B.Sc. Microbiology

PROFESSIONAL ETHICS

First Year | **CORE COURSE I BASICS OF MICROBIOLOGY (Theory)** | **Semester I**

Code:22SCCMB1 | **Credit: 5**

COURSE OBJECTIVES:

- To understand classification of microorganisms and basic concepts of Microscopes.
- To understand bacterial size, shape and their structure.
- To understand the general characteristics of prokaryotic and eukaryotic microorganisms.
- To understand the concept of microbial control.
- To understand the process of microbial growth and nature of culture media.

UNIT - I HISTORY, TAXONOMY AND MICROSCOPY:

Introduction-Definition, scope of Microbiology, Concepts of Microbiology, Major contribution of microbiologists. Classification – Taxonomy, Taxonomic ranks – Three kingdom concept, five kingdom concept, three domain concepts. Microscopy: Principles and applications of microscopes: brightfield, dark field, phase contrast, fluorescent, SEM and TEM. Micrometry – measurement of bacterial size.

UNIT - II CLASSIFICATION AND ULTRASTRUCTURE:

Difference between prokaryotic and eukaryotic microorganisms. Outline classification of bacteria on the basis of Bergey's manual of systemic bacteriology. Structural organization of bacteria – Size, shape and arrangement of bacterial cells - Ultrastructure of a bacterial cell - cell wall, cell membrane, ribosomes, nucleoid, slime, capsule, flagella, fimbriae, spores, cysts, plasmid, mesosomes and cytoplasmic inclusions.

UNIT - III GENERAL CHARACTERS, EUCARYOTIC CLASSIFICATION ANDSTAINING:

General characteristics and nature of Archaeobacteria, Cyanobacteria, Mycoplasma, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Protozoa, Algae, Fungi, lichens and Viruses. Basic understanding of classification of algae-Fritch, fungi-Alexopoulos and protozoa. Principles and types of staining– Simple, gram, acid fast, spore and Capsule staining.

UNIT - IV CONTROL OF MICROORGANISMS:

Physical methods of Sterilization - Moist heat, dry heat and filtration and radiation – Chemical methods of sterilization – phenolics, alcohols, heavy metals, aldehydes and gaseous chemicals. Antimicrobial chemotherapy – Mode of action of antibiotics. Factors affecting the growth of microorganisms.

UNIT - V MICROBIAL GROWTH:

Culture media – Types of Medium, simple, enriched, enrichment, selective, differential and transport medium. Classification medium. Common ingredients of culture media – peptone Sodium chloride, yeast extract beef extract and agar-agar. Pure culture techniques – Serial dilution, pour plate, spread plate and streak plate technique. Aerobic and Anaerobic culture techniques. Preservation of microorganisms.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Comment on recent trends in microbiology. How microbes relate to biotechnological innovations. Impart knowledge in ubiquitous nature of microorganisms. Identification features in relation to morphology and culture.

REFERENCES:

1. Alcamo IE. 2001. Fundamentals of Microbiology, sixth edition, Addison wesley Longman, Inc. California.
2. Dubey RC and Maheswari DK. 2010. A Text Book of Microbiology. S Chand, New Delhi.
3. Madigan MT, Martinko JM, and Parker J. 2009. Biology of Microorganisms, 12th Edition, MacMillan Press, England.
4. Pelczar MJ, Chan ECS and Kreig NR. 2009. Microbiology, 5th Edition. McGraw- Hill. Book Co.Singapore.
5. Prescott LM, Harley JP, and Klein DA. 2007. Microbiology (7th edition) McGraw Hill, Newyork.
6. Schlegel HG. 2008. General Microbiology, Cambridge University Press, U.K.
7. Tortora GJ, Funke BR and Case CL. 2009. Microbiology: An Introduction. 9th Edition, Pearson Education, Singapore.
8. Rajan S and Selvi Christy R. 2018. Essentials of Microbiology, CBS Publishers, NewDelhi, 2018.
9. Holt, J.S., Kreig, N.R., Sneath, P.H.A., Williams, S.T. 1994. Bergeys Manual of Determinative Bacteriology, 9th edition, William and Wilkins, Baltimore.
10. George Plopper, Diana Bebek Ivankovic. 2020. Principles of Cell Biology. 2020. 3rd Edition John willey.
11. https://www.basic-concept.com/c/basic-types-of-nutrition-with-explanations
12. https://www.labconco.com/articles/a-brief-introduction-to-kjeldahl-nitrogen- determ
13. https://microbenotes.com/light-microscope/

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Understand the historical Developments in Microbiology.
- Understand the usage of microscopes to know the size and shape of microorganisms.
- Understand eubacteria, archaebacteria and actinomycetes.
- Understand systemic classification of microorganisms.
- Understand the concept of microbial growth, culture media and the process ofcontrolling microbial growth.

*****

PROFESSIONAL ETHICS

First Year | **CORE PRACTICAL I** | **Semester I**

BASICS OF MICROBIOLOGY

Code: 22SCCMB1P | **(Practical)** | **Credit: 4**

COURSE OBJECTIVE:

- To operation of all laboratory equipments,
- To isolation techniques of microorganisms
- To staining of microbial cells
- To enumeration methods of microorganisms
- To understand basic structure of microbes.

EXPERIMENTS:

1. Laboratory rules and regulations.
2. Basic requirements of Microbiology laboratory.
3. Principles and operations – Autoclave, Hot Air Oven, Incubators, Laminar Air Flow, Filtration, colony counter, Centrifuge, pH meter, Colorimeter and Spectrophotometer
4. Cleaning and sterilization of glassware.
5. Preparation of culture media – solid, semi-solid and liquid.
6. Illustrate contributions of Antony Von Leuwenhoek Louis Pasteur, Sergi Winogradsky, Alexander Fleming, Robert Koch, Joseph Lister and Edward Jenner.
7. Measurement of size of microbes – micrometry.
8. Isolation of bacteria, actinobacteria, fungi and cyanobacteria from soil sample.
9. Pure culture techniques - Streak plate, Pour plate and Spread plate.
10. Test for motility of bacteria – Hanging drop method
11. Staining techniques – Simple staining, Gram's staining, Spore-staining, Capsular staining and LPCB.
12. Observation of permanent slides to study the structural characteristics of algae (*Anabena, Nostoc, Spirulina, Oscillatoria*), fungi (*Rhizopus, Saccharomyces, Penicillium, Aspergillus*, *Agaricus*) and protozoa (*Entamoeba histolytica, Giardia lamblia* and *Plasmodium* sp.).
13. Components and uses of Peptone, sodium chloride, Yeast extract, agar- agar, Nutrient agar, EMB agar, Mac Conkey agar, Mueller Hinton Agar and Potato Dextrose agar.

REFERENCES:

1. Monica Cheesbrough. 2006. District Laboratory Practice in Tropical Countries - Part I and II 2 nd edition. Cambridge University Press, New Delhi.
2. Rajan S. 2012. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai.
3. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. 2007. Bailey and Scott's Diagnostic Microbiology, 12th Edition. Mosby Elsevier.

4. Mackie and McCartney. 2006. Practical Medical Microbiology, 14th Edition. South Asia Edition.
5. Rajan S and Selvi Christy R.2018. Experimental Procedures in Life Sciences. CBS Publishers, New delhi.

COURSE OUTCOME:

After the completion of this lab course, the students will be able to:

- Understand basics of laboratory rules and minimum requirements of a laboratory – equipments/instruments and their operations.
- Understand media preparation methods.
- Understand pure culture methods to isolate and enumerate microbes.
- Understand various staining techniques.
- Understand morphological features of micro-organisms.

*****

PROFESSIONAL ETHICS

First Year	FIRST ALLIED COURSE I FUNDAMENTALS OF BIOLOGICAL SCIENCES	Semester I
Code:22SACMB1	(Theory)	Credit: 4

COURSE OBJECTIVES:

- To gain the basic knowledge about plants and animals.
- To study the biological concepts of plant and animal evolution and establishments.
- To understand the biological sciences' importance to human society.
- To enhance the student knowledge from current biological diversity to safe earth.
- To introduce the recent research topics as to stimulate the learners' interest towards higher studies.

UNIT - I ORIGIN, EVOLUTION, DIVERSITY OF BIOLOGICAL SCIENCES:

Origin of life theory, history and evolution of biology. Chemical basis of life and diversity of life forms. General characteristic features of living organisms: Plants, animals and microorganisms. Hierarchical levels of organization in living organisms; difference between prokaryotes and eukaryotes.

UNIT - II PLANT DIVERSITY AND TAXONOMY:

Introduction, plant nomenclature - Binomial system, International Code of Botanical Nomenclature (ICBN). Types of classification and plant taxonomy. Salient features and distribution of lichens, bryophytes, pteridophytes, gymnosperms and angiosperms.

UNIT - III PLANT FUNCTIONAL TRAITS AND VALUES:

Physiology and reproduction of plants: photosynthesis; anatomy and embryological features; pollination biology; micropropagations. Economic importance of plants and value-added products.

UNIT - IV ANIMAL DIVERSITY AND TAXONOMY:

Introduction to animal kingdom and evolutionary theories. International code of zoological nomenclature (ICZN). Types of classification and nomenclatures of animals. Salient features and distribution of invertebrates and vertebrates.

UNIT - V ANIMAL FUNCTIONAL TRAITS AND VALUES:

Introduction to animal physiology. Growth and homeostasis. Animal behaviour. Brief on comparative anatomy and physiology. Animal reproductive biology and endocrinology. Biological importance on presence of diverse animals.

UNIT - VI CURRENT CONTOUR (For continuous internal assessment only):

Importance of biological sciences and their study with relevance to the existence of life on planet earth. Integration of biological sciences with various fields for human welfare. Stem cells and regenerations research.

REFERENCES:

1. Annie Regland and Kumaresan. Angiosperms, Saras publication, Nagercoil.2013.
2. Pandey BP. Taxonomy of Angiosperms, S. Chand and company ltd, New Delhi.1999.
3. Kumaresan V. Horticulture and plant breeding, Saras publication. 2009.
4. Balinsky B. An introduction to embryology, 3rd edition, W.B. Saunders, Philadelphia. 1981.
5. Pandey BP. Plant pathology, S. Chand and company ltd. 2009.
6. Douglas J Futyma. Evolutionary biology, 2nd edition, Sinauer Associates.1989.
7. Eli C Minkoff. Evolutionary biology, Addition- Wesley.1983.
8. Pandey BP. Taxonomy of Angiosperms, S. Chand, New Delhi.1999
9. Sharma PD. Microbiology and plant physiology Rastogi publications.2001.
10. Young E, Alper H. Synthetic biology: tools to design, build, and optimize cellular processes. J Biomed Biotechnol. 2010; 2010:130781.
11. Verma V. Text book of plant physiology, Ane Books India, New Delhi.2007.
12. Jain VK. Fundamentals of plant physiology, S. Chand and Co, New Delhi.2006.
13. Pandey SN and Sinha BK. Plant physiology, 4th edition, Vikas publishing, ND. 2006.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Gain knowledge about plants and animals on a par with their higher education.
- Understand the biological concepts of plant and animal evolution and their establishments.
- Imbibe the biological sciences' importance to human society.
- Enhance their knowledge of existing biological diversity and of a safe earth.
- Know the current research topics that could stimulate them towards higher studies.

*****

HUMAN VALUES

PART-IV VALUE EDUCATION COURSE

FOR ALL UG ARTS, SCIENCE, COMMERCE AND MANAGEMENT
CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)
(Applicable to the candidates admitted from the academic year 2022-2023 onwards)

First Year	**PART-IV VALUE EDUCATION**	**Semester-I**
Code: 22UGVED	**(Theory)**	**Credit: 2**

OBJECTIVES:

- To understand the philosophy of life and values through Thirukural
- To analyse the components of values education to attain the sense of citizenship
- To understand different types of values towards National Integration and international understanding
- To learn yoga as value education to promote mental and emotional health
- To understand human rights, women rights and other rights to promote peace and harmony

UNIT I : PHILOSOPHY OF LIFE AND SOCIAL VALUES:

Human Life on Earth (Kural 629) -Purpose of Life (Kural 46) -Meaning and Philosophy of Life (Kural 131, 226) -Family (Kural 45), Peace in Family (Kural 1025) Society (Kural 446), The Law of Life (Kural 952), Brotherhood (Kural 807) Five responsibilities / duties of Man (a) to himself (b) to his family (c) to his environment (d) to his society, (e) to the Universe in his lives (Kural 43, 981).

UNIT-II – HUMAN VALUES AND CITIZENSHIP

Aim of education and value education: Evolution of value oriented education, Concept of Human values: types of Values- Character Formation – Components of Value education- A P J Kalam's ten points for enlightened citizenship- The role of media in value building

UNIT-III VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT:

Constitutional or national values: Democracy, socialism, secularism, equality, Justice, liberty, freedom and fraternity - Social Values: Pity and probity, self-control, universal brotherhood - Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith -Religious Values: Tolerance, wisdom, character - Aesthetic Values- Love and appreciation of literature and fine arts and respect for the same- National Integration and International Understanding.

UNIT IV : YOGA AND HEALTH:

Definition, Meaning, Scope of Yoga - Aims and objectives of Yoga - Yoga Education with modern context - Different traditions and schools of Yoga - Yoga practices: Asanas, Pranayama and Meditation.

UNIT V : HUMAN RIGHTS:

Concept of Human Rights: Indian and international perspectives- Evolution of Human Rights- definitions under Indian and International documents -Broad classification of Human Rights and Relevant Constitutional Provisions: Right to Life, liberty ad Dignity- Right to equality- Right against exploitation- Cultural and Educational Right- Economic Rights- Political Rights- Social Rights - Human Rights of Women and Children – Peace and harmony.

UNIT - VI: CURRENT CONTOURS: (for continuous internal assessment only):

BOOKS FOR REFERENCES:

1. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613 004
2. jUfFws - [A.Ngg - Mqf y nkho ahffjJLd ckh E}y nts aLLfk jQrhTH
3. Leah Levin, Human Rights, NBT, 1998
4. V.R. Krishna Iyer, Dialetics and Dynamics of Human Rights in India, Tagore Law Lectures.
5. Yogic Thearpy - Swami Kuvalayananda and Dr.S.L.Vinekar, Government of India, Ministry of Health, New Delhi.
6. SOUND HEALTH THROUGH YOGA - Dr.K.Chandrasekaran, Prem Kalyan Publications, Sedaptti, 1999.
7. Grose. D. N – "A text book of Value Education' New Delhi (2005)
8. Gawande . EN – "Value Oriented Education" – Vision for better living. New Delhi (2002) Saruptsons
9. Brain Trust Aliyar- "Value Education for Health, Happiness and Harmony" Erode (2004) Vethathiri publications

COURSE OUTCOMES: After completion of the course, the student will be able to:

- Apply the values in thirukural to be peaceful, dutiful and responsible in family and society
- Develop character formation and sense of citizenship
- Be secular, self-control, sincere, respectful and moral.
- Master yoga, asana and meditation to promote mental health
- Be attitudinal to follow the constitutional rights

****

PROFESSIONAL ETHICS

First Year | **CORE COURSE II** | **Semester II**

MICROBIAL PHYSIOLOGY

Code: 22SCCMB2 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To impart among the learners the fundamental principles of microbial physiology.
- To provide the role / functions of various organelles of a cell.
- To understand the route of a cell to metabolize carbohydrate, protein and fatty acids.
- To highlight the microbial enzymes' profiles and their activity.
- To underscore the significance of each chemical component of a microbiological medium towards the growth of the organism through theory classes & self- demonstrations.

UNIT - I MICROBIAL GROWTH AND GROWTH CURVE:

Microbial nutrition and growth: Nutritional requirements of microbes - Autotrophs, Heterotrophs, Photoautorophs, Chemoautotrophs, Copiotrophs, Oligotrophs, Factors influencing microbial growth – pH, temperature, substrate and osmotic condition. Bacterial growth curve & importance of the growth phases – Generation time - Growth measurements – batch, continuous and synchronous. Diauxic growth.

UNIT - II MICROBIAL ENZYMES:

Bacterial enzymes – classification & nomenclature, properties, kinetics of enzyme action – Michaelis-Menton equation for simple enzymes - coenzymes and cofactors, isozymes. Factors affecting enzyme activity.

UNIT - III CARBOHYDRATES: ANABOLISM & CATABOLISM:

Carbohydrate metabolism: Anabolism – bacterial phototsynthesis – oxygenic – anoxygenic, synthesis of carbohydrate – catabolism of glucose – EMP – HMP – ED pathways, TCA cycle – electron transport system, Phosphorylation, oxidative and substrate level phosphorylations.

UNIT - IV PROTEINS: ANABOLISM & CATABOLISM:

Protein metabolism – synthesis and degradation of amino acids – glycine tyrosine, cysteine, serine, glutamine, synthesis of peptides and proteins – urea cycle

UNIT - V FATTY ACIDS METABOLISM:

Lipids metabolism – biosynthesis of fatty acids and cholesterol – oxidation of fatty acids. Anaerobic Respiration – Nitrate, sulphate and methane respiration – Fermentations – alcoholic, propionic, mixed acid, lactic acid fermentation.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Demonstration on the role of nutrients & individual components of nutrient agar, nutrient broth, Mac Conkey Agar, *Salmonella–Shigella* Agar, Mueller-Hinton Agar, Hektoen Enteric Agar, Mannitol Salt Agar, Robertson Cooked Meat Broth – assignments on types of microbial nutrients – bacterial growth curve - Diauxic growth – classification & nomenclature of enzymes – factors affecting enzyme activity - EMP – HMP – ED pathways, TCA cycle – ATP production – protein synthesis – fermentation – fatty acid

oxidation – short seminar classes – debates of selected topics of the course – discussionof previous year question papers.

REFERENCES:

1. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology. Fourth edition, A John Wiley sons, Inc. publication. New Delhi.
2. Dubey RC and Maheswari DK (2022). A Text of Microbiology. Revised edition, S. Chand and Company Ltd., New Delhi
3. Namita Gupta, Rani Gupta (2021), Fundamentals of Bacterial Physiology and Metabolism, Springer
4. Rajan S and Selvichristry (2019). Exam Oriented Biochemistry. CBS Publishers,New Delhi
5. Doelle HW. (2005) Microbial Metabolism, Academic Press.
6. Nelson David L, Albert L Lehninger and Michael M Cox. Lehninger (2008) Principlesof biochemistry. Macmillan.
7. Murray RK, Granner DK, Mayes PA and Rodwell VW. (2004) "Harper's Biochemistry, Appleton and Lange: New York, NY.
8. Dubey, R.C. & D.K. Maheshwari. (2022) A Text Book of Microbiology, S. Chand and Company Ltd., New Delhi.
9. Lansing M. Prescott JP, Harley and Donald A Klein. (2003) Microbiology, 5thedition, McGraw-Hill Company, New York..
10. Mathews CK and Holde KEV. (2003) Biochemistry – The Benjamin/Cummings Publishing company, Inc., New York..
11. Murray RK, Granner MD, Mayes PA and Rodwell VW. (2000) Biochemistry – Prentice Hall International Inc., London.
12. Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Tata Mc GrawHillINC., New York.
13. https://www.elsevier.com/books/bacterial-physiology-and metabolism/ sokatch/ 978-1-4832-3137-2
14. 3.https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Bru slind)/11%3A_Microbial_Nutrition
15. https://microbiologynotes.org/introduction-to-the-microbial-nutrition/

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Understand the nature of nutrients required by microbes.
- Learn the macro molecules' classification based on their nutritional needs.
- Grasp various factors which effect & affect microbial growth as well as the functionsof enzymes.
- Comprehend how energy is synthesized from carbohydrates, proteins and fattyacids
- Understand the synthesis of macro molecules through metabolism.

****
*

PROFESSIONAL ETHICS

First Year | **FIRST ALLIED COURSE II GENERAL BIOCHEMISTRY (Theory)** | **Semester II**

Code: 22SACMB2 | **Credit: 4**

COURSE OBJECTIVES:

- To provide basic understandings of cell structural compositions.
- To teach biochemical nature and functions of microbes.
- To study the basics of bio-molecules' synthesizing mechanisms and regulations.
- To know the biological energy sources and transferring molecules.
- To understand the molecules involved in metabolic functional systems.

UNIT - I CELL AND ITS FUNCTION:

Composition of living matter. Biochemistry of microbial, plant and animal cells. Specialized components of microorganisms and their structure and function.

UNIT - II ENZYMES:

Enzymes as biocatalysts, enzyme classification, specificity, active site, unit activity, isozymes. Enzyme kinetics: Michaelis Menton equation for simple enzymes. Enzyme inhibition.

UNIT - III TYPES OF MACROMOLECULES AND PROPERTIES:

Structural features and chemistry of macromolecules. Nucleic acid –Structure of DNA and RNA; functional properties. Proteins – classification – Amino acids - primary-secondary-tertiary – quaternary and three-dimensional structure of proteins. Carbohydrates - mono, di, oligo and polysaccharides. Lipids and biomolecules: Fatty acids, properties, -oxidation and reduction reactions.

UNIT - IV BIOSYNTHESIS OF MACROMOLECULES:

Nucleic acids: biosynthesis of purines and pyrimidines. Proteins – biosynthesis from DNA. Fatty acid biosynthetic pathways. Biosynthesis of cholesterol. Assembly of carbohydrate from monomeric structures and the enzyme involved inthe synthesis.

UNIT - V BIOENERGETICS:

Bioenergetics and strategy of metabolism - flow of energy through biosphere, strategy of energy production in the cell. Oxidation – reduction reactions, coupled reactions and group transfer. ATP production, structural features of biomembranes, transport, free energy and spontaneity of reaction, G, G°, G' and equilibrium. Basic concepts of acids, base, pH and buffers.

UNIT - VI CURRENT CONTOUR (For continuous internal assessment only):

Different biochemical pathways. Types Diabetics mellitus. Promotion and inhibition of drug functioning mechanisms. Biochemical limitation and solutions in disease diagnostic practices.

REFERENCES:

1. Christopher K Mathews and Van Holde KE. Biochemistry. 2nd edition. The Benjamin/Cummings publishing company, Inc.1996.
2. David E Metzler and Carol M Metzler. Biochemistry -The chemical reactions of living cells- Vol1and2.2nd edition. Harcourt/Academic press, Newyork.2001.
3. Donald Voet and Judith G. Voet. Biochemistry – Second Edition. John Willey and Sons, Inc.1995.
4. Freifelder D. Molecular Biology, II Edition, Narosa Publishing House, New Delhi.1996.
5. Geofferey L and Zubay. Biochemsitry. Fourth Edition.Wm. C. Brown Publishers.1998.
6. Jeremy M Berg, John L Tymoczko and Lubert stryer. Biochemistry.5th edition.W.H.Freeman and company, Newyork.2002.
7. Stryer L Berg JM and Tymoczko JL. Biochemistry. 5th edition. New York: W. H. Freeman. 2002.
8. Reginald H Garret and Charles M Grishm. Biochemistry (Second Edition) Saundars College Publishing.1998.
9. Thomas M Devlin. Textbook of Biochemistry with clinical correlations. 5th edition. A John Wiley and sons, Inc., publication, Newyork.2002.
10. Trudy McKee and James R McKee. Biochemistry-An Introduction.2nd edition.WCB McGraw- Hill,U.S.A. 1999.
11. Lehninger, Albert L, David L Nelson and Michael M Cox. Lehninger Principles of Biochemistry. New York: Worth Publishers. 2000.
12. Rafi MD. Textbook of Biochemistry for medical students, 2nd edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2014.

COURSE OUTCOMES:

Upon successful completion of the course, the students would be able to:

- Assimilate the basic knowledge of cell structural compositions.
- Understand the biological & chemical nature and functions of cells.
- Describe the basics of bio-molecules synthesizing mechanisms and their regulations.
- Explain about biological energy sources and transferring molecules.
- Understand the molecules associated with metabolic functional systems.

*****

First Year | **CORE PRACTICAL II MICROBIAL PHYSIOLOGY (Practical)** | **Semester II**

Code: 22SCCMB2P | **Credit: 4**

COURSE OBJECTIVES:

- To provide the students hands-on practice on the first-line microbial physiology experiments.
- To train the learners to independently test various carbohydrate fermenting abilitiesof microbes.
- To make the students to understand the principles of significant biochemical testsdone to identify bacterial isolates.
- To educate microbial growth experiments and their impacting factors.
- To provide hands- on experience of microbial cultivations by different methods.

EXPERIMENTS:

1. Bacteria & carbohydrate fermentation tests: Glucose, Lactose, Sucrose and Mannitol.
2. Biochemical tests to identify bacterial isolates - IMViC test, Oxidase test, Catalase test, Urease test, TSI test
3. Enzymatic Hydrolysis of Starch & Casein by selective bacterial isolates.
4. Bacterial (*Escherichia coli)* Growth curve: Cell count
5. Measurement of Microbial growth –Turbidity methods.
6. Studying the influence of temperature & pH on the growth of test bacteria.
7. Anaerobic bacterial cultivation - candle jar method

REFERENCES:

1. Aneja KR (2017). Experiments in Microbiology, Plant pathology and Biotechnology.4th Edition, NewAge International Publishers, Chennai.
2. J. Mudili (2020), Introductory Practical Microbiology, Narosa publishers
3. Amita Jain, Jyotsna Agarwal, Vimala Venkatesh (2018). Microbiology Practical Manual, 1st Edition
4. James G. Cappuccino, (2014). Microbiology: A Laboratory Manual, 10th Edition, Pearson
5. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S. Chand & Company Ltd., New Delhi.
6. Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains andBuffers. Panima Publishing Corporation, NewDelhi.
7. Rajan S and Selvi Christy R. (2018). Experimental Procedures in Life Sciences. CBS Publishers, New delhi.
8. Sundararaj T. Microbiology laboratory manual. Revised and published by Aswathy Sundararaj.No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
9. https://www.frontiersin.org/books/Microbial_Physiology_and_Metabolism https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Test & determine sugar fermenting/ utilizing abilities of different bacterialspecies.
- Understand the principles behind important biochemical tests done to identify/characterize bacterial species.
- Determine growth stages of a test bacterial species.
- Evaluate the impact of various external components on the microbial growth.
- Grow anaerobic bacteria in a conventional microbiology laboratory.

PROFESSIONAL ETHICS

First Year | **FIRST ALLIED PRACTICAL I** | **Semester I**

FUNDAMENTALS OF BIOLOGICAL SCIENCES & GENERAL BIOCHEMISTRY

Code: 22SACMB1P | **(Practical)** | **Credit: 2**

FUNDAMENTALS OF BIOLOGICAL SCIENCES

COURSE OBJECTIVES:

- To understand the plants' tissue anatomical structure.
- To learn the comparative characteristic features of vegetative natures.
- To study the morphological differences among microbes using microscopes.
- To isolate the endophytic microorganisms from medicinal plants.
- To study the microbes based on various staining techniques
- To be aware of laboratory safety methods and calibration procedures.
- To make well versed in molecular techniques.
- To motivate for innovative findings in microbial molecular mechanism.
- To train on the basic separation techniques.
- To understand the pigments' profiles using appropriate methods.

EXPERIMENTS:

1. Stem, leaf and root sections of a monocot and a dicot plant
2. Study through permanent slides and specimens (vegetative and reproductivestructures) of Coleacheate, *Vaucheria, Polysiphonia, Fucus (*fucus permanent slides only*); Rhizopus, Penicillium* and *Agaricus; Riccia, Anthoceros, Funaria; Cycas, Pinus,*
3. Study of the characteristic features of any two flowers for each family: a. Malvaceae/Fabaceae/Cruciferae (any one family), (b) Compositae, c. Euphorbiaceae, (d) Poaceae/Liliaceae (any one family)
4. Extraction of compound from medicinal plant.
5. Determination of ABO Blood group
6. Enumeration of red blood cells and white blood cells using haemocytometer
7. Estimation of haemoglobin using Sahli's haemoglobinometer
8. Preparation of haemin and haemochromogen crystals

GENERAL BIOCHEMISTRY

EXPERIMENTS:

1. Safety measure in laboratories, use and calibration of pipettes.
2. Preparation of normal, molar and percent solutions.
3. Concept of pH and preparation of buffers.
4. Assay of enzyme activity of Alkanine Phosphatases, SGOT, SGPT.
5. Estimation of polysaccharide (starch or glycogen) from the biological material.
6. Separation of amino acids by paper chromatography and identification of amino acid.
7. Separation of proteins by PAGE, SDS – PAGE – Demonstration.
8. Pigments (Chlorophyll-Carotenoids–Phycobili Proteins)–Spectrophotometry.

REFERENCES:

1. Burran and DesRochers. 2021Principles of Biology I Lab Manual
2. Jerry G. Chmielewski and David Krayesky General Botany Laboratory Manual. 2013 Publisher: Author House ISBN: 978-1-4772-9653-0

3. Naveena Varghese and P.P. Joy Microbiology Laboratory Manual. 2014 Edition: 1 Publisher: Aromatic and Medicinal Plants Research Station.
4. Pakpour & Horgan. 2021.General Microbiology Lab Manual
5. Josephine A. Morello Paul A. Granato Helen and Eckel Mizer. 2003Laboratory Manual and Workbook in Microbiology Applications to Patient Care. ISBN: 0-07-246354-6
6. Pattabiraman, 2015. Laboratory manual in biochemistry fourth edition. All Indian Publisher
7. Sattanathan, S.S. Padmapriya, B. Balamuralikrishnan. 2020. Practical Manual of Biochemistry. Skyfox Publishing Group Skyfox Press
8. DM Vasudevan and Subir Kumar Das. 2013. Practical Textbook of Biochemistry for Medical Students. Jaypee Brothers Medical Publishers (P) Ltd
9. Gyorgy H, Jozsef K, Mihaly, K. Introduction to Practical. 2013 Eötvös Loránd University

COURSE OUTCOMES:

After the completion of the course, students will able to:

- Acquire a knowledge on specimen preparation from plant samples
- Practice handling of microscopes.
- Get a clear practical knowledge on various staining techniques.
- Study the isolation methods of both aerobic and anaerobic bacteria.
- Know the compounds' extraction and purification methods from plant sources for value added products.
- Understand important laboratory safety and precautionary measures.
- Know the principles and calibration of basic analytical instruments.
- Learn the molecules' separation techniques
- Derive the pigmentation profiles of microbes/ plants
- Comprehend the biological materials and their polysaccharide level.

