RAICHUR UNIVERSITY, RAICHUR

Under Graduate Curriculum for Degree of Bachelor of Science (B.Sc) in

Microbiology

(I & VI Semester)

As per Revised NEP 2024
With Effect from the Academic year from 2024-25 and onwards

Raichur University Raichur
B.Sc. Microbiology

Programme Specific Outcomes (PSO):

On completion of the 03 years Degree in Microbiology students will be able to:

- Demonstrate, solve and understand the major concepts in all the disciplines of --.
- Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.
- To apply standard methodology to the solutions of problems in Microbiology
- Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
- Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of Microbiology.
- To build confidence in the candidate to be able to work on his own in industry and institution of higher education.
- To develop an independent and responsible work ethics.
- Exploring the microbial world and analyzing the specific benefits and challenges.
- Applying the knowledge acquired to undertake studies and identify specific remedial
- Measures for the challenges in health, agriculture, and food sectors.
- Thorough knowledge and application of good laboratory and good manufacturing
- Practices in microbial quality control.
- Understanding biochemical and physiological aspects of microbes and developing
- broader perspective to identify innovative solutions for present and future challenges posed by microbes.
- Understanding and application of microbial principles in forensic and working, knowledge about
- Clinical microbiology. Enhance and demonstrate analytical skills and apply basic computational and
- Statistical techniques in the field of microbiology

B.Sc. Semester– II
Discipline Specific Course (DSC)
Course Title:- Microbial Physiology and Genetics
Course Code: C2MCB1T1

Course Outcomes (COs): At the end of the course students will be able to:

CO 1 : Develop thorough knowledge and understanding of concepts of Biochemistry, enzymes, microbial metabolism, growth, bioenergetics and physiology
CO 2 : Students will become efficient in managerial skills by learning the Enzyme kinetics and regulation.
CO 3: Able to employ analytical reasoning, problems solving, interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology.
CO 4: Students will get through knowledge on replication, genetic recombination, mendelian genetics and Transposable elements.

Unit	Title: Microbial Physiology and Genetics (Credits: Theory-4, Practicals-2)
Unit I	**Biomolecules** Introduction, structure, functions significance of biomolecules, properties and importance of Water, pH, buffers, chemical bonding, properties, general characters, structures, classification and biological importance of Carbohydrates, Protein, Lipids and Nucleic Acids. **Enzymes, Kinetics and Regulation** **Enzymes:** Introduction, Nomenclature, structures, classification, properties, mode and mechanism of enzyme action – lock and key hypothesis, induced fit hypothesis. Cofactors, coenzymes, ribozymes and their importance, clinical importance of enzymes. **Enzyme kinetics and regulation:** Michaeli's and Menten equation, Lineweaver Burk plots, Factors affecting enzyme action. Competitive and non-competitive inhibition and allosteric enzymes, kinetics of immobilized enzymes and multienzyme complex.
Unit II	**Bio-energetics and Bacterial Photosynthesis** **Thermodynamics:** Laws of thermodynamics, Free energy, ATP and its production, other high-energy compounds, Oxidation and reduction reactions. **Microbial Metabolism:** EMP, TCA cycle, Electron transport chain Oxidative phosphorylation, E D Pathway, Pentose Phosphate Pathway, HMP Pathway. uncouplers and inhibitors, Fatty acid Oxidation (Beta, Alpha, and Omega oxidation pathway). Amino acid degradation (Transamination. Deamination and Decarboxylation). Brief account on Nitrogen metabolism and Biosynthesis of lipids. Concept of Anaerobic respiration-fermentation: Alcoholic, Lactic (homolactic and heterolactic), acetic acid fermentation and Pasteur effect. **Bacterial Photosynthesis:** Types of bacterial photosynthesis, Photosynthetic pigments. Light reactions. Dark reaction, Comparison of photosynthesis in green plants and bacteria, Oxygenic and Anoxygenic Photosynthesis.

Unit III	**Microbial Growth, Nutrition and Photosynthesis** **Microbial Nutrition:** Nutritional requirements, modes of nutrition – Autotrophs, Heterotrophs, Phototrophs. chemotrophs, methanotrophs, organotrophs and saprotrophs. **Microbial Growth:** Growth Rate, generation time and growth curve - phases of growth and their significance, physical and chemical factors affecting growth - Temperature, Light. pH, Oxygen and saline requirements. Measurement of growth by cell number, cell mass and cell viability. **Microbial Genetics** **Mendelian and Classical genetics:** Concepts, principles inheritance, dominance and segregation, Classical genetics: Chromosomal basis of inheritance and theory of heredity and Chromosomal abbreviations. Genetic Code: Features, triplet code, wobble hypothesis, codons and evolution of genetic code. Genomic organization in Prokaryotes and Eukaryotes.
Unit IV	**DNA Replication, Genetic Recombination in Prokaryotes** **DNA replication:** Introduction, replication models, Enzymes involved in DNA replication, Origin of replication Rolling circle, Unidirectional and Bi-directional. method replication mechanism of Semi-Conservative model of DNA Replication. Proof reading and regulation. Genetic recombination: Transformation, Conjugation and Transduction. Genomic organization in Prokaryotes and Eukaryotes. **Transposable Genetic Eléments** Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, importance.

