Course Name : Bachelor of Science

Discipline : Microbiology
(Those who join in 2018 and after)

Self-Learning Course:

Subject	Credit	Ext =Tot	Subject Code
Food Quality Analysis	5	100 = 100	U1MBSL51

Self-learning

Food Quality Analysis

CREDIT : 5 **SUBJECT CODE: U1MBSL51**
TOTAL MARKS: 100

Objectives:

To gain knowledge about the extrinsic and intrinsic parameters that affect food products.

Unit 1

Fundamentals of Food Microbiology – Types of Food sources - Food Contamination and spoilage

Unit 2

Foodborne Diseases and Beneficial Roles of Microorganisms

Unit 3

Analytical techniques in Microbiology - General techniques to diagnose food borne microorganisms.

Unit 4

Contamination, Preservation and Spoilage of Milk and Milk products- Quality testing of Milk: Dye reduction test.

Unit 5

Contamination, Preservation and Spoilage of Meat and Fish products.

References

1. Adams MR & Moss MO. Food Microbiology, New age international (P) Ltd publications, London
2. Frazier WC & Westhoff DC, Food Microbiology 5th edition, McGraw Hill publications, New York.

Course Name: Bachelor of Science
Discipline : Microbiology
CHOICE BASED CREDIT SYSTEM
(For those who joined in June 2022 and after)
Course Objectives:

This course is designed for science majors who need a Microbiology course for their professional preparation, usually in an area of clinical application as pharmacy, nursing, physician's assistant, dental assistant, and others. In addition, this course is required in the Biotechnology program. In order to enhance learning, the laboratory exercises are coordinated with lecture topics within each unit of study. Critical thinking and problem solving skills are developed in both laboratory and lecture

Eligibility for Admission:

A candidate who has passed Higher Secondary examination in any one of the biological sciences (Academic/Vocational stream) under higher secondary board of examination, Tamil Nadu or as per norms set by the Government of Tamil Nadu or an examination accepted as Equivalent thereto by the Syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the B.Sc., Microbiology degree examination of this University after a course of study of three academic years.

Duration of the Course:

The course for the degree of Bachelor of Microbiology shall consist of three academic years divided into six semesters.

Core Practicals (100 marks) the duration of Practical Examination for B.Sc. (Microbiology) exam shall be 3 Hrs/Day; 2 Consecutive days (3+3=6 Hours).

Course Scheme:

VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
[Re-accredited with 'A' Grade by NAAC]
Virudhunagar – 626 001.

Semester	Part	Subject	Hrs	Cr	Int+Ext= Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject code	Revised/ New/ No Change/ Interchanged. (If revised % of change)
I	Part I	Tamil	6	3	25+75=100		✔					✔					**U22PT11**	
	Part II	English	6	3	25+75=100				✔	✓		✓					**U22PE11**	
	Core 1	General Microbiology	5	4	25+75=100											✓	**U22MBC11**	Revised 45%
	Core 2 Lab	Lab: General Microbiology	3	2	40+60=100			✔		✓				✓			**U22MBCP11**	Revised 20%
	Allied 1	General Chemistry I	4	3	25+75=100			✔		✓						✓	**U22CHAY11/** U3CHA1Y	No Change
	Allied 2 Lab	Lab: Volumetric Analysis	2	--	--		✔			✓				✓			--	No Change
	SEB1	Basic techniques in Microbiology	2	2	25+75=100		✔			✓					✓		**U22MBS11**	Revised 25%
	Part IV SLC	Value Education	-	3	25+75=100	✔				✓						✓	**U22VE11**	
II	Part I	Tamil	6	3	25+75=100		✔					✔					**U22PT21**	
	Part II	English	6	3	25+75=100				✔	✓		✓					**U22PE21**	
	Core 3	Microbial Physiology	5	4	25+75=100			✔		✓						✓	**U22MBC21**	Revised 20%
	Core 4 Lab	Lab: Microbial Physiology	3	2	40+60=100			✔		✓				✓			**U22MBCP21**	Revised 30%
	Allied 3	General Chemistry II	4	3	25+75=100		✔			✓						✓	**U22CHAY21** / U3CHA2Y	No Change
	Allied 4 Lab	Lab: Volumetric Analysis	2	2	40+60=100		✔			✓				✓			**U22CHAYP21** / U2CHA2YP	No Change
	SEB2	Biochemistry	2	2	25+75=100	✔				✓						✓	**U22MBS21**	Revised 50%
	Part IV SLC	Environmental Studies	-	2	25+75=100			✔					✓			✓	**U22ES21**	