*****

PROFESSIONAL ETHICS

PART – IV

CODE: 22PELLS1

PROFESSIONAL ENGLISH FOR LIFE SCIENCES-I

OBJECTIVES:

- To develop the language skills of students by offering adequate practice in professional contexts.
- To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
- To focus on developing students' knowledge of domain specific registers and the required language skills.
- To develop strategic competence that will help in efficient communication
- To sharpen students' critical thinking skills and make students culturally aware of the target situation.

LEARNING OUTCOMES:

- Recognise their own ability to improve their own competence in using the language
- Use language for speaking with confidence in an intelligible and acceptable manner
- Understand the importance of reading for life
- Read independently unfamiliar texts with comprehension
- Understand the importance of writing in academic life
- Write simple sentences without committing error of spelling or grammar

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

UNIT 1: COMMUNICATION

1. **Listening**: Listening to instructions

2. **Speaking**: Telephone etiquette and Official phone conversations

3. **Reading** short passages (3 passages, one from each – Botany, Zoology, Biochemistry/Microbiology/Health)

5. **Writing:** Letters and Emails in professional context

6. Grammar in Context:

- Wh and yes or no,

- Q tags
- Imperatives

7, **Vocabulary in Context:** Word formation - .

i) Creating antonyms using Prefixes

ii) Intensifying prefixes (E. g inflammable)

Changing words using suffixes

A) Noun Endings

B) Adjective Endings

C) Verb Endings

UNIT 2: DESCRIPTION

Listening – Listening to process description

Speaking - Role play

Formal: With faculty and mentors in academic environment, workplace communication

Informal: With peers in academic environment, workplace communication

Reading –Reading passages on plant world, animal world, health

Writing – Writing sentence definitions (e.g. species) and extended definitions (e.g. Taxonomy)

Picture Description – Description of creatures and their habitat

Grammar **in Context**: Connectives and linkers.

Vocabulary – Synonyms (register) - Compare & contrast expressions.

UNIT 3: NEGOTIATION STRATEGIES

Listening - Listening to interviews of specialists / inventors in fields (Subject specific)

Speaking – Brainstorming. (mind mapping). Small group discussions (subject-specific)

Reading – longer Reading text. (Comprehensive passages)

Writing – Essay Writing (250 word essay on topics related to subject area, like pollution, use of pesticides in cultivation, healthy lifestyle, environment consciousness)

Grammar in Context: Active voice & Passive voice – If conditional –

Vocabulary: -Collocations

-Phrasal verbs

UNIT 4: PRESENTATION SKILLS

Listening - Listening to presentation. Listening to lectures. Watching – documentaries (discovery / history channel)

Speaking –Short speech

- Making formal presentations (PPT)

Reading – Reading a written speech by eminent personalities in the relevant field /Short poems / Short biography.

Writing - Writing Recommendations

Interpreting visuals - charts/ tables/flow diagrams/

Grammar in Context – Modals

Vocabulary (register) - Single word substitution

UNIT 5: CRITICAL THINKING SKILLS

Listening - Listening to advertisements/news and brief documentary films (with subtitles)

Speaking – Simple problems and suggesting solutions.

Reading: Motivational stories on Professional Competence, Professional Ethics and Life Skills (subject-specific)

Writing Studying problem and finding solutions- (Essay in 200 words)

Grammar-Make simple sentences

Vocabulary -Fixed expressions

SUGGESTED ACTIVITIES

UNIT 1

Listening: Links for formal conversation can be given - Gap filling exercises – Multiple Choice questions – Making notes.

Speaking - Role play activity

Reading – Note making. Note -Taking.

Writing: Guided Writing (developing hints)

Email

Grammar&**Vocabulary** – Worksheets – Games.

UNIT 2

Listening-

Process Descriptions (Example: Processes of digestion in various forms of life, Photosynthesis, Process of locomotion in various forms of life)

Speaking – Role Play

Reading – Multiple choice questions - Evaluative answers – Classifying and labeling

Writing - Picture description: Description of creatures and their habitat (in 150 to 200 words).

Vocabulary: Expansion of compound nouns

UNIT 3

Listening- Gap fill exercises – Listening comprehension

Speaking -Debates

Reading -Reading comprehension

Writing – Essay Writing

Grammar - Vocabulary, Activities, Worksheets & Games.

UNIT 4

Listening - Note taking (of listening & viewing items) - Filling a table based on the listening item.

Speaking – JAM, Presentations. (PPT-TECHNICAL)

Reading-Reading comprehension

Writing– Difference between recommendations and instructions

Questions/MCQs based on graphs/flow diagrams/charts

Grammar: Vocabulary – Activities, Worksheets & Games.

UNIT 5

Listening – Radio News/ TV-News telecast /

Speaking - Watch or listen to documentaries and ask questions

Reading - Reading motivational stories (success stories in subject area)

Writing - Essay writing.

Grammar &Vocabulary –Activities, Worksheets & Games

ENVIRONMENT & SUSTAINABILITY

First Year | **PART-IV** | **Semester-II**

ENVIRONMENTAL STUDIES

Code:22UGCES | **(Theory)** | **Credit: 2**

COURSE OBJECTIVES:

- To appreciate the scope of Environmental Studies, Community ecology and the interdisciplinary nature of environmental issues
- To have a basic knowledge of Natural resources its classification, concepts, and natural resources of India.
- The course designed to gain knowledge on values of biodiversity and conservation on global, national, and local scales
- To study about sources and effects of environmental pollution like air, water, soil, thermal, marine, nuclear and noise
- To understand the concerns related to Sustainable Development on environment and health
- To introduce the students in the field of Law and Policies and Acts both at the national and international level relating to environment.

UNIT-1: The Multidisciplinary nature of environmental studies

Definition, scope and importance. (2 lectures)

Need for public awareness

UNIT-2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

a) Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resources, land degradation, man induced Landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.

- Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit: 3 Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession.
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem:-
- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit: 4 Biodiversity and its conservation

- Introduction – Definition : Genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Biological Diversity Act 2002/ BD Rules, 2004

(8 lectures)

Unit: 5 Environmental Pollution

Definition

Causes, effects and control measures of :

a. Air Pollution
b. Water Pollution
c. Soil Pollution
d. Marine Pollution
e. Noise pollution
f. Thermal Pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.
- Ill-Effects of Fireworks: Firework and Celebrations, Health Hazards, Types of Fire, Firework and Safety

(8 lectures)

Unit: 6 Social Issues and the Environment

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns.

Case studies

- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation
- Public awareness.

(7 lectures)

Unit: 7 Human Population and the Environment

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

Unit: 8 Field Work

- Visit to a local area to document environmental assets-river / forest/ grassland/ hill / mountain.

References:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt ltd, Ahamedabad – 380013, India, E-mail: mapin@icenet.net(R)
3. Brunner R.C. 1989, Hazardous Waste Incineration, McGraw Hill Inc 480 p
4. Clark R.S. Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P.Cooper, T.H.Gorhani E & Hepworth, M.T. 2001.
6. De A.K. Environmental Chemistry, Wiley Eastern Ltd
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford University, Press 473p.
9. Hawkins, R.E. Encyclopedia of India Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press 1140 p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & Schoch R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition 639 p.
13. Mhaskar A.K. Matter Hazardous, Techno-Science Publications (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p
16. Rao MN & Datta, A.K. 1987 Waste Water treatment, Oxford & IBH Publication Co. Pvt Ltd 345 p.
17. Sharma B.K. 2001 Environmental chemistry Goel Publ House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C. Harper, J and Michael Begon, Essentials of Ecology, Blackwell science (TB)
20. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
21. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB).
22. Wagner K.D. 1998 Environmental Management. W.B. Saunders Co. Philadelphia USA 499 p

    (M) Magazine (R) Reference (TB) Textbook

23. http://nbaindia.org/uploaded/Biodiversityindia/Legal/33%20Biological%20Diversity%20Rules,%202004.pdf.

COURSE OUTCOMES:

- Understand the environmental importance including interactions across local to global scales.
- The learners to update and analyze environmental relationships and interactions of

environmental components

- The student to gain knowledge on importance of natural resources in a systematic way.
- The course content is introduce the concept of renewable and non-renewable energy resources and its scenario in India and at global level
- The students will know the relationship between biodiversity and ecosystem functions, direct and indirect values of biodiversity resources and their bioprospecting opportunities.
- The learners can gain awareness related on environmental pollution, causes and pollution control with case studies.
- Student to obtain the environmental ethics and gain knowledge about the sustainable development.
- Learners should realize the environmental legislation and policies of national and international regime and know the regulations applicable to industries and other organizations with significant Environmental aspects

*****

PROFESSIONAL ETHICS

Second Year **CORE COURSE III** **Semester III**

INTRODUCTORY VIROLOGY

Code : 22SCCMB3 **(Theory)** **Credits : 5**

COURSE OBJECTIVE:

- To facilitate in understanding basics of viruses and their discovery.
- To impart the structure and classification of viruses.
- To teach about virus assay and diagnostics.
- To provide the fundamentals of bacteriophages.
- To understand the important features of plant viruses and common properties of human viruses.

UNIT – I

General Virology: Virus – History of Virology - General properties of Viruses – Classification of Viruses (LHT, Baltimore and ICTV) - Ultra structure of Viruses – Sub viral agentsviroids, prions, virusoids and satellite viruses – Replication of Viruses.

UNIT – II

Diagnostic Virology and Control of Viruses: Cultivation of viruses- Embryonated eggs and Primary and secondary cell cultures. Serological methods- hemagglutination, hemagglutination inhibition, complement fixation, immunofluorescence, ELISA, RIA and assay of viruses. Purification, Characterization, Separation and Assay of Viruses. Viral Vaccines antiviral drugs, Interferons.

UNIT – III

Phages: Bacteriophages - Classification - Structure and life cycle of T4 Phage, Lambda Phage and M13 Phage-lytic and lysogenic Life cycles - Bacteriophage typing - Cyanophages, Microphages and cultivation strategies of phages from sewage.

UNIT – IV

Human Viruses: Classification - Structure, Multiplication, Pathogenesis, Diagnosis, Prevention and Treatment of following animal viruses – Polyomaviridae (Simian Virus – 40), Herpesviridae (HSV 1), Pox viridae (Small Pox), Hepadnaviridae (HBV), Picornaviridae (HAV), Rhabdoviridae (Rabies virus), Orthomyxoviridae (Influenza Virus), Retroviridae (Human Immuno Deficiency virus), Filoviridae (Ebola virus), Flaviviridae (Dengue Virus) and Coronaviridae (SARS-CoV2).

UNIT – V

Plant Viruses: Classification– Transmission of plant viruses – Symptoms of Viral infection in plants - Control of plant viral diseases. Detailed study of TMV and CaMVCommon viral diseases in paddy, cotton, tomato and sugar cane - Name of diseases, pathogens and symptoms. Cultivation of Plant Viruses. Vector control.

UNIT – VI

Current Contours (For continuous internal assessment only): Method of analyzing viral infection in a community. How to control viral spread in a community. Infection control system in a community.

REFERENCES:

1. Martinez J. Hewlett, David Camerini, David C. Bloom. 2021. Basic Virology, Fourth Edition, Wiley Blackwel.

2. Flint, S. J., Enquist, L. W., Racaniello, V. R., and Skalka, A. M. 2015. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses, 4th ed. 944 pp. ASM Press, Washington, DC.

3. Dimmock. N.J and Eatson, A.J., Leppard, K.N. 2016. Introduction to Modern Virology. VII edition. Blackwell Scientific Publications, Oxford.7thEdition.

4. Kenneth M Smith. 1972. A text book of plant viral diseases, 3rd edition, Elsevier Inc, New York.

5. Maureen A Harrison and Ian F Rae. 2010. General techniques of cell cultures, Cambridge University Press, England.

6. Nicklin J, Greame Cook and Killington, R. 2003. Instant notes in Microbiology, 2nd Edition, Viva Books private Limited, New Delhi.

7. Rajan S and Kumaresan. S. 2007. Virology. Saras Publications.

8. Rajan S and Selvichristy J. 2018. Essentials of Microbiology, CBS Publishers, New Delhi.

9. Saravanan. P. 2006. Virology. MJP Publishers.

10. Robert I Krasner. 2002. The Microbial challenge: Human Microbe Interaction, American Society for Microbiology, 2nd edition, Washington.

11. https://www.sciencedirect.com/science/article/pii/S0160412019305410.

12.https://journal.hep.com.cn/fese/EN/article/downloadArticleFile.do?attachTy
pe=PDF&id=28677.

13. https://www.nature.com/scitable/topicpage/the-origins-of-viruses14398218/

14. https://www.sciencedirect.com/journal/virology

15. https://www.news-medical.net/health/What-is-Virology.aspx

16. Topley and Wilson's. 1990. Principles of Bacteriology, Virology and Immunity. VIII edition Vol. IV Virology, Edward Arnold, London.

Course Outcomes

Upon successful completion of the course, the students would be:

- Able to describe the classification of viruses
- Able to explain virus structure, process of virus attachment and entry, virus assembly and release.
- Able to state the steps of viral replication .
- Able to understand the methods of preparing virus vaccines and anti-viral drugs.
- Able to illustrate animal, plant and bacterial viruses.

PROFESSIONAL ETHICS

Second Year | **CORE PRACTICAL - III** | **Semester III**

INTRODUCTORY VIROLOGY

Code : 22SCCMB3P | **(Practical)** | **Credits : 4**

COURSE OBJECTIVES:

- To teach the methods of isolation, concentration and titration of phages.
- To impart the knowledge of plant virus infection.
- To provide a knowledge of human viral diseases and the role of advanced techniques• in viral diagnosis.
- To expose the learners to the methods of animal viral cultivation.
- To describe the symptoms of human viral diseases.

EXPERIMENTS:

1. Isolation and characterization of bacteriophage from natural sources.

2. Determination of Phage Titre.

3. Study of virus infected plant samples – Study any 5 Plant virus symptoms.

4. Cultivation of Animal Viruses – Embryonated Egg.

5. Study on the symptoms of human viral disease Small pox, Chicken Pox, Monkeypox, Mumps and Measles.

REFERENCES:

1. Dharmalingam K. 1986. Experiments with M13 gene cloning and DNA sequencing. Published by Wasani for Macmillan India Limited.

2. Brown W.M.C. 1994. Microbiological Applications. 6th edition, Publishers, a division of W.M.C. Brown Communications, Inc.

3. Dejkstra J, Ces P. de Jager. 1998. Practical Plant Virology (protocols and exercises) Springer Lab Manual, Berlin, Heidelberg, New York.

4. Cappucino, James G. 2016. Microbiology - A laboratory Manual. 11th Edition. Addison - Wesley Publishin Company Inc.

5. Gunasekaran P. 2008. Laboratory Manual in Microbiology, New Age International Pvt. Ltd. Publishers, New Delhi.

6. Kanika Sharma. 2009. Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.

7. Rajan S and Selvi Christy R. 2018. Experimental Procedures in Life Sciences, CBS Publishers.

8. Shawn O' Farrell and Ryan T Ranallo. 2000. Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.

9. Wilson K and Walker J. 2000. Practical biochemistry, 5th edition, Cambridge University Press, London.

10.http://eprints.usm.my/29021/1/isolation_and_characterization_ofbacteriophage_from_raw_sewage_specific_for_escherichia_coli_0157-h7.pdf

COURSE OUTCOMES:

After the completion of the course, students would be able to:

- Isolate and characterize bacteriophage from natural sources.
- Gain knowledge in preparing bacteriophage stock - Lambda & T4.
- Describe viral diagnostic methods in animals and plants.
- Explain animal virus propagation - egg inoculation and cell culture methods.
- Understand the T4 Phage Titration and plant virus transmission methods.

PROFESSIONAL ETHICS

Second Year **SECOND ALLIED COURSE - III** **Semester III**

BIOSTATISTICS

Code : 22SACMB3 **(Theory)** **Credits : 4**

COURSE OBJECTIVES:

- To find numerical solutions to scientific data.
- To analyses and interpret scientific data using numerical and mathematical equations.
- To recognize the definition of statistics, the subject's relation with the other sciences.
- To know how to collect data relating to variable/variables.
- To calculate descriptive statistics for an appropriate data.

UNIT – I

Introduction to Biostatistics: Biostatistics - Definition, statistical methods, biological measurement, kinds of biological data, functions of statistics and limitation of statistics – Application of statistics in various field, biology, medicine, etc...

UNIT – II

Data Collection and Representation: Collection of data, sampling and sampling design, classification and tabulation, Variables vs. Attributes – Primary vs. secondary data - types of representations, Different types of chart and diagrams, graphic–bar diagrams, pie diagrams and curves.

UNIT – III

Central Tendency: Measures of central tendency, mean, median, mode, geometric mean, harmonic mean, Quartile, Deciles, percentiles. (Concept formulae and their calculations)

UNIT – IV

Dispersion & Deviation: Measures of dispersion and variability-changes. Deviations–Mean Deviation, Standard Deviation, Coefficient of variation, Loren Zen's curve – Gini.

UNIT – V

Skewness and ANOVA: Skewness, Kurtosis, Moments, Meaning, test of skewness, characteristics of dispersion and skewness. Measures of skewness, objectives. Karl Pearson's Coefficient of skewness, Bocoley's coefficient of skewness. Software's -ANOVA, SPSS, Sigma plot.

Unit – VI

Current Contour (For continuous internal assessment only): Literature seminar on Biostatistics and its detailed application for all students. Group discussion on How Biostatistics play an important Role on recent day science. – Give a work to the students to know about best statistical research centres and institutes in India. Demonstration of Statistical tools available with the institute.

REFERENCES:

1. Bernard Rosner. Fundamentals of Biostatistics, 7th edition, Cengage Learning, 2010.

2. Maicello Pagano and Kimberlee Gauvreau, 2nd edition Principles of Biostatistics, Duxbury Press.2000.

3. Roland Ennos. Statistical and Data Handling Skills in Biology, Pearson. 2011.

4. Jerrold H Zar. Bio statistical Analysis, 5th Ed, Prentice Hall. 2010.

5. Sundar Rao and Richard. Introduction to Biostatistics and Research Methods, 5th edition, PHI Learning Pvt. Ltd. 2012.

6. Arora PN and Malhan PK. Bio statistics, Himalaya Publishing house.2008.

7. Pranab Kumar Banerjee. Introduction to Bio statistics. 4th edition, S. Chand and company Ltd. 2014.

8. Introductory Statistics (10th Edition) – ISBN 9780321989178, by Neil A, Weiss published by Pearson.

9.Introductory statistics (4th Edition) – Sheldon M. Ross. 10. https://academic.oup.com/biostatistics.

COURSE OUTCOMES:

After completing this course the students would be able to:

- Create graphs using scientific data and to communicate important information about data, and interpret these in the form of graphs.
- Familiarize with widely used statistical databases.
- Know basic concepts of probability and statistics.
- Know the application and limitations of different statistical methods.
- Get conceptual understanding of modern statistical tools and software’s available.

PROFESSIONAL ETHICS & ENVIRONMENT& SUSTAINABILITY

Second Year **NON MAJOR ELECTIVE - I** **Semester III**

NUTRITION FOR HEALTH

Code : 22SNMEND1 **(Theory)** **Credits : 2**

COURSE OBJECTIVES:

To enable the students to

- Know the basic and fundamentals of nutritional science
- Obtain knowledge of different food groups, their composition and nutrients present in the foods.
- Understand the vital link between foods, nutrition and health
- Study the different methods of cooking foods
- Gain knowledge on functions, requirements and effects of deficiency of nutrients

UNIT - I

INTRODUCTION TO NUTRITION SCIENCE: Definition of Food, Nutrition, Nutrients, Dietetics, Balanced Diet, Health, Energy, Adequate Nutrition, Optimal Nutrition, Malnutrition, hunger, hidden hunger, Under Nutrition, Over Nutrition, Phytochemicals, Prebiotics, Probiotics; Physiological, Psychological & social functions of food.

UNIT - II

FOOD GUIDE – BASIC FIVE FOOD GROUPS: Basic five food groups: Cereals & grains, pulses & legumes, milk & meat products, Fruit & vegetable, Fats & sugars; Food pyramid, My plate; Meal planning, factors affecting meal planning

UNIT – III

RDA AND BALANCED DIET: Basic concept and purpose of Recommended Dietary Allowances; Factors Affecting Recommended Dietary Allowances; ICMR – RDA table; Uses of ICMRRDA in planning a balanced diet

UNIT – IV

CONSERVATION OF NUTRIENTS: Minimizing nutrient losses during pre-preparation and preparation of cereals, pulses, fruits and vegetables, milk, oil, egg, meat, fish & poultry

UNIT – V

INTERRELATIONSHIP BETWEEN NUTRITION/NUTRIENTS & HEALTH: Functions, dietary sources and clinical manifestations of deficiency/ excess of the following nutrients:

Carbohydrates, lipids and proteins; Fat soluble vitaminsA&D; Water soluble vitamins – thiamine, riboflavin and vitamin C; Minerals - calcium, Iodine and iron

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only): Planning balanced diet with the use of five food group system. Develop Games - related to nutrition.

REFERENCES:

1. Nutrient requirements and Recommended Dietary Allowances for Indians, ICMR,National Institute of Nutrition, Hyderabad, 2019

2. Dietary guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2010

3. Swaminathan, M. Advanced Textbook on Food Science and Nutrition, Vol:2, Secondedition, Reprinted, Bangalore Printed and publishing Co Inc, Bangalore, 2008.

4. B Srilakshmi, Nutrition Science Edition 2017 ISBN 9386418886 New Age Publishers Pvt Ltd

5. Srilakshmi B. Food Science; Fourth Ed; 2010; New Age International (P) Ltd.

6. Bamji M.S, Prahlad Rao N, Reddy V.,Textbook of Human Nutrition II Edition, Oxfordand PBH Publishing Co. Pvt. Ltd, New Delhi,2004

7. Manay MS, Shadaksharaswamy. Food-Facts and Principles; 2004; New AgeInternational (P) Ltd.

8. Krause,M.V and Hunsher,M.A, Food, Nutrition and Diet Therapy, 11th edition, W.B.Saunders company, Philadelphia, London, 2004.

9. Wardlaw GM, Hampi, JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.

10. Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; AcademicExcellence.

11. https://libguides.reading.ac.uk/

12. https://www.publichealth.org/

13. https://nutrisci.wisc.edu/

COURSE OUTCOMES:

- Summarize and critically discuss and understand both fundamental and applied aspects of Food Science and nutrition Terminologies
- Able to explain functions of specific nutrients in food groups
- Identifying nutrient specific force and apply the principles from the various factors of foods to plan a balanced diet
- Identifying and different methods with critical thinking
- Learn information about the basic of nutrients and their role in the field of health, with specific nutritional needs

PROFESSIONAL ETHICS

Second Year **ADD ON COURSE - II** **Semester III**

PROFESSIONAL ENGLISH FOR LIFE SCIENCES - II

Code : 22PELLS2 **(Theory)** **Credits : 4**

Objectives:

The Professional Communication Skills Course is intended to help Learners in Arts and Science colleges,

• Develop their competence in the use of English with particular reference to the workplace situation.

• Enhance the creativity of the students, which will enable them to think of innovative ways to solve issues in the workplace.

• Develop their competence and competitiveness and thereby improve their employability skills.

• Help students with a research bent of mind develop their skills in writing reports and research proposals.

Unit 1- Communicative Competence (18 hours)

Listening – Listening to two talks/lectures by specialists on selected subject specific topics - (TED Talks) and answering comprehension exercises (inferential questions) Speaking: Small group discussions (the discussions could be based on the listening and reading passages- open ended questions Reading: Two subject-based reading texts followed by comprehension activities/exercises Writing: Summary writing based on the reading passages.

Unit 2 - Persuasive Communication (18 hours)

Listening: listening to a product launch- sensitizing learners to the nuances of persuasive communication Speaking: debates – Just-A Minute Activities Reading: reading texts on advertisements (on products relevant to the subject areas) and answering inferential questions 3 Writing: dialogue writing- writing an argumentative /persuasive essay.

Unit 3- Digital Competence (18 hours)

Listening to interviews (subject related) Speaking: Interviews with subject specialists (using video conferencing skills) Creating Vlogs (How to become a vlogger and use vlogging to nurture interests – subject related) Reading: Selected sample of Web Page (subject area) Writing: Creating Web Pages Reading Comprehension: Essay on Digital Competence for Academic and

Professional Life. The essay will address all aspects of digital competence in relation to MS Office and how they can be utilized in relation to work in the subject area

Unit 4 - Creativity and Imagination (18 hours)

Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos on Indian academic sites – E.g. https://www.youtube.com/watch?v=tpvicScuDy0) Speaking: Making oral presentations through short films – subject based Reading : Essay on Creativity and Imagination (subject based) Writing – Basic Script Writing for short films (subject based) - Creating blogs, flyers and brochures (subject based) - Poster making – writing slogans/captions (subject based)

Unit 5- Workplace Communication & Basics of Academic Writing (18 hours)

Speaking: Short academic presentation using PowerPoint Reading & Writing: Product Profiles, Circulars, Minutes of Meeting. Writing an introduction, paraphrasing Punctuation (period, question mark, exclamation point, comma, semicolon, colon, dash, hyphen, parentheses, brackets, braces, apostrophe, quotation marks, and ellipsis) Capitalization (use of upper case)

Outcome of the Course:

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

- Attend interviews with boldness and confidence.
- Adapt easily into the workplace context, having become communicatively competent.
- Apply to the Research & Development organisations/ sections in companies and offices with winning proposals.

PROFESSIONAL ETHICS

Second Year **CORE COURSE - IV** **Semester IV**

IMMUNOLOGY

Code : 22SCCMB4 **(Theory)** **Credits : 5**

COURSE OBJECTIVES:

- To provide the various components of the host immune system.
- To understand structural organization and functions of immune organs and cells.
- To present the activities of T and B cells.
- To impart the process and properties of antigens and antibodies' reactions.
- To describe the immune reaction with reference to transplantation and autoimmunity.

UNIT – I

Immune System: History of Immunology, Immunity - innate and acquired. Inflammation. Haematopoiesis – Blood Group System, Cells of the immune systemlymphocytes, macrophages, mononuclear phagocytes- dendritic cells, granulocytes, NK cells and mast cells Central and peripheral lymphoid organsThymus, bone marrow, spleen, lymph nodes, MALT and GALT.

UNIT – II

T and B cell: Detailed structure and development of B cell and T cell – receptors - Activation of T and B cells- Maturation of T cell and B cell. Cytokines and Plasma cells. Organization of the genes for B and T cell receptors. Genetic organization of MHCI and MHC-II complex (both HLA and H-2).

UNIT – III

Antigen Antibody: Antigen – Types, Toxoid-vaccines – Antibody – types of antibody. Cell mediated immunity – Humoral mediated immunity – Theories of antibody formation. Antibody biodiversity.

UNIT – IV

Ag-Ab Interactions: Antigen antibody reactions - Precipitation, agglutination, complement fixation, RIA, ELISA, Western blotting and immunofluorescence. Production of polyclonal and monoclonal antibodies.

UNIT – V

Immune Mechanisms: Complement system: Basics of complement protein - different pathways of complement activation - classical and alternative. Hypersensitivity reaction and their types. Auto immune disorders, transplantation and cancer immunology. Deficiencies / defects of T cells, B cells, and phagocytic cells. Immunity to tuberculosis, malaria and HIV.

Unit – VI

Current Contours (For continuous internal assessment only): Review and debate on latest discovery on immunology; Seminar on immune responses against SARS-CoV2 and vaccination for COVID19.

REFERENCES:

1. David Male, R. Stokes Peebles and Victoria Male. 2020. Immunology. 9th Edition, Elsevier.

2. Rajan S and Selvichristy J. 2018. Essentials of Microbiology, CBS Publishers, New Delhi.

3. Charlene Sand. A reference guide to immune disorder including hypersensitivity and auto immune disease, Webster's digital service, ebook. 2013.

4. Goldsby RA, Kindt TK, Osborne BA and Kuby J. Immunology, 5th Edition, W.H. Freeman and Company, New York. 2007.

5. Ivan Roitt, Jonathan Brostoff and David Male. Immunology, 8th edition, Elsevier science Ltd., New York. 2012.

6. Kuby J. Immunology, 7th edition, W.H. Freeman and company, New York. 2008.

7. Tak W Mak and Mary Saunders. The immune response basic and clinical practices. Elsevier Academic press, New York. 2012.

8. Tak W Mak and Mary Saunders. Primer to the Immune Response. 2nd edition from Tak Mak, Mary Saunders, Bradley Jett. New York. 2014.

9. Thomas J Kindt, Barbara A Osborne, and Richard A Golds. Immunology online, University of South Carolina. 2006.

10. William E Paul. Fundamental Immunology. 7th revised edition, Raven press, New York. 2012.

11. Sudha Gangal and Shubhangi Sontakke. Textbook of Basic and clinical Immunology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2013.

12. https://doi.org/10.1016/j.immuni.2020.05.002

13. https://doi.org/10.3389/fimmu.2020.02037

14.https://www.immunopaedia.org.za/immunology/

15. http://cshprotocols.cshlp.org/site/Taxonomy/immunology_l1.xhtml

COURSE OUTCOMES:

Upon successful completion of the course, the students can:

- Understand the fundamental bases of immune system and immune response
- Gather information about the structure and organization of various components of the immune system
- Assimilate the operation and the mechanisms which underlie the immune response.

- Apply the knowledge gained to understand the phenomena like host defense and hypersensitivity (allergy).
- Comprehend the organ transplantation and certain immunological diseases.

PROFESSIONAL ETHICS

Second Year **CORE PRACTICAL - IV** **Semester IV**

IMMUNOLOGY

Code : 22SCCMB4P **(Practical)** **Credits : 4**

COURSE OBJECTIVES:

- To provide hands- on training on the basics to advanced techniques in immunology.
- To teach about blood and to train in blood collection, serum separation.
- To explain blood cell count and its differentiation
- To describe about agglutination and precipitation methods.
- To make the learners understand immune electrophoresis.