Recommended books:

References:

1. Becker, W. M., Kleinsmith, L. J., Hardin, J., & Bertoni, G. P. (2020). *The World of the Cell* (9th ed.). Pearson Benjamin Cummings.
2. Caldwell, D. R. (2015). *Microbial Physiology and Metabolism* (2nd ed.). Brown Publisher.
3. Colwell, R. R. (2012). *Microbial Diversity* (2nd ed.). Academic Press.
4. De Robertis, E. D. P., & De Robertis, E. M. F. (2017). *Cell and Molecular Biology* (8th ed.). Lippincott Williams & Wilkins.
5. Dawes, I. W., & Sutherland, J. W. (2010). *Microbial Physiology* (3rd ed.). Halsted Press.
6. Karp, G. (2023). *Cell Biology* (10th ed.). McGraw Hill.
7. Gottschalk, G. (2012). *Bacterial Metabolism* (3rd ed.). Springer Verlag.
8. Jain, J. L. (2019). *Fundamentals of Biochemistry* (6th ed.). S. Chand Publisher.
9. Karp, G. (2021). *Cell and Molecular Biology: Concepts and Experiments* (8th ed.). John Wiley & Sons.
10. Moat, A. G., & Foster, J. W. (2019). *Microbial Physiology* (5th ed.). John Wiley & Sons.
11. Nelson, D. L., & Cox, M. M. (2021). *Lehninger Principles of Biochemistry* (8th ed.). W.H. Freeman.
12. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2020). *Microbiology* (7th ed.). Tata McGraw Hill.
13. Reddy, S. R., & Reddy, S. M. (2018). *Microbial Physiology* (3rd ed.). Scientific Publishers India.
14. Voet, D., & Voet, J. G. (2021). *Biochemistry* (5th ed.). John Wiley & Sons.
15. Dale, J. W. (2019). *Molecular Genetics of Bacteria* (4th ed.). John Wiley & Sons.

16. Freifelder, D. (2018). *Microbial Genetics* (5th ed.). Narosa Publishing House.
17. Gupta, P. K. (2020). *Cytology and Genetics* (4th ed.). Rastogi Publications.
18. Gardner, E. J., Simmons, M. J., & Snustad, D. P. (2020). *Principles of Genetics* (9th ed.). Wiley-India.
19. Hartwell, L. H., et al. (2020). *Genetics: From Genes to Genomes* (6th ed.). McGraw Hill.
20. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2021). *Lewin's Essential Genes* (4th ed.). Jones & Bartlett Learning.
21. Snustad, D. P., & Simmons, M. J. (2020). *Principles of Genetics* (7th ed.). John Wiley & Sons.
22. Strickberger, M. W. (2019). *Genetics* (4th ed.). Prentice Hall of India.
23. Watson, J. D., et al. (2020). *Molecular Biology of the Gene* (8th ed.). Pearson.

B.Sc. Semester–II
Discipline Specific Course (DSC)
Practical: Microbial Physiology and Genetics

Course Title: Microbial Physiology and Genetics
Course Code: C2MCB1P1

Course Outcomes (COs): At the end of the course, students will be able to:

After completion of course (Practical), students will be able to

CO 1: Develop thorough knowledge and understanding of concepts of Biochemistry, enzymes, microbial metabolism, growth, bioenergetics and physiology
CO 2: Students will become efficient in managerial skills by learning the Enzyme kinetics and regulation experiments at degree level.
CO 3: Able to employ analytical reasoning, problems solving, interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology.
CO 4: Students learn qualitative and quantitative analysis of biomolecules thoroughly same can be useful for their industry jobs.

PRACTICAL II: Microbial physiology and Genetics

1. Qualitative tests for the detection of Carbohydrates: Molisch's test, Anthrone test, Iodie test, Benedict's test, Fehling's test, Picric acid test, Barfoeds test, Selwinoffs test and Bials test.
2. Qualitative tests for Proteins and Amino acids: Biuret test. Ninhydrin test. Millons test Xanthoproteic test, Ehrlich's, Lead sulphide test, Sodium nitroprusside test,
3. Qualitative tests for Lipids: Acrolein test. Sudan III test, emulsification test and solubility test.
4. Colorimetric estimation of sugar by DNS method.
5. Colorimetric estimation of protein by Biuret method.
6. Study of Bacterial Growth curve and Measurement of growth by cell mass using turbidometer/ photocolorimeter/ spectrophotometer.
7. Estimation of Saponification value of oils.
8. Fermentation of glucose, sucrose and lactose - Acid and gas production.
9. Biochemical tests for the identification of bacteria
    a) IMViC tests
    b) Starch hydrolysis
    c) Gelatin hydrolysis
    d) Catalase test
    e) Oxidase test
10. Effect of pH and temperature on bacterial growth.
11. Assay of salivary amylase by DNSA method, determination of specific activity.
12. Effect of temperature and pH on enzyme activity
13. Demonstration of Thin layer chromatography.
14. Cultivation of Cyanobacteria from pond/lake/river/sea water samples.
15. Cultivation of Actinomycetes from different soil.