

BACHELOR OF SCIENCE IN MICROBIOLOGY REGULATIONS

ELIGIBILITY:

A pass in Higher Secondary Examination with any Academic stream or Vocational stream with Biology / Zoology / Botany /Biotechnology/Microbiology/Life Science as one of the subject and as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **Bachelor of Science (Microbiology)** Degree Examination of this College after a course study of three academic years.

OBJECTIVE OF THE COURSE:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To inculcate practical knowledge in correlation with the theoretical knowledge.
2. To equip the students to meet the requirements of the current technology in Microbiology.
3. To motivate and train the students in various clinical and industrial sectors.
4. To encourage students to involve in research to explore microorganisms for the betterment of mankind.

B. Sc., Microbiology (students admitted during 2016 - 2017 onwards)

SCHEME OF EXAMINATIONS FOR UG COURSE

Subject Code	Subject	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
Part - I							
16UTL11T 15UHL11H 15UML11M 15UFL11F	Tamil-I Hindi-I Malayalam-I French - I	6	3	25	75	100	4
Part - II							
16UEG12E	English - I	6	3	25	75	100	4
Part - III							
16UMB13A	Core-I: Fundamentals of Microbiology	6	3	20	55	75	3
16UMB13P	Core Practical- I	6	6	30	45	75	3
16UMA1AB	Allied- I: Basic Mathematics and Statistics	4	3	20	55	75	3
Part - IV							
15UFC1FA	Environmental Studies	2	3	-	50	50	2
		30				475	19
Second Semester							
Part - I							
16UTL21T 15UHL21H 15UML21M 15UFL21F	Tamil-II Hindi-II Malayalam-II French - II	6	3	25	75	100	4
Part - II							
16UEG22E	English - II	6	3	25	75	100	4
Part - III							
16UMB23A	Core -II: Cell Biology	4	3	20	55	75	3
16UMB23P	Core Practical- II	6	6	30	45	75	3
16UCY2AB	Allied- II: Chemistry	3	3	20	55	75	3
16UCY2AQ	Allied Practical- I: Chemistry	3	3	20	30	50	2


BoS Chairman/HOD
Department of Microbiology
Dr. N. G. P. Arts and Science College
Coimbatore - 641 048


Dr. P. R. MUTHUSWAMY
PRINCIPAL
Dr. NGP Arts and Science College
Dr. NGP - Kalapatti Road
Coimbatore - 641 048
Tamilnadu, India

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Part - IV							
15UFC2FA	Value Education : Human Rights	2	3	-	50	50	2
		30				525	21
Third semester							
Part - I							
15UTL31U 15UHL31H 15UML31M 15UFL31F	Tamil-III Hindi-III Malayalam-III French - III	5	3	25	75	100	4
Part - II							
16UEG32E	English-III	5	3	25	75	100	4
Part - III							
16UMB33A	Core-III: Microbial Physiology	4	3	20	55	75	3
16UMB33P	Core Practical- III	6	9	30	45	75	3
16UBC3AA	Allied-III: Biochemistry I	3	3	20	55	75	3
Part - IV							
16UMB3SA	Skill based Subject- 1: Entrepreneur related to Microbiology	3	3	20	55	75	3
	NMEC -I	2	-	-	50	50	2
15UFC3FA 15UFC3FB 15UFC3FC 15UFC3FD 15UFC3FE	Tamil / Advanced Tamil (OR) Yoga for Human Excellence / Women's Rights/ Constitution of India	2	3	-	50	50	2
		30				600	24
Fourth Semester							
Part - I							
15UTL41U 15UHL41H 15UML41M 15UFL41F	Tamil-IV Hindi-IV Malayalam-IV French - IV	5	3	25	75	100	4

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Part - II							
16UEG42E	English-IV	5	3	25	75	100	4
Part - III							
16UMB43A	Core-IV: Bioinstrumentation	4	3	20	55	75	3
16UMB43P	Core Practical- IV	4	6	40	60	100	4
16UBC4AA	Allied- IV: Biochemistry II	3	3	20	55	75	3
16UBC4AP	Allied Practical - II: Biochemistry	2	3	20	30	50	2
Part - IV							
16UMB4SA	Skill based Subject- 2: Entrepreneurial Microbiology	3	3	20	55	75	3
	NMEC - II	2	2	-	50	50	2
15UFC4FA 15UFC4FB 15UFC4FC	Tamil Advanced Tamil (OR) General Awareness	2	3	-	50	50	2
		30				675	27
Fifth Semester							
Part - III							
16UMB53A	Core-V: Microbial Genetics	4	3	20	55	75	3
15UMB53B	Core-VI: Immunology	5	3	20	55	75	3
16UMB53C	Core-VII: Food Microbiology	4	3	20	55	75	3
16UMB53D	Core-VIII: Medical Microbiology I	4	3	20	55	75	3
16UMB53P	Core Practical- V	5	9	40	60	100	4
	Elective- I	4	3	25	75	100	4
Part - IV							
16UMB5SA	Skill based Subject-3: Food Quality Control and Food Preservation	4	3	20	55	75	3
16UMB53T	Industrial Training	Grade A to C					

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		30				575	23
Sixth Semester							
Part - III							
16UMB63A	Core-IX: Virology	4	3	20	55	75	3
16UMB63B	Core-X: Industrial Microbiology	4	3	20	55	75	3
16UMB63C	Core- XI: Medical Microbiology II	4	3	20	55	75	3
16UMB63P	Core Practical VI	6	9	40	60	100	4
	Elective-II	4	3	25	75	100	4
	Elective- III	4	3	25	75	100	4
Part - IV							
16UMB6SA	Skill based Lab- 1	4	6	30	45	75	3
Part - V							
15UEX65A	Extension Activity	-	-	-	50	50	2
		30				650	26
Grand Total						3500	140

ELECTIVE - I

(Student shall select any one of the following subject as Elective - I in fifth semester)

S.No	Subject Code	Name of the Subject
1.	16UMB5EA	Recombinant DNA Technology
2.	15UMB5EB	General Biology
3.	16UMB5EC	Human Physiology

ELECTIVE - II

(Student shall select any one of the following subject as Elective - II in sixth semester)

S.No	Subject Code	Name of the Subject
1.	16UMB6EA	Environmental and Agricultural Microbiology
2.	16UMB6EB	Intermediate Metabolism
3.	15UMB6EB	Hematology

ELECTIVE - III

(Student shall select any one of the following subject as Elective - III in sixth semester)

S.No	Subject Code	Name of the Subject
1	15UMB6EA	Biotechnology
2	16UMB6EE	Enzyme Technology
3	16UMB6EF	Forensic Science

NON MAJOR ELECTIVE COURSES

- The Department offers the following two papers as Non Major Elective Courses for other than the Microbiology students.
- Student shall select any one of the following subject as Non Major Elective Courses during their III and IV semester

S. No.	Semester	Subject Code	Course Title
1.	III	16UNM34F	Microbiology and Public Health
2.	IV	16UNM44F	Microbes in and as food

FOR COURSE COMPLETION

Students have to complete the following Subjects:

- Language papers (Tamil/Malayalam/French/Hindi, English) in I, II, III and IV semester.
- Environmental Studies in I semester.
- Value Education in II and III semester respectively.
- Allied papers in I, II, III and IV semesters.
- Two Non Major Elective courses in the third and fourth semester.
- Extension activity in VI semester.
- Elective papers in the fifth and sixth semesters.
- Industrial training for 15 days during IV Semester Summer Vacation and the Evaluation of the Report done by the Internal and external Examiner in the V Semester. Based on their performance of the Students Grade will be Awarded as A to C.

A- 75marks and above

B- 60-74 marks

C- 40-59 marks

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Below 40 marks - (Re-Appear)

Total Credit Distribution

Subjects	Credits	Total		Credits	Cumulative Total
Part I: Tamil	4	04 x	400	16	32
Part II: English	4	04 x 100 =	400	16	
Part III:					
Core	3	11 x	825	33	94
Core Practical	3	03 x 75 =	225	9	
Core Practical	4	03 x 100 =	300	12	
Allied Theory	3	04 x	300	12	
Allied Practical	2	02 x	100	04	
Elective	4	03 x	300	12	
Skill based subject theory	3	03 x 75 =	225	09	
Skill based subject practical's	3	01 x 75 =	75	03	
Part IV:					
Value Education	2	02 x 50 =	100	04	12
Environmental Studies	2	01 x	50	02	
Foundation Course	2	01 x 50 =	50	02	
NMEC	2	02 x 50 =	100	04	
Part V:					

B. Sc., Microbiology (students admitted during 2016 - 2017 onwards)

Extension Activity	2	01 x	50	02	02
Total			3500	140	140

Earning Extra credits is not mandatory for course completion

Extra credits

Part	Subject	Credit	Total credits
1	BEC/ Self study courses	1	1
2	Hindi / French/ Other foreign Language approved by certified Institutions	1	1
3	Type Writing / Short Hand Course	1	1
4	Diploma/certificate/CPT/ ACS Inter/ NPTEL Course	1	1
5	Representation - Academic/Sports /Social Activities/ Extra Curricular / Co-Curricular activities at University/ District/ State/ National/ International	1	1
Total		5	5

Rules:

The students can earn extra credits only if they complete the above during the course period (I to V sem) and based on the following criteria. Proof of Completion must be submitted in the office of the Controller of Examinations before the commencement of the VI Semester. (Earning Extra credits are not mandatory for Course completion)

B. Sc., Microbiology (students admitted during 2016 - 2017 onwards)

1. Student can opt BEC course/ Self study course to earn one credit. They have to Enroll and complete any one of the course during their course period before fifth semester (I sem to V sem).

Self study paper offered by Microbiology Department

S. No.	Semester	Course Code	Course Title
1.	I sem to V	16UMBSS1	Good Laboratory Practices
2.	sem	16UMBSS2	Food Sanitation

2. Student can opt Hindi/ French/ Other foreign Language approved by certified Institutions to earn one credit. The certificate(Hindi) must be obtained from **Dakshina Bharat Hindi Prachar Sabha** and He/ she has to enroll and complete during their course period (**first to fifth semester**).
3. Student can opt for Type writing /short hand course to earn one extra credit. He/she has to enroll and complete the course during their course period to obtain certificate through **Tamil Nadu Board of Technical Education**.
4. Student can opt for Diploma/certificate/CPT/ACS Inter/ NPTEL Course to earn one extra credit. Student who opt for Diploma/ Certificate course have to enroll any diploma/certificate course offered by Bharathiar University through our Institution. Student who opt for CPT/ ACS/CMA have to enroll and complete the foundation level during the course period. Students who opt for NPTEL course should complete the course certificate through NPTEL.
5. Award Winners in Academic/ Representation in Sports /Social Activities/ Extra Curricular/ Co-Curricular Activities at University/ District/ State/ National/ International level can earn one extra credit.