EXPERIMENTS:

1. Collection of venous blood from human.

2. Preparation of serum and plasma.

3. Total count (RBC and WBC).

4. Differential Count (WBC).

5. Dissection of primary and secondary lymphoid organs in a selected animal.

6. Haemagglutination - ABO Blood grouping.

7. Agglutination reactions – WIDAL, RPR, CRP.

8. Precipitation reactions: Single and Double immune diffusion.

9. Immuno-electrophoresis: Counter current and Rocket immuno electrophoresis.

REFERENCES:

1. Abbas AK, Lichtman AH, Shiv Pillai. 2021. Cellular and Molecular Immunology, 10th Edition. Elsevier.

2. Benjamin E, Coico R and Sunskise. 2000. Immunology: a short course. Edition IV, Wiley – Liss publication, NY.

3. Barbara Detrick, Robert G. Hamilton, James D. Folds. 2006. Manual of Molecular and Clinical Laboratory Immunology 7th Edition. ASM press.

4. Talwar GP and Gupta SK. 2012. A Handbook of Practical & Clinical Immunology. CBS Publishers

5. Frank C. Hay and Olwyn M.R. Westwood. 2008. Practical Immunology, 4thEdition, Wiley-Blackwell.

6. Rajan S and Selvi Christy R. 2018. Experimental Procedures in Life Sciences, CBS Publishers.

7.HilaryWarren.2003.PracticalImmunology.Wiley-Blackwell

8.https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelingerlab/documents/Immunology-Lab-Manual.pdf

9. https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/fr

10. Rajan S. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai. 2012.

11. Monica Cheesbrough. District Laboratory Practice in Tropical Countries - Part I and II (Second Edition). Cambridge University Press, New Delhi.

Course Outcomes:

After the completion of the course, students will able to:

- Understand blood collection, serum & plasma separation methods.
- Understand cells and organs of immune system.
- Obtain hands- on training on immune-electrophoresis technique
- Perform blood grouping technique and other immunological tests
- Perform complete blood count.

PROFESSIONAL ETHICS

Second Year **SECOND ALLIED COURSE - II** **Semester IV**

BIOINORMATICS AND COMPUTATIONAL BIOLOGY

Code : 22SACMB4 **(Theory)** **Credits : 4**

COURSE OBJECTIVES:

- To introduce the rapidly evolving field of Bioinformatics.
- To transfer basic knowledge of computers and internet.
- To teach the computational methods as to utilize expression data of cellular biology.
- To study of the inherent structure of biological information.
- To analyse the gene and protein sequences as to reveal protein evolution.

UNIT – I

Basics of Computer: Computers – Characteristics of Computers – Areas of computer applications- I-PO Cycle. Components of Computers – Memory and control units-Input devices and output devices- Hardware and Software -Operating Systems. Languages – Basics, Windows, Unix and Linux.

UNIT – II

Web and Browsers: Internet-History of Internet-Uses of internet. Connection to Internet-Getting connection-Web page- www, websites, URL, browsers, search engines, ModemInternet Service Providers-E-mail and Voice Mail, Creating E-mail Address, IoTInternet of Things.

UNIT – III

Basics of Bioinformatics: Introduction to bioinformatics – history and its development – Scope and applications of bioinformatics. Computer aided drug design, docking, screening. Bacterial identification system. Applications of computational biology.

UNIT – IV

Databases and Phylogeny: Biological database – NCBI-GenBank, EMBL, DDBJ. DNA Sequence analysis, Sequence Alignment-Pairwise (BLAST and FASTA and its features) and Multiple sequence alignment (ClustalW) – PAM matrix - Conservation score, Phylogenetic trees

UNIT – V

Proteomics: Structure of Protein, Classification –PDB, Swiss-PROT, SCOP, CATH. Protein visualization tools-RASMOL, Swiss PDB viewer. – three kinds of protein structures, protein sequence analysis, hydrophophobicity profiles – Ramachandran plot.

UNIT – VI

Current Contours (For continuous internal assessment only): Give a Literature seminar on Computational biology and its importance in the field of Microbiology for all students. – Group discussion on biological software's – to learn about computational research centres and Institutes all around the world. Demonstrate the students with basics of protein structure visualization tools and the different models of proteins. Experience them with the updated versions of Nucleotide databases.

REFERENCES:

1. Chavali LN. Bioinformatics and Bio programming in C, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2009.

2. Ruchi Singh and Richa Sharma. Bioinformatics: Basics, algorithms and applications, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2010.

3. Srinivasa Vallabhan SV. Computer Applications in Business, 3rd edition, Sultan Chand and sons, educational publishers. New Delhi. 2006.

4. M. Michael Gromiha, Protein Bioinformatics: From sequence to function, Academic Press, 2010.

5. D.E. Krane M.L. Raymer, Fundamental concepts of bioinformatics, Pearson education Inc. 2006.

6. Computational Biology: A Hyper text book (ASM Books) 1st Edition by Scott T. Kelley (Author), Dennis Didulo. Jan - 2018.

7. https://link.springer.com/book/10.1007/978-981-16-4241-8

8.https://www.elsevier.com/books/encyclopedia-of-bioinformatics-andcomputational-biology/ranganathan/978-0-12-811414-8

COURSE OUTCOMES:

After completing this course, students will gain knowledge:

- In understanding the biological challenges and the computational solutions.
- Of computer basics and usage of biological software.
- To analyse the biological data using computer.
- Required for sequence submission and retrieval.
- Of protein sequencing, nucleic acid sequencing techniques and their analysis.

PROFESSIONAL ETHICS

Second Year **SECOND ALLIED PRACTICAL** **Semester IV**

BIOINORMATICS AND COMPUTATIONAL BIOLOGY

Code : 22SACMB2P **(Practical)** **Credits : 4**

COURSE OBJECTIVES:

- To provide foundational skills and knowledge in biostatistics as to gain a deeper understanding to introduce probability and sampling distributions
- To analyse quantitative and qualitative data using biostatistics
- To interpret results of data analysis
- To appraise how quantitative and qualitative data can be integrated into mixed methods
- To gain an understanding of the computational challenges in the analysis of large biological data sets.
- To provide a hands- on understanding of how some of the commonly used bioinformatics tools work.
- To teach the learners on the effective usage of the tools as well as the methods to read and evaluate research articles in a field.
- To practise about structural protein using software.
- To train sequence alignment methods.

EXPERIMENTS:

1. Collection of data, sampling designs, tabulation and graphic representation using biological materials.

2. To find Mean, Mode, Median, Co-efficient of variance using biological materials.

3. Tests of significance ‘t’ test, ‘chi’ square, standard error and standard deviation.

4. ‘t’ Test, chi square, statistical error, standard deviation also, to be practically done through SPSS programme [Statistical Package for Social Sciences].

5. F – test

6. ANOVA

7. Study of Nucleic acid sequence databanks – GenBank, EMBL nucleotide sequence databank, DDBJ.

8. Study of Protein Structure and Classification databases – PDB, SCOP and CATH.

9. Multiple sequence alignment - ClustalW.

10. Evaluation of protein structure by Swiss PDB viewer and RASMOL

11. Sequence alignment - Local and global, pair wise and multiple, BLAST.

REFERENCES:

1. Maicello Pagano, Kimberlee Gauvreau. Principles of Biostatistics, 2nd edition, Duxbury Press. 2000.

2. Roland Ennos. Statistical and Data Handling Skills in Biology, 3rd edition. Pearson. 2011.

3. http://en.m.wikipedia.org/wiki/Nucleotide sequence database4

4. https://www.statsref.com/StatsRefSample.pdf

5. http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/102_10_ Longnecker_An-Introduction-to-Statistical-Methods-and-Data-Analysis-6th-Ed.pdf

6. https://www.spss-tutorials.com/tools/

7. Maicello Pagano, Kimberlee Gauvreau. Principles of Biostatistics, 2nd edition, Duxbury Press. 2000. 23

8. Roland Ennos. Statistical and Data Handling Skills in Biology, 3rd edition. Pearson. 2011.

9. http://en.m.wikipedia.org/wiki/Nucleotide sequence database

10. http://en.m.wikipedia.org/wiki/Multiple sequence alignment

11. http://en.m.wikipedia.org>wiki>Swiss PDB viewer

12. Reece, J. B., Taylor, M. R., Simon, E. J., & Dickey, J. (2009). Biology: concepts & connections (Vol. 3, p. 2). Pearson/Benjamin Cummings

13. Fall, C.P., Marland, E.S., Wagner, J.M., Tyson, J.J.(2002). Computational Cell Biology. Springer

COURSE OUTCOMES:

After successful completion of this course, students are expected to:

- Analyse statistical data using MS-Excel.
- Organize, manage and present data.
- Present statistical data graphically using frequency distributions and cumulative frequency distributions.
- Evaluate statistical data using measures of central tendency, dispersion and location.
- Acquire knowledge of statistics and its scope and importance.

- Get introduced to the basic concepts of Bioinformatics and its significance in biological data analysis.
- Gain knowledge about various biological databases that provide information about nucleic acids and protein.
- Secure knowledge on primary and secondary structures of proteins.
- Be knowledgeable on the tertiary and quaternary structures of proteins.
- Be trained on the basics of sequence alignment.

PROFESSIONAL ETHICS & ENVIRONMENT& SUSTAINABILITY

Second Year **NON MAJOR ELECTIVE - II** **Semester IV**

NUTRITION FOR WOMEN

Code : 22SNMEND2 **(Theory)** **Credits : 2**

COURSE OBJECTIVES:

To enable the students to

- Know the basic concepts of nutrition
- Understand the importance of meal and the functions of the nutrients
- Gain knowledge on the deficiency disorders
- Gain knowledge on importance of planning menu during their different growth period

UNIT – I

CONCEPT AND DEFINITION OF NUTRITION: Health, Nutrients, Nutrition, food, Meal, Menu, Balanced diet over nutrition, under nutrition, malnutrition. Hunger, hidden and hollow, Nutrients and their functions.

UNIT – II

CONCEPTS OF FOOD: Basic Five Food groups, My Plate, meal planning, Balanced diet RDA, Functions and classification of food

UNIT – III

MAJOR NUTRIENT DEFICIENCY DISORDER: Signs and Symptoms, foods to be included and avoided Kwashiorkar, Marasmus, MarasmicKwashiorkar

UNIT – IV

MINOR NUTRIENT DEFICIENCY DISORDER: Signs and Symptoms, foods to be included and avoided- Vitamin A, Iron deficiency disorder, Iodine deficiency Disorder

UNIT – V

NORMAL NUTRITION THROUGH LIFE CYCLE: Nutrition in adolescence, Diet in adolescence pregnancy,eating disorders, food consumption pattern among women, Nutritional needs in elderly women, Nutrition in female athletes.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only): Note the processing of cooking/ cooking methods adopted in their respective households for different foods and ways to conserve nutrients. Identify the eating disorders among the peer groups and ways to rectify.

REFERENCES:

1. Swaminathan, M. Hand book of Foods and Nutrition, Bappco Publishers (2010).

2. Srilakshmi. E. Nutrition Science, New Age International Publishers; sixth edition (2017).

3. Srilakshmi. E. Dietetics, New Age International Publishers; seventh multicolour edition (2014)

4. Mahtab, S, Bamji, Kamala Krishnasamy, G.N.V. Brahmam, Text Book of Human Nutrition,Third Edition, Oxford and IBH Publishing Co. P. Ltd., New Delhi, 2012.

5. Sumati,R., Mudambi,M.V., Rajagopal. (2015). Fundamental of food, nutrition and diet therapy. New age international publishers. New Delhi.

6. Dietary Guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2013.

7. Gopalan, C. Rama Sastri B.V. and Balasubramanian, Nutritive Value of Indian Foods, NIN, ICMR, Hyderabad, 2014.

8. Eastwood,M.(2003). Principles of Human Nurition. 2ndEdition. C.V.Mosby Company

9. Krause, M.V. and Hunscher, M.A., Food, Nutrition and Diet Therapy, 14th Edition, W.B. Saunders.

10. Brow, A.(2000). Understanding Food. Thomson Learning Publications. Wadsworth.

11. https://www.physiology.org/journal/physrev

12. https://www.annualreviews.org/journal/food

13. https://www.eatright.org/food#Nutrition

14. www.nutrition.gov

15. http://www.nutritionsocietyindia.org/

COURSE OUTCOMES:

- Role of nutrients and food in daily life
- Understand the various factors influencing health and nutritional status of women
- Aware of foods to be included and avoided to combat nutrient deficiency disorders.
- Understand the role of nutrition in different stages of life cycle.

- Understand the implications of women’s health on family, community and national development

PROFESSIONAL ETHICS

CORE COURSE V Semester V

MEDICAL MICROBIOLOGY

Code **: 22SCCMB5** Credit 5

COURSE OBJECTIVES:

- To make the students understand normal flora, host parasite interactions and
- epidemiology of infectious diseases.
- To acquire a basic understanding of the common infections
- To understand the diseases of medical importance, their microbial causes,
- pathogenic action.
- To diagnose infection associated with microbial infection.
- To understand the fungal and protozoan diseases and preventive measures.

UNIT – I Introduction to Medical Microbiology:

History of Medical Microbiology - Classification of medically important microbes - Normal microbial flora of the human body-Host bacterial interactions – Nosocomial and community acquired infections – Epidemiology of infectious diseases.

UNIT – II Medical Bacteriology:

Morphological, cultural and biochemical characteristics of and epidemiology, mechanism of bacterial pathogenesis, lab diagnosis, prophylaxis and control of medically important diseases caused by: Staphylococcus aureus, Group A Streptococci, Corynebacterium diphtheriae, Clostridium tetani, Treponema pallidum, Mycobacterium tuberculosis, Escherichia coli, Vibrio cholerae, Niesserriae gonorrhoea, Haemophilus influenza, Zoonotic bacterial diseases.

UNIT – III Medical Mycology:

Morphological and cultural characteristics of and epidemiology, mechanism of fungal pathogenesis, lab diagnosis and treatment of medically important diseases caused by: Superficial mycosis – Tinea versicolor. Cutaneous mycoses: Microsporum, Trichophyton, Epidermophyton. Subcutaneous mycoses: Sporotrichosis, Chromoblastomycosis. Systemic Mycoses – Histoplasma capsulatum and Cryptococcus neoformans,

UNIT – IV Medical Virology:

General properties of and epidemiology, pathogenesis, lab diagnosis and treatment of medically important viral diseases - Measles, Mumps, Rubella, Chicken Pox, Hepatitis A, B,C, D and E, Poliomyelitis, HIV, Rabies, Yellow fever, Dengue and Covid 19. Brief note on oncogenic viruses. Antiviral drugs, antiviral vaccines.

UNIT – V Medical Parasitology and Diagnostic Microbiology:

Morphology of, and pathogenesis, laboratory diagnosis and treatment of medically important protozoan diseases amoebiasis, giardiasis, malaria, Kala-azar,filariasis, Ascariasis and Fascioliasis. Diagnosis of protozoal and helminthic disease of Human.

UNIT – VI Current Contours (For continuous internal assessment only) :

Making awareness and celebration of world AIDS day, World TB, cancer Day, Pulse polio immunization day etc., awareness programme on personal hygiene and vaccination.

REFERENCES:

1. Aejaz Iqbal and Zafar Nowshad. 2020. MEDICAL MICROBIOLOGY: Millennium Edition. Notion Press.

2. Jawetz, Melnick, &Adelberg's Medical Microbiology by Carroll KC, Hobdon JA, Miller S, Morse SA, Mietzner TA. 27th edition. Lange Publication, 2016.

3. Persing DH, Tenover FC, Hayden R, Leven M, Miller MB, Nolte FS, Tang YW, Belkum AAV. Molecular Microbiology: Diagnostic Principles and Practice, 3rd edition. Washington, American Society for Microbiology Press, 2016

4. David Greenwood. Mike Barer, Richard Slack and Will Irving. Medical Microbiology. A Guide to Microbial Infections: Pathogenesis, immunity, Laboratory investigation and Control, 18th edition, Churchill Livingstone. 2012.

5. Rajan S and Selvichristy J. Essentials of Microbiology, CBS Publishers, New Delhi. 2018.

6. Chatterjee KD. Medical Parasitology, 7th edition. Chatterjee Medical publishers India. 2007.

7. Prescott, Harley and Klein's. Microbiology, 7th edition McGraw Hill Medical Publication division. 2007.

8. Rajan S. Medical Microbiology, MJP Publishers Chennai. 2007.

9. Topley and Wilsons. Principles of Bacteriology, Virology and Immunology. Edward Arnold, London. 1995.

10. https://www.mooc-list.com/tags/bacteriology

11. https://mycology.adelaide.edu.au/

12. http://nvbdcp.gov.in/

13. https://www.mooc-list.com/tags/human-parasitology

14. https://www.mooc-list.com/tags/tropical-parasitology

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

 Understand of normal flora and host parasite interaction.

 Describe the characteristics of disease-causing bacteria and viruses

- Assess fungal infections in human beings.
- Understand the problems of parasitic diseases.
- Know the diagnostic features of infectious diseases.

PROFESSIONAL ETHICS & ENVIRONMENT & SUSTAINABILITY

CORE COURSE VI **Semester V**

ENVIRONMENT AND AGRICULTURAL MICROBIOLOGY

Code: 22SCCMB6 **Credit 5**

COURSE OBJECTIVES:

 To communicate the students with basic principles of microbiology and their applications to environment and agriculture.

 Students will be able to know extremophilic microorganisms and their significant role.

 To know the type of waste disposing mechanisms using microbial sources.

 To provide the fundamental knowledge pertaining to the various scopes of agricultural and environmental microbiology.

 Students will learn the course concepts of plant diseases, aeromicrobiology, aquatic microbiology, disposal of wastes and commercial aspects of soil microbiology.

UNIT I Microbiology of Air and Extremphiles:

Distribution and sources. Droplet nuclei, aerosol, assessment of air quality. Brief account of air borne transmission of harmful microbes. Concepts of microbial ecology - Relationship between microorganism and different environments land, water and air. Extremophiles – Thermophiles, mesophiles, psychrophiles, Deep-sea, Desert, Acidophilic, Alkalophilic and Halophilic microorganisms.

UNIT II Microbiology of Water:

Different kinds of water. Physico-chemical properties of water, brief account of water borne diseases, microbial assessment of water quality, water purification, brief account of water borne diseases. Aquatic micro flora and fauna of lake, ponds, river, estuary, mangrove and sea.

UNIT III Wastes and Its Management:

Types of wastes – characterization of solid and liquid wastes. Solid waste treatment – saccharification – gasification – composting, Utilization of solid wastes for mushroom production. Liquid waste treatment - Treatment methods– primary and secondary (anaerobic – methanogenesis) aerobic: trickling, activated sludge, oxidation pond – tertiary treatment.

UNIT IV Microorganisms in Agriculture:

Microorganisms in the rhizosphere, root surfaces and phylloplane –Biofertilizer- Advantages over chemical fertilizers, types, production and - quality control of biofertilizers - Isolation, mass inoculum production, field application. Types of biofertilizers - Rhizobium, Azotobacter, Azospirillum, Cyanobacteria, Azolla, Mycorrhizae, Frankia. Biological nitrogen fixation.

UNIT V Plant Diseases:

Mode of entry of pathogens, Symptoms, Disease cycle and control measures. Different types of plant diseases - Tobacco mosaic, Bacterial blight of paddy, Downymildew of bajra, Powdery mildew of cucurbits, Head smut of sorghum, Red rot of sugar cane, Citrus cancer, Downy mildew of bajra, Powdery mildew of cucurbits. Microbial Pesticides – types and applications. Integrated Pest and Disease Management (IDPM).

UNIT – VI Current Contours (For continuous internal assessment only):

Assignment shall be given based on the syllabus and seminar was subjected to students related to their assignment topics individually. A group project shall be assigned in the topic of assessment of microorganisms in air. Mini project in various recent research topics related to the course shall be given.

REFERENCES:

1. Agrios AG. Plant Pathology, Elsevier Academic Press, New Delhi. 2006.

2. Baker WC and Herson DS. Bioremediation – McGraw Hill Inc., New York. 1994.

3. Burns RC and Slater JH. Experimental Microbial Ecology – Blackwell Scientific Publications, Oxford, London. 1982.

4. Chatterji AK. Introduction to Environmental Biotechnology. Prentice-Hall of India Private Limited. 2005.

5. Christon J Hurst. Manual of Environmental Microbiology, 2nd edition. American Society for Microbiology, Washington. 2002.

6. Duncan Mara and Nigel Horen. The Handbook of water and waste water Microbiology. Academic press-An imprint of Elsevier. 2003.

7. Ec Eldowney S, Hardman DJ and Waite S Pollution: Ecology and Biotreatment – Longman Scientific Technical.1993.

8. Gareth M Evans and Judith C Furlong. Environmental BiotechnologyTheory and Application, John Wiley and sons Ltd. 2003.

9. Jogdand SN. Environmental Biotechnology, Himalaya Publishing House. New Delhi. 2010.

10. Munn CB. Marine Microbiology- Ecology and Applications. Bios Scientific publishers, New York. 2004.

11. Sambamurty A. Textbook of Plant Pathology, I.K. International Publishing House, New Delhi. 2009.

12. https://www.pdfdrive.com/principles-and-applications-of-soil-microbiologyd8264286.html

COURSE OUTCOMES:

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

 Know the significance of the microbes in atmosphere and water.

 Get in-depth information about the harmful effects and beneficial role of microbes in each sector.

 Acquire deeper knowledge on water and waste water treatment to tackle the current environmental problems.

 Elicit meticulous thoughts on the task of microbes in waste water treatment and solid waste management.

 Understand methods to exploiting natural wastes by producing bioorganic fertilizers.

PROFESSIONAL ETHICS

CORE COURSE VII **Semester V**

MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Code: 22SCCMB7 **Credit 5**

Course Objectives:

- To provide the students with the fundamental principles and concepts of prokaryotic genes and genomes.
- To study about the molecular organization, replication and functions of gene and genome.
- To understand the genetic transfer mechanisms in microbes.
- To learn about the mutation and mutagenesis.
- To know about the mechanisms of DNA replications and it's Repairing.

UNIT - I Genetic Material and Its Structure:

Milestones in history – Definition of nucleic acids - Experimental proofs of DNA as the genetic material (Griffith and Hershey Chase) – Experimental proofs of RNA as the genetic material - Chemistry and molecular structure of DNA double helix - Discovery of DNA structure – Brief account on types and forms of DNA – Types of RNA - Definition of a gene. Organization of DNA in prokaryotes (E. coli) and viruses. Brief note on plasmids: Extra chromosomal elements – Plasmid and transposons, Brief note's structure and types.

UNIT - II DNA Replication and Its Mechanisms:

DNA Replication in prokaryotes: Meselson and Stahl experiment – Mechanism, enzymes and proteins of replication – Theta replication and Rolling circle replication. Replication of DNA – semi conservative mechanisms, enzyme involved in replication – Replication of RNA – reverse transcriptase - cloning and its mechanisms-hybridization.

UNIT - III Transcription and Translation:

DNA Transcription: Definition – Brief account on transcriptional machinery and mechanism of transcription – Genetic code – RNA Translation: Definition – Brief account on translational machinery and mechanisms of translation. Regulation of gene expression in prokaryotes – Operon concept – lac and trp operons.

UNIT – IV Transformation:

Transformation - Discovery, mechanism of natural competence - Conjugation - Discovery, F+ v/s F-, Hfr+ v/s F- - Transduction – Generalized and specialized transductions.

UNIT – V Mutation and Mutagenesis:

Definitions of mutations, mutagenesis and mutants - types of mutations; Physical and chemical mutagens. Transposons - Applications of mutations, Carcinogenicity testing. DNA repair mechanisms. Immuno precipitations.

UNIT – VI Current Contours (For continuous internal assessment only):

Group discussion on Molecular Biology related recent invention and research, give a seminar on each student from Microbial genetics related topics. Demonstrate them the importance of Horizontal Gene Transfer in Natural Selection and Evolution.

REFERENCES:

1. David Frifelder Molecular Biology, Narosa publishing house, New Delhi. 2nd edition. 2008.

2. George M Malacinski. Freifelder's Essentials of Molecular Biology. 4th edition. Narosa Publishing House. 2008.

3. Stanly R Maloy, John E Cronan Jr. and David Freifelder, Microbial Genetics, 2nd edition, Narosa publishing house, New Delhi. 2006.

4. Larry Synder and Wendy Champness. Molecular Genetics of Bacteria, 2nd edition, American Society for Microbiology, Washington. 2003.

5. De Robertis EDP and De Robertis EMF. Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia. 2006.

6. Karp G. Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley and Sons. Inc. 2010.

7. Sambaurthy AVSS. Molecular biology. Narosa publishing house, New Delhi.2008.

8. Channarayappa A. Cell Biology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2010.

9. Channarayappa A. Molecular Biology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2010.

10. Watson JD, Tania AB, Stephen PB, Alexander G, Michael L, Richard L (2017) Molecular Biology of the Gene. 7th Edition. Pearson Education.

11. Wilson K, Walker J (2010) Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, Cambridge.

12. http://cshprotocols.cshlp.org/site/Taxonomy/molecular_biology_l1.xhtml

COURSE OUTCOMES:

After Completion of the course, the students will learn:

- Processes behind mutations and other genetic changes
- The genetic regulatory mechanisms at different levels
- The common methods in microbial genetics
- About DNA replication and repairing mechanisms

PROFESSIONAL ETHICS

CORE PRACTICAL VII **Semester V**

MEDICAL MICROBIOLOGY, ENVIRONMENT & AGRICULTURAL MICROBIOLOGY AND MOLECULAR BIOLOGY & MICROBIAL GENETICS

Code: 22SCCMB5P **Credit 4**

COURSE OBJECTIVES:

- To provide hands- on training in identifying bacteria using culture media
- To handle clinical specimen for fungal infection diagnosis
- To handle microscopic methods to diagnose protozoa and helminth infections.
- To impart hands- on training in conventional methods of microbial identification.
- To perform antibiotic sensitivity assay.
- This course is designed to prepare the students for a sensible knowledge in a wide range of profession.
- This paper provides the scientific discipline that deals with the application of microorganisms and a knowledge about them.
- Applications of microorganisms for sustainable agriculture and Environment.
- It also covers important experiments linked with this course.
- To exhibit practical knowledge in the research laboratories and industries.
- To provide fundamental knowledge and techniques in microbial genetics.
- To know about the isolation of bacterial chromosomal and plasmid DNA
- To analyse the quality and to estimate the quantity of DNA
- To isolate the genomic RNA and auxotrophic mutants
- To experience the Agarose gel electrophoresis technique

EXPERIMENTS:

1. Isolation and identification of Staphylococcus aureus from pus.
2. Isolation and identification of Salmonella from stool.
3. Isolation and identification of E. coli from urine.
4. Antibiotic susceptibility test – Disc diffusion method (Kirby –Bauer).
5. Identification of Candida albicans
6. Saline and Iodine wet mount to detect cysts, trophozoites and eggs.
7. Giemsa staining to detect blood parasites
8. Enumeration of microorganisms from air by open plat technique.

9. Isolation and identification of air-borne microbes using Andersen sampler.

10. Isolation of phosphate solubilizing bacteria from soil

11. Assessment of water quality by MPN technique

12. Screening of antagonistic bacteria in soil by agar block overlay method.

13. Enumeration of microbial population from rhizosphere and non-rhizosphere soil

14. Isolation of Azospirillum and Azotobacter from soil

15. Isolation of Rhizobium sp. from root nodules of legumes

16. Evaluation of root nodule by cross section of legume roots.

17. Isolation of Cyanobacteria from agricultural soil and water

18. Isolation of bacterial and fungal pathogens from plants.

19. Prevalence of Arbuscular Mycorrhizae (AM) in infected plants.

20. Demonstration of the plant diseases: a) Bacterial blight of paddy; b) Powdery mildew of cucurbits; c) Red rot of sugar cane; d) Citrus cancer;

21. Isolation of chromosomal DNA from bacteria

22. Isolation of plasmid DNA from bacteria

23. Isolation of microbial Genomic RNA

24. Quantification of DNA and RNA by Spectrophotometric method

25. Isolation of Auxotrophic mutants.

26. Demonstration of bacterial transformation technique.

27. Demonstration of Agarose gel electrophoresis (to study DNA/ RNA) and SDS – PAGE (to study proteins).

NOTE: Identification of bacteria should be done using microscopic methods, culturing on selective cum differential media and biochemical tests (Indole, Methyl Red, Voges Proskauer, Citrate utilization, TSI, Urease, Nitrate, Catalase, Oxidase Carbohydrate fermentation tests, Sensitivity test for gram positive organisms, Hippurate hydrolysis, Coagulase test, Salt tolerance test, Bile solubility etc.,

REFERENCES:

1. Monica Cheesbrough. 2006. District Laboratory Practice in Tropical Countries – Part I and II 2nd edition. Cambridge University Press, New Delhi.

2. Rajan S. 2012. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai.

3. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. Bailey and Scott's Diagnostic Microbiology, Mosby Elsevier. 12th edition. 2007.

4. Mackie and McCartney. 2006. Practical Medical Microbiology, South Asia Edition. 14th edition.

5. Rajan S and Selvi Christy R. 2018. Experimental Procedures in Life Sciences. CBS Publishers, New Delhi, 2018.

6. Aneja, K.R., 1993. Experiments in Microbiology: Plant Pathology and Tissue Culture, Wishwa Prakashan, New Delhi.

7. Cappuccino, J.G. and Sherman, N., 2012. Microbiology – A Laboratory Manual. 7th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.

8. Gunasekaran, P., 2008. Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.

9. Harry W. Seeley J.R., Paul J Van Demark, John J Lee, 1997. Microbes in Action – A Laboratory Manual of Microbiology. W.H. Freeman and Company, New York.

10. Kanika Sharma, 2009. Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.

11. Thangaraj, M., Santhana Krishnan, P., 1998. Practical Manual on Microbial inoculants, Centre of advanced studies in agricultural University, TNAU, Coimbatore.

12. http://www.fssai.gov.in/Portals/0/Pdf/15Manuals/MICROBIOLOGY%20MANUAL.pdf

13. http://www.unido.org/fileadmin/media/documents/pdf/Agro/MacroLab.pdf

14. http://samples.sainsburysebooks.co.uk/9780470757482_sample_385283.pdf

15. https://jascoinc.com/wp-content/uploads/2017/09/APP-Note-UV0004-Chromium- Quantitative-Determination.pdf

16. Atlas RM and Bartha R. Microbial Ecology: Fundamentals and Applications, 3rd Ed., Benjamin and Cummings Pub. Co. New York. 1993.