Year	Part	Subject	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education – Sports/YRC/RRC	3	100=100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ **U22RR4**

CORE-1 GENERAL MICROBIOLOGY

Contact Hours per week: 5 **Credits: 4**
Contact Hours per semester: 75 **Subject Code: U22MBC11**

Course Outcomes

COs	CO Statement
CO1	Provide an idea about the major types of microbes
CO2	Evaluate the importance of the contributions to microbiology
CO3	List the characteristics originally used to describe prokaryotic cells
CO4	Describe the characteristics of typical archaeal cell and Eukaryotic cell
CO5	Compare the eukaryotic, bacterial, and archaeal cells in terms of their use of membranes, size, morphological diversity, and organelles.

Unit-I **(12 Hours)**

The evolution of Microorganisms – Groups of Microorganisms, types Biological entitles (Cellular and Acellular), Five kingdom concept - Monera, Protista, Fungi, Plantae, Animalia, Three domains - Bacteria, Archaea, and Eukarya.

Unit-II **(12 Hours)**

Microbiology Encompasses and Major fields in Microbiology; contributions of Scientists – Robert Hooke, Antony van Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Alexander Fleming. Theory of Spontaneous Generation - Abiogenesis

Unit-III **(12 Hours)**

Prokaryotes – Shape, Arrangement and Size of Bacteria, structure of bacterial cell and their cellular components functions - Capsule, Bacterial cytoplasm, Inclusions, Nucleoid, Ribosomes, Plasmids, Pili, Flagella, Endospore; Chemotaxis.

Unit-IV **(12 Hours)**

Bacterial Plasma Membranes – Fluid Mosaic Model of Membrane structure; Bacterial Cell walls – Gram-positive and Gram-Negative Bacteria and its comparisons; Mechanism of Gram staining; Structure and organization of Archaea.

Unit-V **(12 Hours)**

Eukaryotes – Size, Shape, structure and their functions of cell Organelles; Comparison of Bacterial, Archaeal and eukaryotic cells; Viruses – General structural properties, Viroids, satellites and Prions.

Text Books

1. J. M. Willey, L. M. Sherwood, C. J. Woolverton, "Prescott's Microbiology", Published by McGraw-Hill Education, 10th edition, 2017.

Unit I	1.1, 1.2
Unit II	1.3, 1.4
Unit III	3.1 , 3.2, 3.5 - 3.9
Unit IV	3.3, 3.4 4.1.
Unit V	5.1, 5.8, 6.1, 6.2, 6.7.

2. M. J. Pelczar, E.C.S. Chan and N. R. Kreig, "Microbiology", Tata McGraw Hill Publication, 5th edition, 2001.
3. R. C. Dubey and D. K. Maheshwari, D.K, "A text book of Microbiology", Chand publications, 4th edition, 2015.

Reference Books

1. Schlegel, H.G.1993.General Microbiology. Cambridge University Press, Cambridge.
2. Stainer, R.Y., Ingraham, Wheelis, M.G. and Paintor, P.R.1986. The Microbial World. PrenticeHall, New Jersey.
3. Tauro, P., Kapoor, K.K. and Yadav, K.S.1989. An Introduction to Microbiology. WilleyPublications. New Delhi.

e- Resources

1. https://www.bellarmine.edu/faculty/dobbins/Secret%20Readings/Lecture%20Notes%20313/Ch01_.pdf
2. https://www.bellarmine.edu/faculty/dobbins/Secret%20Readings/Lecture%20Notes%20313/Ch03_.pdf
3. http://samples.jbpub.com/9781449635978/05940_pdfx_ch04_pommerville.pdf
4. https://www.bellarmine.edu/faculty/dobbins/Secret%20Readings/Lecture%20Notes%20313/Ch05_.pdf
5. https://www.bellarmine.edu/faculty/dobbins/Secret%20Readings/Lecture%20Notes%20313/Ch06_.pdf