16UMB13A	CORE- I: FUNDAMENTALS OF MICROBIOLOGY	SEMESTER - I
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Total Credits: 3
Hours per Week: 6

OBJECTIVES:

This course has been designed for students to learn and understand

1. The history behind microbiology
2. Microscopy, Sterilization methods and Cultural media
3. Microbial Diversity.

CONTENTS

UNIT - I

History and Scope of Microbiology - Spontaneous generation theory and its disproval - Contribution of Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister and John Tyndall.

UNIT - II

Microscopy - Principles and application - Bright field, Dark field, Phase contrast, Fluorescence, SEM & TEM . Stains - Staining reactions - Types of staining - Simple, Differential (Gram's, Spore, AFB), Capsule staining, fungal staining.

UNIT - III

Sterilization and Disinfection- Principles- Methods of Sterilization - Physical methods: Dry Heat, Moist heat, Filtration and Radiation. Chemical methods - Formaldehyde, Alcohol, Phenol and Gaseous sterilizing agents.

UNIT - IV

Culture Media - Types of Media - Enriched, Selective, Differential and Special Purpose Media (one e.g. for each type). Maintenance and Preservation of microbial culture.

UNIT - V

Morphology, General Characteristics, Classification, and economic important of Fungi (Aspergillus, Saccharomyces) Algae (Anabena, Chlamydomonas, Volvox, Spirogyra).

TEXT BOOK:

1. *Joanne M. Willey Linda M. Sherwood and Christopher J. Woolverton.* 2011. **Prescott's Microbiology** 8th edition. McGraw Hill International Edition.

REFERENCE BOOKS:

1. *Salle A.J.* 2014. **Fundamental Principles of Bacteriology** 7th edition, Tata Mc Hill Publishing Company Ltd.,
2. *Michael Madigan, John Martinko, Kelly Bender, Daniel Buckley and David Stahl,* 2015. **Brock Biology of Microorganisms** 14th edition. Pearsons Education Ltd.

16UMB13P	CORE PRACTICAL- I	SEMESTER - I
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Total Credits: 3
Hours per Week: 6

CONTENTS

1. Laboratory precautions
2. Preparation of cleaning solutions - Chromic acid
3. Culture media preparation - Nutrient Broth
4. Nutrient Agar (Plate, Deep, Slant)
5. Differential medium
6. Selective medium.
7. Sterility testing of Autoclave
8. Sterility testing of Hot air Oven
9. Decimal Dilution Technique
10. Pure culture techniques - Streak plate method, Pour plate method, Spread plate method
11. Isolation and Enumeration of bacteria from soil
12. Isolation of fungi from soil
13. Isolation of Actinomycetes from soil
14. Bacterial staining - Simple Staining
15. Gram Staining
16. Slide culture Technique

TEXT BOOKS:

1. *James.C.Cappuccino*. 2013. **Microbiology A laboratory manual**. 1st edition, Pearson education publishers.
2. *Kannan, N.* 1996. **Laboratory manual of General Microbiology**, 2nd edition, Panima publishing house.

REFERENCE BOOKS:

1. *Aneja. K.R.* 2012. **Experiments in Microbiology, plant pathology and biotechnology**, 4th Edition. New age publishers.
2. *Kannan, N.* 2003. **Hand book of Laboratory culture media** 1st edition, Panima publishing house.

16UMA1AB	ALLIED - I: BASIC MATHEMATICS AND STATISTICS	SEMESTER -I
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Credit Points: 3
Hours Per Week:4

OBJECTIVE:

1. On successful completion of this course the students shall enrich to solve various problems in bioscience.
2. It helps the students to do research problems.

CONTENTS

UNIT-I

Matrices - Determinant of a matrix - Transpose of a matrix - Inverse of a matrix -Solutions of simultaneous linear equations in three variables using matrices.

UNIT -II

Nature and Scope of Statistical methods and their limitations - Data collection - Classification and Tabulation - Primary and Secondary data and their applications in life sciences.

UNIT -III

Measures of central tendency - Mean, Median, Mode - Measures of dispersion - Quartile deviation - Mean deviation - Standard deviation.

UNIT- IV

Correlation - Karl Pearson's Coefficient of correlation - Rank correlation - Permutations and Combinations (Simple Problems).

UNIT-V

Regression Analysis - Meaning and definition-Method of forming regression equations-Uses of regression equations- Simple Problems.

TEXT BOOK:

1. *Navnitham, P.A.* 2013. **Business Mathematics & Statistics.** Jai Publishers, Trichy.

REFERENCE BOOKS:

1. *Sanchetti, D.C and Kapoor, V.K.* 2000. **Business Mathematics.** Sultan chand Co& Ltd, Newdelhi.
2. *Gupta, S.P. and Gupta, M.P.* 2002. **Business Statistics.** Sultan Chand and Sons.

16UMB23A	CORE - II: CELL BIOLOGY	SEMESTER - II
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

To develop basic knowledge in

1. The complexity and harmony of cell structure and functions
2. The mode of cell divisions and
3. Mechanism of nutrient transportation inside the cell.

CONTENTS

UNIT - I

Structure of Prokaryotes - Cell wall - Cell membrane- Extra mural layer - Slime - Capsule - Cytoplasmic inclusions - Mesosomes - Nuclear material - Reserve materials - Pigment - Cell appendages - Flagella - Pili.

UNIT - II

Structure of Eukaryotes - Cell wall - Cell membrane - Mitochondria - Chloroplast - Endoplasmic reticulum - Golgi complex - Nucleus - Ribosomes - Inclusions Bodies - Flagella.

UNIT - III

Cell division in Bacteria - Binary fission - Cell division of Eukaryotes - Mitosis and Meiosis. Cell cycle.

UNIT - IV

Transport mechanisms - Diffusion - Facilitated diffusion - Active transport - Group translocation - Phagocytosis - Pinocytosis.

UNIT - V

Archaeobacterial cell wall and cell membranes of Methanogens - Halophiles - Thermoacidophiles.

TEXT BOOK:

1. *Lansing M. Prescott, John P. Harley, Donald A. Klein. 2001. **Microbiology**, 5th Edition. McGraw - Hill Higher Education.*

REFERENCE BOOKS:

1. *Stanier, Y. Ingraham J.L. Wheolis H.H and Painter P.R. 1986. **The Microbial world**, 5th edition. Eagle Works Cliffs N.J. Prentica Hall.*
2. *Tortora, Funke and Case. 2008. **Microbiology**, 8th edition. Mc Graw Hill Company.*
3. *Verma P S, 2004. **Cell biology, Genetics, Evolution and Ecology**, 14th Edition, S Chand Publishers.*

16UMB23P	CORE PRACTICAL -II	SEMESTER - II
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Total Credits: 3
Hours per Week: 6

CONTENTS

1. Observation of Plant cell
2. Observation of animal cell
3. Measurement of Microbial cell size by Micrometry
4. Cell count- Microscope
5. Screening of PHB production
6. Observation of permanent slides of Algae, Fungi and Protozoa
7. Observation of permanent slide for stages of mitosis
8. Observation of permanent slide for stages of meiosis
9. Extraction of chlorophyll pigments.
10. Acid Fast Staining
11. Capsular staining - Negative staining
12. Spore Staining
13. Motility test - Hanging drop and SIM agar
14. Fungal staining - Lacto phenol Cotton Blue Mount

TEXT BOOKS:

1. *J Jayaraman*, 2005. **Laboratory manual in Biochemistry**. 1st Edition. New Age International.
2. *James.C.Cappuccino*. 2013. **Microbiology A laboratory manual**. 1st edition, Pearson education publishers.

REFERENCE BOOKS:

1. *Aneja. K.R.* 2012. **Experiments in Microbiology, Plant Pathology and Biotechnology**, 4th edition. New age publishers.
2. *Kannan, N.* 2003. **Hand Book of Laboratory Culture Media** 1st edition, Panima publishing house.

16UCY2AB	ALLIED - II: CHEMISTRY	SEMESTER - II
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Total Credits: 3

Hours/Week: 3

OBJECTIVES:

1. On successful completion of this course the students shall gain knowledge in the basics of chemistry which helps bioscience students to understand chemical bonding in the biomolecules and the techniques involved in the biochemistry.

CONTENTS

UNIT - I

Chemical bonding

1. Molecular Orbital Theory - bonding, anti bonding and nonbonding orbitals. MO configuration of H_2 , N_2 , O_2 , F_2 - bond order - diamagnetism and paramagnetism.
2. Ionic Bond: Nature of ionic bond, structure of $NaCl$ and $CsCl$, factors influencing the formation of ionic bond.
3. Covalent Bond: Nature of covalent bond, structure of CH_4 , NH_3 , H_2O , shapes of $BeCl_2$, BF_3 , based on VSEPR theory and hybridization.

UNIT - II

Solutions

1. Normality, molarity, molality, mole fraction, mole concept.
2. Preparation of standard solutions - primary and secondary standards.
3. Principle of Volumetric analysis.
4. Strong and weak acids and bases - Ionic product of water- pH, pKa, pKb, Buffer solution, pH and pOH simple calculations.

UNIT-III

Basic Organic Chemistry

1. Electron displacement effect in organic compounds - Inductive effect - Electromeric effect - Resonance effect, Hyperconjugation and Steric effect.
2. Isomerism, Symmetry of elements (Plane, Centre and Axis of symmetry), Molecules with one chiral carbon and two adjacent chiral carbons -Optical isomerism of lactic acid and tartaric acid, Enantiomers, Diastereomers, Separation of racemic mixture (chemical, mechanical, biochemical and kinetic), Geometrical isomerism (maleic and fumaric acid).

UNIT - IV

1. Surface Chemistry

Adsorption – adsorbent and adsorbate, adsorption and absorption - chemisorption - physisorption - Difference between chemisorption and physisorption - applications of adsorption - Factors influencing adsorption, adsorption isobar, adsorption isostere.