17. Rajan S and Selvi Christy R. Experimental Procedures in Life Sciences. Anajanaa Book House, Chennai

18. Monica Cheesbrough. District Laboratory Practice in Tropical Countries - Part I and II, 2nd edition, Cambridge University Press, New Delhi. 2011.

19. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. Bailey and Scott's Diagnostic Microbiology, Mosby Elsevier. 12th Edition. 2007.

20. Current protocols in molecular biology (2007). John Wiley & Sons Inc. Vol. 1 & 2.

21. Sambrook J and Russell DW (2001). Molecular cloning - A laboratory manual, Cold Spring Laboratory Press, New York, 3rd Edition. Vol. 1, 2, 3.

22. Surzyeki S (2000). Basic Techniques in Molecular Biology, Springer.

23. http://www.ncbi.nlm.nih.gov/

24. www.yeastgenome.org

25. http://sequence-ww.stanford.edu/group/yeast_deletion_project /deletions3.html

COURSE OUTCOMES:

- After the completion of the course, students will able to:
- Practice handling the clinical samples
- Get a clear practical knowledge on molecular techniques.
- Understand the transformation mechanisms.
- Learn the quantification of macromolecules in industrial point of view.
- Know the applications of various instruments to analyses the quality of macromolecules in a solution.
- Know about the techniques to isolate and assess the harmful microorganisms in environmental samples.
- Provide meticulous ideas for the enumeration of air and water borne microorganisms.
- Get an idea to isolate and characterize the microbes in extreme environmental conditions.
- Gain several practical knowledge & opportunities.
- Understand the common plant diseases and their symptoms.
- Learn all the identification methods of bacterial pathogens.
- Learn the diagnostic techniques of fungal and parasitic diseases.
- Become familiar with all microscopic methods of microbial identification.
- Understand all methods of cultivation and familiarize with all biochemical tests.
- Understand the principles of antibiotic sensitivity assay.

PROFESSIONAL ETHICS

MAJOR BASED ELECTIVE I **Semester V**

DIAGNOSTIC MICROBIOLOGY

Code: 22SMBEMB1A **Credit 4**

COURSE OBJECTIVES:

- To impart the students with the knowledge of various clinical specimen collection from human cases.
- To provide the basics of clinical pathology and hematology.
- To expose the students to microbiological, biochemical, immunological and molecular scrutinization so as to diagnose specific clinical abnormalities among human patients.
- To provide methods of handling instruments, principle and advantages of diagnostics.
- To know the diagnostic challenges of the mycological diseases.

UNIT – I Clinical Specimen Collection and Investigation:

Human clinical specimens – methods of collection, processing, transport and their storage – Throat swab, Blood, Urine, Stool, Sputum, pus & body fluids (CSF, ascetic fluids). Microscopic identification of bacterial pathogens – urine & pus specimens – differential staining and motility.

UNIT – II General Clinical Pathology and Haematology:

Preparation, staining & examination of human blood smear and morphological abnormalities. RBC count & Differential WBC count – Reticulocyte count- absolute eosinophil count – E.S.R, P.C.V, Blood indices - Platelet count: BT, CT – Prothrombin time, APTT, FDP estimation.

UNIT - III: Urine Specimen and Molecular Diagnosis

Human urine examination: physical and chemical tests, microscopic examination – crystals, casts, sediments, pregnancy tests – Diagnostic protocol of urinary tract infection. Advanced diagnostic techniques (outline of the protocol) – ELISA, Western blot analysis for HIV, RT-PCR for Covid 19. Antimicrobial susceptibility testing- Kirby Bauer Disc diffusion method - reporting of results and their interpretation.

UNIT – IV Stool Specimen and Mycology Lab:

Human stool examination – Physical, Chemical and Microscopic examination and their significance. Laboratory methods in basic Mycology-Direct Microscopic examination of clinical specimens and culture media. Serological tests for fungi - Antifungal susceptibility testing.

UNIT – V Sputum Specimen and Parasitological Lab:

Sputum examination: Microscopic examination – Diagnostic protocol of Respiratory tract infections (Upper and Lower). Laboratory methods for parasitic infections – Diagnostic technique from faecal specimen. Identification of Protozoa – Amoebiasis and Malaria.

UNIT – VI Current Contours (For continuous internal assessment only):

A visit to a diagnostic laboratory/ hospital/ primary health care centre – Internship at a diagnostic lab for 'one day' - assignments on clinical specimens' collection & processing – viral infections - Detection of viral antigen (flourescent antibody and solid phase immunoassays) - viral serology – antimicrobial susceptibility testing and results interpretation – Throat swab, Blood, Urine microbiological examination steps/ stages for each – ELISA – western blot – RT- PCR – Literature seminar topics representing each unit – Debate on PCR & disease diagnosis.

REFERENCES:

1. Ananthanarayanan R and CK Jayaram Panicker (2017), Textbook of Microbiology, 10thEd.. OrientLongman.
2. Abdul Khader, (2003). Medical laboratory techniques, 1st Ed. Frontline Publications.
3. P.B. Godkar (2003), Text Book of Medical Laboratory Technology, 2 ndEd. Bhalani Publication.
4. Bailey and Scot's, (2013). Diagnostic Microbiology, 13thEd. The Mosby Company.
5. Yi-Wei Tang, Charles W. Stratton (2019) Advanced Techniques in Diagnostic Microbiology: Volume 2: Applications, Springer
6. Talib. V.H, (2008). Handbook of Medical Microbiology, 2 ndEd. CBS Publishers.
7. Cappuccino and James G. (2021). Microbiology: A Laboratory Manual 10Th Edition, Pearson India.
8. Dubey, R.C. & D.K. Maheshwari. (2022) A Text Book of Microbiology. S. Chand & Co.
9. Rajan S. (2012) Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai.
10. Subash O. Parija, (2013) Textbook of Medical Parasitology,. 1st Ed. All India Publishers and Distributors.
11. Rajesh Karyakarte and Ajith Damle, (2005). Medical Parasitology, Books and Allied Pvt.Ltd.
12. Kani L Mukherjee, (2010) Medical Lab technology Hill Publishing Co., Ltd., New Delhi Vol I-III
13. https://www.academia.edu/10296941/diagnostic_microbiology
14. https://www.youtube.com/watch?v=uAmTgVvTUNk
15. https://www.youtube.com/watch?v=Oy5uixdzJ_c

Course Outcomes

After a successful completion of the course, the students who undergo the course will be able to:

- Collect, transport, store and microbiologically process a variety of routine human clinical specimens.

- Prepare and investigate blood smears as well as to interpret various common blood clinical parameters.
- Investigate urine, stool & sputum specimens as well as to interpret various common urine clinical parameters.
- Realize the need of molecular methods and their importance in disease diagnosis.
- Understand the health care sectors and laboratories' role in microbial disease diagnostic procedure.

PROFESSIONAL ETHICS

SKILL BASED ELECTIVE I **Semester V**

MUSHROOM TECHNOLOGY

Code: 22SSBEMB1 **Credit 2**

COURSE OBJECTIVES:

- The course contents are designed as to gain basic science knowledge of mushroom cultivation.
- The learners will understand the nutritional benefits of the microbes concerned and also related drawbacks.
- Learners can acquire knowledge about the prevailing market demands and scope of these technologies.
- They will learn to apply the gained knowledge for strain improvement to support their entrepreneurship talents.
- Students can develop their knowledge to start an industry as an entrepreneur.

UNIT – I Applied Mushroom Biology :

Introduction and Definition of a Mushroom, Mushroom Hunting, Ecological Classification of Mushrooms, Magnitude of Mushroom Species. Mushroom Science -Food Supply through Mushroom Themselves, Mushroom technology. Mushroom spoilages and mushroom borne diseases.

UNIT – II History of Mushroom Cultivation:

Biology of mushrooms; Nutritional value: (Proteins, amino acids, mineral elements, carbohydrates, fibers, vitamins); Medicinal value of mushrooms; Poisonous mushrooms and mushroom poisoning; edible mushrooms and cultivation in India and world; Mycorrhizal mushrooms and their role in plant growth.

UNIT – III Cultivation Technology:

Infrastructure, equipment and substrates required for mushroom cultivation: Polythene bags, vessels, inoculation hook, inoculation loop, love cost stove, sieves, culture racks, mushroom unit or mushroom house, water sprayer, tray, boilers, driers, pure culture, Spawns - types of spawn, preparation of spawn, mushroom bed preparation and factors affecting mushroom bed preparation. Compost - materials used for compost preparation, compost technology in mushroom production.

UNIT – IV Casing and Mass Cultivation :

Casing - raw material used for casing, preparation of casing material; important sanitation during various stages of mushroom cultivation. Cultivation of important mushrooms - General process for the cultivation of Agaricus bisporus, Pleurotus ostreatus and Volvariella volvaceae. Pests and Pathogens of mushrooms and their management with reference to Agaricus bisporus.

UNIT – V Storage and Food Preparation from Mushrooms:

Methods of storage of mushroom cultivation, Long term and short term storage of mushrooms Foods/recipes from mushrooms. Mushroom research centers or farms - National level and regional level. Marketing of mushrooms in India and world.

UNIT – VI Current Contours (For continuous internal assessment only):

Field trip to mushroom farms and research Institutes. Analysis of biological properties in the mushroom products. Awareness to the industrialists about the prevention of microbial contamination in the mushroom farms and products.

REFERENCES:

1. Tavis Lynch, 2018. Mushroom Cultivation: An Illustrated Guide to Growing Your Own Mushrooms at Home. Quarto Publishing. USA.

2. Kaul, T.N. and B. L. Dhar, 2007. Biology and Cultivation of Edible Mushrooms. Westville Publishing House. New Delhi, 240pp

3. Chang, S.T., Miles, P.G., 2004. Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact (Second Edition). CRC Press. Boca Raton, 451pp.

4. Delcaire, J.R., 1978. Economics of cultivated mushrooms. In The Biology and Cultivation of Edible Mushrooms, Chang, S.T. and H.A. Hayes, ed., Academic Press. Inc. New York. 726-793.

5. Dewhurst, M., 2002. Phase III –the future? The Mushroom J. 626, 17-18.

6. Bhalla, T.C., Sharma, N.N., Sharma, M., 2007. Production of Metabolites, Industrial Enzymes, Amino Acids, Organic Acids, Antibiotics, Vitamins and Single Cell Proteins. National Science Digital Library, India.

7. https://www.mushroomoffice.com/mushroom-cultivation/

8. https://vikaspedia.in/agriculture/farm-based-enterprises/mushroomproduction/button-mushroom-production

9. https://krishijagran.com/agripedia/a-complete-guide-to-profitable-mushroomfarming-in-india-read-composting-harvesting-techniques/

10. https://cropbag.in/mushroom-cultivation-complete-guide/

COURSE OUTCOMES:

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

- Draw out the importance of mushrooms and their applications in health and neutraceuticals.
- Work out the production process for optimum mushroom yield.
- Explain their beneficial and erratic role during human consumption.
- List out the substrates employed in mushroom cultivation and sketch out the methods for improvement.

- Gain well-rounded knowledge and get fully prepared for employment, marketing and entrepreneur activities related to mushroom industries.

PROFESSIONAL ETHICS & HUMAN VALUES

SEMESTER: V **COURSE CODE: 22UGSDC**

PART IV - SOFT SKILLS DEVELOPMENT

Learning Objective:

Today's world is all about relationship, communication and presenting oneself, one's ideas and the company in the most positive and impactful way. This course intends to enable students to achieve excellence in both personal and professional life.

Unit I

Know Thyself/ Understanding Self Introduction to Soft skills-Self discovery-Developing positive attitude-Improving perceptions-Forming values

Unit II

Interpersonal Skills/ Understanding Others Developing interpersonal relationship-Team building-group dynamics-Net workingImproved work relationship

Unit III

Communication Skills / Communication with others Art of listening-Art of reading-Art of speaking-Art of writing-Art of writing e-mails-e mail etiquette

Unit IV

Corporate Skills / Working with Others Developing body language-Practising etiquette and mannerism-Time managementStress management

Unit V

Selling Self / Job Hunting Writing resume/cv-interview skills-Group discussion- Mock interview-Mock GD – Goal setting - Career planning

Text Books:

(i) Meena.K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills : A Road Map to Success), P.R. Publishers & Distributors, No, B-20 & 21, V.M.M. Complex, Chatiram Bus Stand, Tiruchirappalli- 620 002. (Phone No: 0431-2702824: Mobile No: 94433 70597, 98430 74472)

(ii) Alex K. (2012) Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi- 110 055. Mobile No : 94425 14814 (Dr.K.Alex)

Reference Books:

(i) Developing the leader within you John c Maxwell
(ii) Good to Great by Jim Collins
(iii) The seven habits of highly effective people Stephen Covey
(iv) Emotional Intelligence Daniel Goleman
(v) You can win Shive Khera
(vi) Principle centred leadership Stephen Covey

PROFESSIONAL ETHICS & HUMAN VALUES

CORE COURSE VIII **Semester VI**

FOOD MICROBIOLOGY

Code: 22SCCMB8 **Credit 5**

COURSE OBJECTIVES:

- To learn the fundamental association between food and microbes.
- To acquire knowledge about the key concept of food fermentations
- To analyze the mechanism of food spoilage
- To understand the principles of food preservation.
- To enrich the knowledge of food quality control.

UNIT – I Food and Microbial Contamination:

Concepts of food and nutrients - Physicochemical properties of foods - Food and microorganisms – Importance and types of microorganisms in food (Bacteria, Mould and Yeasts) - Sources of contamination- Factors influencing microbial growth in food – pH, moisture, Oxidation-reduction potential, nutrient contents and inhibitory substances.

UNIT – II Food Fermentations:

Food Fermentations – Manufacture of fermented foods - Fermented dairy products (yoghurt and Cheese) - plant products- Bread, Sauerkraut and Pickles - Fermented beverages- Beer. Brief account on the sources and applications of microbial enzymes – Terminologies - Prebiotics Probiotics and synbiotics. Advantages of probiotics.

UNIT – III Fermented Food Products:

Contamination, spoilage and preservation of cereals and cereal products – sugar and sugar products - Vegetables and fruits- meat and meat products- Spoilage of canned food.

UNIT – IV Food Borne Diseases:

Food borne diseases and food poisoning – Staphylococcus, Clostridium, Vibrio parahaemolyticus and Campylobacter jejuni. Escherichia coli and Salmonella infections, Hepatitis, Amoebiosis. Algal toxins and Mycotoxins.

UNIT - V Food Preservation:

Food preservations: principles- methods of preservations-Physical and chemical methods- food sanitations- Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. Food safety- control of hazards.

UNIT – VI Current Contours (for continuous internal assessment only):

Students may have a field visit to a food industry. Assignment, seminar and group discussion may be encouraged on Grain based fermented food - Koozhu, Pazhaiya soru, idli, dosa, Adai dosa, kallappam, dhokla etc.

REFERENCES:

1. Adams, M.R., Moss, M.O. 2018. Food microbiology, 1st edition, New Age international (P) Ltd, New Delhi.
2. Chris Bell., Paul Neaves., Anthony P.W. 2006. Food Microbiology and Laboratory Practicals, 2nd edition, Blackwell Scientific Publishers, UK.
3. Choudhary, N.L. 2012. Food Processing and Biotechnology Applications, Oxford Press, New Delhi.
4. Frazier WC and Westhoff DC. Food Microbiology, Sixth edition, Tata McGraw- Hill Publishing Ltd., New Delhi. 2017.
5. Foster, W.M. 2020. Food Microbiology, CBS publishers & distributors (P) Ltd.
6. Khetarpaul Neelam. 2005. Food Processing and Preservation, Daya Publishing House, Delhi.
7. Raheena, B.M. 2010. A Text Book of Foods, Nutrition, and Dietetics, Sterling Publishers Pvt. Ltd.
8. Singh K. 2012. Dairy Technology, Oxford Book Company, New Delhi.
9. Sinha., Sharma. 2012. Food Microbiology, Oxford Book Company, New Delhi.
10. Shakuntala, M.N., Shadaksharaswamy M. 2020. Food Facts and Principles Paperpack, New Age International.
11. Subbulakshmi, G., Shobha, A. U., Padmini, S. G. 2022. Food Processing and preservation, 2nd edtion, New Age international (P) Ltd.
12. Varun Mehta. 2006. Food Biotechnology, Campus Books International, New Delhi.
13. Vijaya, R.K. 2021. Food Microbiology, MJP Publishers.
14. Lund, B.M., Baird P.A.C., Gould, G.W.2000. The Microbiological Safety and Quality of foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
15. https://microbenotes.com/factors-affecting-the-growth-of-microorganismsin- food/

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

- Comprehend the functions of Microorganisms in food.
- Acquire knowledge about the fermented food products.
- Build awareness about microbial spoilage of food.
- Gain acquaintance with food borne diseases and their significance.
- Carry a knowledge on food sanitations, quality assurance and food safety.

PROFESSIONAL ETHICS

CORE COURSE IX **Semester VI**

INDUSTRIAL MICROBIOLOGY

Code: 22SCCMB9 **Credit 5**

COURSE OBJECTIVES:

- To impart the knowledge of current technology as to produce microbial products from cheap sources.
- To present the nature of the industrially important microorganisms, up and down stream process, functions of the fermentors, primary and secondary metabolites as the products.
- To provide the students broad theoretical and practical skills in industrial microbiology.
- To explain the nature of the bio-resources, industrially important microorganisms, up and down stream process.
- To describe the functions of the fermentors, primary and secondary metabolites and production of recombinant products.

UNIT – I Origin of Fermentation Industry:

Historical development of Industrial Microbiology. Industrially important microorganisms - the range of fermentation process, chronological development, component parts of a fermentation process, fermentation economics. Isolation, screening, improvement, preservation and handling the microbial strains.

UNIT – II Industrial Fermentation Media:

Formulation strategies, economical means of providing energy, carbon, nitrogen, vitamin and mineral sources. Role of additional ingredients - buffers, precursors, chelators, inhibitors, inducers and antifoams. Sterilization of industrial fermentation media.

UNIT – III Fermentor Design and Types:

Body construction, mass transfer, heat transfer, oxygen transfer, stirring and mixing. Sterilization of a Fermentor vessels. Scale up and scale down fermentation process. Control of temperature, pH, form pressure Computer application in fermentation technology. Fermentation types- Submerged and solid state.

UNIT – IV Downstream Processing:

Intracellular and extracellular fermentations products. Recovery and purification of the products - removal of solid matters and biomass, cell disruption by physical and chemical methods, extraction of the products, chromatographic techniques, reverse osmosis, ultrafiltration, drying and crystallization of the products.

UNIT – V Production of Varying Microbial Products:

Organic acids - Amino acids, Antibiotics, Enzymes, Vitamins, Alcoholic beverages - wine and beer, Fermented foods - bread, cheese and soy sauce. Recombinant products-insulin. Fermentation products from molasses, starch wastes and cellulosic wastes. Recycling and disposal of industrial wastes through microbes.

UNIT – VI Current Contours (For continuous internal assessment only):

Field trip to dairy, beverage Industry and food processing research Institutes. Analysis of microbiological quality in industrial products. Fermented food preparation. Awareness to the industrialists about the prevention of microbial contamination in industrial products.

REFERENCES:

1. Crueger, W., Crueger, A., 2000. Biotechnology: A Test Book of Industrial Microbiology, 2nd edition. Panima Publishing corporation, New Delhi.

2. Glazer, N.A., Nikaido, H., 2007. Microbial Biotechnology: Fundamentals of Applied Microbiology 2nd edition, Cambridge University Press.

3. Pandey, A., Soccol, R.C., Larroche, C., 2008. Current Developments in Solid-state Fermentation. Springer Verlag.

4. Patel, A.H., 2005. Industrial microbiology. Published by Mac Millan India Ltd., Chennai.

5. Peppler, H.J., Pearlman, D., 2004. Microbial Technology – Fermentation Technology. Vol.1 and 2, 2nd edition, Academic Press, London.

6. Prescott, L.M., Harley, J.P., Helin, D.A., 2002. Microbiology, 5th edition, McGraw Hill, New Delhi.

7. Purohit, S.S., Saluja, A.K., Kakrani, H.N., 2004. Pharmaceutical Microbiology. 1st edition, Agrobios India.

8. Sivakumar, P.K., Joe, M.M., Sukesh, K., 2010. An introduction to Industrial Microbiology. 1st edition, S. Chand and Company Ltd, New Delhi.

9. Waites, M.J., Morgan, N.L., Rockey, J.S., Higton, G., 2001. Industrial Microbiology: An Introduction, Blackwell Science, London.

10. https://bmcenergy.biomedcentral.com/articles/10.1186/s42500-019-0004-7

11. https://www.biologydiscussion.com/fermentation/fermentation-technologymeaning-methodology-types-and-procedure/17492

12. https://www.omicsonline.org/enzyme-production-by-fermentation-technologyscholarly-open-access-journals.php

13. https://www.biologydiscussion.com/industrial-microbiology-2/fermentorbioreactor-history-design-and-its-construction/55756

14. https://thebiologynotes.com/design-of-a-fermenter/

15. https://www.bioxcellence.com/our-business/upstream-downstream-processing

COURSE OUTCOMES:

The students will be able to know

- The nature and current status of the microorganisms in producing industrial fermentation products.
- About utilization of natural resources on the production of microbial products like enzymes, organic acids, antibiotic, vitamins and alcoholic beverages.
- The methods of transforming natural resources in to products.
- Imbibe ideas on different types of fermentors and their functions.
- The opportunities to develop as a bio-entrepreneur by producing microbial products using the natural wastes.

PROFESSIONAL ETHICS

MAJOR BASED ELECTIVE II **Semester VI**

2. MICROBIAL BIOTECHNOLOGY AND BIOETHICS

Code: 22SMBEMB2B **Credit 4**

COURSE OBJECTIVES:

- To introduce the role of micro-organisms in biotechnology.
- To understand various metabolic processes involved.
- To provide the first- line knowledge of utilizing microbes for the industrial production.
- To create awareness on the roles of microbes in the biotechnology field.
- To gather a sound knowledge of genetic manipulation as to attribute desirable
- characteristics.

UNIT – I Microbial Production of Therapeutic Agents and Vaccines:

Biotechnology: Definition – Milestones in History - Scope of microbial biotechnology and its applications - Microbial production of pharmaceuticals – antibiotics, hormones (insulin), enzymes (streptokinase), recombinant vaccines (Hepatitis B vaccine) - Edible vaccine, Monoclonal antibodies.

UNIT - II Production of Biofertilizer, Biopesticides, Bioplastics and Bioremediation:

Microbial production of biofertilizers – (Rhizobia, Azospirillum, Frankia and VAM). Microbial production of bio-pesticides (Bacillus thuriengiensis). Microbial production of bioplastics. Microorganisms in bioremediation: Degradation of xenobiotics.

UNIT – III Algal Biotechnology:

Single cell protein (algae and yeast). Microalgal technology – Industrial cultivation methods of Spirulina – biotechnological potentials of Spirulina as: food and feed – fuel production from microalgae – pharmaceutically valuable compounds from microalgae. Commercial production of bio-ethanol and bio-diesel using lignocellulosic waste.

UNIT – IV Genetic Engineering of Plants and Animals:

Genetic engineering of plants: Ti plasmid vectors and gene transfer in plants – Development of insect, virus and herbicide resistant plants. Transgenic animals: methods of creating transgenic mice and sheep. Human gene therapy – in vivo and ex vivo gene therapy.

UNIT – V IPR and Bioethics:

Intellectual Property Rights (IPR) - different types of IPRs - Principles of Bioethics (IB) - Definition of Ethics and Bioethics. - Ethics committee - Brief account on risks and ethics of modern biotechnology - Ethical concerns in human gene therapy – Ethical limits of animal use. Ethical issues at the beginning

of life (abortion) – Ethical issues at the end of life (withholding and withdrawing medical treatment and euthanasia).

UNIT – VI Current Contours (for continuous internal assessment only):

Learners can visit nearby agricultural field (Rice, onion, cotton or any other) to enrich knowledge on the application of biofertilizers. Students may prepare posters and models on Biogas, biofuel, Organic farming, Panchagavya, dolly, knockout mice, double transgenic mouse.

REFERENCES:

1. Desmond, S.T Nicholl. 2002. An Introduction to Genetic Engineering, 2nd edition, Cambridge university press.

2. Das, H.K. 2017.Textbook of Biotechnology,5th edition, Wiley Press.

3. Sivaji Mathivanan. 2020. Advances in Microbial Biotechnology, LAP Lambert Academic Publishing.

4. Chawla, H.S. 2020. Introduction to Plant Biotechnology, 3rd edition, Oxford &IBH Publishing.

5. Glick, B.R., Pasternak, J.J., Patten, C.L. 2010. Molecular Biotechnology 4th edition, ASM Press.

6. Mukesh Pasupuleti. 2006. Molecular Biotechnology. MJP Publishers, Chennai.

7. Ratledge C., Kristiansen, B. 2001. Basic Biotechnology, 2nd edition, Cambridge University Press.

8. Willey, J.M., Sherwood, L.M., Woolverton, C.J. 2014. Prescott, Harley and Klein's Microbiology, 9th edition, Mc Graw Hill Publishers.

9. Gupta, P.K. 2009. Elements of Biotechnology, 2nd edition, Rastogi Publications.

10. Glazer, A.N., Nikaido, H. 2007. Microbial Biotechnology, 2nd edition, Cambridge University Press.

11. Stanbury, P.F., Whitaker, A., Hall, S.J. 2016. Principles of Fermentation Technology, 3rd edition, Butterworth-Heinemann Publisher.

12. Nancy, S.J., Albert, R. J., Robert, A. P. 2010. Bioethics- An introduction the history, methods and practice, 2nd edition. Jones and Bartlett Publishers.

13. https://www.onlinebiologynotes.com/human-insulin-production-by-geneticengineering/

14. https://www.biotechnologynotes.com/transgenic-plants/edible-vaccinesapplications- advantages-and-limitations/627

15. https://www.biologydiscussion.com/microbiology-2/bioremediation/ xenobiotic - compounds-meaning-hazards-and-biodegradation/55625

COURSE OUTCOMES:

After successful completion of this course, the learners will be able to:

- Gather the basics of producing pharmaceutically valuable products from microbiota.
- Enrich themselves with knowledge of producing biofertilizers and biocontrol agents.

- Attain the knowledge on the exploitation and applications of microalgae.
- Posses the concepts of genetic engineering in plants and animals.
- Get a comprehensive idea about IPR and Bioethics.

PROFESSIONAL ETHICS

SKILL BASED ELECTIVE II **Semester VI**

BIOFERTILIZER TECHNOLOGY

Code: 22SSBEMB2 **Credit 4**

COURSE OBJECTIVES:

- To introduce the necessity and application relevance of biofertilizers.
- To initiate the students towards the development of sustainable agriculture.
- To learn how biofertilizers can be produced in large scale level.
- To signify the microbial biofertilizers namely, bacteria, fungi, cyanobacteria
- and actinorhiza.
- To present various methods of applying biomanures in the current
- agriculture.

UNIT - I Origin of Fertilizers and Natural Cycle:

Introduction - History, importance and present status of different types of fertilizers and their application to crop plants. Importance of macro and micro nutrients. Biological fixation of nitrogen; Natural cycles associated with microorganisms - carbon, nitrogen, phosphorous and sulphur.

UNIT – II Cyanobacterial and Bacterial Biofertilizers:

Cyanobacterial Biofertilizers - Nostoc, Anabaena, Gloeocapsa and Scytonema as biofertilizers; Symbiotic association with Azolla; Multiplication of blue green algae and its effect on rice yields. Bacterial biofertilizers - Free living forms: Azotobacter, Azospirillum; Symbiotic forms: Rhizobium - Legume Association; Pseudomonas, Non-legume association.

UNIT – III Fungal and Actinobacterial Biofertilizers:

Fungal biofertilizers – Types of fungal biofertilizers, ectomycorrhizal association with pines; arbuscular mycorrhizal association - Glomus sp., actinomycetes as Biofertilizers – Actinorhiza, Actinorhizal associations - Frankia sp.

UNIT - IV Biomanure Production:

Biomanures - A general account of manures – Moulds; Composts Farm Yard Manure- Oil seed cakes - Castor and neem; Green leaf manures - Gyricidia, Sesbania and Crotalaria; Agro-industrial wastes - Poultry manure and saw-dust; Vermi Compost; Microbial compost - pure culture techniques, consortium – types of compost pits. Biodegradation of organic components.

UNIT – V Mass Production of Biofertilizers:

Production of Rhizobium, mycorrhiza. Synthesis of micro and macro nutrients. Application of biofertilizers and manures - A combination of biofertilizer and manure applications with reference to

soil, seed and leaf sprays. Laboratory and field application; Cost analysis of biofertilizer and biomanure production.

UNIT – VI Current Contours (For continuous internal assessment only):

Field trip to the institutes related to biofertilizers and biomanure production. Analysis of microbiological quality in fertile and infertile soil. An awareness to the farmers about the importance of the biofertilizers.

REFERENCES:

1. Manoj Kaushal, Ram Prasad, 2021. Microbial Biotechnology in Crop Protection, Springer, ISBN: 978-9811600487.

2. Kaushik, B.D., Deepak Kumar, Md. Shamim, 2020. Biofertilizers and Biopesticides in Sustainable Agriculture, Apple Academic Press, ISBN: 9781771887939.

3. Goyal, M.R., 2018. Sustainable Biological System for Agriculture, APP Apple Academic Press, ISBN: 978-1-77188-614-7.

4. Borkar, S.G., 2015. Microbes as Bio-fertilizers and their Production Technology (Woodhead Publishing India in Agriculture), WPI Publishing, ISBN: 9380308574.

5. Shagufta, 2012. Biofertilizer Technology, 1st Edition, Published at Delhi.

6. Subba Rao, N.S., 1995. Soil Microorganisms and plant growth, Oxford and IBH, New York.

7. Totawat, K.L., Somani, L.L., Sharma, R.A., Maloo, S.R., 2004. Biofertilizer Technology, Agrotech Publishing Academy. Udaipur, Rajasthan.