General Microbiology Question Bank:

1. Describe the groups of Microorganisms
2. Tabulate the five kingdom concept
3. Discuss the encompasses of Microbiology
4. List out the contributions to Microbiology - Antony van Leeuwenhoek
5. Draw the structure of bacterial cell
6. Discuss the types of flagella
7. Describe the endospore formation
8. Define chemotaxis
9. Draw the Fluid mosaic model of membrane structure
10. Differentiate the Gram positive and Gram Negative Cell wall
11. Illustrate the mechanism of Gram staining
12. Tabulate the eukaryotic cell organelles and its functions
13. Compare the Bacterial, Archaeal and eukaryotic cells
14. List out the General structural properties of Virus

15. Define – Viroids, Satellites and Prions

CORE 2 - LAB: GENERAL MICROBIOLOGY

Contact Hours per week: 3 **Credits: 2**
Contact Hours per semester: 45 **Subject Code: U22MBCP11**

Course Outcomes

COs	CO Statement
CO1	To understand about the various applications of light microscope
CO2	To gain knowledge on various microscopic calibrations
CO3	To perform the removal microorganisms by different sterilization techniques
CO4	To observe the microbial morphology through various staining techniques
CO5	To isolate microorganisms by pure culture techniques

1. Principle and applications of compound microscope and its handling.
2. Sterilization techniques – Dry Heat (Hot air oven), Moist Heat (Autoclave)
3. Microbiological Culture Media Preparation – Nutrient agar, Nutrient Broth and peptone broth
4. Staining methods: Simple Staining and Gram staining.
5. Endospore staining.
6. Capsular staining.
7. Enumeration of bacteria from soil sample.
8. Pure culture techniques: spread plate, pour plate and Streak plate method.
9. Observation of microbial motility by hanging drop method.
10. Fungal staining by lactophenol cotton blue.
11. Microscopic observation of bacteria (Gram positve Bacilli and cocci, Gram negative Bacilli and cocci).
12. Cyanobacteria (*Nostoc*, *Spirulina*), algae (*Chlamydomonas*, *Diatoms*), and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Mucor*).
13. Diagrammatic observation of TMV, HIV and T4 phage.
14. Industrial visit & Report (Visiting nearby institutes for instrumentation facility).

Text books

1. Cappuccino, J.G. and Sherman, N., "Microbiology: A laboratory manual" Additon Wesley, Europe, 2002.
2. Gunasekaran, P., "Microbiology: A laboratory manual" New Age international publishers, New Delhi, 1996.
3. Kannan, N., "Laboratory manual in General Microbiology" Panima publishers, New Delhi, 2002.
4. Harley, Prescott's Laboratory Exercises in Microbiology (5th Edition). The McGraw−Hill Companies, 2002.

References

1. Betstir, L., "Microbiology in Practice" Adeland Wesley, Langman, New York, 6th edition, 1996.
2. Benson, J.H., "Microbiological applications: A laboratory Manual in General Microbiology" En. C.Brown Publication IOWK ,USA. 6/1996.

3. James G.C. and Sharman, N., "Microbiology: A laboratory Manual" The Benjamin/Cummings Publishing Company, International USA, 4/1996.
4. Atlas, R.M., "Microbiology- Fundamentals and applications" Macmillan Publishing Company, New York, 1987
5. Dubey, R.C. and Maheshwari, D.K., "Practical Microbiology" S. Chand and Co.Ltd., New Delhi, 9/2005.

Semester I– Part III– Allied subject I – GENERAL CHEMISTRY –I for Biological science

Hours per week: 4 **Credits: 3** **Subject Code: U22CHAY11/ U3CHA1Y**
(For those who joined from 2022 onwards)

Course Outcomes

CO1: Understand fundamental ideas about organic chemistry and isomerism

CO2: Preparation properties of hydrogen isotopes

CO3: Know the various types of colloids

CO4: Become professionally trained in the area of petrochemicals products and fertilizers

CO5: Understand importance of polymers in our daily life

Unit I: Basic concepts of organic chemistry **12 Hours**

Organic compounds — general properties and classification of organic compounds — functional groups — homologous series. Isomerism — structural isomerism and stereoisomerism — examples — Types of organic reactions: substitution, addition and elimination with examples.