2. Chromatography - Principles and applications of column, paper and thin layer Chromatography.

UNIT - V

Dyes

1. Terms used – chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift. Classification of dyes based on chemical structure and application- Preparation of azo (Methyl orange) and triphenyl methane (Malachite green) dyes.

TEXT BOOKS :

1. *R. D. Madan. 2001. Modern Inorganic Chemistry. S. Chand & Company, New Delhi.*
2. *Puri, Sharma, Pathania. 2004. Principles of Physical Chemistry, Vishal Publishing Company, Jalandhar.*
3. *B.S.Bhal, Arun Bhal, 1997. Advanced Organic Chemistry, S. Chand & Co Limited, New Delhi.*
4. *M. K. Jain, S. C. Sharma. 2001. Organic Chemistry, Shoban Lal Nayin Chand, Jalandhar.*
5. *Gopalan R. 1991. Elements of Analytical Chemistry, Sultan Chand & Sons, New Delhi.*

16UCY2AQ	ALLIED PRACTICAL - I: CHEMISTRY	SEMESTER - II
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Total Credits: 2

Hours/Week: 3

CONTENTS

I Volumetric analysis

1. Estimation of Sodium Hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Oxalic acid using standard Sulphuric acid.
4. Estimation of Ferrous sulphate using standard Mohr salt solution.

II Organic Analysis

1. To distinguish between aliphatic & aromatic.
2. To distinguish between saturated & unsaturated.
3. Detection of Elements (N, S, Halogens).
4. Functional group tests for phenols, acids (mono & di), aromatic primary amine, monoamide, diamide, carbohydrate.
Functional group characterized by Confirmatory test.

TEXT BOOK :

1. *V. Venkateswaran, R. Veeraswamy & A. R. Kulandaivelu. 2004. Basic Principles of practical chemistry, Sultan Chand & Co.*

16UMB33A	CORE- III: MICROBIAL PHYSIOLOGY	SEMESTER - III
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

This course illustrates

1. Nutritional requirements and classification of microorganisms.
2. Microbial growth and physical factors affecting growth
3. General metabolic pathways of microorganisms

CONTENTS

UNIT - I

Nutrition: Nutritional requirements of micro organisms - Autotrophs, Heterotrophs, Photoautotrophs, Chemoautotrophs, Copiotrophs, Oligotrophs, Major and Minor nutrients required by microorganisms- Nutritional classification of microorganisms.

UNIT - II

Different phases of growth - growth curve - generation time - factors influencing microbial growth - temperature, pH, pressure, salt concentration, nutrients - synchronous growth and continuous cultivation. Diauxic growth- Estimation of Microbial growth - Direct Microscopic count, Turbidometric assay, TVC- Indirect Method- CO₂ liberation -Protein estimation

UNIT -III

Metabolism - EMP - HMP - ED pathway- TCA cycle-. Oxidation - Reduction. Substrate level phosphorylation - Chemiosmosis and ATP generation

UNIT- IV

Photosynthesis - Oxygenic and Anoxygenic. Anaerobic respiration - Sulphur and nitrogen metabolism. Fermentation - alcoholic, propionic and mixed acid fermentation. Methanogens.

UNIT- V

Biosynthesis of bacterial cell wall. Biosynthesis of amino acids (Glutamic acid and Aromatic acid family). CO₂ fixation- Bioluminescence.

TEXT BOOKS:

1. *Gerhard Gottschalk*, 2006. **Bacterial Metabolism**. Springer-Verlag New York.
2. *David White and George D. Hageman*. 2000. **Microbial Physiology and Biochemistry Laboratory**. Oxford University Press.

REFERENCE BOOKS:

1. *Doelle. H.W.*1975.**Bacterial Metabolism**. 2nd edition. Academic Press.
2. *Moat. A.G. and Foster. J. W.* 1988. **Microbial Physiology**. 4th edition. John Wiley & sons.

16UMB33P	CORE PRACTICAL - III	SEMESTER - III
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Total Credits: 3
Hours per Week: 6

CONTENTS

1. Measurement of microbial growth – TVC-Micrometry-Turbidity method-Determination of generation time
2. Utilization of amino acid as Carbon source
3. Mixed acid Fermentation test
4. Non-acid end product test
5. Citrate utilization test
6. Carbohydrate fermentation test
7. Preferential sugar utilization test - TSI.
8. H₂S production
9. Starch hydrolysis
10. Catalase test
11. Oxidase test
12. Urease test
16. Gelatin liquefaction
17. Starch Hydrolysis test
18. Casein hydrolysis test

TEXT BOOKS:

1. *James.C.Cappuccino*. 2013. **Microbiology A laboratory manual**. 1st edition, Pearson education publishers.
2. *Kannan, N.* 1996. **Laboratory manual of General Microbiology**, 2nd edition, Panima publishing house.

REFERENCE BOOKS:

1. *Aneja. K.R.* 2012. **Experiments in Microbiology, plant pathology and biotechnology**, 4th Edition. New age publishers.
2. *Kannan, N.* 2003. **Hand book of Laboratory culture media** 1st edition, Panima publishing house.

16UBC3AA	ALLIED - III: BIOCHEMISTRY- I	SEMESTER - III
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Total Credits: 3
Hours per Week: 3

OBJECTIVES:

This course has been designed to study the

1. Nature of biological macromolecules namely carbohydrate, lipids, and proteins.
2. Importance of DNA and RNA
3. Role of Vitamins, Minerals and Hormones in the functioning of cell.

CONTENTS

UNIT - I

Carbohydrate classification structure, properties & chemical reactions of monosaccharide - Glucose, Fructose, Galactose, Mannose, Arabinose. Disaccharides - Maltose, Lactose and Sucrose. Polysaccharides - Homo polysaccharides - Starch, Glycogen and Cellulose & Hetero polysaccharides - Hyaluronic acid, Heparin, Chondroitin sulphate. Biological importance of sugar derivatives - glycosaminoglycan, proteoglycan & glycoprotein - Blood group & Bacterial cell wall polysaccharides.

UNIT - II

Lipids: Definition classification of lipids, physiochemical properties. Storage lipids - fatty acids - types. Structural lipids - phospholipids, glycolipids & sphingolipids. Structure & Biological role of cholesterol, prostaglandins Thromboxanes, Leukotrienes.

UNIT - III

Classification of amino acids, general properties, Non protein amino acids. Peptide bond - structure & conformation, Protein classification, Physiochemical properties of proteins. Organization of protein Structure - Primary, Secondary (Keratin, Collagen) Tertiary (Myoglobin), Quaternary structure (Hemoglobin).

UNIT - IV

Structures of Purines, pyrimidines, Nucleoside & Nucleotides. Properties of nucleic acids. DNA Double helical structure - Isoform. RNA - Types - mRNA, tRNA, rRNA - structure & function.

UNIT - V

Minerals in biological system & their importance - Iron, Calcium, Phosphorous, Iodine, Copper, Zinc. Vitamins - Definition, classification: Fat soluble (Vitamin A,D,E,K) and Water Soluble vitamins (Vitamin B)- Sources, functions and deficiencies. Role of vitamins as antioxidants & cofactors. Hormones involved in regulatory metabolism: Insulin, Glucagon and thyroid.

TEXT BOOKS:

1. *J.L.Jain*. 2007. **Fundamentals of Biochemistry**, 1st edition. S. Chand and company Ltd.
2. *Sathyannarayana U*. 2008. **Biochemistry** 3rd Edition. Books and Allied (P) Ltd.
3. *Stryer L*. 1995. **Biochemistry** 4th Edition. W. H. Freeman and Company, New york.

REFERENCE BOOKS:

1. *Zubay*, 1999. **Biochemistry** 4th edition. William.C.Brain publishers.

16UMB3SA	SKILL BASED SUBJECT I : ENTREPRENUR RELATED TO MICROBIOLOGY	SEMESTER- III
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Total Credits: 3
Hours per Week: 3

OBJECTIVES:

The subject aims to understand the concept regarding:

1. Concept of Entrepreneurship
2. Development of small scale industries

CONTENTS

UNIT - I

Concept of Entrepreneurship - Definition -Concept - Role and reasons.
Entrepreneurial scenario in India - Entrepreneurial environment.

UNIT - II

Establishment of Small scale Industries - Generation of project - Project identification - Designing capital structure - Preparation of Project report - Provisional registration of small scale units- Statutory licences - Applying for Permanent Registration.

UNIT - III

Planning - Characteristics of Planning - Elements of Planning - Advantages and Limitations. Promotion of Venture - Legal requirements - Raising of Funds - Needs of Funds.

UNIT - IV

Financial institutions - Small Industries Development Bank of India (SIDBI) - Industrial Development Bank of India (IDBI) - State Financial Corporation (SFCs) - National Bank of Agricultural and Rural Development (NABARD) - Role of Commercial Banks - Schemes available with Commercial Banks.

UNIT - V:

Social responsibility of Entrepreneur - Business ethics.

TEXT BOOKS:

1. *Dr. O. P. Gupta.* 2015. **Fundamentals of Entrepreneurship.** SBPD publications.
2. *Dr. P. T. Vijayashree and Dr. M. Alagammai.* 2013. **Entrepreneurship and Small Business Management.** Margham Publications.

16UMB43A	CORE - IV: BIOINSTRUMENTATION	SEMESTER - IV
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The subject aims to build knowledge on

1. Concept of buffers, Ph and biochemical calculations
2. Instrumental aspects in microbiology
3. Separation, Purification & Quantification of Biomolecules

CONTENTS

UNIT - I

Buffers-Types of Buffers- Molarity -and Normality-Calculation methods-, PH meter-Instrumentation- PH electrodes- calomel and glass electrode - Appliactions.

UNIT - II

Principle, Instrumentation, and Applications of Autoclave, Hot air oven, Incubator, Laminar air flow, metabolic shaker, Lyophilizer.

UNIT -III

Centrifugation: Principle- Types of Centrifuges -Low speed, High speed, Microfuge -Ultra centrifuge-Analytical and Differential Centrifuge- Applications.

UNIT -IV

Colorimetry - Principle, Instrumentation and Applications- Spectrometry - UV & Visible Spectrophotometer. Spectrofluorimeter.

UNIT-V

Chromatography - Paper, Thin layer, Column, Ion-exchange, Gas and HPLC. Electrophoresis -SDS - PAGE and Agarose gel electrophoresis.