8. Mathur, R., 2013. A text book of Entomology, Neha Publishers & Distributors. ISBN: 8187815648.

9. https://www.bio-fit.eu/upload/Bio-Fit-Book/EN/Bio-FIT_Book_EN.pdf

10. http://www.amm-mcrc.org/publications/Biofertilizers.pdf

11. http://www.normevents.fr/frd-9/biofertilizer-frankia.pdf

12.http://plantpath.osu.edu/sites/plantpath/files/imce/images/McSpadden-Gardener/OEFFA%202014%20Biofertilizer.pdf

13.https://www.wpi.edu/Pubs/E-project/Available/E-project-030311-115831/unrestricted/English_Biofertilizers_Brochure.pdf

14. http://www.arvin-agri.com/Maghalat/GiyahPezeshki/Ipm/biopesticide.pdf

15. http://www.jbiopest.com/users/lw8/efiles/suman_gupta_v31.pdf

COURSE OUTCOMES:

After successful completion of the course, the students will learn about:

- The importance and applications of the biofertilizers for a sustainable agriculture.
- To foster biofertilizers to overcome the applications of chemical fertilizers in the modern farmings.

- The opportunities for the students to develop as a bio-entrepreneur through the production of biofertilizers.
- Exploitation of natural wastes by producing bioorganic fertilizers.
- The concept of biofertilizers' applications in lab and field levels.

PROFESSIONAL ETHICS

CORE PRACTICAL VI **Semester VI**

FOOD MICROBIOLOGY AND INDUSTRIAL MICROBIOLOGY

Code: 22SCCMB6P **Credit 4**

COURSE OBJECTIVES:

- To study the basics of food microbiology processes.
- To know the food quality assessment testing procedures.
- To learn about the different types of fermentation processes, equipments used and
- microbiological processes involved.
- To provide the food contaminants possibility and causing agents.
- To realize significance and activities of microorganisms in food.
- The aim of this course is to know various methods adopting to isolate, screen the industrially important microorganism.
- The course topic explored its production of microbial products like enzyme, antibiotic, alcohol and biosurfactants.
- It also covers purification and characterization of the products by appropriate methods.
- To study the microbial by products immobilization techniques.
- It promotes the students for employability in varying industries.

EXPERIMENTS:

1. Assessment of milk quality by methylene blue reduction test
2. Performance of phosphatase test for pasteurized milk.
3. Isolation of bacteria from food by Standard Plate Count method
4. Isolation of Yeast from grapes.
5. Wet mount preparation of spoiled bread, tomato, grapes, potato.
6. Observation of food samples to study Leuconsostoc, Lactobacillus, Streptococcus lactis and Saccharomyes.
7. Preparation of fermented food – Yoghurt and cheese (demonstration).
8. Screening of antibiotic producing microorganisms from soil.
9. Screening of enzyme producing organisms (e.g. Amylase and Cellulase).
10. Production of industrially important enzymes by solid state fermentation (Any one enzyme).
11. Production of wine from grapes.

12. Production of alcohol from agricultural wastes (sugarcane molasses and beetroot).

13. Characterization of alcohol: Nutritive value, Colour, Haze, Viscosity, foam Characteristics, gurting flavor

14. Microbial production of citric acid by using Aspergillus.

15. Production, extraction and characterization of biosurfactant of biosurfactant (emulsification index, foaming index, oil spread nature and ionic charecters).

16. Separation of bioactive compounds - TLC or Column Chromatography.

17. Immobilization of cells and enzymes.

18. Antibiotic sensitivity test: a) Kirby Bauer's method and b) MIC determination by filter paper assay and broth dilution assay.

REFERENCES:

1. Aneja, K.R. 2005. Experiments in Microbiology, Plant pathology and Biotechnology. 4th edition, New Age International Publishers, Chennai.

2. James G Cappuccino., Natalie Sherman. 2004. Microbiology: A laboratory manual, 6th edition, Pearson Education.

3. Kannan, N.2003. Handbook of laboratory culture media, Reagents, Stains and buffers, Panima Publishing Corporation, New Delhi.

4. Kulanthaivel S., Janarthanan S. 2012. Practical Manual on Fermentation Technology, I.K. International publishing house. New Delhi.

5. Neelima, G., Garg, K.L., Mukerji, K.G. 2020. Laboratory manual of Food Microbiology, 1st edition, Dreamtech Press.

6. Ponmurugan, P., Nithya, R., Fredinose, M. 2012. Experimental Procedure in Bioprocess Technology and Downstream Processing, Anjana Book House. Chennai.

7. Rajan, S., Selvi Christy. 2011. Experimental procedures in life sciences, Anjana Book House, publishers and distributors, Chennai.

8. Shalini, S. 2020. A laboratory manual of Food analysis, 1st edition, Dreamtech Press.

9. Benson, H.J. 1994. Microbiological Applications, WMC. Brown Publishers, Oxford.

10. Jay, J.M. 2000. Modern Food Microbiology, 4th edition, CBS Publishers and distributors, New Delhi.

11. Basanta Kumar Rai, Dil Kumar Subba, 2016. Basic Practical Manual on Industrial Microbiology, Dharan Multiple Campus, Nepal.

12. Mathur, N., Singh, A., Industrial Microbiology: A Laboratory Manual, Pointer publishers.

13. Arnold L. Demain, Julian E. Davies, Ronald M. Atlas, Gerald Cohen, Charles L.

Hershberger, Wei-Shou Hu, David H. Sherman, Richard C. Willson and David Wu, J.H., 1999. Manual of Industrial Microbiology and Biotechnology, 2nd Edition.

14. Sadasivam, S., Manickam, A., 1996. Biochemical Methods. New Age International (P) Limited, Publishers.

15. https://www.researchgate.net/publication/344465390_PRACTICAL_MANUAL_CUM_WORKBOOK_on_INDUSTRIAL_MICROBIOLOGY

16. https://cevre.erciyes.edu.tr/upload/M6Z30UUmicrobiology-laboratory-manual.pdf

17. https://www.ikbooks.com/openPdf/9789381141809

18. https://app.knovel.com/web/toc.v/cid:kpMIMBE006/viewerType:toc/

19. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf

COURSE OUTCOMES:

After completion of the lab course, learners will able to:

- Assess the quality of milk by microbiological analysis.
- Acquire a knowledge on food samples and their analysis.
- Evaluate the microorganisms involved in food spoilage.
- Learn about the preparation of fermented food.
- Understand the microbial roles in food preparations.
- Know about the techniques to isolate and screen the significant microorganisms capable to produce products.
- Generate ideas for the production of ethanol from natural and industrial wastes.
- Carry in-depth knowledge and ideas for the production of biosurfactant and its characterization.
- Isolate and characterize microbial products for further applications.
- Understand the opportunities to emerge as a bio-entrepreneur by producing microbial products from naturalwastes.

GENDER

VI SEMESTER

COURSE CODE :

22UGGS

PART V - GENDER STUDIES

Objectives:

- To make boys and girls aware of each others strengths and Weakness.
- To develop sensitivity towards both genders in order to lead an ethically enriched life.
- To promote attitudinal change towards a gender balanced ambience and women empowerment .

Unit I

Concepts of Gender: Sex – Gender – Biological Determinism – Patriarchy – Feminism – Gender Discrimination – Gender Division of labour – Gender Stereotyping – Gender Sensitivity – Gender Equity – Equality – Gender Mainstreaming - Empowerment.

Unit II

Women's Studies vs Gender Studies : UGC's Guidelines – VII to XI Plans – Gender Studies : Beijing Conference and CEDAW – Exclusiveness and Inclusiveness.

Unit III

Areas of Gender Discrimination : Family – Sex Ratio – Literacy – Health – Governance – Religion Work Vs Employment – Market – Media – Politics – Law – Domestic Violence – Sexual Harassment – State Policies and Planning .

Unit IV

Women Development and Gender Empowerment : Initiatives – International Women's Decade – International Women's Year – National Policy for Empowerment of Women – Women Empowerment Year 2001 – Mainstreaming Global Policies .

Unit V

Women's Movements and Safeguarding Mechanism : In India National /State Commission for Women(NCW) – All Women Police Station – Family Court – Domestic Violence Act – Prevention of Sexual Harassment at Work Place Supreme Court Guidelines – Maternity Benefit Act – PNDT Act – Hindu Succession Act 2005 – Eve Teasing Prevention Act – Self Help Groups – 73rd and 74th Amendment for PRIS

References :

1. Bhasin Kamala, Understanding Gender : Gender Basics , New Delhi : Women Unlimited , 2004

2. Bhasin Kamala, Exploring Masculinity: Gender Basics , New Delhi: Women Unlimited ,2004

3. Bhasin Kamala , What is Patriarchy? : Gender Basics, New Delhi :Women Unlimited ,1993

4. Pernau Margrit, Ahmad Imtiaz, Reifeld Hermut (ed.,)Family and Gender : Changing Values in Germany and India ,New Delhi :Sage Publications,2003

5. Agarwal Bina, Humphries Jane and Robeyns Ingrid(ed.,) Capabilities , Freedom , and Equality: Amartya Sen's Work from a Gender Perspective,New Delhi : Oxford University Press ,2006

6. Rajadurai. S.V,Geetha.V,Themes in Caste Gender and Religion, Tiruchirappalli : Bharathidasan University ,2007

7. Misra Geetanjali, Chandiramani Radhika (ed.,) Sexuality , Gender and Rights: Exploring Theory and Practice in South and Southeast Asia, New Delhi : Sage Publication ,2005

8. Rao Anupama (ed.,) Gender &Caste : Issues in Contemporary Indian Feminism, New Delhi : Kali for Women, 2003

9. Saha Chandana , Gender Equity and Gender Equality : Study of Girl Child in Rajasthan , Jaipur: Rawat Publication ,2003.

10. Krishna Sumi, (ed.,),Livelihood and Gender : Equity in Community Resource Management, New Delhi : Sage Publication ,2004

11. Pludi.A Michele(ed.,) praeger Guide to the Psychology of Gender ,London : Praeger Publisher ,2004

12. Wharton .S Amy , The Sociology of Gender : An Introduction to Theory and Research , USA : Blackwell Publishing ,2005

13. Mohanty Manoranjan(ed.,) Class ,Caste ,Gender : Readings in Indian Government and Politics – 5,New Delhi : Sage Publications ,2004.

14. Arya Sadhna Women ,Gender Equality and the State ,New Delhi :Deep &Deep Publication, 2000

M.Sc.Microbiology

PROFESSIONAL ETHICS

First Year | **CORE COURSE I GENERAL MICROBIOLOGY (Theory)** | **Semester I**

Code: P22MBCC11 | **Credit: 5**

COURSE OBJECTIVES:

- To introduce the beginners to the microbial arena as well as to orient them on the fundamental equipments, tools and techniques required for a primary but, a strong understanding of microbes.
- To impart the knowledge of different methods of classification of bacteria, viruses, fungi& others.
- To provide unique characteristic features of microbes.
- To describe the different types of microscopy and their working principles.
- To explain about microbial media, preservation and control techniques.

UNIT - I INTRODUCTION:

Spontaneous generation, conflict - contributions of early microbiologists: Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner & Winogradsky. Bacteria: Cell walls of Gram negative, Gram positive, and L-forms. Cell wall synthesis. Structure and mechanism of movement of flagella - Pili and fimbriae: types, structure and their role. External cell surface structures: capsule, glycocalyx, slime layer and S-layer. Brief account on gas vesicles, chlorosomes, carboxyomes, magnetosomes, phycoblisomes& PHB.

UNIT - II MICROSCOPY AND MICROBIAL TAXONOMY:

Principle, working & applications of Bright field, Dark field, Phase Contrast, Fluorescence, Confocal scanning microscope and Electron (TEM, SEM) microscopes. Microbial Taxonomy - Definition and systematics, Nomenclature and identification. Classification of microorganisms & its basis - Haeckel's three kingdom concept, Whittaker's five kingdom concept and Three domain concept of Carl Woese. Major characteristics used in taxonomy – morphological, physiological, metabolic, serological and molecular. Classification and salient features of bacteria according to Bergey's Manual of Determinative Bacteriology - Ninth edition. Numerical taxonomy - 16S rRNA based classification

UNIT - III CLASSIFICATION AND BASICS OF FUNGI AND VIRUSES:

Alexopoulos & Mims Classification of fungi - characteristics of fungi – Filamentous, non-filamentous and dimorphic fungi -Morphology, structure and life cycle of *Aspergillus niger* and *Saccharomyces cerevisiae.* Parasitism, mutualism and symbiosis with plants and animals. Viruses: ICTV system of classification, General properties, Morphology, viral capsids and their arrangements, viral envelopes and their composition, viral genome(RNA, DNA); Viroids, Prions - structure and importance.

UNIT L IV CLASSIFICATION AND BASICS OF ALGAE AND PROTOZOA:

Fritsch system of algal classification – General characters of Blue-green Algae (Cyanobacteria) - Structure and reproduction of *Chalmydomonas* sp. - Macroalgae - Biological and Economic importance of algae. Protozoa – modified form of Levine classification & characteristics - Structure and reproduction of *Paramecium* sp.

UNIT - V METHODS OF MICROBIAL CULTURE, PRESERVATION AND CONTROL:

Isolation of different types of bacteria - Fungi – Actinomycetes - Cyanobacteria - Protozoa. Physical and Chemical requirements for growth; Pure culture methods. Anaerobic culture techniques. Preservation methods of microbes. Type culture collections. Physical and chemical methods of controlling microorganisms.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Cultivable and uncultivable microbe importance for evolutionary studies. Preparation of power point presentations (ppts) or charts representing a topic of the course and their seminar presentations – chart preparations and presentations covering equipments/ tools of the course & their display - Quiz classes – discussion of previous semester question papers.

REFERENCES:

1. Jacquelyn G. Black., Laura J. Black (2015). Microbiology: Principles and Explorations 9th Ed.., John Wiley & Sons.
2. Atlas, R.M., (2015). Principles of Microbiology 2nd Ed. WCB McGraw Hill Publications, New Delhi
3. Rajan S and Selvi Christy R. (2018). Essentials of Microbiology, CBS Publishers, New Delhi, 2018.
4. Dubey RC and Maheswari DK (2022). A Text of Microbiology. Revised edition, S. Chand and Company Ltd., New Delhi
5. Alexopoulos CJ, Mims CW and Blackwell M. (2007) Introductory Mycology. Fifth edition John Wiley and Sons. Chichester.
6. Prescott LM, Harley JP and Klein DA (2013). Microbiology. 7th edition, McGraw Hill, Newyork
7. DM Knipe, PM Howley. 2007. Fields Virology. 5th Edition. ippincott Williams & Wilkins Health
8. Johri RM, Snehlatha, Sandhya Shrama. A Textbook of Algae. Wisdom Press, New Delhi. 2010.
9. Pelczar TR, Chan ECS and Kreig NR (2006) Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.
10. Schlegel HG. (2008) General Microbiology, Cambridge University Press, UK..
11. http://ecoursesonline.iasri.res.in/course/view.php?id=108
12. http://www.microbiologyonline.org.uk/links.html
13. http://www.bact.wisc.edi/Microtextbook/index.php
14. http://www.bris.ac.uk/vetpath/cpl/tut.html
15. http://www.bmb.leeds.ac.uk/mbiology/ug/ugteach/elect/elect.htm

COURSE OUTCOMES:

Students who undergo the course, will be able to:

- Strongly understand the basic features of microbes such as bacteria, fungi,algae, protozoa & viruses
- Master the classifications the microbes.
- Learn the working principles of important equipments like microscopes.Clearly recognize the contributions of early microbiologists.
- Understand molecular tools required for accurate microbial identifications.

*****

First Year | **CORE COURSE II BIOLOGICAL MACROMOLECULES (Theory)** | **Semester I**

Code: P22MBCC12 | **Credit: 5**

COURSE OBJECTIVES:

- To educate the structure and functions biological molecules.
- To know the interrelationship between various biomolecules and consequences of any deviation from normal.
- To understand the structure and functions of blood, hormones and phytohormones.
- To study the basic metabolic regulators' characteristic features.
- To understand the interrelationships among biological energy, functions and health.

UNIT - I CARBOHYDRATE, PROTEINS AND AMINO ACIDS:

Carbohydrate: Definition, sources, classification, structure of glucose, biological significance, digestion and absorption. Proteins: Definition, sources, classification and structure of proteins (Primary, secondary, tertiary), Amino acids–structure-classification - essential and non-essential, protein and non-protein amino acids.

UNIT - II LIPIDS, FATTY ACIDS AND NUCLEIC ACIDS:

Lipids: Definition, sources, classification, structure, properties and functions, Fatty acids-saturated, unsaturated and essential fatty acids. Nucleic acids: Definition, structure, forms and functions of DNA. Types, structure and functions of RNA (mRNA, tRNA, rRNA).

UNIT - III HORMONES:

Hormones: Definition, classification of hormones, Human- Endocrine glands – Pituitary, thyroids, Para thyroid, pancreas, adrenal, testis and ovary. Phytohormones: Structure and functions of auxin, gibberellins, cytokinins and abscissic acid.

UNIT - IV VITAMINS AND MINERALS:

Vitamins – Definition, sources, deficiency syndromes and functions of Fat-soluble vitamins (A, D, E and K) and Water-soluble vitamins (B complex and C). Minerals - Zn, Ca, Iodine, Fe, and Mg.

UNIT - V BLOOD AND PIGMENTS:

Blood: Introduction, origin, composition, characterization, functions andcoagulation of blood. General account and secondary metabolites. Major and accessory microbial pigments – chlorophylls, carotenoids, phycobilins and anthocyanins.

UNIT - VI CURRENT CONTOUR (Only for continuous internal assessment):

Diseases associated with deficiency of endocrine hormones- hypo and hyper secretions. Life style diseases and metabolic diseases. Diet-biochemical-health. Food as drug.

REFERENCES:

1. Albert L Lehninger, David L Nelson and Michael M Cox. Lehninger Principles of Biochemistry, 2nd edition, Wiley publisher. 2010.
2. Ambika Shanmugam. Fundamentals of Biochemistry for Medical students. Nagaraj and Company Pvt ltd, India. 1998.
3. Charlotte W Pratt and Kathleen Comely. Essential Biochemistry, 3rd edition Wiley publisher. 2013.
4. Deb AC. Edition. Fundamentals of Biochemistry, 10th edition, New Central Book Agency (p) ltd, London. 2011.
5. Denise R Ferrier. Biochemistry, 6th edition, LWW publishers. 2013.
6. Rafi MD. Textbook of Biochemistry for medical students, 2nd edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2014.
7. Rajagopal G. Concise textbook of biochemistry, 2nd edition. Ahuja Publishing House.2010.
8. Reginald H Garrett and Charles M Grisham, 5th edition. Biochemistry, Brooks Cole publishers. 2012.
9. Sathyanarayana U and Chakrapani U. Biochemistry, 4th edition, Elsevier publishers. 2013.
10. Thomas M Devlin. Textbook of Biochemistry with Clinical Correlations, 7th edition, Wiley publisher. 2010.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Gain the knowledge of structure and function of biological molecules.
- Discuss the interrelationship between various biomolecules and consequences of deviation from normal.
- Understand the structure and functions of blood,hormones and phytohormones.
- Provide the information about basic metabolic regulators' characteristic features.
- Able to explain the interrelationships among biological energy, functions andhealth.

******

First Year | **CORE CHOICE COURSE I** | **Semester I**

APPLIED BIOLOGICAL SCIENCES

Code: P22MBCC1A | **(Theory)** | **Credit: 5**

COURSE OBJECTIVE:

- To enable the students to understand the basics components of biology.
- To understand the biological diversity, uniqueness and their characteristic features.
- To study the importance of biological sciences in human welfare.
- To educate about the farm animals developmental principles and essentialqualities.
- To create an awareness as to ensure nature based activities and minimizeusage of experimental animals.

UNIT - I ALGAE AND FUNGI:

Thallophytes: Algae-General characteristics- Economic importance- Types of life cycle- Outline of various classifications. Fungi: General characteristics- Classifications and Economic importance

UNIT - II CRYPTOGAMIC PLANTS:

General characteristics- Economic importance and outline of reproductionmethods in Lichens, Bryophytes, Pteridophytes and Gymnosperms. Stelar evolution

UNIT - III PHANEROGAMIC PLANTS:

Salient features of monocot and dicot. Taxonomy: Systems of classification, (Artificial, Phylogenetic and Natural). Morphometric diversity: Morphology; types of inflorescences. Technical description of flower and floral diagram and types of fruits. Economic importance.

UNIT - IV INVERTEBRATES:

General characteristics and outline classification up to classes in Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda and Echinodermata; Economic importance of invertebrates. General characters - a brief study on Star fish.

UNIT - V VERTEBRATES:

Classification of Chordata – General characteristic features and Classification (up to the orders) – Prochordata, Pisces, Amphibia Reptilia, Aves and Mammalia- Economic importance of Vertebrates. Farm animals – Controlling of breeding animals.

UNIT - VI CURRENT CONTOUR (For continuous internal assessment only):

Bioluminescence. Principles of insect control: physical, mechanical, chemical,biological and integrated methods of pest control. Cell cultures and line lines.

REFERENCES:

1. Arumugam N. Invertebrate Zoology, Saras publication, Nagercoil.2002.
2. Ekambaranatha Iyar M and Ananthakrishnan TN. Manual of Zoology. Vol. I. part I and II, S. Visvanathan publication, Chennai.1994.
3. Ayyar EK and Ananthakrishnan. A Manual of Zoology, Vol. II (Chordata).1992.
4. Ekambaranatha Iyar M and Ananthakrishnan TN. Manual of Zoology Vol.II. S. Visvanathan publication, Chennai.1994.
5. Ranganathan TN.Chordata Zoology, Rainbow printers, Palayamkottai.1996.
6. Ekambaranatha Ayyar. Outlines of Zoology. Vols. I and II S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.1993.
7. Kotpal RL. Invertebrata, Rastogi Publication, Meerut.2000.
8. Jordan EL and Verma PS. Invertebrate Zoology, 12th Edition, S. Chand and Co.1995.
9. Mani MS. General Entomology, Oxford and IBH publishing Co., New Delhi. 1982.
10. Nayar KK, Ananthankrishnan TN and David M. General and applied Entomology, Tata McGraw Hill Pub. Co., Ltd., New York. 1995.
11. David BV. Pest Management and pesticides Indian Scenario, Namrutha Publications.1992.
12. Krishnan NT. Economic Entomology, J.J. Publications, Madurai. 1993.
13. https://oer.galileo.usg.edu/biology-textbooks/
14. https://DAMS-CSIR-Companion-Handbook-Applied-Biology-CCH-12/dp/B07J5YTZV9#detailBullets_feature_div

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Understand the important components of biological sciences.
- Understand the biological diversity, uniqueness and their characteristicfeatures.
- Know the importnce of biological sciences in human welfare
- Appreciate the farm animals' developmental principles and essential qualities.
- Create an awareness to ensure the nature based activities and minimizeusage of the experimental animals.

****

ELECTIVE COURSE I **Semester I**

First Year

FOOD AND DAIRY MICROBIOLOGY

Code: P22MBE1B **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To enable the students to imbibe essential knowledge in key concepts of food anddairymicrobiology
- To understand various methods of food fermentations and fermented food products.
- To portray the conceptual basis for understanding probiotics.
- To impart an awareness about microbial illness in foods, food sanitations and other related aspects.
- To provide the skills of preparing fermented milk products.

UNIT - I FOOD AND MICROBES:

Types of microorganisms in food – Bacteria, molds, yeast and protozoa. Source of contamination- Factors influencing microbial growth in food- pH, moisture, oxidation – Reduction potential, Nutrient content and Inhibitory substances and biological structure.

UNIT - II FOOD FERMENTATION AND FERMENTED FOOD PRODUCTS:

Food fermentations: methods of fermentations and organisms used -Cheese, bread, wine, beer. Fermented vegetables. Food and enzymes from microorganisms - single cell protein and mushrooms. Prebiotics, Probiotics and symbiotics. Advantages of probiotics. Contamination, spoilage and preservation of cereals and cereals products, sugar and sugar products, vegetables, fruits, meat and meat products, Fish and other sea foods,egg and poultry, dairy and fermentative products.

UNIT - III FOOD BORNE DISEASES AND CONTROL:

Food borne diseases and food poisoning. General principles underlying food spoilage and contamination – *Staphylococcus, Clostridium, Escherichia coli* and *Salmonella* infections, Hepatitis, Amoebiosis and Mycotoxins. Spoilage in canned foods. Food sanitation and control measures, HACCP, GMP, GLP.

UNIT - IV FOOD PRESERVATION METHOD:

Food preservations: principles- methods of preservations- Physical and chemical methods. Canning: classification of can, structure of cans, canning of food items, Thermal process time calculations for canned foods.

UNIT - V DAIRY MICROBIOLOGY:

Microbes in milk, sources of contamination, microbiological changes in milk during production and processing. Starter cultures- lactic acid bacteria. Fermented milk products- dahi, lassi, yoghurt, cultured buttermilk, kefir, cheese. Microbiological standards and quality of dairy products- cream, butter, dried and evaporated milk, sweetened condensed milk, frozen dairy products and indigenous dairy products.

UNIT - VI CURRENT CONTOURS (for continuous internal assessment only):

To enrich knowledge on the production, processing and preservation of foods and food products Learners may visit food / dairy industry and shall submit a report. May prepare fermented food in groups or individual.

REFERENCES:

1. Adams, M.R., Moss, M.O., Peter McClure. 2015. Food Microbiology. The Royal Society of Chemistry, Cambridge.
2. Adrian, E. 1996. Microbial food poisoning, Springer Science and Business Media, e-book.
3. Barrett, D.M., Somogyi, L., Ramaswamy, H. 2004. Processing fruits, CRC press, Boca raton, US.
4. Frazier., Westhoff, D.C. 2003. Food Microbiology, 5th edition, TATA McGraw Hill Publishing Company Ltd., New Delhi.
5. Halasz, A., Lasztity, R. 2013. Use of yeast biomass in food production, CRC press, Boca raton, US.
6. Hui, Y.H., Goddick, L.M., Hansen, A.S., Josephsen, J., Wai-Kit-Nip., Stanfield, P.S., Doldra, F. 2008. Hand book of food and beverage fermentation technology, CRC press, Boca raton, US.
7. Jacobs, M.B., Gerstein, M.J., Watter, W.G. 1960. Dictionary of Microbiology, Vanwostrant co.Inc, Princeceton, US. .
8. Kaferstein, F. 1988. Ten golden rules for safe food preparation. Magazine of the World Health Organization, Geneva.
9. Kiss, I. 1984. Test in methods in food microbiology, Akademiai kiado, Budapest, Hungary.
10. Reed, G. 2014. Prescott's and Dunn's Industrial Microbiology. 4th edition. AVI publishing co Inc., West port.
11. Sofos, J. 2013.Advances in microbial food safety. Center for Meat Safety and Quality, The College of Agricultural Sciences, Colorado State University, USA.
12. Subbulakshmi, G., Shoba, A.U. 2009. Food processing and preservation –New Age Publisher, Chennai.
13. Swaminathan, M. 2008. Advanced Text Book: Foods Nutrition, Bappco Publication, Jaipur.
14. https://www.slideshare.net/mohitjindal/principles-and-methods-for-food-preservation
15. https://www.onlinebiologynotes.com/food-borne-disease-food-poisoning-and-food-infection-with-example/

COURSE OUTCOMES:

After completion of this course, the students will be able to:

- Know Food and microbes and food borne diseases and control.
- Understand the Food fermentation.
- Acquire knowledge on Fermented food products.
- Get a comprehensive idea about the process of Food preservation.
- Develop an understanding of Microbiological standards and quality of dairy products.

*****

PROFESSIONAL ETHICS

First Year | **VALUE ADDED COURSE I MEDICAL LABORATORY TECHNOLOGY** | **Semester I**

Code: P22MBVAC1 | **(Theory)** | **Credit: 2**

COURSE OBJECTIVES:

- To teach conventional methods of disease diagnosis and their moderation in thecurrent era.
- To provide the knowledge of collection and processing of clinical samples
- To study the pathogenic microbial culture and their identification techniques.
- To give awareness of how to manage and dispose the biomedical waste.
- To strengthen the learners with the knowledge of current diagnostic methods including molecular methods required to secure a profession/career in health care sectors.

UNIT - I LAB TECHNOLOGIST, SOLUTIONS AND MEASUREMENTS:

Medical lab technologist: role, responsibility & ethics to be followed - types of hazards and laboratory accidents – first aid and safety measures to be followed. Preparation of normal, molar, percent & buffer solutions, dilutions, w/v, v/v, standard and aqueous solutions, concepts of acid and base. Units of measurement: SI Unit, reference range, conversion factor, Units for measurement of bio metabolite, enzymes, protein, drugs, hormones, vitamins.

UNIT - II CLINICAL SPECIMENS AND TESTING:

Clinical specimen collection and processing: Blood, Urine, Stool and & other body fluids - normal & abnormal constituents. Semen analysis - Hyper & hypoglycemia - *Diabetes mellitus*, Histopathology: Tissue Processing - Fixing, Embedding, Microtomy, Staining, mounting, decalcifications.

UNIT - III MICROBIAL CULTURE & IMMUNOLOGICAL:

Microbial culture techniques, Bacterial & Fungal culture media & their uses, Antibiotic sensitivity test, Diagnostic test for HIV, Hepatitis B, Hepatitis C, Malaria, Tuberculosis. WIDAL, RPR, CRP, Pregnancy test, Stool examination- Identification of different ova & cysts.

UNIT - IV SEROLOGY AND LAB AUTOMATION:

Liver, Renal functions & their assessment, Jaundice, its types and their biochemical findings, Blood urea estimation, Serum uric acid, total protein, albumin, globulin, glucose, total, HDL LDL cholesterol, Triglyceride, Bilirubin total estimation, Serum SGOT, SGPT estimation, Clinical enzymology - automation of microbiology labs: merits and impediments.