Unit II: Hydrogen, Hydrides and Oxides **12 Hours**

Hydrogen:

Isotopes of hydrogen — preparation, properties and uses of heavy hydrogen — ortho and para hydrogen.

Hydrides:

Definition — classification of hydrides (Saline hydrides, Metallic hydrides, Molecular hydrides and Polymeric hydrides.) — Nature of hydrides and position of hydrogen in the periodic table.

Oxides:

Definition — classification — examples.

Unit III: Colloids **12 Hours**

Colloidal state of matter — various types — classification. Sols — dialysis — electroosmosis- electrophorosis — stability of colloids — protective action — Hardy Schulze law — gold number.

Emulsion: types of emulsion — emulsifier.

Gels: Classification, preparation — application of colloids.

Unit IV: Petroleum and fertilizers **12 Hours**

Refining of petroleum — composition and uses of petroleum fractions — thermal and catalytic cracking — octane number, cetane number — antiknocking agents - unleaded petroleum — petrochemicals — synthetic petrol.

Fertilizers — classification — important manures — manufacture and uses of urea — super phosphate — calcium ammonium nitrate (CAN) fertilizer.

Unit V: Polymers **12 Hours**

Polymers — general characteristics — plastics — elastomers and fibres — thermoplastics and thermosetting plastics - methods of polymerization — bulk — suspension and solution polymerization. Uses of polycarbonates — polyurethanes — epoxy resins and teflons (PTFE).

Text Books

Unit I

1. B.S.Bah1 and Arun Bah1, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Unit II & III

1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Villabh Publishing , 2003.

Unit-IV & V

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Reference Books

Unit I

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Unit II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.
2. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

Unit III

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

Unit IV

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrota, A Text book of Organic Chemistry, 2nd revised edition, Vikas publishing house PVT LTD, New Delhi, 2005.

Unit V

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

e-Resources:

1. https://www.priyamstudycentre.com/chemistry/organic-compound
2. https://youtu.be/XklMKuEAWdU
3. https://www.adichemistry.com/inorganic/hydrogen/H2/hydrogen.html
4. https://en.m.wikipedia.org/wiki/Isotopes_of_hydrogen
5. https://byjus.com/jee/colloids/
6. https://youtu.be/QAH-cCK1bS8
7. https://en.m.wikipedia.org/wiki/Petroleum_refining_processes
8. https://youtu.be/Dmn1X_z985A
9. https://www.britannica.com/science/polymer/Synthetic-polymers
10. https://youtu.be/t9UtS70GR44

SBE 1: BASIC TECHNIQUES IN MICROBIOLOGY

Contact Hours per week: 2 **Credit: 2**
Contact Hours per Semester: 30 **Subject code: U22MBS11**

Course Outcomes

COs	CO Statement
CO1	To make the students aware of the basic rules of microbiological laboratory
CO2	To enable the students to acquire basic knowledge in microbiological techniques
CO3	To understand the basic information in Sterilization
CO4	Recognize the basic concept of the Lab instruments
CO5	Apply the knowledge of microscope

Unit I **(6 Hours)**

Good Microbiological Practices: General Precautions, Rules and regulations - Biosafety level (BSL) 1, 2, 3 and 4 – Containment: Physical, Chemical and Biological.

Unit II **(6 Hours)**

Aseptic transfer of microbial cultures - culture preservation techniques and methods of Culture Maintenance: periodic transfer, refrigeration, cryopreservation. American Type Culture Collection (ATCC) and Microbial Type Culture Collection (MTCC).

Unit III **(6 Hours)**

Sterilization: definition and applications - sterilization methods: Dry heat – Red heat and flaming, Moist heat – autoclave, Pasteurization – HTST (high temperature short time) and LTHT (low temperature high time) – Radiation - UV and Chemical – Alcohol.

Unit IV **(6 Hours)**

Precautions and Applications of Lab instruments: – Analytical balance – Bunsen burner – colony counter – homogenizer – hot plate - Incubator – Laminar Air Flow chamber – Hot air Oven – Fermentor - Rotary shaker – Cooling centrifuge.

