gasification- biological treatment- composting- vermi composting in detail- Biogas production land- disposal- sanitary landfills

(16 Hrs)

Unit III

Recovery and reuse of solid waste- energy production- biodiesel production- industrial and hazardous solid waste management- management of E- waste- solid waste reduction strategies.

(10 Hrs)

Books for study

1) Mishra S G and Mani D . pollution through solid waste. Ashok Publishing House, New Delhi

Books for Reference

1) Khan I H , Ahsan N TextBook of solid waste management. C B S Publisher , New Delhi

Marks including choice:

Unit	Marks
I	8
II	15
III	7

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (6 questions x Marks 2 each = 12)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (2 questions x Marks 6 each = 12)
Answer any 1 questions (1 questions x Marks 6 each = 6)

Total marks including choice - 30
Maximum marks of the course - 20

GENERIC ELECTIVE COURSE IV:
MUSHROOM CULTIVATION AND PROCESSING

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 04 MCB	2	2	2

COURSE OUTCOME

CO 1. Understand and identify the edible and poisonous mushrooms and their significance
CO 2. Create skills in mushroom cultivation methods
CO 3. Understand the marketing trends of mushroom
CO 4. Train and help students to learn a means of self employment and income generation

Unit I

Introduction – general history, edible mushrooms and poisonous mushrooms, common Indian mushrooms, Nutritional value and medicinal value. Morphology, structure (Agaricus) and distribution

(10 Hrs)

Unit II

Cultivation – Paddy straw mushroom and Oyster Mushrooms – substrate, spawn making, method of cultivation – bed method, polythene bag method and field cultivation, Pre treatment of substrate.

(10 Hrs)

Unit III :

Maintenance of Mushroom – Diseases- common pests, disease prevention and control. Processing – blanching, steeping, sun drying, canning, pickling, freeze drying

(10 Hrs)

Unit IV

Production level, economic return, foreign exchange from mushroom cultivating countries and international trade.

(6 Hrs)

Books for study

1) Text book of fungi – Pandey.B.P
2) Mushroom- the art of cultivation – Harander Singh

Books for Reference:

1) Elements of biotechnology – Gupta.P.K
2) Mushroom- the art of cultivation – Harander Singh

Marks including choice:

Unit	Marks
I	5
II	10
III	10
IV	5

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (6 questions x Marks 2 each = 12)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (2 questions x Marks 6 each = 12)
Answer any 1 questions (1 questions x Marks 6 each = 6)

Total marks including choice - 30
Maximum marks of the course – 20

GENERIC ELECTIVE COURSE V:
FERMENTED FOODS AND BEVERAGES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 D 05 MCB	2	2	2

COURSE OUTCOME

CO 1. Understand the role of microorganisms in the production of fermented foods and beverages
CO 2. Understand the production of important fermented foods, beverages and single cell proteins

Unit I
History of fermented foods- microorganisms involved in fermentation- advantages of fermented foods

(5 hrs)

Unit- II
Fermented foods- bread, cheese, yoghurt, soy sauce, idli, -brief account on raw materials, organism involved- starter culture, steps in production

(13 hrs)

Unit III
Fermented beverages- wine, beer brief account on raw materials, organism involved- starter culture, steps in production. Types of wine (names only)

(13 Hrs)

Unit IV
Microbial cells as fermentation products – SCP- Spirulina.

(5 Hrs)

Books for Study

1) Vijaya Ramesh K (2007). Food Microbiology. First edition, MJP Publishers, Chennai.
2) Adams MR - Moss (2004). Food Microbiology. Second edition, Panima publishing house New Delhi.
3) BanwartGJ (2004). Basic Food Microbiology. Second edition, CBS Publishers and Distributors, New Delhi.
4) Frazier WC and West Hoff DC (1988). Food Microbiology. Fourth edition, McGraw Hill, New York.

Books for Reference

1) SivakumarPK, Joe MM and Sukesh K (2010). An introduction to Industrial Microbiology. First edition, S.Chand& Company Ltd, New Delhi.
2) Agrawal AK and PradeepParihar (2006). Industrial Microbiology. Student edition, Jodhpur.
3) Patel AH (2005). Industrial microbiology. Published by Mac Millan India Ltd., Chennai
4) Methods in Food Microbiology-W F Harrigan

Marks including choice:

Unit	Marks
I	7
II	10
III	8
IV	5

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (6 questions x Marks 2 each = 12)
Answer any 4 questions (4 questions x Marks 2 each = 8)

Part C - Essay (2 questions x Marks 6 each = 12)
Answer any 1 questions (1 questions x Marks 6 each = 6)