UNIT - V ENDOCRINOLOGY AND BIOMEDICAL WASTES:

Hormones of the Thyroid gland- chemistry and normal physiology, Thyroid test. Hormones of the gonads- Estimation of fertility hormones: FSH, LH, Beta-hCG, Progesterone. Cancer – Estimation of cancer marker: PSA & Pap smear test for cervical cancer. Drug abuse screening. Biomedical waste management.

UNIT - VI CURRENT CONTOURS (for continuous internal assessment only):

A visit to a diagnostic laboratory and a hospital/primary health center – semester end internship for 'one day' at a hospital or a clinical laboratory – seminar classes on molecular methods of diagnosis like PCR - assignments submission on result interpretation of various diagnostic tests - Quiz classes - short seminar presentations after internship – debates on biomedical waste management – discussion of previous year question papers.

REFERENCES:

1. Dacie and Lewis, (2016). Practical Haematology, Elsevier
2. Praful Godkar, Darsan, (2014). Textbook of Medical Laboratory Technology Vol I&II, Bhalani Publishing House
3. Baker F.J. and R.E.Silverton.(1976). Introduction to Medical Laboratory Technology. Fifth Edition,
4. Mehdi SR. (2013) Essentials of Blood banking. Jaypee Brothers, Medical Publishers Pvt. Limited.
5. Rajan S. (2012) Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai.
6. Satish Gupte. (2014). The short text book of Medical Laboratory for technicians- Jaypee Brothers Pvt.Limited
7. Jayaraman J (1981). Laboratory manual in Biochemistry, New Age Int. Publishers, New Delhi
8. Sood Ramnik. (2009). Medical Laboratory Technology: Methods and Interpretations. Jaypee Brothers, Medical Publishers Pvt. Limited.
9. Ochei. J and A. Kolhatkar, (2000). Medical Laboratory science: Theory and practice, McGraw Hill Education.
10. Myers R.M, Koshi G (1982) Diagnostic procedures in medical microbiology. IELC Combodia Press.
11. Gerhardt P, Murray R.G, Wood W.A and Kreig N.R. (ed) (1994) Methods for General and Molecular Bacteriology - American Society for Microbiology, Washington D.C
12. https://www.mooc-list.com/tags/medical-diagnosis
13. https://www.mooc-list.com/tags/clinical-diagnostics
14. http://www.winthrop.org/diagnostic-technology-techniques
15. http://www.ttsglobalinitiative.com/newsletter/clinical-diagnostic-technologies- face-new-obstacles/

COURSE OUTCOMES:]

Students who undergo the course will be able to:

- Prepare various solutions required for diagnostic procedures in laboratories.
- Conduct immunological tests towards diagnosis of various clinical conditions.
- Handle histopathology-based disease diagnosis.
- Learn various serology & molecular based diagnostic tests; exposures toautomation part of diagnostic laboratories.
- Understand the management of biomedical waste and disposing mechanisms.

*****

First Year | **CORE PRACTICAL I** | **Semester I**

GENERAL MICROBIOLOGY & BIOLOGICAL MACROMOLECULES

Code: P22MBCC1P | **(Practical)** | **Credit: 3**

COURSE OBJECTIVES:

- To educate hands-on skills on the first-line experimental methods of the fundamental microbiology.
- To deepen students' understanding on the importance of lab sterility.
- To understand sterilization and decontamination procedures as to maintain agood microbiology laboratory.
- To provide a better practice on various media preparation and pure culturemethods.
- To describe assessment of microbes using microscopes after staining.

EXPERIMENTS:

1. Sterility control test
2. Principles and methods of sterilization, decontamination and laboratory fumigation, Preparation and use of glassware cleaning solutions.
3. Staining and direct microscopic observations of bacterial shape- cocci, rodsand chains; fungal spore- mycelium, yeast budding
4. Preparation of media: Liquid and Solid media, Agar deep, slant and plate and soft agar
5. Pure & axenic culture techniques - serial dilution - pour plate, spread plate, streak plate methods, decimal dilution and stab culture techniques
6. Bacterial Staining methods - simple, Gram's, acid fast, flagella, capsule and spore.
7. Fungal Staining methods - Lacto-phenol cotton blue
8. Motility of bacteria - Hanging drop and soft agar inoculation
9. Enumeration of microorganisms from soil: Bacteria, Fungi and Actinomycetes, total count (Haemocytometer)
10. Isolation and purification of cyanobacteria, actinomycetes and fungi
11. Phenol Co-efficient test.
12. Micrometry – counting & measurements of microbes

REFERENCES:

1. James G Cappuccino (2014) Microbiology – A Laboratory Manual. 10th edition, Pearson Education India
2. David R Brooke. (2007) Bergey's Manual of systematic bacteriology (Vol 1), Eastern Halz, Springer publication, US..
3. Gunasekaran P. (2008) Laboratory Manual in Microbiology, New AgeInternational Pvt. Ltd. Publishers, New Delhi.
4. Kanika Sharma. (2009) Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.

5. Keith Wilson and John Walker. (1995). Principles and Techniques of Practical Biochemistry. 4th edition. Cambridge University press, Britain.
6. Nizhny Novgorod. (2008) Laboratory manual on Biochemistry: Publishing House of Nizhny Novgorod State medical academy.
7. Rajan S and Selvi Christy R. (2015) Experiments in Microbiology. Anjana Books House, Chennai.
8. Merck (2010) Microbiology Manual 12th Edition.
9. Shawn O' Farrell and Ryan T Ranallo. (2000) Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.
10. Wilson K and Walker J. (2000). Practical biochemistry, 5th edition, Cambridge University Press, London.
11. Mahatma Gandhi-Doerenkamp Centre (MGDC) for Alternatives to Use of Animals in Life Science Education. http://www.mgdcaua.org/

COURSE OUTCOMES:

Students who undergo the course will be able to:

- Independently check the sterility of the microbiology or other laboratories.
- Carry out sterilization and decontamination of various articles.
- Determine the size of microbes.
- Isolate and preliminarily identify different microbes.
- Check whether a bacterium is motile or non- motile.

BIOLOGICAL MACROMOLECULES

COURSE OBJECTIVES:

- To understand the biological macromolecules' types and structures.
- To provide hands- on experience on analytical techniques.
- To describe the principles of analytical agents in confirmation tests.
- To teach the estimation procedure for biochemical test
- To motivate towards innovative findings in microbial molecularmechanism.

EXPERIMENTS:

1. Carbohydrate reducing sugars-Anthrone method/Benedicts method.
2. Aminoacids-Ninhydrin method
3. Protein–Lowry's method/Biuret method/ Bradford assay
4. Estimation of Cholesterol-Acetic anhydride method,
5. Estimation of lipid.
6. DNA-Diphenylamine method
7. RNA-Orcinol method
8. Determination of Phosphorous content of nucleic acids-Perchloric acidtest.
9. Pigments (Chlorophyll-Carotenoids–Phycobili Proteins)– Spectrophotometric
10. Estimation of Vit. C concentration by DCPIP method

11. Estimation of haemoglobin on Blood
12. Immobilization of cell: RBC
13. Determination of A/G ratio in serum

REFERENCES:

1. Palanivel P. 2013. Analytical Biochemistry and Seperation Techniques –A laboratory manual. Twentyfirst century publications
2. Boyer,R.2012. Biochemistry Laboratory: Modern Theory and Techniques, 2nd Edition ,Benjaminand Cummings Publishing Company Inc.
3. Wilson .K and Walker 2012, Practical Biochemistry-Principles and technicsof Biochemistry and Molecular Biology 7th edition Cambridge Press India,
4. Switzer, R.L., Garrity, L.F.1999. Experimental Biochemistry, 3rd edition,WH Freeman and Co.
5. Awasthi D, Santosh Kumar, Ashwani S and Shiv S S. 2013. Biochemistry Laboratory Manual. International E – Publication

COURSE OUTCOMES:

Upon successful completion of the course, the students can:

- Practice laboratory safety and precautionary measures.
- Understand the basic analytical instruments, principles and their calibration.
- Learn the molecules separation and filtration techniques.
- Understand the pigmentation profiles of biological materials.
- Comprehend the biochemical differences among animal, plant and microbialcells.

*****

First Year | **CORE COURSE III** | **Semester II**

MICROBIAL PHYSIOLOGY AND METABOLISM

Code: P22MBCC21 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To provide the learners a strong base of bacterial cell physiology so as to impart them with the principal knowledge of functions of bacterialorganelles.
- To describe the anabolic and catabolic sections of metabolism deeply.
- To impart the knowledge of extremophilic organisms and their merits.
- To understand metabolic processes of energy substrates.
- To teach unique physiological features like methanogenesis, bioluminescences and quorum sensing.

UNIT - I BACTERIAL CELL STRUCTURE AND FUNCTION:

Ultrastructure of and differences between Prokaryotic and Eukaryotic cells – Exopolysaccharides, cytoplasmic membrane, Capsules, pili, fimbriae, Slime layer of prokaryotes. Bacterial cell wall - Biosynthesis of peptidoglycan - outer membrane, teichoic acid. Electron carriers – artificial electron donors – inhibitors - uncouplers – energy bond – phosphorylation.

UNIT - II MICROBIAL NUTRIENTS AND GROWTH:

Common nutrient requirements, Growth factors - nutritional groups/ types - Bacterial growth - Phases of growth curve – measurement of growth – calculations of growth rate – generation time – synchronous growth – induction of synchronous growth, synchrony index – factors influencing growth – Uptake of nutrients by the cell – Facilitated diffusion – Active transport – Group translocation, Iron uptake - Pinocytosis and Phagocytosis. Survival at extreme environments – starvation – Extremophiles: adaptative mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic organisms.

UNIT - III PHOTOTROPHY AND CHEMOLITHOTROPHY:

Autotrophs - photosynthetic bacteria and green algae – heterotrophs – bacteria, fungi, myxotrophs. Photosynthetic and accessory pigments: Chlorophyll,bacteriochlorophyll, carotenoids, phycobilliproteins, fluorescence, phosphorescence, rhodopsin, Oxygenic and anoxygenic Photosynthesis– Autotrophic generation of ATP. Fixation of CO_2. – C3, C4 pathways. Chemolithotrophy – Sulphur, Iron, Hydrogen, Nitrogen oxidations. Physiology and regulation - methanogenesis, bioluminescences and quorum sensing.

UNIT - IV CARBOHYDRATE METABOLISM AND FERMENTATION:

Glycolytic pathways – Embden – Meyerhoff pathway - the pentose phosphate pathway – the Entner Douderoff pathway – the tricarboxylic acid cycle – glyoxyate cycle. Electron Transport Chain. Substrate level phosphorylation – Oxidative

phosphorylation & ATP synthesis – reverse TCA cycle – gluconeogenesis – lipid catabolism – beta oxidation. Anaerobic respiration – sulfur compounds – nitrate and carbon dioxide as electron acceptors. Homo and heterolactic acid fermentations. Fermentation by *Ruminococcus albus*

UNIT - V NITROGEN METABOLISM & BACTERIAL SPORULATION:

Biological nitrogen fixation – nitrogenase enzymes – structure and properties – '*nif*' gene – regulation – functions. Assimilation of inorganic nitrogen –nitrate, nitrite – dinitrogen –ammonia. Cell division – endospore – structure – properties – germination. Microbial sporulation and morphogenesis: Bacteria including cyanobacteria and actinobacteria, fungi and algae.

UNIT - VI CURRENT CONTOURS (for continuous internal assessment only):

Chart preparation showing bacterial cell structure and functions of each part, biochemical pathways of Phototrophy and chemolithotrophy, Carbohydrate metabolism and Fermentation, and Nitrogen metabolism & bacterial sporulation - preparation of a biofertilizer using any one nitrogen fixing organism and a locally available carrier material - Quiz classes - short seminar presentations on theprepared charts.

REFERENCES:

1. Harley JP and Klein DA. Microbiology. Latest edition, (2013). Prescott LM,. McGraw Hill, New York.
2. Byung Hong Kim & Geoffrey Michael Gadd. (2016) Microbial physiology and metabolism
3. Moat. A.G. and Foster. J.W. (2017). Microbial Physiology, John Wily sons. White J.D. Motteshead. D.W. Harrison S.J. Enivronmental system.
4. Stainier R.Y. Ingraham,J.L. Wheolis, H.H. and Painter. P,R. 1986. Microbiology.
5. Lehninger (2017) Principles of Biochemistry: International Edition
6. David White, James Drummond, and Clay Fuqua, (2011) The Physiology and Biochemistry of Prokaryotes. 4 th Edition, Oxford University Press
7. Michael M. Madigan, Kelly S. Bender, Daniel H. Buckley, W Matthew Sattley, David A. Stahl, (2017) Brock Biology of Microorganisms, 15th edition,. Published by Pearson
8. Caldwell DR. (1995) Microbial Physiology and metabolism, Wm. C. Brown Publishers, USA.
9. Rajan S and Selvichristy. (2019). Exam Oriented Biochemistry. CBS Publishers, New Delhi.
10. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2003) Microbiology.5th edition. McGraw-Hill Company, New York.
11. Pelczar Jr MJ, Chan ECS and Kreig NR. (2013) Microbiology, 5th edition. Mc. Graw Hill. Inc, New York.
12. Kenneth P. Murphy (2001) Protein Structure, Stability and Folding. Published by Humana Press Inc.
13. Salle AJ. (1996) Fundamental principles of Bacteriology, 7th edition. Tata McGraw-Hill publishing company limited, New Delhi.
14. White D. The physiology and biochemistry of Prokaryotes, Oxford University Press, Oxford, New York. 1995.
15. Robert Poole K. (2007). Advances in Microbial Physiology, Volume 53, Elsevier

Science and Technology.

16. https://www.academia.edu/35258859/Microbial_Physiology_4th_Edition_A_G_Moat_J_W_Foster_and_M_P_Spector_pdf
17. https://dl.icdst.org/pdfs/files3/0bc9d88695de86f1fbad48fe3fccffc9.pdf
18. file:///C:/Users/Admin/Downloads/microbial-trishul-sci-gu-edu-au.pdf
19. https://fccljohnson.files.wordpress.com/2012/10/kim-and-gadd-bacterial-physiology-and-metabolism-b-h-kim-g-m-gadd-cambridge-university-press-2008.pdf.

COURSE OUTCOMES:

Students who undergo the course will be able to:

- Understand the functional principles of various bacterial cell structures.
- Assimilate the mechanism of bacterial cell wall synthesis.
- Differentiate the types of energy generating mechanisms among prokaryotes. Understand the microbial adaptation on chemical-ecological processes.
- Clearly understand carbohydrate and nitrogen metabolisms.

*****

PROFESSIONAL ETHICS

First Year | **CORE COURSE IV** | **Semester II**

MEDICAL MICROBIOLOGY

Code: P22MBCC22 | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To make the students understand various attributes which make the microbes pathogenic or disease-causing, the emergence of newer pathogens with relevance to India and various routes of local or global spread.
- To learn the mechanisms of resistance of bacteria to antibiotics and role of newer vaccines in controlling infectious diseases.
- To describe the molecular diagnostic methods and automated equipmentsused for diagnosis of diseases caused by microorganisms.
- To understand the common infections and diseases of medical importance, their microbial causes and pathogenic action.
- To understand the fungal and protozoan diseases and their preventive measures

UNIT - I INTRODUCTION TO MEDICAL MICROBIOLOGY:

Significance of Microbiology in Medicine. Koch Postulates and Molecular Koch's postulates - Classification of medically important microbes - Normal microbial flora of the human body-Host bacterial interactions – Transmission, attachment, entry mechanisms, microbial pathogenicity. Virulence factors of bacteria. Quantitative measures of pathogenicity: minimal lethal dose (MLD), LD50, ID50, TCID50. Nosocomial and community acquired infections - investigation of epidemic diseases. Type three secretion system (TTSS, T3SS), Role of biofilms and quorum sensing in microbial pathogenicity.

UNIT - II MEDICAL BACTERIOLOGY:

Morphological, cultural and biochemical characteristics of and epidemiology, pathogenesis, lab diagnosis, prophylaxis and control of medically important diseases caused by*: Staphylococcus aureus, Streptococcus pyogenes, Corynebacterium diphtheriae, Clostridium tetani, Bacillus anthracis, Leptospira interrogans, Treponema pallidum, Mycobacterium tuberculosis, Escherichia coli, Vibrio cholerae, Niesserriae, Haemophilus influenza, Helicobacter pylori, Pseudomonas* and *Salmonella.* Zoonotic bacterial pathogens, Antibiotic susceptibility test: Kirby – Bauer disk diffusion method. General methods ofBacterial diagnosis.

UNIT - III MEDICAL MYCOLOGY:

Morphological and cultural characteristics of and epidemiology, mechanism of fungal pathogenesis, lab diagnosis and treatment of medically important diseases caused by*:* Superficial mycosis – *Tinea versicolor*. Cutaneous mycoses: *Microsporum, Trichophyton, Epidermophyton*. Subcutaneous mycoses: Sporotrichosis, Chromoblastomycosis, Zygomycosis. Systemic Mycoses – *Histoplasma capsulatum, Blastomyces dermatitidis, Cryptococcus neoformans, Coccidioides immitis, Paracoccidioides brasiliensis*. Opportunistic mycoses: Candidiasis, Cryptococcosis and Aspergillosis. Antifungal susceptibility testing.

UNIT - IV MEDICAL VIROLOGY:

General properties of and epidemiology, pathogenesis, lab diagnosis and treatment of medically important viral diseases - Influenza, Measles, Mumps, Rubella, monkey pox, Chicken Pox, Poliomyelitis, HIV, Rabies, Yellow fever, Dengue, Covid-19 and Japanese Encephalitis. Brief note on oncogenic viruses. Emerging viral diseases - Antiviral drugs, antiviral vaccines.

UNIT - V MEDICAL PARASITOLOGY AND EMERGENCE OF ANTIBIOTICRESISTANT PATHOGENS:

Morphology of, and pathogenesis, laboratory diagnosis and treatment of medically important protozoan diseases caused by: *Entomoeba histolytica, Giardia lamblia, Trichmonas vaginalis, Plasmodium vivax, Leishmania donovani, Taenia solium, Ascaris lumbricoides, Ancyclostoma duodenale* and *Wuchereria bancrofti*. Diagnosis of parasitic infection using clinical samples. Role of Nucleic acid probes in diagnostic microbiology.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Survey of dermatophytic infections in student's communities. Analysis of worm infections in animal and human stool samples. Daily news and research paper collection and recording of recent outbreak of bacterial, fungal, viral, protozoan diseases. Universal Immunization Programme (UIP) and IAP. Making awareness and celebration of world AIDS day, World TB, cancer Day, Pulse polio immunization day etc., awareness programme on personal hygiene and vaccination.

REFERENCES:

1. Aejaz Iqbal and Zafar Nowshad. 2020. Medical Microbiology: Millennium Edition. Notion Press
2. Jawetz, Melnick, &Adelberg's. 2016. Medical Microbiology by Carroll KC, Hobdon JA, Miller S, Morse SA, Mietzner TA. 27th edition. Lange Publication.
3. Wilson BA, Salyers AA, Whitt DD, Winkler ME. 2011. Bacterial Pathogenesis: A molecular approach. 3rd edition. American Society for Microbiology Press, Washington, DC USA.
4. Locht C, Simonet M, Caister. 2012. Bacterial Pathogenesis: Molecular and Cellular Mechanisms by Academic Press,
5. Persing DH, Tenover FC, Hayden R, Leven M, Miller MB, Nolte FS, Tang YW, Belkum AAV. 2016. Molecular Microbiology: Diagnostic Principles and Practice, 3rd edition. Washington, American Society for Microbiology Press.
6. David Greenwood. Mike Barer, Richard Slack and Will Irving. 2012. Medical Microbiology. A Guide to Microbial Infections: Pathogenesis, immunity, Laboratory investigation and Control, 18th edition, Churchill Livingstone.
7. Parija SC. 2004. Text book of Medical Parasitology, 1st Ed. All India publishers and Distributors Regd. 920. Poonamallee High Road, Madras.
8. Rajan S and Selvichristy J. 2018. Essentials of Microbiology, CBS Publishers, New Delhi.

9. Prescott, Harley and Klein's. 2007. Microbiology, 7th edition McGraw Hill Medical Publication division.
10. Rajan S. 2007. Medical Microbiology, MJP Publishers Chennai. 2007.
11. Topley and Wilsons. Principles of Bacteriology, Virology and Immunology. Edward Arnold, London. 1995.
12. Kenneth j. Ryan, C. George Ray. 2014. Sherris Medical Microbiology, 4th edition. McGraw-Hill Medical Publishing Division. New York.
13. https://www.aspergillus.org.uk/mycology-courses?page=5
14. https://www.mooc-list.com/tags/human-parasitology
15. https://www.mooc-list.com/tags/tropical-parasitology

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able:

- Understand classical and molecular determinants of disease-causing microbes.
- Describe the characteristics of newer disease-causing bacteria and viruses
- Operate and critique the various molecular tools available to work on the molecular epidemiology of disease-causing microorganisms
- Evaluate mechanisms underlying resistance of bacteria to antibiotics, spread of resistance and the use of newer vaccines to control infectious diseases
- Understand how the infectious diseases are diagnosed using newer diagnostic tools and what automated equipments are available for use in diagnostic microbiology laboratories

*****

First Year | **CORE PRACTICAL II** | **Semester II**

MICROBIAL PHYSIOLOGY AND METABOLISM & MEDICAL MICROBIOLOGY

Code: P22MBCC2P | **(Practical)** | **Credit: 3**

MICROBIAL PHYSIOLOGY AND

METABOLISMCOURSE OBJECTIVES:

- To provide hands-on practice on microbial physiology and metabolism-based experiments so as to enlighten the learners on the fundamental principles of the course.
- To impart skills required for estimating protein & nucleic acids.
- To study the microbial growth influencing factors.
- To understand the colorimetric estimating principles of biological molecules.
- To practice the students on the cultivation methods of anaerobic microbes

EXPERIMENTS:

1. Colorimetric estimation of Protein (Biuret method/Lowry et. al. method)
2. Colorimetric estimation of amino acid (Ninhydrin method)
3. Colorimetric estimation of DNA (Diphenylamine method), RNA (Orcinol method)
4. Carbohydrate fermentation tests: Glucose, Lactose, Sucrose and Mannitol.
5. Biochemical test to identify bacterial isolates - IMViC test, Oxidase test, Catalase test, Urease test, Hydrogen sulphide, coagulase, TSI test, Nitratereduction test
6. Enzymatic hydrolysis of Starch, Gelatin, Casein & lipid.
7. Bacterial Growth curve: Cell count/viable count/absorbance (total count)
8. Measurement of Microbial growth –Turbidity methods – Determination of Generation time, Neubaur Counting chamber.
9. Studying the influence of osmotic pressure, pH, temperature, moisture, radiations, different chemicals, carbon and nitrogen sources.
10. Anaerobic cultivation- candle jar, gas pack method. Wrights tube – Mclntoshand Fildes' jar

REFERENCES:

1. Aneja KR (2017). Experiments in Microbiology, Plant pathology and Biotechnology. 5th Edition, New Age International P ublishers,Chennai.
2. Dubey RC and Maheswari DK (2012). Practical Microbiology 3rd Edition, S. Chand & Company Ltd., New Delhi.
3. Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains and Buffers. Panima Publishing Corporation,New Delhi.
4. Rajan S and Selvi Christy R.2018. Experimental Procedures in Life Sciences. CBS Publishers, New delhii
5. Sundararaj T. Microbiology laboratory manual. Revised and published by AswathySundararaj.No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
6. https://www.frontiersin.org/books/Microbial_Physiology_and_Metabolism
7. https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867

COURSE OUTCOMES:

Students who undergo the course will be able to:

- Independently estimate concentrations of amino acid, protein or carbohydrate of a sample.
- Test & determine sugar fermenting/ utilizing abilities of different bacterial species.
- Determine growth stages of a test bacterial species.
- Evaluate the impact of various external components which would affector effect microbial growth.
- Cultivate anaerobic bacteria and thus will be able to grow such organisms.

MEDICAL MICROBIOLOGY

COURSE OBJECTIVES:

- To provide hands- on training as to identify bacteria, fungi, protozoa andhelminths from clinical specimens.
- To provide the knowledge of clinical specimens' collection and methods ofscrutinization.
- To educate diagnostic and public health microbiology and to expose to themodern techniques employed to identify pathogens in diagnostic laboratories.
- To train on the usage of various instruments.
- To ensure a familiarity with all conventional methods of microbial identification.

EXPERIMENTS:

1. Collection, coding and transport of clinical specimens for microbiological examinations.
2. Isolation and identification of *Streptococcus pyogenes* from throat swab.
3. Isolation and identification of *Staphylococcus aureus* from pus.
4. Isolation and identification *of Klebsiella pneumoniae* from sputum.
5. Isolation and identification of *Salmonella* and *Shigella* from stool.
6. Isolation and identification of *E. coli* from urine.
7. Antibiotic susceptibility test – Disc diffusion method (Kirby –Bauer).
8. Determination of MIC of any one antibiotic against any one bacterial species.
9. Laboratory diagnosis of dermatophytic diseases- Wood lamp examination and culture and identification of dermatophytes – KOH Mount, LPCB staining and other related tests.
10. Identification of *Candida albicans* – Microscopy (LPCB stain), culturing, germ tube technique.
11. Identification of *Cryptococcus neoformans* – Negative staining (India Ink), culturing.
12. Laboratory diagnosis of intestinal protozoan and helminthic infections – Direct examination and concentration of stool – Saline and Iodine wet mount to detect cysts, trophozoites and eggs.

13. Examination of blood for protozoa and helminths (malaria, filaria) by wet mount, thin and thick stained smears (Giemsa, Wrights or Leishman's staining)

Note: Identification of bacteria should be done using microscopic methods, culturing on selective cum differential media and biochemical tests (Indole, Methyl Red, Voges Proskauer, Citrate utilization, TSI, Urease, Nitrate, Catalase, Oxidase Carbohydrate fermentation tests, Sensitivity test for gram positive organisms, Hippurate hydrolysis, Coagulase test, Salt tolerance test, Bile solubility etc.,

REFERENCES:

1. Monica Cheesbrough. 2006. District Laboratory Practice in Tropical Countries - Part I and II 2nd edition. Cambridge University Press, New Delhi.
2. Rajan S. 2012. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai.
3. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. 2007. Bailey andScott's Diagnostic Microbiology, Mosby Elsevier. 12th edition.
4. Mackie and McCartney. 2006. Practical Medical Microbiology, South Asia Edition. 14th edition.
5. Rajan S and Selvi Christy R. 2018. Experimental Procedures in LifeSciences. CBS Publishers, New Delhi.

COURSE OUTCOMES:

After completion of this course the student can:

- Describe the collection and transportation of clinical specimens anddiagnosis ofvarious important infections.
- Learn all the identification methods of bacterial pathogens.
- Understand the laboratory diagnosis of all system-based diseases.
- Learn the diagnostic techniques of fungal and parasitic diseases.
- Understand all biochemical tests and the process of antibiotic sensitivityassay.

*****

PROFESSIONAL ETHICS

First Year | **CORE CHOICE COURSE II** | **Semester II**

PHARMACEUTICAL MICROBIOLOGY

Code: P22MBCC2B | **(Theory)** | **Credit: 5**

COURSE OBJECTIVES:

- To provide the basics of antimicrobials with special reference to antibiotics andantifungals.
- To present antimicrobials' assessment procedures along with sterilization, sterilitytesting of various pharmaceutical products.
- To impart production and quality control of prophylactic compounds.
- To teach methods of controlling pharma products microbial contamination and roleofcell culture in pharmacy.
- To bring an awareness about antimicrobial resistance.

UNIT - I ANTIMICROBIALS, TYPES AND ACTION MECHANISMS:

Antibiotics-Natural and synthetic - antifungal agents, Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolinone antimicrobial agents. Chemical disinfectants, antiseptics and preservatives - Laboratory evaluation of antimicrobial agents - Mechanism of action of antibiotics and synthetic anti-infective agents - Clinical uses of antimicrobial drugs.

UNIT - II DRUG DELIVERY AND DELIVERY SYSTEMS:

Molecular principles of drug targeting. Drug delivery system in gene therapy- Bacterial resistance to antibiotics. Mode of action of non-antibiotic antimicrobial agents. Delivery systems – formulations, targeted drug delivery, Sustained release of drugs. Drug distribution in body, bio-availability and pharmacokinetic studies.

UNIT - III PHARMA PRODUCTS, PROCEDURE, NOVEL VACCINE TECHNOLOGY

Microbial contamination and spoilage of pharmaceutical products – infection risk and contamination control - and their sterilization. Manufacturing procedures, in-processcontrol of pharmaceuticals. Chemical disinfectants, antiseptics and preservatives- Other pharmaceuticals produced by microbial fermentations. New vaccine technology, DNA, synthetic peptide, multivalent subunit vaccines.

UNIT - IV ANTIMICROBIAL BIOASSAY AND ANTIMICROBIAL TESTING:

Bioassay of antibacterial agents in liquid media and in agar media using CLSI (NCCLS) guidelines - Factors affecting bioassay, Laboratory methods to assess activity of antimicrobial combinations (antagonism, synergism and additive effect). Methodologies for testing of antimycobacterial, antifungal, antiparasitic and antiviral drugs *(in vivo* and *in vitro* infectivity models). Application of cell cultures in pharmaceutical industry and research.

UNIT - V QUALITY CONTROL AND CLINICAL STUDIES:

Government regulatory practices and policies, Sterilization control and sterility testing- Chemical and biological indicators. Regulatory authorities for introduction of medicines in market – Role of Food and Drug Administration, FDA guidelines for drugs / biologicals, Validation of GMP, GLP & GCP. Clinical studies: Phase I, phase II, phase III and phase IV of clinical trials –Objectives, Conduct of trials, Outcome of trials.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

A visit to a pharmaceutical industry / pharmacy institution - assignments submission on various topics of the pharmaceutical microbiology - Quiz classes - short seminarpresentations after a visit – debates on GMPs, GLPs and clinical trials – discussion of previous year question papers.