TEXT BOOK:

1. *Keith Wilson and John Walker*. 2010. **Principles and Techniques of Biochemistry and Molecular Biology**. Cambridge University Press. UK.

REFERENCE BOOKS:

1. *Gedder , A. and L. E. Balse*, **Principles of applied Biomedical instrumentation**. John Wiley and Sons Publications.
2. *Dean, Willard and Merrit*. **Instrumental Methods of analysis** Asian Ed.
3. *Boyer, Rodney, F. Benjamin and Cummins*, **Modern Experimental Biochemistry** 2 Ed.

16UMB43P	CORE PRACTICAL - IV	SEMESTER - IV
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Total credits: 4
Hours per week: 4

CONTENTS

1. Preparation of Buffers-Acidic, neutral and alkaline range
2. Preparation of Normal solutions-0.1 N and 1N
3. Preparation of Normal solutions-0.1 M and 1M
4. Measurement of pH -pH meter
5. Extraction and quantification of Pigments from Plants
6. Extraction and quantification of Pigments from bacteria
7. Separation of amino acids-Paper Chromatography
8. Separation of amino acids-Thin Layer Chromatography
9. Agarose Gel Electrophoresis-Demonstration
10. Estimation of Protein-Lowry *et al* method
11. Estimation of sugars-DNSA method

LAB MANUALS:

1. *Aneja. K.R.* 2012. **Experiments in Microbiology, plant pathology and biotechnology**, 4th Edition. New age publishers.
2. *James.C.Cappuccino.* 2013. **Microbiology A laboratory manual**. 1st edition, Pearson education publishers.
3. *Rajan S. and Selvi Christy.* **Experimental Procedures in Life Sciences**. Anjana book House.
4. *Kannan,N.* 1997. **Laboratory Manual of General Microbiology**, 1st edition, Panima Publishing

16UBC4AA	ALLIED - IV: BIOCHEMISTRY - II	SEMESTER - II
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Total Credits: 3
Hours per Week: 3

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Definition, classification and types of carbohydrates.
2. Amino acid, protein and lipid classifications and structural characteristics.
3. Nucleic acid content and enzymes activities.

CONTENTS

UNIT - I

Carbohydrate metabolism: Glycolysis- The citric acid cycle and regulation. The pentose phosphate pathway & its importance. Glycogenesis and Glycogenolysis

UNIT - II

Lipid metabolism: α , β , γ - Oxidation of fatty acids: Saturated and unsaturated - Biosynthesis of Lipids: Triacylglycerols, Glycerophospholipids and Cholesterol.

UNIT - III

Nucleic acid metabolism: Biosynthesis of Purines and Pyrimidines. Synthesis, Replication and Degradation of DNA and RNA.

UNIT - IV

Enzymes Classification & nomenclature. Specificity of Enzymes. Active site- Overview of Coenzymes and cofactors in enzyme catalyzed reaction.- - Enzyme Kinetics - factors affecting enzyme activity, Michaelis-Menten plot, Lineweaver-Burk plot.

UNIT - V

Enzyme regulation - Enzyme inhibition - Reversible - competitive, noncompetitive, uncompetitive and mixed inhibition- irreversible inhibition.

TEXT BOOKS:

1. *Rodney Boyer*, 2001. **Modern Experimental Biochemistry**. Prentice Hall Publisher.
2. *Albert L. Lehninger, David L. Nelson, Michael M. Cox*, 2004. **Biochemistry**, 1st Edition. Palgrave Macmillan Limited.
3. *A. C. Deb*. **Fundamentals of Biochemistry**, 1983. New Central Book Agency, Kolkata.

REFERENCE BOOKS:

1. *Jayaraman J* 1981. **Laboratory Manual in Biochemistry**, 5th Edi. New Age Int. Publishers, New Delhi.
2. *Plummer DT* 1977 **An Introduction to Practical Biochemistry**, 3rd Edi. Tata McGraw Hill, Bombay.
3. *Sawhney S K*, 2000. **Introductory Practical Biochemistry**, Narosa Publishing House.

16UBC4AP	ALLIED PRACTICAL-II : BIOCHEMISTRY	SEMESTER- IV
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Total Credits: 2
Hours per Week: 2

1. Analysis of Carbohydrates:

- a. Monosaccharide - Pentose- Arabinose. Hexoses- Glucose, Fructose,
- b. Disaccharides - Sucrose, Maltose and Lactose
- c. Polysaccharide - Starch.

2. Analysis of Amino acids:

- a. Histidine
- b. Tyrosine.
- c. Tryptophan
- d. Arginine

3. Characterization of lipids

1. Determination of acid number.
2. Determination of iodine number.

4. Quantification technique

1. Quantification of Protein by Lowry *et al* method
2. Quantification of Carbohydrate by DNSA method

REFERENCE BOOKS:

1. David T. Plummer 1978. **An introduction to practical biochemistry** 2nd Edition. McGraw Hill Higher Education.
2. Pattabiraman T. N and Sitarama Acharya U. 1994. **Laboratory Manual in biochemistry** 2nd Edition. All India Traveller Book Seller.
3. J Jayaraman, 2005. **Laboratory manual in Biochemistry.** 1st Edition. New Age International

16UMB4SA	SKILL BASED SUBJECT- 2: ENTREPRENEURIAL MICROBIOLOGY	SEMESTER- IV
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Total Credits: 3
Hours per Week: 3

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Entrepreneur development
2. Fermentation products, Mushroom cultivation and Composting
3. Brewing Process.

CONTENTS

UNIT - I

Microbial cells as fermentation products- Baker's yeast, food and feed yeasts, Bacterial Insecticides, Legume Inoculants, Mushrooms, Algae.

UNIT - II

Enzymes as fermentation products- Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases.

UNIT - III

Mushroom cultivation and Composting- Cultivation of *Agaricus campestris*, *Agaricus bisporus*, and *Volvariella volvaciae*; Preparation of compost, filling tray beds, spawning, maintaining optimal temperature, casing, watering, harvesting, storage.

UNIT - IV

Biofertilizers - Historical background, Chemical fertilizers versus biofertilizers, organic farming. *Rhizobium* sp, *Azospirillum* sp, *Azotobacter* sp, Azolla, PGPR as Biofertilizers.

UNIT -V

Brewing- Media components, preparation of medium, Microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, Aging, by products. Production of Industrial alcohol.

TEXT BOOKS:

1. *Aneja. K.R.* 2012. **Experiments in Microbiology, plant pathology and biotechnology**, 2nd edition, New age publishers.
2. *Stanbury P T and Whitaker* 1984. **Principles of Fermentation Technology**, 1ST edition. Adithya Books pvt ltd.

REFERENCES:

1. *Glick B .R and Pasternak J .J* .1994. **Molecular Biotechnology. Principles and Application of recombinant DNA**, 2 nd edition. ASM Press, Washington.
2. *Pandey RK* 1996.**Handbok of Mushroom Cultivation**, 1st Edition, Emkay Publications.
3. http://agritech.tnau.ac.in/org_farm/orgfarm_compost_index.htm
1
4. http://agritech.tnau.ac.in/org_farm/orgfarm_ferti_mannure.html

16UMB53A	CORE - V: MICROBIAL GENETICS	SEMESTER - V
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The course aims to build the concepts regarding

1. Molecular basis of genetic material and its expression
2. Microbial genetic recombination and its regulation
3. Genetic variation

CONTENTS

UNIT-I

DNA: - DNA as genetic material, Structure of DNA and RNA, DNA Replication-Semiconservative-enzymology-mechanism.

UNIT-II

Transcription (General)-Genetic Code-Translation-enzymology and mechanism.

UNIT-III

Mutation-types-silent-missense-non-sense-insertion-deletion-substitution - spontaneous and induced. Repair-light-dark-SOS-Recombinant

UNIT-IV

Bacterial Genetics (Mutant phenotype, DNA mediated Transformation; Conjugation (Cointegrate Formation and Hfr Cells, Time-of-Entry Mapping, F' Plasmid); Transduction (Generalized transduction, Specialized Transduction) - gene mapping

UNIT-V

Molecular Mechanism of gene regulation in prokaryotes - lac, trp, Ara operons. Eukaryotic gene regulation.

TEXT BOOKS:

1. *Gardner, E. J, Simmons, M J & D P Snustard* . 1991, **Principles of Genetics**, 8th edition. John Wiley & Sons. NY.
2. *Freifelder .S.* 1987. **Microbial Genetics**, 1st Edi. Jones & Bartlett, Boston.
3. *Robert H. Tamarin.* 1992. **Principles of Genetics**, 7th edition, Cm Brown Publishers.

REFERENCE BOOKS:

1. *Lewin.B,* 1990. **Genes**, 1st edition, Oxford University Press.
2. *Klug .W.S. & Cummings, MR.* 1996, **Essentials of Genetics**, Mentics Hail. New Jersey.

15UMB53B	CORE-VI: IMMUNOLOGY	SEMESTER- V
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Total Credits: 3
Hours per Week: 5

OBJECTIVES:

The aim of the course is

- i. To develop knowledge among students about the immune system, its interaction with pathogens and
- ii. Responses to stimulation and vaccines.

CONTENTS

UNIT- I

History and Scope of Immunology. The basis of defense mechanisms. Cells and Organs involved in immune system.

UNIT- II

Types of immunity, Antigen and Antibody types, Complement pathways - Classical, alternate and lectin pathway. Immunoglobulin - structure, Isotypes, and functions.

UNIT- III

Allergy and Hypersensitivity - Classification types and Mechanisms. Autoimmunity mechanisms and autoimmune response diseases: cell specific: Systemic Lupus Erythematosus and Organ Specific: Myasthenia Gravis.

UNIT -IV

Antigen-Antibody reactions - Agglutination: Direct, indirect, RPR and Hemaagglutination. Precipitation: Double Immuno Diffusion. ELISA. Radio immune assay (RIA). Monoclonal antibodies and its applications.

UNIT -V

Immuno hematology - Blood transfusion - ABO grouping - Rh factor. Tissue transplantation - HLA typing - Mechanism of acceptance and rejection. Immunodeficiency disease: AIDS.

TEXT BOOKS:

1. *Nandhini Shetti*, 2009. **Immunology, an Introductory Text Book**.
1st edition. New Age International Limited.
2. *Tizard, I R.* 1998. **Immunology an Introduction**, 4th edition.
Thomson publishers, Australia.