Total marks including choice - 30
Maximum marks of the course – 20

PART D
GENERAL AWARENESS COURSES

MICROBIOLOGY GENERAL AWARENESS COURSES WORK AND CREDIT DISTRIBUTION (2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HRS
3A11MCB	Biochemistry for Microbiology	**III**	4	4	3
3A12MCB	Bioinformatics and Bioinstrumentation	**III**	4	4	3
4A13MCB	Molecular Biology	**IV**	4	4	3
4A14MCB	Microbial Genetics and rDNA Technology	**IV**	4	4	3

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

INTERNAL ASSESSMENT

COMPONENT*	WEIGHTAGE	REMARKS
Component 1 Written class test	**50 %**	**Minimum two test, average of the best two shall be taken**
Component 2 Seminar and Assignment	**50 %**	**30 % for seminar and 20 % for assignment**

*Any two components, Attendance shall not be a component

GENERAL AWARENESS COURSE I:
BIOCHEMISTRY FOR MICROBIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3A11MCB	4	4	3

COURSE OUTCOME

CO 1. Understand the aspects of different types of bonding in biomolecules and the concept and importance of pH and redox reactions in living systems.
CO 2. Describe the detailed structure of carbohydrate with different bonding patterns, their properties, classification and functions in cells.
CO 3. Explain the structure, classification, properties of amino acids and the structure , levels of organization, types, conjugate forms and functions of protein in cells.
CO 4. Understand in detail the properties, classification, mechanism and kinetics of enzyme action and the principles of enzyme regulation.
CO 5. Describe the components, structure and organization of nucleic acids (DNA and RNA) and their functional importance in living systems.
CO 6. Understand the structure, types and properties of fats, fatty acids, lipids, their conjugate forms and their functional importance.

Unit I

Chemical bonds and weak forces of attraction in bio-molecules, Hydrogen bond and properties of water. Acids, bases and buffers, pH and its measurement, Preparation of buffer solutions, Chemical Reactions: Redox reactions, redox potentials and their role in living system.

(10 Hrs)

Unit II

Carbohydrates –Classification, Stereoisomerism and optical activity in Monosaccharides, Structure of glucose and other important monosaccharides. Properties of Monosaccharides. Disaccharides brief account with examples. Polysaccharides – brief account with examples. Peptidoglycan

(12 Hrs)

Unit III

Amino acids and proteins. Important functions of proteins- brief account. General structure of aminoacid and aminoacid classification. Non protein amino acids. Ionic charge of protein molecule and electrophoresis. Primary, secondary and tertiary structure- (mention briefly) Folding of polypeptide chains. Occurrence of secondary structures in proteins. Globular proteins and their sub structures. Immunoglobulin Gas example.

(15 Hrs)

Unit IV

General properties of Enzymes. Classification of enzymes, mechanism of enzyme action- enzyme substrate interaction, activation energy, rate of reaction and Michaelis constant. Michaelis - Menton equation. Regulations of enzyme catalyzed reactions, enzyme inhibitors and allosteric inhibition

(15 Hrs)

Unit V

Nucleic acids – Components and organization, nucleoside di and triphosphate, cyclic nucleotides. Covalent structure of RNA and DNA, DNA double helix

(12 Hrs)

Unit VI

Fats and fatty acids, Nomenclature of lipids and fats. Acyl glycerols, waxes, phospholipids glycolipids, glyceryl esters, and steroides. Functions of lipids. Lipoproteins.

(8 Hrs)

Books for study

1) Lehninger Principles of Biochemistry- David L Nelson, Michael M Cox
2) Outlines of Biochemistry - Eric E. Conn, Paul K. Stumpf, George Bruening, Roy H.Doi
3) Biochemistry- Donald Voet, Judith G Voet

Books for reference

1) Harper's illustrated Biochemistry- Robert k Murray, Darryl k Granner,Peter A Mayor, Victor W R
2) Molecular cell Biology: Harwey lodish et al.
3) Principles of Biochemistry: moran, Hortan
4) Biochemistry : Jeremy M Berg et al.
5) Biochemistry: U Sathyanarayana, U Chakrapani

Marks including choice:

Unit	Marks
I	8
II	12
III	15
IV	12
V	8
VI	5

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

GENERAL AWARENESS COURSE II:
BIOINFORMATICS AND BIOINSTRUMENTATION

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3A12MCB	4	4	3

COURSE OUTCOME

CO 1. Understand the basic concepts in Bioinformatics and its applications in various fields
CO 2. Describe biological databases available online and sequence alignment using bioinformatics tools
CO 3. Understand bioinformatics tools for phylogenetic analysis, structure prediction and drug designing.
CO 4. Explain the principle, working and applications of biological techniques such as chromatography, electrophoresis, spectrophotometry and centrifuge.
CO 5. Understand basic molecular techniques.