REFERENCES:

1. Vyas SP and Dixit VK (2010). Pharmaceutical Biotechnology, CBS Publishers & Distributors, New Delhi.
2. Joseph D Nally (2016). Good Manufacturing Practices for Pharmaceuticals, CRCPress, 6thedn.
3. Stephen P Denyer, Norman A Hodges, Sean P Gorman, Brendan F Gilmore (2011). Hugo and Russell's Pharmaceutical Microbiology, John Wiley and Sons, 8thedn.
4. Chakrabarty AM, Omenn and Gilbert S (1990). Biopharmaceuticals in Transition: Advances in Applied Biotechnology, Portfolio publisher, Vol. 10.
5. Hill RG (2012). Drug Discovery and Development-E-Book: Technology in Transition, Elsevier Health Sciences.
6. Tille P (2015). Bailey & Scott's Diagnostic Microbiology-E-Book, Elsevier Health Sciences.
7. Kim SK (2012). Marine pharmacognosy: Trends and applications, CRC Press.
8. Denyer S, Russell A (2004). Non-Antibiotic Antibacterial Agents: Mode of Action and Resistance, Hugo and Russell's: Pharmaceutical Microbiology, 7thEdn, 306-22.
9. Denyer SP, Hodges NA and Gorman SP eds., (2008). Hugo and Russell's pharmaceutical microbiology, John Wiley & Sons.
10. Zhang R *et al*., (2018). Mxra8 is a receptor for multiple arthritogenic alphaviruses, *Nature* DOI: 10.1038/s41586-018-0121-3
11. https://medicine.wustl.edu/news/why-chikungunya-other-arthritis-causing-viruses-target-the-joints/
12. https://www.news-medical.net/news/20180511/Addressing-Antimicrobial-Resistance-Through-Industry.aspx
13. https://www.eurekalert.org/pub_releases/2018-05/uon-nlb050918.php
14. https://pubs.acs.org/stoken/presspac/presspac/full/10.1021/acsami.8b04433
15. https://www.cell.com/cell-host-microbe/fulltext/S1931-3128(18)30198-7

COURSE OUTCOMES:

Students who undergo the course will be able to:

- Know how to evaluate a new drug for its antimicrobial property in thelaboratory
- Perform standard sterility testing procedures of pharmaceutical products.
- Prepare and control the quality of pharmaceutical products representing various categories.
- Understand the contaminants & spoilage of pharmaceutical products & their prevention.
- Recognize the importance of good manufacturing, laboratory & clinical practicesaswell as the role of animal cell culture in pharmacy industries.

*****

First Year **NON-MAJOR ELECTIVE COURSE I** **Semester: II**

FITNESS NUTRITION

Code: P22FSNME1 **(Theory)** **Credits: 2**

COURSE OBJECTIVES:

- To enable the students to Acquire knowledge on sports nutrition.
- Understand the various diets for sportspersons.
- Gain insight into the vital role of dietary management to enhance sports performance

UNIT - I TYPES OF FITNESS:

Definition of fitness, health and related terms, Approaches for keeping fit, Alternative forms of fitness- Yoga, Pilates, Kickboxing, Boot camps, components of physical fitness.

UNIT – II ASSESSMENT OF BODY COMPOSITION:

Measurement of body composition, methods of measuring energy expenditure, Somato typing, dietary assessment, biochemical assessment, clinical assessment, body composition and sports performance – Assessment of Aerobic Capacity, Maximal oxygen uptake, Muscle Endurance.

UNIT – III NUTRITIONAL PROBLEMS:

The female athlete triad, eating disorders, amenorrhea, osteoporosis, travelling athletes, diabetic athletes, Gastro Intestinal stress and athletes, cramps and stitches.

UNIT – IV NUTRITIONAL REQUIREMENTS:

Importance of Nutrition, Role of macronutrient on exercise and sports performance, Role of micronutrient on exercise and sports performance, Hydration Assessment and recommendation.

UNIT – V PRINCIPLES OF DIET PLANNING:

Principles of diet planning for and different exercise/sports conditions, Pre Game meals, Post Game meals, During meals, On-season and Off-season meals, Ergogenic aids, Nutritional Standards – Dietary reference Intake, Probiotics, Exercise and weight management

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Browse for the latest updates on fitness nutrition. Measure body composition of any two Sports students.

REFERENCES:

1. B.Srilakshmi et al, (2017). Exercise Physiology fitness and sports nutrition, Publishers New Age International
2. Michael.J,Gibney Marinos Elia, Olle Ljungqvist, Rebecca J Stratton Dr,, Susan a Lanham-New, Dame Sally C. Davies (2015).Clinical Nutrition. .(2nd ed) John Wiley & Son
3. Kathleen Mahan (2008).Krause Food & Nutrition Therapy. Sauders Elsevier. Canada.
4. Jose Antonio et al (2009). Essentials of sports Nutrition and Supplements. Humana Press.
5. Wener W.K.Hoeger (2012). Lifetime Physical Fitness and Wellness :A Personalized, Cengage Learning, United States
6. Jerrold S.Greenberg (2013) Empowering Health Decisions, Jones & Barlett Publishers, Burlington.
7. Subrhangini A Joshi (2014) Nutrition and Dietetics with Indian case Studies,McGraw Hill Education (India) Private Limited
8. Asker jeukendrup, Michaelgleson,(2019).Sports Nutrition. Human Kinetics. United States.
9. http://www.ignouhelp.in/ignou-mfn-06-study-material/
10. http://samples.jbpub.com/9781284036695/9781449690045_ch01_pass03.pdf
11. https://www.militarynewbie.com/wp-content/uploads/2013/11/Performance-Through-Nutrition-and-Exercise.pdf
12. https://www.pdfdrive.com/nutrition-in-sport-e9596094.html
13. https://www.nutrition.gov/topics/basic-nutrition/eating-exercise-and-sports

COURSE OUTCOMES:

- List different type of fitness activities
- Explain functional and nutritional assessment techniques among individual.
- Relate nutritional problems associated with sports person.
- Determine the nutritional requirements of athletes.
- Assess the dietary requirements for pre and post events

*****

First Year | **ELECTIVE COURSE II** | **Semester II**

MICROBIAL BIOTECHNOLOGY

Code: P22MBE2B | **(Theory)** | **Credit: 4**

COURSE OBJECTIVES:

- This course summarizes the role of microorganisms and their scope in the diverse processes of microbial biotechnology.
- To transpire a knowledge about production of pharmaceuticals.
- To portray about microbial biopolymers.
- To impart the potential applications of microbial and molecular biotechnology inmedicine, agriculture and various other current industrial processes.
- Enable the students to become familiar with potential application of PGPR

UNIT – I MICROBIAL PRODUCTION OF THERAPEUTIC AGENTS AND VACCINES:

History – Microbial vs molecular biotechnology and Commercialization – concerns and consequences - Pharmaceuticals - interferons and growth hormones, enzymes: DNase I and alginate lyase, Monoclonal antibodies - HIV therapeutic agents. Subunit vaccines: Herpes simplex virus, Foot and mouth disease virus, TB, Peptide vaccines – genetic immunization – vector vaccines.

UNIT – II MICROBIAL PRODUCTION OF COMMERCIAL PRODUCTS:

Microbial production of restriction endonucleases: *Pst*I, Dye: Indigo, Antibiotics: Synthesis of Novel antibiotics. Biopolymers: Xanthan gum and PHA. Microbial production of alcohol, lactic acid, streptomycin, L- glutamic acid, lipase and riboflavin.

UNIT – III PRODUCTION OF PGPR, BIOFERTILIZERS AND BIOCONTROL AGENTS:

Plant growth promoting bacteria (PGPR) – genetic engineering of nitrogenase gene cluster, hydrogenase and Nodulation. Mass cultivation of microbial biofertilizers: Cyanobacteria (*Sprirulina*), *Azolla* and other nitrogen fixers (*Rhizobia, Azospirillum, Azotobacter* and AMF) Biocontrol of pathogens: Siderophores, antibiotics and enzymes. Release of genetically engineered organisms - Ice nucleation and anti-freeze proteins. Microbial herbicides. Microbial insecticides (*Pseudomonas* and *Bacillus thrungiensis*): - genetic engineering of Bt strains – Bt cotton – viral insecticides – entomopathogenic fungi.

UNIT – IV PLANT AND ALGAL BIOTECHNOLOGY AND BIOREMEDIATION:

Ti plasmid derived vector systems - Development of insect, virus and herbicide resistant plants, stress and senescence tolerant plants, modification of flower nutritional content, sweetening by genetic engineering. Plant as bioreactors. Production of food, colourant and fuel from microalgae.

UNIT – V ANIMAL BIOTECHNOLOGY AND IPR:

Transgenic animals: methods of creating transgenic mice, cattle and sheep. Human gene therapy – *in vivo* and *ex vivo* gene therapy. Molecular diagnostics for genetic diseases. Biosafety and Bioethics. Intellectual Property Rights: Patents - copy right and neighboring rights, patents for invention, Drafting and filing a patent application, exploitation of patented invention. Indian patent laws.

UNIT – VI CURRENT CONTOURS (for continuous internal assessment only);

Group discussion, quiz and seminar on recent advances in production PGPR,biofertilizers, recombinant bioinoculant for sustainable agriculture, biofuel.

REFERENCES:

1. GIick, B.R., Pasternak, J.J. 2003. Molecular Biotechnology – Principles and Applications of Recombinant DNA, ASM Press, Washington DC.
2. Winnacker, E.L. 2003. From Genes to Clones – Introduction to Gene Technology. First Indian reprint, PANIAMA publishing Co-operation, New Delhi. 2003.
3. Elsa Cooper. 2009. Microbial biotechnology. Syrawood Publishing House.
4. Padma Singh. 2009. Recent Trends in Microbial Biotechnology, CBS Publishers and Distributors.
5. Sandeep Gupta., Pawan Kumar B. 2016. Bioremediation and Microbial Biotechnology. Discovery Publishing House.
6. Swarna Latha, C. D., Bhaskara Rao, D. 2007. Microbial Biotechnology. Discovery Publishing House.
7. Ratul Saikia. 2008. Microbial Biotechnology. New India Publishing Agency.
8. Brown, T.A. 2001. Gene cloning and DNA analysis introduction,4th edition, Blackwell Science Ltd, London.
9. Raledge, C., Kristiansen, B. 2001. Basic Biotechnology, 2nd edition, Cambridge University Press.
10. Puvanakrishnan, R., Sivasubramanian, S., Hemalatha, T. 2021. Microbial Techology, 1st edition. MJP publishers.
11. Borowitzka, M.A. Borowitzka, L.J. 1989. Microalgal Biotechnology, Cambridge University Press.
12. Glazer, A.N., Nikaido, H. 1994. Microbial Biotechnology – Fundamentals of Applied Microbiology, WH Freeman and Company, New York.
13. https://www.biotechnologynotes.com/industrial-biotechnology/anaerobic-fermentations/production-process-of-ethyl-alcohol-production-and-applications-anaerobic-fermentations/13723
14. https://archive.nptel.ac.in/courses/102/105/102105058/
15. https://www.biologydiscussion.com/biotechnology/microbial-polysaccharides-application-production-and-features/10412

COURSE OUTCOMES:

Subsequent to accomplishment of this course, the students would be able to:

- Receive a fundamental knowledge on therapeutic agents and vaccines
- Understand the microbial production of commercial products
- Acquire idea about the role of PGPR, biofertilizers and biocontrol agents
- Carry a knowledge on plant and algal biotechnology and bioremediation
- Impart ideas on animal biotechnology and IPR

*****

PROFESSIONAL ETHICS

Second Year **CORE COURSE V** **Semester III**

MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Code : P22MBCC31 **(Theory)** **Credits : 5**

COURSE OBJECTIVES:

In addition to the most essential fundamentals of the subject, the paper aims to

- Impart the current updated knowledge on molecular genetics of prokaryotes.
- Understand the Genetic replication and repair mechanisms
- Learn about gene transfer mechanisms and their importance in natural evolution
- Provide the required fundamental details on prokaryotic and eukaryotic molecular genetics.
- Explain the processes behind mutations and other genetic changes, identify and distinguish genetic regulatory mechanisms at different levels

UNIT – I GENETIC MATERIAL, DNA REPLICATION AND REPAIR:

Identification of genetic material (Griffith, Avery and Hershey and Chase experiments). Organization of genetic material: Bacteria – Eukaryotes: nucleus and nucleosomes, lamp brush and giant chromosomes. DNA replication - Meselson – Stahl experiment, Molecular mechanisms of DNA Replication – bidirectional and rolling circle replication. Differences between prokaryotic and eukaryotic replication. Pi X 174 replication. Plasmids – types, structure and replication. Inhibitors of DNA replication - DNA repair – mechanism of excision repair, SOS repair and mismatch repair.

UNIT – II TRANSCRIPTION AND TRANSLATION:

Process of transcription – initiation, elongation – termination. Synthesis of mRNA in prokaryotes and eukaryotes. RNA splicing. Synthesis of rRNA and tRNA. RNA processing – capping and polyadenylation. Inhibitors of transcription. Genetic code, process of translation – initiation, elongation and termination. Signal sequences and protein transport. Inhibitors of translation.

UNIT – III REGULATION OF GENE EXPRESSION:

Organization of Genes in Prokaryotes and Eukaryotes - Introduction - Operon concept, lac, trp, arabinose operons, promoters and repressors. Regulation of gene expression – Transcriptional control – promoters, terminators, attenuators and anti-terminators; Induction and repression; The lac operon – catabolite repression; trp operon, two component regulatory system. Translational control – ribosome binding, codon usage, antisense RNA; post-transcriptional gene silencing – RNAi.

UNIT – IV GENE TRANSFER AND GENETIC RECOMBINATION MECHANISMS:

Transformation – competence cells, regulation, general process; Transduction – general and specialized; Conjugation – Discovery, mechanism of F+ v/s F-, Hfr+ v/s F-, F' v/s F-, triparental mating, self-transmissible and mobilizable plasmids, pili. Linkage and genetic maps – genetic mapping of T4 phage. C- value paradox. Hardy Weinberg Equilibrium.

UNIT - V MUTATION AND TRANSPOSABLE ELEMENTS:

Types and molecular basis of mutation– Agents of mutation - Importance of mutations in evolution of species. Discovery of insertion sequences, complex and compound transposons – T10, T5, and retroposon – Nomenclature- Insertion sequences – Mechanism – Transposons of E. coli, Bacteriophage and Yeast. Isolation, analysis and detection methods of Mutants. Uses of Mutants. Importance of transposable elements in horizontal transfer of genes and evolution. Mobile genetic Elements – IS elements.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only):

Discuss gene-therapy workflow from production to quality control - Quiz related to Covid 19 and its mutations and genetic structure-Round table chat section on Molecular computation strategy for classifying complex gene expression- splice Detector- Nanobot- motifs inside human cells, literature seminar on Genome editing technique in embryo- Open talk on - Biomedical tattoo, Disorder due to Mutation to the FGFR2 gene.

REFERENCES:

1. Friedberg EC, Walker GC, Siede W. DNA repair and mutagenesis. ASM press. 2005.

2. James D Watson, Tania A Baker, Stephen P Bell and Alexander Gann. Molecular Biology of the Gene, 5th edition. 2008.

3. Antony JF, Griffiths, Gilbert WM, Lewontin RC and Miller JH. Modern Genetic Analysis, Integrating Genes and Genomes, 2nd edition, WH. 2002.

4. Ajoy Paul. Text Book of Cell and Molecular Biology, Books and Allied (P) Ltd. Kolkata. 2007.

5. Gardner EJ, Simmons MJ, Snustad DP. Principles of Genetics. 8th edition. John Wiley and sons. 2008.

6. George M Malacinski. Freifelder's Essentials of Molecular Biology. 4th edition. Narosa Publishing House. 2008.

7. Stanly R Maloy, John E Cronan and David Freifelder Jr. Microbial Genetics. Narosa publishing house, New Delhi. 2nd edition. 2006.

8. Channarayappa A. Cell Biology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2010.

9. Channarayappa A. Molecular Biology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2010.

10. http://www.dailymail.co.uk/sciencetech/article-4884760/DNA-nanobot- delivermedicine-human-bloodstream.htm 11. https://cen.acs.org/biological-chemistry/genomics/DNAmotifs-found-humancells/96/i1

COURSE OUTCOMES:

After the successful completion of this course, the students would be able to:

- Explain the processes behind mutations and other gene transfer mechanism.
- Understand genetic regulatory mechanisms at different aspect.
- Describe mechanisms of transcription, translation and gene expression in detail.
- Investigate interesting biological problems with genetic relevance.
- Evaluate the current topics of microbial genetics and related fields.

PROFESSIONAL ETHICS

Second Year **CORE COURSE VI** **Semester III**

ENVIRONMENT AND AGRICULTURAL MICROBIOLOGY

Code : P22MBCC32 **(Theory)** **Credits : 5**

COURSE OBJECTIVES:

- This course aims to communicate the students with basic principles of microbiology and their applications to environment and agriculture.
- To explore the field of environmental microbiology by educating about microbes of soil, water and air.
- To prepare as to redress pressing environmental challenges by developing a fundamental understanding of the microbial communities and processes in natural and built-in environments.
- To study pathogens of drinking water
- To provide an in-depth exploration of the diverse role of microbes and microbial communities in each sector.

UNIT – I AEROMICROBIOLOGY:

Microbiology of air - Composition of air, Number and types of microorganisms in air. Distribution and sources of air borne organisms - Droplet and Droplet nuclei, Aerosol. Airborne diseases in Plants, animals and human beings. Methods for assessment of air borne microbes. Air sanitation - Physical and chemical methods.

UNIT – II MICROBIOLOGY OF WATER:

Fresh water and marine Environment - Different kinds of water body, Water pollutants, Physico-chemical properties of water. Aquatic microbiology - Sources of microorganisms in water, Microbial assessment of water. Aquatic biota in lake, ponds, river, estuary, mangrove and sea. Extremophiles –Thermophiles, mesophiles, psychrophiles, Deep Sea, Desert, Acidophilic, Alkalophilic and Halophilic microorganisms. Impact of environmental factors on the aquatic biota.

UNIT – III MANAGEMENT OF LIQUID AND SOLID WASTES:

Classification of wastes. Waste treatment - Types and characterization of liquid and solid wastes. Treatment of liquid wastes - Primary, secondary (anaerobic and aerobic) - trickling, activated sludge, oxidation pond, oxidation ditch-tertiary and disinfection. Treatment of solid wastes - composting, vermiform composting, silage, pyrolysis and saccharifications. Xenobiotic compounds and their degradation - Crude oil, hydrocarbons, pesticides and heavy metals. Bioleaching of copper and uranium. Biodegradation of natural substances - Cellulose, xylan, hemicellulose, starch, fructose, mannan, pectin and lignin.

UNIT – IV MICROBIOLOGY OF SOIL:

Soil microbiology: Distribution of microorganisms in soil, Factors influencing the soil microflora, Biogeochemical cycles: Carbon, Nitrogen, Phosphorus and Sulfur, Interactions among microorganisms: Mutualism, commensalism, ammensalism, synergism, parasitism, predation and competition. Interaction of microbes with plants: Rhizosphere, phyllosphere, mycorrhizae. Nitrogen fixation: Symbiotic and asymbiotic. Soil reclamation.

UNIT – V PLANT PATHOGENS AND ITS CONTROL:

Introduction to plant pathology - Bacterial, viral and fungal plant pathogens. Morphological, physiological changes with reference to disease establishment in plants. Role of insect Entomopathogenic nematodes, viruses, bacteria, fungi and protozoa in biocontrol and their mode of action. Plant protection-phenolics – phytoalexins and related compounds. Disadvantages of chemical pesticides. Microbial pesticides- types, mechanisms, advantages and limitations. Brief conception of Integrated Pest Management (IPM), Integrated Pest and Disease Management (IDPM).

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Assignment shall be given based on the syllabus and seminar shall be given to students related to their assignment topics individually. A project shall be assigned in the topic of leguminous plants submission. Mini project in various recent research topics related to the subject shall also be given.

REFERENCES:

1. Borkar, S.G., 2015. Microbes as Bio-fertilizers and their Production Technology (Woodhead Publishing India in Agriculture), WPI Publishing, ISBN: 9380308574.

2. Subba Rao, N.S., 1995. Soil Microorganisms and plant growth, Oxford and IBH, New york.

3. Totawat, K.L., Somani, L.L., Sharma, R.A., Maloo, S.R., 2004. Biofertilizer Technology, Agrotech Publishing Academy. Udaipur, Rajasthan.

4. Subba Rao, N.S., 1995. Biofertilizer in agriculture and forestry, Oxford and IBH, New york.

5. Christon J Hurst, 2002. Manual of Environmental Microbiology. 2nd edition. American Society for Microbiology, Washington.

6. Clescri, L.S., Greenberg, A.E., Eaton, A.D., 1998. Standard Methods for Examination of Water and Waste Water, 20th Edition, American Public Health Association.

7. Dirk, J. Elasas, V., Trevors, J.T, Wellington, E.M.H., 1997. Modern Soil Microbiology, Marcel Dekker INC, New York, Hong Kong.

8. Duncan Mara, Nigel Horen, 2003. The Handbook of water and waste water Microbiology. Academic press-An imprint of Elsevier.

9. Gareth M. Evans, Judith C Furlong, 2003. Environmental Biotechnology-Theory and Application, John Wiley and sons Ltd.

10. http://ssu.ac.ir/cms/fileadmin/user_upload/Daneshkadaha/dbehdasht/behdasht_imani/book/Microbiology_Handbook_Dairy_Products.pdf

11. http://www6.zetatalk.com/docs/Soil/Principles_Of_Soil_Microbiology_Waksman_1927.pdf

12. http://www.textbooksonline.tn.nic.in/books/11/std11-microbio-em.pdf

13. http://site.iugaza.edu.ps/tbashiti/files/2010/02/Environmental_Microbiology.pdf

14. https://www.kobo.com/us/en/ebook/microbial-ecology-2

15. https://www.pdfdrive.com/principles-and-applications-of-soil-microbiologyd8264286.html

COURSE OUTCOMES:

After the successful completion of this course, the students would be able to:

- Know about the significance of the microbes in atmosphere and water.
- Get in-depth information about the harmful effects and beneficial role of microbes in each sector.
- Acquire in depth knowledge on water and waste water treatment to tackle the current environmental problems.
- Provide meticulous thoughts on the task of microbes in waste water treatment and solid waste management.
- Get in-depth information about exploitation of natural wastes by producing bioorganic fertilizers.

PROFESSIONAL ETHICS

Second Year **CORE CHOICE COURSE III** **Semester III**

BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS

Code : P22MBCC3B **(Theory)** **Credits : 5**

COURSE OBJECTIVES:

- To educate the ethical practices appropriate to the discipline at all times.
- To gain knowledge about Hippocratic tradition.
- To create awareness on human embryonic development.
- To adopt safe working practices relevant to the bioindustries & field of research.
- To educate the students to acquire knowledge about IPR.

UNIT – I BIOETHICS:

Definition - Basic human values such as the rights to life and health - The use of nature, Different views of Nature, Dynamic Nature, Interfering with Nature, Integrity of Species; Reducing Genetic Diversity; Biological Warfare; General Ethical Concerns for recombinant research.

UNIT – II HISTORY OF MEDICAL ETHICS:

The Hippocratic tradition: A Profession, Philanthropy, Do no harm. Adoption to the Oath by Western Medicine - Retaining the Hippocratic Oath – modern medical code of ethics – essential features of a good physician.

UNIT – III STATUS OF HUMAN EMBRYO:

Human Embryonic Development; Ethics through Embryo Development: Fertilization, The Fetus and feeling pain; Scientific Research on Human Embryos and its Experimental goals - Ethical issues in Embryo Research.

UNIT – IV ANIMAL RIGHTS:

Making New Strains of Animal: Ethical limits and regulations of Animal use: Religious views of Animal status. Human Gene Therapy: Ethical issues in Gene Therapy: Efficiency of treatment; Safety of Transferred Genes; Human rights, Ethical guidelines for genetically modified foods.

UNIT – V INTELLECTUAL PROPERTY RIGHTS:

Definition, types, tools – Patenting; Trademark; Trade secret; Copyrights; related rights; Geographical Indications; Industrial Designs. TRIPS. National (IPO) and International Agencies (WTO, WIPO) involved in IPR and Patenting. NABL accreditation.

UNIT – VI CURRENT CONTOURS (for continuous internal assessment only):

Current amendments in ethical issues regarding human embryo research, human gene therapy, copy right, patents may discuss in groups, conducting quiz and seminar to make the students to become familiar in biosafety and bioethics.

REFERENCES:

1. Nancy, S. J, Albert, R.J., Robert A. Pearlman. 2011. Bioethics: An Introduction to history, methods and practice. Jones and Barlett Publishers.

2. Sibi, G. 2020. Intellectual Property rights, bioethics, biosafety and entrepreneurship in biotechnology, 1stedition. IK International Publishing House Pvt. Ltd.

3. Tom, L.B., Childress, F. 2013. Principles of biomedical ethics, 5th edition, Oxford University Press, USA.

4. Vaughan Manomy. 2009. Animal Experimentation: A guide to the issues, 2nd edition, Cambridge university press.

5. Lewis Vaughn 2013. Bioethics: Principles, Issues and Cases, Oxford University Press, USA.

6. Beauchamp, T., Childress, J. 2013. A Principles of Biomedical Ethics, 7th edition, New York: Oxford University Press.

7. Macer D.R.J. 1990. Shaping Genes: Ethics, Law and Science of Using New Genetic Technology in Medicine and Agriculture, [online (Eubios Ethics Institute)].

8. Frederic, H., Erbisch., Karim, M. Maredia. 2004. Intellectual Property Rights in Agricultural Biotechnology, CABI publisher.

9. Sateesh, M.K. 2008. Bioethics and Biosafety, I.K. International Pvt. Ltd, New Delhi, India.

10. Deepa Goel., Shomini Parashar. 2013. IPR, Biosafety and Bioethics, 1st edition, Pearson Education, India.

11. https://www.slideshare.net/ishahak16/lecture-3-ethics-and-bioethics

12.https://www.asrm.org/globalassets/asrm/asrm-content/news-andpublications/ethics-committee- opinions/ ethics_ in_ embryo _research.pdf

13. https://www.ndsu.edu/pubweb/~mcclean/plsc431/students/bergeson.htm

COURSE OUTCOMES:

After the successful completion of this course, the students would be able to:

- Gain awareness about Intellectual Property Rights (IPRs) for protecting their ideas.
- Competent to devise business strategies by taking account of IPRs
- Proficient in technology upgradation and enhancing competitiveness.

- Acquire adequate knowledge in the use of genetically modified organisms and their effect on human health
- Gain more insights into the regulatory affairs.

PROFESSIONAL ETHICS

Second Year **CORE PRACTICAL III** **Semester III**

MOLECULAR BIOLOGY AND MICROBIAL GENETICS & ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Code : P22MBCC3P **(Practical)** **Credits : 3**

MICROBIAL GENETICS AND MOLECULAR BIOLOGY

COURSE OBJECTIVES:

- To impart advance knowledge to the students related to the field of Microbial genetics.
- To educate about isolation of Nucleic acids
- To get a knowledge on checking the quantity and quality of the nucleic acids.
- To carry out the Blotting techniques.
- To identify the types of staining and their application in detection of microorganisms.

EXPERIMENTS:

1. Isolation of Microbial DNA

2. Isolation of Microbial RNA

3. Isolation of antibiotic resistant microbes

4. Quantification of DNA/Plasmid by Spectrophotometric method

5. characterization of DNA / plasmid DNA by agarose gel electrophoresis.

6. Isolation of plasmids from E. coli (mini preparation).

7. Competent cell preparation and Bacterial transformation

8. Polymerase Chain Reaction

9. Blotting techniques (Southern, Northern, Western and Dot blotting's) 10. Generalized transduction in E. coli.

11. Characterization of plasmid DNA by agarose gel electrophoresis.

12. Restriction digestion and Ligation of DNA

13. Isolation of mutants by spontaneous mutation – Gradient plate technique

14. Isolation of auxotrophic and antibiotic resistant mutants by physical and chemical mutagens

REFERENCES:

1. Current protocols in molecular biology (2007). John Wiley & Sons Inc. Vol. 1 & 2.

2. Sambrook J and Russell DW (2001). Molecular cloning - A laboratory manual, Cold Spring Laboratory Press, New York, 3rd Edition. Vol. 1, 2, 3.

3. Surzyeki S (2000). Basic Techniques in Molecular Biology, Springer.

4. http://www.ncbi.nlm.nih.gov/

5. www.yeastgenome.org

6. http://sequence-ww.stanford.edu/group/yeast_deletion_project/deletions3.html

COURSE OUTCOMES:

After the completion of the course, students will be able to:

- Handle the clinical samples and process them for molecular techniques
- Get a clear practical knowledge on instruments used in molecular biology lab.
- Study about the Antibiotic resistance among microbes
- Understand the Transformation mechanisms.
- Learn the quantification of macromolecules in industrial point of view.

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

COURSE OBJECTIVES:

- To prepare the students for sensible knowledge in a wide range of profession.
- To provide the scientific discipline that deals with the application of microorganisms and the knowledge about them.
- To explain the applications of the course in microbial biotechnology, agriculture, food microbiology and bioremediation.
- To impart significant experiments linked with environment and agriculture.
- To train on the assessment of microbial quality of air, water and soil.

EXPERIMENTS:

1. Enumeration of Microorganisms from air by open plat technique

2. Enumeration of Microbial population from rhizosphere and non-rhizosphere soil

3. Isolation and enumeration of soil microorganisms (bacteria, fungi and actinomycetes).

4. Localization of Arbuscular Mycorrhizae (AM)

5. Isolation of Azospirillum and Azotobacter from soil

6. Isolation of Rhizobium sp. from root nodules of legumes

7. Evaluation of root nodule by cross section of legume roots.

8. Isolation of phosphate solubilizing bacteria from soil

9. Isolation of Cyanobacteria from agricultural soil and water

10. Isolation of bacterial and fungal pathogens from plants

11. Isolation and identification of air-borne microbes using Andersen sampler.

12. Determination of BOD and COD of polluted and pond water.

13. Assessment of water quality by MPN technique

14. Screening of antagonistic bacteria in soil by agar block overlay method.

15. Demonstration of the plant diseases: a) Tobacco mosaic; b) Bacterial blight of paddy; c) Downy mildew of bajra; d) Powdery mildew of cucurbits; e) Head smut of sorghum; f) Red rot of sugar cane; g) Citrus cancer; h) Downy mildew of bajra; i) Powdery mildew of cucurbits.