REFERENCE BOOKS:

1. *Roitt, IM.* 2011. **Immunology** 1st edition. Mosby Publishers.
2. *Kuby.J.* 2002. **Immunology** 5th edition. W.H.Freeman, NY.
3. *Rao C. V.* 2002, **an Introduction to Immunology**, Narosa
Publishing House, Chennai.
4. *Pavri K. M.* 1996, **Challenge of AIDS**, National Book Trust, India.

16UMB53C	CORE - VII: FOOD MICROBIOLOGY	SEMESTER - V
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The course is used to study

1. To know the nature of food and its factors disturbing microbes.
2. To understand the role microbes in food fermentation.
3. To understand the concept of food borne diseases.

CONTENTS

UNIT - I

Food and Microorganisms - Important microorganisms in food (List of Bacteria, Mold and yeasts); Factors affecting the growth of microorganisms in food - pH, moisture, oxidation - Reduction potential, Nutrient content and Inhibitory substances and biological structure.

UNIT - II

Fermented food - Bread, fermented fish and meat products - Fermented dairy products - Yoghurt and cheese. Fermented beverages: Wine and beer.

UNIT -III

Spoilage of food - vegetables, fruits, Meat, Fish, Poultry, egg and milk - canned foods.

UNIT - IV

Food borne diseases - Food poisoning and Food borne infections - Bacterial: *Salmonella*, *E.coli*, *Staphylococcus*, *Clostridium*, *Listeria*, *Shigella*, *Campylobacter*, *Yersinia*, *Vibrio*, *Aeromonas*, *Mycobacterium* and *Bacillus*.

UNIT- V

Non Bacterial Food borne illness: Mycotoxins, Parasites, Viruses, Biohazards and other hazards. - Investigation of food poisoning outbreaks

TEXT BOOKS:

1. *Frazier. W.C and D.C Westhoff.* 1978. **Food Microbiology.** 3rd ed. Tata Macgraw Hill publishing Co., New Delhi.
2. *Adams M.R. and Moss M. O.,* 2000. **Food Microbiology** 2nd edition. Panima Publishers.

REFERENCE BOOKS:

1. *Roger.Y.Stainer.* 2003. **Basic Food Microbiology.** 2nd edition, CBS Publishers.
2. *Jay,J.M .* 1991. **Modern Food Microbiology** 4th edition. Van Nostra and Rainhokdd Co.

16UMB53D	CORE - VIII: MEDICAL MICROBIOLOGY - I	SEMESTER -V
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Infections and types
2. Gram positive and Gram negative organisms
3. Mycobacterium and Spirochetes

CONTENTS

UNIT - I

Infections- sources of infections- Types of infections- methods of infections - Definitions- Epidemic, Pandemic, Endemic diseases- Epidemiology of Infectious diseases, Infectious diseases cycle- Investigation of epidemics- control of epidemics.

UNIT-II

Morphology, Pathogenicity and laboratory diagnosis- Gram positive & negative coccus - *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pneumococcus*, *Neisseria gonorrhoea* and *Neisseria meningitidis*.

UNIT- III

Morphology, Pathogenicity and laboratory diagnosis- Gram positive organisms- *Bacillus anthracis*, *Corynebacterium diphtheriae*, *Clostridium botulinum*, *Clostridium tetani*.

UNIT -IV

Morphology, Pathogenicity and laboratory diagnosis- Gram negative Organisms - *Escherichia coli*, *Klebsiella*, *Proteus*, *Salmonella*, *Shigella*, *Pseudomonas*, *Vibrio cholerae*.

UNIT-V

Morphology, pathogenicity and laboratory diagnosis- *Mycobacterium tuberculosis*, *Mycobacterium leprae*, *Treponema pallidum*, *Leptospira*.

TEXT BOOKS:

1. *Ananthanarayanan R and CK Jayaram Panicker, 1994, Textbook of Microbiology.* Orient Longman.
2. *Chakraborty P 1995, A Text book of Microbiology,* New Central Book Agency Pvt Ltd. Calcutta.

REFERENCE BOOKS:

1. *Bailey and Scotts, 1994, Diagnostic Microbiology,* 9th edition, Baron and Finegold CV Mosby Publications.
2. *Jawetz E Melnic JL and Adel berg EA 1998, Review of Medical Microbiology.* Lange Medical Publications, USA.
3. *Mackie and Mc Catney, 1994, Medical Microbiology No I and II.* Churchill Livingston, 14th edition.

16UMB53P	CORE PRACTICAL -V	SEMESTER- V
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Total Credits: 4
Hours per Week: 5

CONTENTS

1. DNA Extraction from Bacteria.
2. Plasmid Extraction.
3. Separation of DNA by Agarose electrophoresis.
4. Isolation of drug resistant mutants using UV.
5. Slide agglutination -Blood grouping
6. Tube agglutination- WIDAL
7. Precipitation - RPR
8. Ouchterlony's Immunodiffusion
9. DOT ELISA
10. Separation of proteins by SDS - PAGE.
11. Isolation and Identification of clinical pathogens - *Staphylococcus aureus*, *Streptococcus pyogenes*, *Escherichia coli*, *Klebsiella pneumonia*, *Proteus*, *Salmonella*, *Shigella* and *Pseudomonas*.

TEXT BOOKS:

1. Maniatis, T. Fritsch E F and Sambrook J, 2010. **Molecular Cloning. A Laboratory Manual.** Cold Spring Harbor Laboratory, New York.
2. Rajan S. and Selvi Christy. **Experimental Procedures in Life Sciences.** Anjana book House.
3. Aneja. K.R. 2012. **Experiments in Microbiology, Plant Pathology and Biotechnology**, 2nd edition, New age publishers.

REFERENCE BOOKS:

1. Jeffrey H. Miller, 1972. **Experiments in Molecular genetics.** Cold Spring Harbor Laboratory, New York.
2. Kannan N., 1997. **Laboratory Manual of General Microbiology**, 2nd ed

16UMB5EA	ELECTIVE- I: RECOMBINANT DNA TECHNOLOGY	SEMESTER- V
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Total Credits: 4
Hours per Week: 4

OBJECTIVES:

The subject aim to build the concept

1. To construct recombinant DNA molecules and to direct their replication within host organisms.
2. To explain molecular screening and diagnostic methods.

CONTENTS

UNIT - I

Gene manipulation - Restriction Enzymes - Discovery, types and mode of action, Polymerases - Ligases - Methylases.

UNIT - II

Isolation and Purification of DNA (Chromosomal and Plasmid)-Isolation and Purification of RNA - Chemical Synthesis of DNA - Genomic Library and cDNA Library.

UNIT - III

Vectors - Plasmid based Vectors - Natural vectors - pSC101, pSF2124 and pMB1. Artificial vectors - pBR322 & pUC. Phage based Vectors- λ phage Vectors. Hybrid Vectors - Phagemid, Phasmid and Cosmid, BAC and YAC.

UNIT - IV

Gene Transfer Techniques - Biolistic Method, Calcium chloride and DEAE Methods. Screening and Selection of recombinants - Direct Method - Selection by Complementation, Marker inactivation Methods. Indirect Methods - Immunological and Genetic Methods.

UNIT - V

PCR - DNA Sequencing (Sanger's Method) - Blotting (Southern, Western, Northern) Techniques - RFLP - RAPD - Microarray. Protein Engineering.

TEXT BOOKS:

1. *Old. RW and Primrose, 1995. Principle of Gene Manipulation, 5th edition. Blackwell Scientific Publication, Boston.*
2. *T.A Brown 1st edition, 2002. Genomes, John- Wiley & Son.*

REFERENCE BOOKS:

1. *Winnecker, E.D, 1987. From Gene to Clones, Introduction to Gene Technology, 1 st edition. Panima educational book agency.*
2. *Glick B .R and Pasternak J .J .1994. Molecular Biotechnology. Principles and Application of recombinant DNA, 2 nd edition. ASM Press, Washington.*

16UMB5EB	ELECTIVE-I: GENERAL BIOLOGY	SEMESTER- V
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Total Credits: 4
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Cellular Organization
2. Different systems in human beings
3. Interdisciplinary studies in life sciences

CONTENTS

UNIT - I

Introduction: Study on Life- - Cellular Organization-Chemistry of Cell-membrane structure and diversity- osmosis and diffusion- mitosis and cell cycle- prokaryotes and eukaryotes- water and life.

UNIT - II

Digestive system- Respiratory system- Excretory system in human beings
- Homeostasis- Circulation- -Nervous System

UNIT - III

Plant Photosynthesis- pigments- light reaction and dark reaction- C₃ and C₄ Photosynthesis-plant hormones.

UNIT - IV

Genetics: Heredity- Patterns of Inheritance- Dominant/Recessive - Sex-linked
Incomplete Dominance- Co-dominance- Polygenic Inheritance- Multiple Alleles

UNIT - V:

Ecology: Ecosystem Structure: Abiotic Factors, Biotic Factors, The Flow of Energy in Ecosystems- Food Chains, Food Webs, Energy Pyramids.

B. Sc., Microbiology (students admitted during 2016 - 2017 onwards)

TEXT BOOKS:

1. *Taylor D J, Green, N P O, Stout G W.* 1997. **Biological Science**, 3rd edition, Cambridge University Publishers,
2. *Verma P S,* 2004. **Cell biology, Genetics, Evolution and Ecology**, 14th Edition, S Chand Publishers.
3. Chandi Charan Chatterjee, 1958. **Human Physiology**, 4th Edition. Central Book Agency.

REFERENCE BOOK:

1. *Gerald Karp,* 2010. **Cell Biology**, 6th Edition, John Wiley & sons Publishers.

16UMB5EC

ELECTIVE -I:

SEMESTER -V

	HUMAN PHYSIOLOGY	
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Total Credits: 4
Hours per week: 4

OBJECTIVE:

1. This course has been designed to enable students to understand the general structure and functions of various systems and organs in the body.
2. This will help students to understand the abnormal changes in tissues and organs in several disease states.

CONTENTS

UNIT - I

Organs of respiration - Nose, Larynx, Trachea, Bronchi, Lungs and their capacity - structure and functions. Mechanism of respiration - chemical respiration - Tissue respiration .

UNIT - II

Digestive System: Organs, structure, functions-Teeth, tongue, Salivary glands - Saliva- Composition and function. Oesophagus, stomach, small intestine,
Large intestine. Glands -Liver, Pancreas, gallbladder.