Unit V **(6 Hours)**

Stereo microscope – Principle (Resolving power, Numerical aperture) and applications of Bright field microscopy, Dark field microscopy and Phase contrast microscopy, Scanning electron microscopy and Transmission electron microscopy.

Text books

Unit I

1. Kumaresan, V. 2015. Biotechnology. Saras Publication, Nagercoil, Tamil Nadu.
2. Illuminating DNA – An NCBE, Unilever educational guide.

Unit II

1. Mani , A., Selvaraj , A.M., Narayanan , L.M. and Arumugam, N. 2014. Microbiology – General and Applied . Saras Publication, Nagercoil, Tamil Nadu.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.

Unit III & IV

1. Dubey, R.C. and Maheshwari, D.K. 2006. A text book of Microbiology. Chand publications,

New Delhi.
2. Prescott, Harley and Klein. 2006. Microbiology(6th Edition). The McGraw-Hill Publishing Co., Ltd., New Delhi.

Unit V

1. Annie. 2000. A text book of Botany. Saras publications, Nagercoil, Tamil Nadu.
2. Prescott, Harley and Klein. 2006. Microbiology(6th Edition). The McGraw-Hill Publishing Co., Ltd., New Delhi.
3. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.

References Books:

1. Prescott, Harley and Klein. 2006. Microbiology (6th Edition). The McGraw-Hill Publishing Co., Ltd., New Delhi.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
3. Tauro, P., Kapoor, K.K. and Yadav, K.S.1989. An Introduction to Microbiology. Willey Publications. New Delhi.

URL:

https://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf
American Type Culture Collection (ATCC)
https://www.atcc.org/
Microbial Type Culture Collection (MTCC)
https://mtccindia.res.in/

Question Bank:

1. How many BSL biosafety levels are there?
2. What are the differences between BSL 1 and BSL-2?
3. Describe Physical Containment
4. Elucidate cryopreservation
5. Explain American Type Culture Collection (ATCC)
6. Write a short note on Microbial Type Culture Collection (MTCC)
7. List out the applications of Sterilization
8. Describe Pasteurization
9. Enumerate the Uses of UV
10. List out the applications of Laminar Air Flow chamber
11. What are some advantages of phase contrast microscopy?
12. What is the difference between dark field microscopy and bright field microscopy?

II- SEMESTER

Core 3 - MICROBIAL PHYSIOLOGY

Contact Hours per week: 5 **Credits: 4**
Contact Hours per semester: 75 **Subject Code: U22MBC21**

Course Outcomes:

COs	CO Statement
CO1	The students will gain knowledge about role of macronutrients and micronutrients in growth of microbes.
CO2	Acquire knowledge on prokaryotic and eukaryotic cell structure and its function
CO3	To develop the techniques in involved in microbial growth
CO4	Concern the regulation of metabolism by various pathways.
CO5	Understand about the various pigments essential for photosynthesis

Unit I **(12 Hours)**

Common nutrient requirements of Bacteria - Nutritional types of microorganisms based on carbon, energy, electron - Growth factors (vitamins) - Culture media - Types of media (Synthetic media, Complex media, selective and differential media).

Unit II **(12 Hours)**

Microbial growth – Growth curve of bacteria – Generation time and specific growth rate. Measurement of microbial growth: total count, viable count and turbidity method –Factors affecting microbial growth: temperature, pH, osmotic pressure and oxygen.

Unit III **(12 Hours)**

Uptake of nutrients by cell – Membrane transport system – Passive and Facilitated diffusions, Primary and Secondary active transports – Symport, antiport and uniport - Group translocation.

Unit IV **(12 Hours)**

Respiratory metabolism: Embden-Mayer Hoff pathway, Entner- Doudroff pathway, Kreb's cycle, Oxidative level phosphorylation, Electron Transport Chain (ETC).

Unit V **(12 Hours)**

Bacterial Photosynthesis: Oxygenic and Anoxygenic photosynthesis. Microbial photosynthetic and accessory pigments: Chlorophyll, Bacterio chlorophyll, Carotenoids and Phycobilins. Bioluminescence and its advantages.