REFERENCES:

1. Aneja, K.R., 1993. Experiments in Microbiology: Plant Pathology and Tissue Culture, Wishwa Prakashan, New Delhi.

2. Cappuccino, J.G., Sherman, N., 2012. Microbiology - A Laboratory Manual. 7th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.

3. Gunasekaran, P., 2008. Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.

4. Harry W. Seeley, J.R., Paul J Van Demark, John J Lee, 1997. Microbes in Action - A Laboratory Manual of Microbiology. W.H. Freeman and Company, New York. 49

5. Kanika Sharma, 2009. Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.

6. Thangaraj, M., Santhana Krishnan, P., 1998. Practical Manual on Microbial inoculants, Centre of advanced studies in agricultural University, TNAU, Coimbatore.

7. http://www.fssai.gov.in/Portals/0/Pdf/15Manuals/MICROBIOLOGY%20MANU AL.pdf

8. http://www.unido.org/fileadmin/media/documents/pdf/Agro/MacroLab.pdf

9. http://samples.sainsburysebooks.co.uk/9780470757482_sample_385283.pdf

10. http://www.fao.org/docrep/018/aq359e/aq359e.pdf

11. http://krishikosh.egranth.ac.in/bitstream/1/2047193/1/ANAND-22.pdf

12.https://jascoinc.com/wp-content/uploads/2017/09/APP-Note-UV0004- Chromium-Quantitative-Determination.pdf

COURSE OUTCOMES:

By the end of the course, the students will able to

- Know about the techniques to isolate and assess the harmful microorganisms in environmental samples.
- Practice procedures to enumerate microbes of air and water.
- Get an idea to isolate and characterize the microbes in extreme environmental conditions.
- Acquire advanced practical knowledge.
- Exhibit their practical knowledge in research laboratories and industries.

PROFESSIONAL ETHICS

Second Year **ELECTIVE COURSE III** **Semester III**

GENETIC ENGINEERING

Code : P22MBE3A **(Theory)** **Credits : 4**

COURSE OBJECTIVES:

- To educate the learners with the growing significance of genetic and protein engineering
- To impart the genetic molecules' cloning techniques.
- To provide the students with the advanced tools, techniques and methods employed in DNA studies
- To know the gene cloning & expression as well as protein engineering strategies.
- To study the genome mapping and human genome profile status.

UNIT – I INTRODUCTION TO DNA CLONING: DNA cloning:

Basic steps and methods of DNA cloning - Isolation and purification of nucleic acids (genomic DNA, RNA and Plasmids) – Methods of handling and quantification of DNA and RNA. Analyses of DNA/ RNA and proteins: Agarose gel, polyacrylamide and pulsed field gel electrophoresis of DNA - Blotting – Southern, Northern and Western Blottings. Labeling of probes. Chromosome walking. Native PAGE, and two-dimensional PAGE analysis of proteins.

UNIT – II TOOLS OF GENE CLONING & SCREENING OF CLONES:

Enzymes for gene manipulation - DNA polymerases, nucleases, DNA ligases, methylases – Cutting, joining and introduction of DNA into living cell: adapters, linkers and homopolymer tailing. Gene transfer techniques: electroporation, microinjection, protoplast fusion and microparticle bombardment. Screening for recombinants: Direct: Insertional inactivation, plaque phenotype and indirect methods: Immunochemical detection, nucleic acid hybridization, Dot and Colony Blotting. Construction and applications of Genomic DNA and cDNA libraries.

UNIT – III CLONING AND EXPRESSION VECTORS:

Vectors: types, properties - plasmids vectors for cloning in E. coli (pBR322 and derivatives, pUC vectors and pGEM3Z) - plasmids– host range and incompatibility. Vectors constructed based on bacteriophages (M13 and Lambda), cosmids, phasmids, phagemids and BACs. Eukaryotic vectors - 2µm plasmid, YACs, and P elements – animal (retroviruses) and plant vectors (Ti plasmid based vectors) – over expression vectors: E. coli lac and T7 phage, and Tet-regulatable promoters based vectors - shuttle vectors – Brief account on over expression systems: Saccharomyces cerevisiae, Pichia pastoris, Schizosaccharomyces pombe and Kluyveromyces lactis. Baculovirus & Mammalian cell over expression systems.

UNIT – IV GENOME MAPPING AND HGP:

Genomic mapping: genetic and physical - Restriction mapping, RFLP, FISH, Sequence tagged site. Polymerase chain reaction (PCR) – Principles, types and their applications. Sequencing genomes – primer walking, chain termination, chemical degradation, Pyrosequencing – DNA chips and micro array. Sequence assembly – shot gun, clone contig methods. Human Genome Project (HGP).

UNIT – V PROTEIN ENGINEERING AND PROTEOME ANALYSIS:

Site directed mutagenesis: conventional and PCR-based methods - Design and construction of novel proteins and enzymes, Basic concepts in enzyme engineering, engineering for kinetic properties of enzymes, protein folding, protein sequencing, protein crystallization. Data analysis - Mass spectrometry based Proteome analysis, MALDI-TOF and LC-MS platforms – Applications of protein engineering: Examples of engineered proteins. Protein 51 arrays and their applications.

UNIT – VI CURRENT COUNTERS (For continuous internal assessment only):

Any one demonstration related to genetic engineering/gene cloning using charts or prepared models or teaching kits – Assignments - Quiz classes - short seminar presentations – debates on genetic engineering and human ethics.

REFERENCES:

1. Old RW and Primrose SB. (2001) Principles of gene manipulations – An introduction to genetic engineering, 5 ed. University of California Press.

2. Winnacker EL. From Genes to Clones. (2003) Introduction to gene technology. New Delhi Panima publishing corporation.

3. Glick BR. (2017) Molecular Biotechnology – Principles and applications of recombinant DNA. 5th edition, ASM Press, Washington, DC

4. Nicholl DST (2008). An introduction to genetic engineering. Cambridge University Press.

5. Brown TA. Gene Cloning & DNA analysis. (2016) London; New York: Chapman and Hall.

6. Pinler A. (2001) Genetic engineering of microorganisms. Protein Structure, Stability and Folding by Kenneth P. Murphy. Published by Humana Press Inc.

7. Jeffrey L, Cleland and Charles S Craik. (1996) Protein Engineering Principles and Practice Published by Wiley-Liss Inc.

8. Paul R Carey. (1996) Protein Engineering and Design, Published by Academic Press Inc.

9. Old RW and Primrose SB. Principles of Gene Manipulation - An Introduction to Genetic Engineering. 5th edition. Blackwell Scientific Publications, London. 2003.

10. Brown TA. (2012) Genomes. 2nd Ed, John Wiley and sons.

11. D.P. Clarke, N. Pazdernik. (2012) Molecular Biology by 2nd edition. Academic Press.

12. J. Sambrook, D. Russell. (2012) Molecular Cloning: A laboratory manual by 4th edition. Cold Spring Harbor laboratory Press.

13. I. Edward Alcamo (2001) DNA Technology: The Awesome Skill by. Harcourt Academic Press.

14. J. Watson, T. Baker, S. Bell, A. Gann, M. Levine, R. Losick. (2014) Molecular Biology of the Gene by 7th edition. Pearson.

15. T.A. Brown (2016) Gene Cloning and DNA Analysis: An Introduction by. 7th edition. Wiley Blackwell Publishers.

16. http://www.bio.brandeis.edu/classes/heredity/Lecture%20Powerpoints/Chapter_13_1 .pdf

17. https://www.cheric.org/files/education/cyberlecture/e200402/e200402-301.pdf

18. https://www.onlinebiologynotes.com/gene-cloning-steps-involved-gene-cloning/

19. https://uenf.br/cbb/lbt/files/2014/09/Cloning-vectors.pdf

20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6393796/

COURSE OUTCOMES:

Students who undergo the course will be able to:

- Understand the basics of gene cloning steps and various methods of gene cloning.
- Acquire the knowledge of various tools required for genetic engineering.
- Grasp various gene cloning and expression vectors needed for gene cloning / manipulation.
- Understand genome mapping and protein engineering methods.
- Comprehend the genetic engineering knowledge that could lead to next level of research.

PROFESSIONAL ETHICS

Second Year **NON MAJOR ELECTIVE II** **Semester III**

COMMUNITY NUTRITION

Code : P22FSNME2 **(Theory)** **Credits : 2**

COURSE OBJECTIVES:

To enable the students to

- Understand national nutritional problems and their implications.
- Familiarize with nutrition intervention programmes.
- Know the importance of nutrition education.

UNIT - I CONCEPT AND SCOPE OF PUBLIC NUTRITION:

Definition, concept, scope and multidisciplinary nature of public nutrition. Nutritional problems affecting the community- Etiology, prevalence, clinical features and preventive strategies for malnutrition related problem and deficiency disordersProtein energy malnutrition, Obesity, Nutritional anemia, Vitamin A deficiency, Iodine deficiency disorders, Fluorosis.

UNIT - II COMMUNITY ASSESSMENT IN PUBLIC HEALTH:

Community assessment models, methods of data collection, Basic needs of assessment, Skills in assessment. Assessment of nutritional status- Objectives and importance, Methods of assessment: Direct -Anthropometry, biochemical tests and Clinical. Indirect -Diet surveys, 24-hour dietary recall, food frequency questionnaire, dietary record.

UNIT - III INTERNATIONAL AND NATIONAL INTERVENTION:

International nutritional Policy – Global nutrition policy, Sustainable development goals, World food Programme. National nutritional policy - Integrated Child Development Services (ICDS), National programs for the prevention of anemia , National Prophylaxis Programme against Vitamin A Deficiency Diseases, Goitre Control Programme, Poshan Abhiyan 2.0.

UNIT – IV NATIONAL AND INTERNATIONAL AGENCIES IN COMBATING MALNUTRITION:

National Organization concerned with food and nutrition – Indian Council of Medical Research (ICMR), National Institute of Nutrition (NIN), World Health Organization (WHO).

UNIT – V NUTRITION EDUCATION:

Objectives, principles, scope of nutrition education. Organization, planning, executing and evaluation of nutrition education. Role of audio-visual aids in nutrition education.

UNIT - IV CURRENT CONTOURS (For Continuous Internal Assessment Only):

Development of low cost nutritious recipes for population groups vulnerable to nutritional deficiencies. Commerate any two nutrition related event within College premesis.

REFERENCES:

1. Bamji .M.S, PrahladRao.N, Reddy V (2016). Textbook of Human Nutrition.Oxford and PBH Publishing Co. Pvt. Ltd, New Delhi.

2. Park K (2011). Park's Textbook of Preventive and Social Medicine, 21st Edition. M/s Banarasidas Bhanot Publishers. Jabalpur. India

3. Wadhwa A and Sharma S (2003). Nutrition in the Community- A textbook. Elite Publishing House Pvt. Ltd. New Delhi.

4. Park K (2011). Park's Textbook of Preventive and Social Medicine, 21st Edition. M/s Banarasidas Bhanot Publishers. Jabalpur. India.

5. WHO (2006). Child Growth Standards: Methods and development: height-forage, weight-for-age, weight-for-length, weight-for-height and body mass indexfor-age (http://www.who.int/childgrowth/standards/en/).

6. M. Margaret Barth Ronny A Bell Karen Grimmer (2021).Public Health Nutrition,Rural Urban and Global based practice. Springer Publishing Company.

7. Bamji .M.S, Prahlad Rao.N, Reddy V (2016).Textbook of Human Nutrition. Oxford and PBH Publishing Co. Pvt. Ltd, New Delhi.

8. Swaminathan. M. (2014).Advanced Textbook of Food and Nutrition. The Bangalore Printing and Publishing Co. Ltd. Bangalore.

9. https://egyankosh.ac.in/bitstream/123456789/44220/3/Unit-2.pdf

10. https://www.unicef.org/media/60806/file/SOWC-2019.pdf

11. https://www.who.int/health-topics/nutrition

12. http://www.ignouhelp.in/ignou-mfn-06-study-material/

COURSE OUTCOMES:

- List ecological factors leading to malnutrition
- Explain nutritional problems of the community
- Asses nutritional status of the community
- Describe role of various governmental nutrition intervention programmes
- Create nutrition awareness and implement nutrition education programmes.

PROFESSIONAL ETHICS

Second Year **CORE COURSE VII** **Semester IV**

ADVANCES IN VIROLOGY

Code : P22MBCC41 **(Theory)** **Credits : 5**

COURSE OBJECTIVE:

- To facilitate an understanding on the basics of viruses, virus discovery, viral structure, classification of viruses.
- To provide a general account of bacteriophages, plant, animal and human viral diseases.
- To gain a knowledge on instrumentation relevant to virology.
- To teach the strategies by which viruses spread within a host, and are maintained within populations.
- To describe the molecular biology of viral reproduction and addresses the interplay between viruses and their host organisms.
- To expose to molecular diagnostics and emerging infectious diseases of human and animals.

UNIT – I GENERAL VIROLOGY:

Virus – Virion - Discovery of Viruses – General properties of Viruses – Classification of Viruses (LHT, Baltimore and ICTV) - Ultra structure of Viruses – Sub viral agents- viroids, prions, virusoids and satellite viruses – Replication of Viruses - Virus attachment, Initiation of infection, cellular receptor for viruses, entry of viruses, genome replication, assembly, Packaging signals, packaging of segmented genome, acquisition of an envelope, budding strategies.

UNIT – II MICROBIAL VIRUSES:

Bacteriophages – Classification - Structure and life cycle - T4 Phage, Lambda Phage, Mu Phage, M13 Phage, P1 Phage – lytic and lysogenic Life cycles - Bacteriophage typing, Phage therapy (bacteriophage therapy), Cyanophages, Mycoviruses (Mycophages), Rhizobiophages – Cultivation strategies of phages from sewage and other ecosystem – Importance of phages in pollution control.

UNIT – III ANIMAL AND HUMAN VIRUSES:

Classification - Structure, Multiplication, Pathogenesis, Diagnosis, Prevention and Treatment of following animal viruses – Papovaviridae (Human Papilloma Virus), Adenoviridae, Herpesviridae (Chicken Pox), Poxviridae (Monkey Pox), Hepadnaviridae (HBV), Picornaviridae (Polio Virus), Rhabdoviridae (Rabies), Orthomyxoviridae (Swine Flu), Reoviridae (Rota Virus), Retroviridae (HIV) and Flaviviridae (Chikungunya virus) - Cultivation of human viruses- Embryonated eggs and Cell culture system - Serological and immunological methods of diagnosis.

UNIT – IV PLANT VIRUSES:

Classification– Transmission of plant viruses – Symptoms of Viral infection in plants - Control of plant viral diseases - Cultivation of Plant viruses – Meristem culture – TMV - CaMV- Common viral diseases in paddy, cotton, tomato and sugar cane - Name of diseases, pathogens and symptoms. Generation of virus-free planting material; vector control.

UNIT – V EMERGING VIRUSES, ONCOGENIC VIRUS AND CONTROL OF VIRUSES:

Control of Viruses - requirement of an effective vaccine, different ways of making vaccine, types of Vaccine. Anti-viral drugs - Theories on origin of virus, evolution of new viruses, emerging viruses, Factors that drive viral emergence - viral cancer, transformation and oncogenesis-Virus-induced cancer, Avian leucosis retroviruses, Proviral DNA sequences, Proto-oncogenes, DNA tumor Viruses, the link between DNA virus biology and transformation.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Case study of health risk associated with a virus epidemic, the origin of outbreak, the spread, the intervention strategies, public health response.

REFERENCES:

1. Martinez J. Hewlett, David Camerini, David C. Bloom. 2021. Basic Virology, Fourth Edition, Wiley Blackwel.

2. Rajan S and Selvichristy J. 2018. Essentials of Microbiology, CBS Publishers, New Delhi.

3. Flint, S. J., Enquist, L. W., Racaniello, V. R., and Skalka, A. M. 2015. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses, 4th ed. 944 pp. ASM Press, Washington, DC.

4. Dimmock. N.J and Eatson, A.J., Leppard, K.N. 2016. Introduction to Modern Virology. VII edition. Blackwell Scientific Publications, Oxford.7th Edition.

5. Alan J. Cann. 2015. Principles of Molecular Virology. 6th edition, Academic press, California.

6. John Carter and Venetia Saunders. 2013. Virology: Principles and applications, 2nd Edition, John wiley and son's publishers, USA.

7. Maureen A Harrison and Ian F Rae. 2010. General techniques of cell cultures, Cambridge University Press, England. 8. Rajan S and Kumaresan. S. 2007. Virology. Saras Publications.

9. Rajan S and Selvichristy J. Essentials of Microbiology, CBS Publishers, New Delhi. 2018

10. Roger Hull. Mathews' Plant Virology, 4th edition, Academic press- A Harcourt Science and technology company, New York. 2002.

11.https://www.nature.com/scitable/topicpage/the-origins-of-viruses-14398218/

12.https://bsppjournals.onlinelibrary.wiley.com/doi/10.1111/j.1364-3703.2011.00752.x

13.https://www.sciencedirect.com/journal/virology

14. https://www.news-medical.net/health/What-is-Virology.aspx

15. Saravanan. P. Virology. MJP Publishers. 2006.

COURSE OUTCOMES:

Upon successful completion of the course, the students would be able to:

- Describe virus structure, process of virus attachment and entry, virus assembly and release.
- Explain steps in virus infection, transmission, patterns of infection, virus virulence, and host defense against virus infection.
- Know methods of making virus vaccines and anti-viral drugs, drivers of virus evolution, and emerging viruses.
- Understand unusual infectious agents, virus mediated cellular transformation and oncogenesis.
- Gain knowledge about newer emerging viral infections including the viral mutant forms for emerging.

PROFESSIONAL ETHICS

Second Year **CORE COURSE VIII** **Semester IV**

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Code : P22MBCC42 **(Theory)** **Credits : 5**

COURSE OBJECTIVES:

To understand the various components of the host immune system.

To study the structural organization and functions of immune cells and organs.

To learn the antigens, antibodies and antigen antibody reactions.

To understand the structural nature of T cells, B cells and immunity.

To describe the concepts of immune-technology.

UNIT – I IMMUNE SYSTEM:

History of Immunology, Immunity - innate and acquired. Inflammation. Haematopoiesis – Blood Group System, Cells of the immune system- lymphocytes, macrophages, mononuclear phagocytes- dendritic cells, granulocytes, NK cells and mast cells Central and peripheral lymphoid organs- Thymus, bone marrow, spleen, lymphnode, MALT and GALT.

UNIT – II T AND B CELL:

Detailed structure and development of B cell and T cell – receptors - Structure of CD4, CD8, MHC-I, MHC-II molecules, cellular adhesion molecules (ICAM, VCAM, selectins, integrins). Activation of T and B cells- Maturation of T cell and B cell. Organization of the genes for B and T cell receptors. Genetic organization of MHC-I and MHC-II complex (both HLA and H-2). Peptide loading and expression of MHC-I and MHC-II molecules

UNIT – III ANTIGEN, ANTIBODY AND AG-AB REACTIONS:

Antigen – Types, Toxoid-vaccines -antigen recognition, processing and presentation - Cell mediated immunity – Humoral mediated immunity – antibody – types. Theories of antibody formation. Rearrangenment of genes in antibody formation - Molecular mechanisms responsible for generating diversity of antibodies and T cell receptors. Interaction of T and B cells. Antigen –antibody reactions - Precipitation, agglutination, complement fixation, RIA, ELISA, Western blotting and immunofluorescence.

UNIT – IV IMMUNE MECHANISMS:

Complement system: Basics of complement protein - different pathways of complement activation - classical and alternative. Hypersensitivity reaction and their types. Auto immune disorders, transplantation and cancer immunology. Deficiencies / defects of T cells, B cells, and phagocytic cells. Immunity to tuberculosis, malaria and HIV.

UNIT – V IMMUNOTECHNOLOGY AND ITS APPLICATIONS:

Production of polyclonal, monoclonal antibodies and phage display - techniques and applications. Immunization practices- active and passive immunization. Vaccines killed and attenuated, recombinant vaccines, DNA and peptide vaccines. Applications of immunotechniques – Flow cytometry, Immunoelectron microscopy, Immunohistochemistry and Bioplex array.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Review and debate on latest discovery on immunology; Seminar on immune responses against SARS-CoV2 and vaccination for COVID-19. Quiz: Autoimmune diseases, Tumor immunology, immunological biosensors. Review on prospects and future of immunosensors.

REFERENCES:

1. David Male, R. Stokes Peebles and Victoria Male. 2020. Immunology. 9th Edition, Elsevier.

2. Rajan S and Selvichristy J. 2018. Essentials of Microbiology, CBS Publishers, New Delhi.

3. Charlene Sand. A reference guide to immune disorder including hypersensitivity and auto immune disease, Webster's digital service, ebook. 2013.

4. Goldsby RA, Kindt TK, Osborne BA and Kuby J. Immunology, 5th Edition, W.H. Freeman and Company, New York. 2007.

5. Ivan Roitt, Jonathan Brostoff and David Male. Immunology, 8th edition, Elsevier science Ltd., New York. 2012.

6. Kuby J. Immunology, 7th edition, W.H. Freeman and company, New York. 2008.

7. Patricks S and Larkin MJ. Immunological and molecular aspects of bacterial virulence. John wiley and sons, England. 1995.

8. Tak W Mak and Mary Saunders. Primer to the Immune Response. 2nd edition from Tak Mak, Mary Saunders, Bradley Jett. New York. 2014.

9. Thomas J Kindt, Barbara A Osborne, and Richard A Golds. Immunology online, University of South Carolina. 2006.

10. William E Paul. Fundamental Immunology. 7th revised edition, Raven press, New York. 2012.

11. Sudha Gangal and Shubhangi Sontakke. Textbook of Basic and clinical Immunology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2013.

12. https://doi.org/10.1016/j.immuni.2020.05.002

13.https://doi.org/10.1038/s41577-020-0311-8

14. https://www.immunopaedia.org.za/immunology/

15. http://cshprotocols.cshlp.org/site/Taxonomy/immunology_l1.xhtml

COURSE OUTCOMES:

Upon successful completion of the course, the student can:

- Understand the fundamental bases of immune system and immune response.
- Gather information about the structure and organization of various components of the immune system.
- Elaborate the genetic organization of the genes meant for expression of immune cell receptors and the bases of the generation of their diversity.
- Point out the operation and the mechanisms which underlie the immune response.
- Describe the phenomena like host defense, hypersensitivity (allergy), organ transplantation and certain immunological diseases.

PROFESSIONAL ETHICS

Second Year ENTREPRENEURSHIP / INDUSTRY BASED COURSE Semester IV

ENTREPRENEURSHIP IN MICROBIOLOGY

Code : P22MBIBC (Theory) Credits : 5

COURSE OBJECTIVES:

- To project the development role of government and non-government schemes for entrepreneurship programmes.
- To know the role of skills of entrepreneurs.
- To acquire a basic understanding on biological entrepreneurial programs.
- To learn about different types of biofertilizer and its market potentials.
- To know about the techno-economical assessment.

UNIT – I CONCEPT OF ENTREPRENEUR AND ENTREPRENEURSHIP:

Definitions-concept of entrepreneurship, development. Structure of a biobased technology, start-up of biobased technology company and biobased business development. Government and non-Govt. Schemes for entrepreneurship programmes. Funding agency and opportunity.

UNIT – II SKILLS FOR ENTREPRENEURS:

communication skills, problem solving skills; Business plan development; Market need-distribution, price, promotion and market goal setting, Develop the business at Global level. Financial plan -Financial support for business, business insurance,

UNIT – III PROJECT AND BIO PRODUCT DEVELOPMENT:

Project: identification, classification, formulation, appraisal. Small, large-scale production and cost benefit analysis and marketing of edible and medicinal mushroom cultivation-button, Oyster, Ganoderma. Single cell protein -Production of Yeast and Spirulina.

UNIT – IV BIOFERTILIZER PRODUCTIONS:

Mass multiplication, production cost analysis and marketing of Cyanobacterial biofertilizer, Bacterial biofertilizer- Rhizobium, Azospirillum, Fungal biofertilizersAMF, Actinobacterial biofertilizer-Frankia sp. Seaweed liquid biofertilizer, Biopesticides - Bacillus, Bacillus thuringiensis, Bacillus sphaericus, etc.

UNIT – V DAIRY AND FOOD PRODUCE:

Small, large-scale production and cost benefit analysis and marketing of agarGellidium and fermented foods- cheese, pickles and other probiotic food. Mass production and marketing of compost- Vermicomposting and microbial compost - types of compost pits- Laboratory and field application; cost-benefit analysis.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Visit to a nearby small scale industrial unit of biological importance. Experience the 61 students on how to calculate the cost benefit ratio before becoming an entrepreneur. Give seminar and problems on how to initiate and to know the process of starting a start up at a smaller level.

REFERENCES:

1. Nagendra S. (2008). Entrepreneurship and management Sanguine technical publishers

2. Bhatia, B.S. and G.S Batra. (2003). Entrepreneurship and small business management. Deep and deep publications

3. Naidu, N.V.R. (2008). Management and entrepreneurship. I.K. International Pvt. Ltd.

4. Greene. (2000). Entrepreneurship ideas in action. Thomson learning.

5. Sandera, F.E., B.Mosse and P.B.Tinke. (1975). Endomycorrhizae, Academic Press, London.

6. Rao,N.S. (1980). Biofertilizers in Agriculture. Oxford & IBH Publishing Co. Pvt. Ltd., Bombay.

7. Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies Shimasaki, CD. (2014). Amsterdam: Elsevier. Academic Press is an imprint of Elsevier, ISBN: 0124047300.

8.https://study.com/academy/lesson/what-is-an-entrepreneur-definitioncharacteristics examples.html

9. https://study.com/academy/lesson/institutional-entrepreneurship-theoryexamples.html

10.https://study.com/articles/Fermentation_Microbiologist_Job_Description_Salar y_and_Care er Outlook.html

COURSE OUTCOMES:

After completion of this course, the student can:

- Understand the basic knowledge of entrepreneurship programmes.
- Learn the resource for government and non-government schemes for entrepreneurship Imbibe structure of a bio-based technology.
- Initiate a Start-up of bio-based technology, bio-based business development.
- Make an impact on societal development in rural and under-privileged sectors.

PROFESSIONAL ETHICS

Second Year **VALUE ADDED COURSE II** **Semester IV**

QUALITY CONTROL IN INDUSTRIES

Code : P22MBVAC2 **(Theory)** **Credits : 5**

COURSE OBJECTIVES:

- To acquire the knowledge of quality control in pharmaceutical industry.
- To learn the quality control audits in industries.
- To understand the basics of food safety and food quality.
- To realize the microbial quality control in hospitals.
- To acquire knowledge on environment monitoring and regulations.

UNIT – I QUALITY CONTROL IN PHARMACEUTICAL INDUSTRY:

Basic of pharmaceutical products and their quality control: bulk drugs, forms, vaccines – both chemical and microbiological parameters. Environmental Monitoring – Pharmaceutical industry, Manufacture of Sterile Medicinal Products British, European, USA-US and Indian pharmacopoeias.

UNIT – II INDUSTRIAL QUALITY CONTROL AND QUALITY AUDITS:

Process quality control- sterile and nonsterile preparations, Quality control – raw materials, purity check, quality check of finished products, Industrial responsibilities – social and environmental safety.

UNIT – III FOOD SAFETY AND FOOD QUALITY:

Microbiological criteria of food, food products, beverages. Monitoring of factory hygiene and sanitation, Microbiological quality of ingredients, processing and finished products. Food Safety and Standards Authority of India (FSSAI). Food contaminants and diseases.

UNIT – IV MICROBIAL QUALITY CONTROL IN HOSPITALS:

Control of Healthcare associated infections (HAI) - Culture Identification, Sensitivity pattern, report preparations, HAI surveillance, resistance surveillance, Monitoring water quality in hospital, healthcare infrastructures. Corrective action system, Environmental monitoring and clean room commission

UNIT – V MICROBES AND THEIR APPLICATIONS:

Quality control in biodegradation and bioremediation. Microbes used in the biofertilizers and bio-pesticides and bio-fuels.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Assignment shall be given based on the syllabus and seminar shall be assigned to students related to their assignment topics individually. A project shall be assigned in the topic of prevalence of microorganisms in industrial products. Mini project in various recent research topics related to subject can be given.

REFERENCES:

1. Nally, J.D. (Ed.) 2007. Good Manufacturing Practices for Pharmaceuticals, Sixth Edition, Informa Healthcare USA, Inc., ISBN 10: 0-8593-3972-3 & ISBN 13: 978-0-8493-3972-1, New York.

2. The training manual for Food Safety Regulators, 2011. Food Safety regulations and food safety management. Food Safety and Standards Authority of India, New Delhi (http://www.fssai.gov.in/ trainingmanual.aspx)

3. U.S. Environmental Protection Agency (EPA). Washington, D.C., 2014. 21-Food and drugs, chapter I-Food and Drug Administration.

4. WHOTRS823, 1992. WHO expert committee on specifications for pharmaceutical preparations: thirty-second report. WHO Technical Report Series: 823, ISBN 92 4140823 6, ISSN 0512-3054, Geneva.

5. EPA, 2010. Noise Pollution, 2010-05-18.

6.https://www.alten.pt/2021/06/14/quality-control-in-the-pharmaceuticalindustry/

7.https://www.pharmaguideline.com/2017/09/functions-of-quality-control.html

8.https://www.slideshare.net/SihamAbdallaha/quality-control-ofpharmaceutical-products-31353025

9.https://www.cfpie.com/how-quality-control-is-done-in-the-pharmaceuticalindustry

10.https://www.fssaifoodlicense.com/different-food-safety-food-quality/

11. https://pharmaphorum.com/viewsandanalysis/the_importance_of_microbiological_quality_control_in_the_pharmaceuti cal_industry_/

COURSE OUTCOMES:

After completion of this course, the student can:

- Enhance their knowledge on quality control management in the various industries.
- Know how all the fundamental disciplines of industry are intrinsically linked with the concepts of service excellence and quality.
- Explore mainly the quality control of pharmaceutical and food products.
- Investigate the quality control of food foodstuffs to maintain their safety and quality.
- Acquire knowledge on environment monitoring and regulations.