UNIT - III

Excretory system: Organs, structure and functions. Kidney, Ureter, Urinary bladder-Formation of Urine, Constitution of Normal Urine. Abnormal Constituents of Urine and diseases associated with it. Nephritis, Nephritis, Renal stones.

UNIT - IV

Skin - structure and Function. Disorders of skin - Dandruff, Dermatitis and Burns.

UNIT - V

The Skeleton - A general account of the axial skeleton and appendicular skeleton. Blood composition, Blood group - Blood Vessel - artery, Vein. Capillary, structure of heart. Blood pressure - pulse, systolic-diastolic, Lymphatic system.

TEXT BOOKS:

1. *Guyton, Arthur C.* 1987 .11th edition. **Textbook of medical physiology.** Elsevier Saunders publication.
2. *Chandi Charan Chatterjee.* 2016. **Human Physiology** 11th edition. Central Book Agency.

16UMB5SA	SKILL BASED SUBJECT- 3 : FOOD QUALITY CONTROL & FOOD PRESERVATION	SEMESTER- V
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

1. To get the Knowledge about wide variety of parameters affecting food safety
2. To Understand the Quality food manufacturing & Food regulations
3. Acquire skills in methods of food preservation

CONTENTS

UNIT-I

Principles of food safety–Establishment: design and facilities –emergency preparedness –Maintenance cleaning and sanitation–personal hygienic–packaging and labeling– transportation– traceability–recall procedure.

UNIT -II

Codex Alimentarius –GMP -SSOP, HACCP-principles–Hazard analysis–determine CCP–establish critical limit–establish monitoring procedure–establish corrective action–recordkeeping–verification –HACCP plan chart. Food Adulteration: Intentional and unintentional.

UNIT -III

Food Laws: FSSAI, Essential Commodities Act, BIS, organizational chart –prohibition and regulation of sales – Laboratory and sampling analysis Scope and objective of industry – food safety policy – environmental policy Glass policy – jewelry policy– visitor policy.

UNIT -IV

Principles of food preservation – General principles and application methods – Asepsis - Techniques of removal – use of high temperature preservation and Canning Process.

UNIT -V

B. Sc., Microbiology (students admitted during 2016 - 2017 onwards)

Preservation by use of low temperature, Drying, chemical preservatives and Radiation.

TEXT BOOKS:

1. *Frazier. W.C and D.C Westhoff. 1978. Food Microbiology. 3rd ed.*
Tata Macgraw Hill Publishing Co., New Delhi.
2. *Adams. M. R and M. D Moss. 1995. Food Microbiology. 5th*
Edition. New Age International limited.

REFERENCES:

1. Food safety and standards regulations, 2010.
2. *Jay,J.M .1991. Modern Food Microbiology 4th edition , Van Nostra*
and Rainhokdd Co.
3. The ministry of health and family welfare,The Gazette of India :
Extraordinary, Part - III, section
4. *D Kumar Bhatt, Priyanka Tomar, 2010.An Introduction to Food*
Science Technology and Quality Management 1st Edition, Kalyani
Publishers

16UMB63A	CORE - IX : VIROLOGY	SEMESTER- VI
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The subject aims to understand the concept regarding:

1. Development in virology and general study on viruses
2. Reproduction of Bacteriophages and Eukaryotic viruses
3. Disease and Diagnostic importance of recent and emerging human viruses.

CONTENTS

UNIT - I

Early development of Virology - Virus - Morphology, General characteristics, Structure of viruses - Virion size - General structural properties - Helical and icosahedra capsid - Nucleic acids - Viral envelopes and enzymes. Classification of viruses. Cultivation of Viruses - Virus purification and assays.

UNIT- II

Reproduction of DNA phages - ds DNA lytic phages - T4 phage - The one step growth - Adsorption to the host cell and penetration- Synthesis of Phage nucleic acids - Protein assembly of phage particles - Release of phage particles. ss DNA phage - ϕ X 174 - Rolling circle replication.

UNIT-III

Lysogeny - Temperate bacteriophages - lambda phage - Induction of lysogens - Generation of defective phages and their uses. Reproduction of RNA phages.

UNIT -IV:

Viruses of Eukaryotes - Reproduction of animal and plant viruses - Viruses of Algae, fungi and viruses - Viruses and cancer.

UNIT- V

Human viral infections - Pathogenicity and diagnosis of Hepatitis (A, B, C), Mumps, AIDS, Rabies, Influenza, Measles, Rubella, Polio virus, Emerging viral diseases: Ebola, Dengue.

TEXT BOOKS:

1. *Dimmock*. 1998. **Introduction to Modern Virology**. 5th edition. Blackwell scientific publications.
2. *Rogger Hull*. 2001. **Mathews Plant Virology**. 4th edition. Academic press.

REFERENCE BOOKS:

1. *Luria S.E. Darnel, J.E Jr. Baltimore. D and Campbell A.* 1978. **General Virology**, 3rd edition, Wiley and sons.
2. *Ananthanarayanan R and CK Jayaram Panicker*, 2005. **Introduction to Medical Microbiology**, 2nd edition .Orient Longman.

16UMB63B	CORE -X: INDUSTRIAL MICROBIOLOGY	SEMESTER- VI
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Screening and improvement of microorganism for industrial purpose
2. Design and types of fermentor
3. Industrial scale production of microbial products.

CONTENTS

UNIT -I

Industrially important strains- Screening methods- Primary and Secondary screening. Strain development for improved yield- Mutation, Recombination and protoplasmic fusion.

UNIT -II

Fermentation- Definition & types - Submerged and Solid state. Batch fermentation - Continuous fermentation. Fermentors -Design of a fermentor- Components (Baffles, Agitator, Impellers and Antifoaming agents). Types of Fermentors - Tower, cylindroconical & airlift,CSTF

UNIT -III

Industrial scale Production of beverages - beer and wine- vitamin B12 and Riboflavin - Antibiotics- penicillin and streptomycin - production of enzymes - Amylases and Proteases.

UNIT- IV

Single cell protein- Baker's yeast, Spirulina- Details of mushroom development- *Oyster Pleurotus* and Button (*Agaricus*) mushroom. Baker's yeast-Cell and Enzyme immobilization methods and its applications

UNIT -V

Downstream process- Intercellular and extracellular - Filtration-Centrifugation-Breakage of cells - physical and chemical methods, Flootation- solvent extraction, precipitation-Chromatography-Drying and Crystallisation

TEXT BOOKS:

1. *Patel A.H.* 2011. **Industrial Microbiology**. 2nd Edition. Mac Millan Publishers.
2. *Crueger W and Crueger A.* 1991. **Biotechnology. A textbook of Industrial Microbiology**. Sinauer Associates Inc.,U.S.
3. *Stanbury P T and Whitaker* 1984. **Principles of Fermentation Technology**, 1st Edition. Adithya Books pvt ltd.

REFERENCE BOOKS:

1. *Prescott and Rehm* 1986. **Industrial Microbiology**. 1st edition. Agarbios.
2. *R.C.Dubey*,Textbhook of Biotechnology

16UMB63C	CORE- XI: MEDICAL MICROBIOLOGY - II	SEMESTER -VI
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Total Credits: 3
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Medically important fungal infections
2. Parasitic infections
3. Antibiotics and chemotherapeutic agents

CONTENTS

UNIT-I

Classification of Fungal infection: skin mycology: Superficial Mycoses- Cutaneous Mycoses- Subcutaneous Mycoses. Infectious disease mycology: Dimorphic Systemic Mycoses- Opportunistic Systemic Mycoses

UNIT-II

Pityriasis versicolor- Dermatophytes and agents of superficial mycoses. Trichophyton, Epidermophyton and Microsporum. Subcutaneous mycoses - sporotrichosis- chromoblastomycosis- mycetoma. Dimorphic systemic mycoses -Histoplasmosis, Coccidioidomycosis

UNIT-III

Opportunistic mycoses -Candidiasis, Cryptococcosis, Aspergillosis. Mycotoxins, Antifungal agents, testing and methods.

UNIT-IV

Introduction to medical Parasitology - Classification, Protozoa - Entamoeba - Plasmodium- Leishmania - Trypanosoma -Giardia - Trichomonas.

UNIT-V

Life cycle and infection - Platyhelminthes - Taenia-Nematihelminthes - Ascaris - Enterobius - Trichuris - Wuchereria.

Antibiotics: Introduction, Mode of action with example of each class, Antibiotic resistance and prevention of antibiotic resistance.

TEXT BOOKS:

1. *Prescott, L.M J.P. Harley and C.A. Klein.* 1995. **Microbiology** 2nd edition. Wm, C. Brown Publishers.
2. *Ananthanarayanan R and CK Jayaram Panicker,* 1994, **Textbook of microbiology.** Orient Longman.
3. *Chakraborty P* 1995, **A Text book of microbiology,** New Central Book Agency Pvt Ltd. Calcutta.
4. *CK Jayaram Paniker.* 2007. **Medical Parasitology,** 6th Edition. Jaypee Brothers Medical Publishers (p) Ltd. New Delhi.

REFERENCE BOOKS:

1. *Bailey and Scotts,* 1994, **Diagnostic Microbiology,** 9th edition, Baron and Finegold CV Mosby Publications.
2. *Jawetz E Melnic JL and Adel berg EA* 1998, **Review of Medical Microbiology.** Lange Medical Publications, USA.
3. *Jagdish Chander,* 2009. **Textbook of Medical Mycology,** 3rd edition. Mehta Publishers, New Delhi.

16UMB63P	CORE PRACTICAL - VI	SEMESTER- VI
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Total Credits: 4
Hours per Week: 6

CONTENTS

1. Isolation and titration of coli phages.
2. Cultivation of Animal viruses.
3. Enzyme production and assay - protease
4. Enzyme production and assay - amylase
5. Alcohol production - wine
6. Immobilization using Sodium alginate
7. Study of parasites - *Entamoeba*, *Plasmodium*, *Ascaris*, *Taenia*.
8. Isolation and Identification of clinically important fungi - *Candida* sp., and *Aspergillus* sp.,
9. Water potability test-MPN Test
10. Isolation of free living nitrogen fixers - *Azotobacter*, *Azospirillum*
11. Phosphate solubilizers
12. Isolation of symbiotic nitrogen fixers - *Rhizobium* from nodule.