Unit I

Introduction to Bioinformatics- scope and applications- Biological data- definition and types- biological database-primary nucleotide sequence databases- GenBank, DDBJ, EMBL, Secondary nucleotide sequence databases- protein sequence databases- Swiss Prot, PIR, TrEMBL, Secondary Protein Sequence Databases- Specialized Databases- PROSITE, PRINT, CATH, Protein Structure Databases- PDB, Genomic Databases, Database Search Tools- Entrez , SRS

(15 Hrs)

Unit II

Sequence Alignment- Local and Global alignment- Pairwise and Multiple Sequence Alignment- Dot Matrix, Scoring Matrix, Similarity Matrix- PAM and BLOSUM – Pairwise Alignment – BLAST, FASTA- Methodology- Multiple Sequence Alignment- Clustal W, Clustal X- Phylogenetic Analysis- PHYLIP

(12 Hrs)

Unit III

Genomics, Proteomics and Metabolomics, Secondary Structure Prediction tools- Brief account- Molecular Modelling, drug designing.

(15 Hrs)

Unit IV

General principle and application of chromatography- types- paper chromatography- thin layer chromatography- Principle and applications of electrophoresis- agarose gel electrophoresis- Principle of PCR.

(18 Hrs)

Unit V

Measurement of pH- Absorption spectra of biomolecules- Principle and applications of spectrophotometry-UV and visible- Beer Lambert's law- Principle and applications of centrifugation

(12 Hrs)

Books for study

1) Bioinformatics: A beginner's Guide. By Jean Michel Claveries and Cedric Noterdame. Wiley Publication
2) Lesk M A. Introduction to Bioinformatics. Oxford publication.
3) Biophysical Chemistry- Principles and techniques- Upadhyay and Nath
4) Expanding horizons of Biotechnology- B.D Singh

Books for Reference

1) Rastogi S C. Bioinformatics: Methods and Applications, Genomics, Proteomics and Drug Discovery. Prentice Hall India Publication
2) Ghosh A and Mallick V. Bioinformatics- Principles and applications- Oxford University Press.
3) Practical Biochemistry – Principles and techniques- Ed Kleith Wilson & John Walker, Cambridge University Press, Cambridge U K
4) Modern experimental Biochemistry- Rodney F Boyer. The Benjamin/Cunning Publishing Company
5) Nelson D L & Cox M M. Lehninger Principles of Biochemistry. W H Freeman and Company

Marks including choice:

Unit	Marks
1	12
2	12
3	10
4	15
5	11

About the Pattern of Questions:

Part A - Short answer (6 questions x Mark 1each = 6)
Answer all questions (6 questions x Mark 1each = 6)

Part B - Short Essay (8 questions x Marks 2 each = 16)
Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

GENERAL AWARENESS COURSE III: MOLECULAR BIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4A13MCB	4	4	3

COURSE OUTCOME

CO 1. Understand the history of molecular biology, the experiments that proved the role of DNA as genetic material, physical and chemical properties of DNA, and organisation of genetic material in cells.
CO 2. Explain mechanisms and molecules involved in replication of DNA and different models of replication.
CO 3. Describe molecular mechanisms of recombination.
CO 4. Understand chemical nature and types of RNA , transcription mechanisms and different types of molecules involved and processing of RNA
CO 5. Understand concept of genetic code and concept of translation, steps involved and post translational modification.
CO 6. Understand concept of gene regulation in prokaryotes using lac and trp operon as examples.

Unit I

Historical background of Molecular Biology. DNA as the genetic material - experimental evidences. Chemical and physical properties of DNA. Organization of bacterial and eukaryotic chromosome. DNA super coiling- chromatin and nucleoid structure. Histones- structure and function.

(8 Hrs)

Unit II

DNA Replication- semi - conservative mode of replication. Enzymes and accessory proteins involved in DNA replication and their mechanism (bi-directional, semi discontinuous, RNA priming). Various models of DNA replication- rolling circle, D loop, θ(theta) replication. Molecular mechanism of DNA recombination - site specific recombination, homologous recombination and transposition

(20 Hrs)

Unit III

Chemistry of RNA - brief account. Ribosomal RNA, messenger RNA and transfer RNA. Transcription- DNA depended synthesis of RNA, RNA polymerases and mechanism.
RNA depended synthesis of RNA and DNA- Reverse transcriptase and RNA replicase- brief account. RNA processing. Ribosomal structure - Prokaryotic and eukaryotic comparative account.

(18 Hrs)

Unit IV

Genetic code: codon assignment, universality, triplet binding and reading frame, anticodons, degeneracy, and wobble hypothesis. Translation - activation of amino acids and mechanism of protein synthesis. Polysomes. Folding and post translational processing.

(14 Hrs)

Unit V

Regulation of gene expressions in prokaryotes- Operon concept, positive and negative regulation, attenuation regulation- Lac operon and tryptophan operon as examples. Gene regulation by recombination.

(12 Hrs)

Books for Study

1) Principles of Biochemistry - Lehninger
2) Microbial Genetics - David Freifelder
3) Molecular Biology- David Freifelder

Books for Reference

1) Molecular biology of the Gene - James D Watson
2) Cell and molecular Biology- E.D.P De Robertis, E.M.F De Robertis
3) Genes IX - Benjamin Lewin
4) Cell and Molecular Biology-Concepts and Experiments- Gerald Karp

Marks including choice:

Unit	Marks
I	10
II	15
III	12
IV	13
V	10

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Answer any 6 questions (6 questions x Marks 2 each = 12)

Part C - Essay (6 questions x Marks 3 each = 18)
Answer any 4 questions (4 questions x Marks 3 each = 12)

Part D - Long Essay (4 questions x Marks 5 each = 20)
Answer any 2 questions (2 questions x Marks 5 each = 10)

Total marks including choice - 60
Maximum marks of the course - 40

GENERAL AWARENESS COURSE IV:
MICROBIAL GENETICS AND rDNA TECHNOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4A14MCB	4	4	3

COURSE OUTCOME

CO 1. Understand genomic organization of prokaryotes including bacterial chromosome, plasmids and transposable genetic material
CO 2. Understand gene transfer mechanism in prokaryotes, its applications and genetic make-up of bacteriophage and yeast briefly
CO 3. Explain molecular mechanism underlying mutations and useful phenotypes of bacterial mutants.
CO 4. Explain the basics and molecular techniques involved in recombinant DNA technology and the role of microbes in rDNA technology
CO 5. Describe the applications of transgenic plants and animals.

Unit I

Introduction to Microbial Genetics- Mendelian laws- Chromosome theory of heredity- Genotype and Phenotype-Genomic organization in prokaryotes- Bacterial chromosome structure- extra chromosomal genetic material- plasmids- Types- F plasmid, R plasmid, colicinogenic plasmids, Degradative plasmids, Ti plasmids and yeast 2 µm plasmid, host range- plasmid incompatibility- Prokaryotic transposable genetic elements- IS- composite and non-composite transposon, replicative and non- replicative transposition.

15 Hrs)

Unit II

Genetic exchange in bacteria- Transformation, conjugation, transduction- discovery, mechanism and its applications. Bacteriophage genetics- lytic and lysogenic phages- genetic basis of lytic versus lysogenic switch of lambda phage- yeast genetics- mating types, mitochondrial inheritance in yeast.

(15 Hrs)

Unit III

Mutations- Definition and types- molecular basis of mutations-point mutation- base substitution- deletion, insertion, frame shift, suppression, reversion- useful phenotypes of mutants (auxotroph, conditional, resistant)- isolation of mutants, Ames test- DNA repair in bacteria- excision repair and SOS repair.

(15 Hrs)

4jkUnit IV

Introduction to rDNA technology- tools and strategies- restriction enzymes- mode of action- uses- DNA modifying enzymes- cloning vectors- plasmid, phage, cosmids, shuttle and expression vectors- methods of introduction of rDNA in to host cells- selection of transformants and recombinant clones- detection of recombinant clones containing desired gene- colony hybridization, in vitro translational system.

(15 Hrs)

Unit V

Transgenic plants and animals, Bt transgenic cotton, brinjal- recombinant products of human therapeutic interest- insulin and recombinant vaccines- basics of DNA sequencing, Gene libraries, Gene therapy , antisense RNA

(12 Hrs)

Books for study

1) Microbial Genetics. Stanely R Maloy, Friefelder and Cronan
2) Genetics. Strickberger M W. Prentice, Hall of India, Pvt Limited, New Delhi.
3) Brown TA. Gene Cloning and DNA analysis. Blackwell Publishing, Oxford UK
4) Watson James D. recombinant DNA. Scientific American Books, New York.

Books for Reference

1) Friefleder David. Microbial Genetics. Narosa Publishing House , New Delhi.
2) Prescott Lansing M, Harley John P and Klein Donald A. Microbiology, WBCB, Mc Graw Hill , New York.
3) Gardener E J, Simmons M j , Snustad DP. Principles of genetics, Wiley- India
4) Russel P J. I Genetics- A molecular Approach, 3rd Edition, Benjamin Cumings
5) Primrose S B and Twyman R M. Principles of Gene Manipulation and genomics- Blackwell Publishing, Oxford U K.

Marks including choice:

Unit	Marks
1	12
2	15
3	9
4	12
5	12

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