TEXT BOOKS:

1. *Aneja. K.R.* 2nd edition, **Experiments in Microbiology, Plant Pathology and Biotechnology**, New age publishers.
2. *Rajan S. and Selvi Christy.* **Experimental Procedures in Life Sciences**. Anjana book House.

REFERENCE BOOKS:

1. *James.C.Cappuccino.* 2013. **Microbiology A laboratory manual**. 1st edition, Pearson education publishers.
2. *Kannan N.,* 1997. **Laboratory Manual of General Microbiology**, 2nd edition, Panima Publishing House.

16UMB6EA	ELECTIVE-II : ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	SEMESTER- V
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Total Credits: 4
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Exploration and dissemination of microflora in environment
2. To understand the role of microbes to better ecological niche
3. Understand the significance of microbes in Agricultural field

CONTENTS

UNIT -I

Distribution of microorganisms in nature – Microbial communities in soil-factors Influencing the microbial density in soil- zymogenous and autochthonous flora in Soil- Microbial associations – symbiotic proto cooperation, ammensalism, Commensalism, syntropism, parasitism and predation with suitable examples.

UNIT -II

Microbial decomposition; cellulose, Hemi cellulose, lignin, pectin and chitin. –Factors influencing degradation- acetate utilization - bioconversion of organicwastes- composting, principles and Applications- conversion process
sugarcane wastes- coir pith composition.

UNIT- III

Microorganisms in the decomposition of organic matter- carbon cycle – nitrogen Cycle- nitrogen fixing microorganisms- root nodule bacteria (symbiotic) – non symbiotic Nitrogen fixers – biofertilizers in agriculture- Rhizobium and phosphate solubilisers- Mycorrhizial association – phosphorous cycle.

UNIT- IV

Water microbiology, algae, phytoplankton- eutrophication- water treatment- Primary, secondary and tertiary. Drinking water- Portability- MPN technique.

UNIT-V

Aero microbiology- aerosol, droplet nuclei, air pollution- sources (Microbiological) – air quality analysis- air sampling devices.

TEXT BOOKS:

1. *Atlas R. M. and Bartha., 1998. Microbial Ecology. 1st edition.* Pearson education.
2. *Subbarao. 2005. Soil Microbiology Soil Microorganisms and Plant Growth. 1st edition.* Oxford and IBH,
3. *Mark S Coyne, Soil Microbiology: An Exploratory Approach, Delmar Publishers.*

REFERENCE BOOK:

1. *Black, J.G. 2013. Microbiology, 8th Edition.* John Wiley and Sons.
2. *N.S. Subba Rao 2014. Soil Microbiology (Fourth Edition of Soil Microorganisms and Plant Growth), Science Publishers*
3. *Michael J. Pelczar 2001, Microbiology, Tata Mc Graw Hill Eduaction*

16UMB6EB	ELECTIVE -II: INTERMEDIATE METABOLISM	SEMESTER -V
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Total credits: 4
Hours per week: 4

OBJECTIVE:

To teach metabolic pathways, their regulation and engineering and methods used in their elucidation.

CONTENTS

UNIT - I

Introduction to metabolism: Basic concepts and design. High energy compounds.

UNIT - II

Carbohydrate metabolism: An overview of aerobic and anaerobic carbohydrate metabolism. Glycolysis and the catabolism of hexoses. Feeder pathways. Regulation. Pentose phosphate pathway. Utilization of glycogen. The Citric Acid cycle. Anaplerosis. Regulation. The glyoxylate cycle. Carbohydrate biosynthesis. Gluconeogenesis. Glycogen synthesis. Glycogen storage diseases. Glucuronic acid pathway, Photosynthesis. Light and dark reactions. Electron flow. ATP synthesis by photophosphorylation. Biosynthesis of starch and oligosaccharides.

UNIT - III

Lipid metabolism: Introduction to Lipids as energy sources. β oxidation. Oxidation of unsaturated and odd chain fatty acids. Ketone bodies. Biosynthesis

of: Fatty acids. Triacyl glycerols. Membrane phospholipids. Cholesterol, steroids and isoprenoids. Membrane Phosphoinositides, Ceramides.

UNIT - IV

Protein Metabolism: Metabolic fate of amino groups. Transamination, deamination and decarboxylation. Essential and non-essential amino acids. Nitrogen excretion and the urea cycle. Pathways of amino acid degradation. One carbon transfers, role of tetrahydrofolate and S - adenosyl methionine.

UNIT - V

Overview of Nitrogen Metabolism. Biosynthesis of amino acids and compounds derived from amino acids. Inborn errors of metabolism.

TEXT BOOKS:

1. *Lehninger*: 2000. **Principles of Biochemistry**, 3rd edition, by David L. Nelson and M.M. Cox Maxmillan/ Worth publishers.
2. *Donald Voet and Judith G Voet*, 1999. **Fundamentals of Biochemistry**. John Wiley & Sons, NY

15UMB6EB	ELECTIVE -II: HEMATOLOGY	SEMESTER- VI
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Total Credits: 4
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Blood and its nature
2. Blood Transfusion and blood transfusion reactions
3. Blood Analysis

CONTENTS

UNIT-I

Blood: Definition, Characters, Composition. Collection of Blood - Capillary Blood: from Adults, Infants. Venous blood: from Adults, Infants. Anticoagulants: Definition - Type: Wintrob's /EDTA /Heparin /Citrate.

UNIT-II

Counting of Blood Cells: Neubauer counting chamber - Total RBC count: diluting fluids, Macro dilution, and Micro dilution technique. Normal values - Total WBC count: diluting fluids, Macro dilution, and Micro dilution technique. Absolute Eosinophil count - Differential Leucocyte count: Granulocyte, Agranulocytes, Morphology, Function, Staining Technique - Platelet Count: Morphological characters, Functions. Haemoglobin: Composition, Normal Values:- Determinations:

UNIT-III

Coagulation Mechanism:- Factors: Bleeding time, Clotting time. Haematological indices:- Packed cell volume : Wintrob's , Micro HCT method - Erythrocyte sedimentation Rate - Principle - Determination.

UNIT-IV

Preparations of stains and staining techniques: - Wright stain - Leishman's stain -Giemsa's stain -Fields stain - Peroxidase stain: Examination of Blood smear:-Peripheral smear report: Size, colour, shapes, inclusions.

UNIT-V

Coombs test : Direct, Indirect - Donor screening - Cross matching : Major, Minor - Collection of blood, preservation, storage.

TEXT BOOKS:

1. *Mukerjee, K.L.* 1988. **Medical Laboratory Technologies Vol I - III**
Tata McGraw Hill. Publishers, New Delhi.
2. *Mukerjee, K.L.* 1988. **Medical Laboratory Technology: A
Procedures Manual for Routine Diagnostic Tests.** Tata McGraw
Hill. Publishers, New Delhi.

REFERENCE BOOKS:

1. *Gadkar, P.B and Gadakar, D.P.* 2014. **Textbook Medical Laboratory
Technology** 2nd Edition. Bhalani Publishing House.

15UMB6EA	ELECTIVE - III: BIOTECHNOLOGY	SEMESTER -VI
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Total Credits: 4
Hours per Week: 4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Microbial synthesis of commercial products
2. Transgenic plants, transgenic animals and Bioremediation

CONTENTS

UNIT - I

Microbial synthesis of commercial products-Proteins-Pharmaceuticals - Interferon's - Human growth hormone- Antibiotics -Biopolymers. Vaccines - subunit vaccines, Edible vaccines, Recombinant vaccine - Monoclonal antibody.

UNIT - II

Transgenic plants-Ti plasmid - insect, virus, herbicide resistant plants - microbial insecticides - bacteria, fungi and viruses.

UNIT - III

Transgenic animals - mice - retroviral method - DNA Microinjection method - embryonic stem cell method. Application-Transgenic Sheep and Transgenic Fish.

UNIT - IV

Microbial Degradation of Xenobiotics: Manipulation by Transfer of Plasmids. Manipulation by gene alteration. Utilisation of Starch and Sugars - Improving alcohol production, Improving fructose production, *Zymomonas mobilis* -Utilisation of cellulose - Isolation of prokaryotic and Eucaryotic cellulose gene. Manipulation of cellulose gene.

UNIT - V

DNA finger printing and its Application. Gene therapy. Human Genome Project.

TEXT BOOKS:

1. *Brown T.A.*, 2002. **Genomes**, 1st edition, John- Wiley & Son.
2. *Glick B .R and Pasternak J .J* .1994. **Molecular Biotechnology. Principles and Application of recombinant DNA**, 2nd edition. ASM Press, Washington.

REFERENCE BOOKS:

1. *Winnecker, E.D*, 1987. **From Gene to Clones**, Introduction to Gene Technology, 1st edition. Panima educational book agency.
2. *Old. RW and Primrose*, 1995. **Principle of Gene Manipulation**, 5th edition. Blackwell Scientific Publication, Boston.

16UMB6EE	ELECTIVE III: ENZYME TECHNOLOGY	SEMESTER- VI
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Total Credit: 4
Hours per week: 4

OBJECTIVE:

The subject aim to

1. Construct knowledge on roles and reactions of enzymes.
2. Instill the applications of enzymes in industrial microbiology.

CONTENTS

UNIT - I

Factors affecting the enzyme activity - Concentration, pH and temperature. Kinetics of a single - substrate enzyme catalysed reaction, Michealis - Menten Equation, Km, Vmax, L.B Plot, Turnover number, Kcat. Kinetics of Enzyme Inhibition. Kinetics Allosteric enzymes.

UNIT - II

Industrial Enzymes - Thermophilic enzymes, amylases, lipases, proteolytic enzymes in meat and leather industry, enzymes used in various fermentation processes, cellulose degrading enzymes, Metal degrading enzymes.

UNIT - III

Clinical enzymes- Enzymes as thrombolytic agents, Anti-inflammatory agents, streptokinase, asparaginase, Isoenzymes like CK and LDH, Transaminases (AST, ALT), Amylases, Cholinesterases, Phosphatases.

UNIT - IV

Immobilization of enzymes, ELIZA. Biosensors. Enzyme Engineering and site directed mutagenesis, Designer enzymes

UNIT - V

Organisation of enzymes in the cell. localization, compartmentation of metabolic pathways, enzymes in membranes, concentrations. Mechanisms of enzyme degradation, lysosomal and nonlysosomal pathways.

TEXT BOOKS:

1. *J.L.Jain*. 2007. **Fundamentals of Biochemistry**, 1st edition. S. Chand and company Ltd.
2. *Sathyannarayana U.* 2008. **Biochemistry** 3rd Edition. Books and Allied (P) Ltd.
3. *Stryer L.* 1995. **Biochemistry** 4th Edition. W. H. Freeman and Company, New york.

REFERENCE BOOKS:

1. *Zubay*, 1999. **Biochemistry** 4th edition. William.C.Brain publishers.
2. *Donald J. Voet and Judith G. Voet.* 2004. **Biochemistry** 3rd edition. John Wiley & Sons (Asia) pvt ltd.

16UMB6EF	ELECTIVE -III: FORENSIC SCIENCE	SEMESTER -VI
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Total Credits: 4
Hours per week: 4

OBJECTIVE:

1. Basics of Forensic Science
2. Role of Biological sciences in Forensic Science
3. Applications of Biological techniques in Forensic science

CONTENTS

UNIT-1

Definition of Forensic Science, Scope of Forensic Science, Need of Forensic Science, Basic Principles of Forensic Science, Tools and Techniques of Forensic Science. Ethics in Forensic Science, Duties of Forensic Scientist, Qualification of Forensic Scientist.

UNIT - II

Forensic Biology: Introduction, importance of various biological evidences (hair, fiber, pollens, wood), collection and evaluation in general, bite marks, human skeletal remains, importance and examination.

Forensic Serology: Forensic importance of various serological evidences (Blood serums, saliva, urine), collection, preservation and evaluation in general. DNA profiling: Introduction, importance and applications in forensic cases.

UNIT- III

Forensic Entomology: Forensic importance of various insects, importance of various insect growth stages, Entomological evidences, their location, collection and packing, Determination of time since death from entomological evidences.

UNIT - IV

Forensic Microbiology and Molecular techniques: Bacterial Pathogens, Bacterial Toxins, Virus general characteristics and diseases .DNA isolation, RFLP, MLST, Southern Blotting DNA finger printing.

UNIT - V

Forensic Toxicology: Introduction, types of cases, definition and classification of poisons, poisoning trends in India, collection and preservation of viscera, A brief introduction to extraction, isolation and identification of commonly used poisons (insecticides/pesticides, vegetable poisons, metallic poisons).

TEXT BOOKS:

1. *James, S.H and Nordby, J.J.*. 2003. **Forensic Science : An introduction to scientific and investigative techniques** CRC Press,
2. *Curry .* 1986. **Analytical Methods in Human Toxicology**.
3. *Chowdhuri, S.* 197): **Forensic Biology**, B P R & D, Govt. of India.
4. *Jason H. Byrd and James L. Castner;* 2001. **Forensic entomology**, CRC Press LLC,

REFERENCE BOOKS:

1. *Race, R. R. and Sangar, R.* 1975: **Blood Groups in Man**. Blackwell Scientific, Oxford.
2. *Prescott, L.M J.P. Harley and C.A. Klein* 1995. **Microbiology** 2nd edition Wm, C. Brown Publishers.
3. *Old. RW and Primrose,* 1995 **Principle of Gene Manipulation**, 5th edition. Blackwell Scientific Publication, Boston.

16UMB6SA	SKILL BASED LAB	SEMESTER - VI
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Total Credits: 3
Hours per week: 4

CONTENTS

1. Production of Button Mushroom
2. Production of Oyster Mushroom
3. Production of Biofertilizer-Phosphobacteria
4. Production of Biofertilizer-Azospirillum
5. Quality control of packed food and canned food
6. Biomass production of Baker yeast
7. Biomass production of Brewer's yeast
8. Biomass production of Single Cell protein-Spirulina
9. Vermicomposting
10. Production of Biopesticide-*Trichoderma* sp.,

TEXT BOOKS:

1. *James.C.Cappuccino*. 2013. **Microbiology A laboratory manual**. 1st edition, Pearson education publishers.
2. *Kannan, N.* 1996. **Laboratory manual of General Microbiology**, 2nd edition, Panima publishing house.

REFERENCE BOOKS:

1. *Aneja. K.R.* 2012. **Experiments in Microbiology, plant pathology and biotechnology**, 4th Edition. New age publishers.
2. *Kannan, N.* 2003. **Hand book of Laboratory culture media** 1st edition, Panima publishing house.

16UNM34F	NMEC I: MICROBIOLOGY AND PUBLIC HEALTH	SEMESTER - III
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Total Credits: 2
Hours per Week: 2

OBJECTIVES:

The course is designed

1. To meet a national demand, which has reached critical proportions, for a trained workforce in biodefense and emerging infections.
2. It also addresses an international demand for training in diseases that affect developing countries.

CONTENTS

UNIT -I

Communicable Diseases: Introduction, Terminology. Modes of disease transmission, general measures for prevention & control of communicable diseases.

UNIT-II

Disinfection & Sterilization: Effective disinfection by liquid chemical agents like Halogen, Potassium per magnate solution etc. Solid chemical agent - Bleaching powder, Lime.

UNIT-III

Non-Communicable Diseases: Diagnosis & prevention of Cancer, Cardiovascular Diseases and Diabetes.

UNIT-IV

Food borne infection - Salmonellosis, Shigellosis and Hemorrhagic colitis. Food intoxication - *Staphylococcus aureus*, *Bacillus cereus* and Mycotoxins.

UNIT-V

Personal Hygiene: Factors influencing health & hygiene. Health habits & practice. Maintenance of normal circulation, respiration, digestion etc. Skin care cleanliness. Dental care. Care of hands, hand washing. Exercises-importance. Food values. Nutrition.

TEXT BOOKS:

1. *Frazier, W.C. and Westhoff, D.C.* 2008. **Food microbiology**. 4th Edition. McGraw Hill NY.
2. *Park K.* 2013. **Preventive and Social Medicine 22nd Edition**, Banarsidas Bhanot *Publishers*.

REFERENCE BOOK:

1. *Adams, M.R.and Moss. M.O.* 1996. **Food Microbiology**. 2nd edition. Panima Publishers.

16UNM44F	NMEC II: MICROBES IN AND AS FOOD	SEMESTER - III
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Total Credits: 2
Hours per Week: 2

OBJECTIVES:

The course is designed

1. To understand the relationship between food and microorganisms.
2. To create an awareness on production of fermented foods.

CONTENTS

UNIT - I

History and development of Food microbiology - Common Food borne Bacteria and Molds - Role and Significance of Microorganisms in Foods. Parameters Affecting Microbial Growth: Intrinsic and Extrinsic.

UNIT - II

Detection of Microorganisms in Foods - Milk, Fruits and Vegetables, fermented foods - Culture, Microscopic, and Sampling Method for detecting microbes.

UNIT - III

Production of Fermented foods- Idly, Bread, wine, Curd, Yoghurt, Butter milk, Cheese.

UNIT - IV

Microbial Food Spoilage and Food borne diseases - *Staphylococcal*, *E coli*, Salmonellosis, Shigellosis, Listerial infections. Mycotoxins and Aflatoxins.

UNIT - V

Applications of Food Microbiology: Beneficial Uses of Microorganisms in Food - Intestinal Beneficial Bacteria- Concept of Prebiotics and Probiotics - Mushroom - Single Cell Protein. Genetically modified foods. Biosensors in food

TEXT BOOKS:

1. *Frazier, W.C. and Westhoff, D.C.* 2008. **Food microbiology**. 4th Edition. McGraw Hill NY.
2. *Roger Y Stainer*, 1989. **Food Microbiology**. 2nd edition. CBS, New Delhi.

REFERENCE BOOKS:

1. *Adams, M.R. and Moss. M.O.* 1996. **Food Microbiology**. 2nd edition. Panima Publishers.
2. *James M Jay*, 1996. **Modern Food Microbiology**. 1st edition. CBS, New Delhi.

16UMBSS1	SELF STUDY PAPER- I: GOOD LABORATORY PRACTICES	SEMESTER I to V
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Total credits: 1

OBJECTIVES:

1. To inculcate the knowledge on proper and safe handling of hazardous materials in the laboratory.
2. To understand the role of GMPs.

CONTENTS

UNIT - I

Chemical Labelling & Safety - Safe handling of chemicals and equipment in the laboratory. Handling and disposal of infected, dangerous materials, accidents, safety measures, emergency treatment.

UNIT - II

Good Manufacturing Practice - Good Laboratory Practices (GLPs)- Fire Safety Regulatory Agencies.

UNIT - III

International and federal regulatory agencies that impact the work of Microbiology.

UNIT - IV

Emergency Equipment & Standard Operating Procedures - Maintenance of emergency equipment in a laboratory setting - evaluating Standard Operating Procedures (SOPs) and safety plans.

UNIT - V

Calibration of volumetric and gravimetric equipment and apparatus.

TEXT BOOKS:

1. *Mark Gregory Slomiany. The indispensable guide to Good laboratory practices.* Second edition.
2. *Sandy Weinberg. Good Laboratory Practice Regulations,* Fourth Edition. CRC Press.

16UMBSS2	SELF STUDY PAPER- I: FOOD SANITATION	SEMESTER I to V
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Total credits: 1

OBJECTIVES:

1. To understand the laws and regulations related to food standards.
2. To widen the knowledge on hygiene and sanitation on food preparation.

CONTENTS

UNIT - I

Food Laws and Regulations - Essential commodities Act, Standards of Weights and Measures Act, Agmark, Bureau of Indian Standards, Export and Quality Control, Prevention of Food Adulteration Act.

UNIT - II

Food additives and contaminants, food colours flavouring agents and related substances, sweeteners, preservatives, antioxidants, emulsifying and stabilizing agents, antimicrobial substances, -Indirect additives, residues, contaminants and adulterants, pesticide residues, contaminants from packaging material, Metallic contaminants , adulterants Irradiated Food.

UNIT - III

Hygiene and sanitation in food sector - pest control measures, Garbage and Sewage disposal, Water - Sources, purification, Hazards Analysis & Critical Control Point (HACCP), Good Manufacturing Practices (GMP) .

UNIT - IV

International Organizations - FAO (Food & Agriculture Organization), WHO(World Health Organization), Codex Alimentarius, ISO, WTO.

UNIT - V

National Organizations - ICMR, ICAR, Council for social welfare, Ministry of Health & Family Welfare - delivery Health Services in India.