Text books

Unit I

1. Prescott, Harley and Klein. 2006. Microbiology (6th Edition). The McGraw-HillPublishing Co., Ltd., New Delhi.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi
3. Dubey, R.C. and Maheshwari, D.K. 2006. A Text book of Microbiology(3rd Edition). Chand publications, New Delhi.
4. Schlegel, H.G.1993.The text book of General Microbiology. Cambridge University Press, Cambridge.

Unit II

1. Prescott, L.M., Hariey, J.P. and Klein, D.A. 2001. Microbiology. Wm. C Brown PublicationLowa. U.S.A.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.

Unit III

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Annie. 2000. A text book of Botany. Saras publications, Nagercoil, Tamil Nadu.
3. Prescott, Harley and Klein. 2006. Microbiology (6th Edition). The McGraw-Hill PublishingCo., Ltd., New Delhi.
4. Dubey, R.C. and Maheshwari, D.K. 2006. A Text book of Microbiology (3rd Edition). Chandpublications, New Delhi.

Unit IV

1. Stainer, R.Y., Ingraham, Wheelis, M.G. and Paintor, P.R.1986. The Microbial World. PrenticeHall, New Jersey.
2. Benjamin Lewin. 1997. Gene VI. Oxford University Press, UK.
3. Johri B.N. 2000. Extremophiles. Springer V erlag. , New York.

Unit V

1. Michael T. Madigan, John M. Martinko. Jack Parker. 1997. Brocks Biology of Microorganisms(8th Edition). Prentice Hall, New Jersey.
2. Thomas D. 2001. Brock Thermophiles. General, Molecular and Applied Microbiology. WileyInterscience Publication, New York.
3. Johri, B.N. 2000. Extremophiles. Springer V erlag. , New York.

References

1. Atlas, R.M., 2001. Principles of Microbiology (2nd Edition), Moshby year Book Inc., UnitedStates.
2. Schlegel, H.G.1993.General Microbiology. Cambridge University Press, Cambridge.
3. Stainer, R.Y., Ingraham, Wheelis, M.G. and Paintor, P.R.1986. The Microbial World. PrenticeHall, New Jersey.
4. Tauro, P., Kapoor, K.K. and Yadav, K.S. 1989. An Introduction to Microbiology. WilleyPublications. New Delhi.

E Resources

1. https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/
2. https://www.youtube.com/watch?v=MWRowUYh5po
3. https://www.ramauniversity.ac.in/online-study-material/pharmacy/bpharma/iiisemester/pharmaceuticalmicrobiology/lecture-5.pdf
4. https://www.youtube.com/watch?v=Yl1EZi0qX1Q
5. https://www.onlinebiologynotes.com/membrane-transport-system-passive-active-transport/#:~:text=Membrane%20transport%20system%20is%20the,Cells%20have%20various%20transport%20mechanism.
6. https://www.youtube.com/watch?v=J5pWH1r3pgU

7. https://www.youtube.com/watch?v=7Lh-M-rX86Q
8. https://www.airtekenv.com/2017/06/15/factors-affecting-microbial-growth/#:~:text=Warmth%2C%20moisture%2C%20pH%20levels%20and,chemical%20factors%20affecting%20microbial%20growth.
9. https://www.biotecharticles.com/Biology-Article/The-Process-of-Bacterial-Photosynthesis-and-its-Importance-671.html#:~:text=Process%20of%20bacterial%20photosynthesis%3A%20Bacterial,molecule%20to%20an%20excited%20state.
10. https://oceanservice.noaa.gov/facts/biolum.html
11. https://www.youtube.com/watch?v=oKjFVBVGad0

Question Bank:

1. Describe the common nutritional requirements of microorganisms?
2. Enlist about the various types of culture media
3. Illustrate the methods of cultivation of aerobic and anaerobic microorganisms
4. Discuss about the various methods of preservation of microorganisms
5. Describe the methods of uptake of nutrients by group translocation
6. Explain the mechanism of active transport
7. Paraphrase on the mechanism of facilitated diffusion
8. Discuss the various phases of growth curve
9. Write down the various factors responsible for microbial growth
10. Explain the measurement of growth curve
11. Describe about the accessory pigments present in bacteria
12. Explain the importance of bacteriochlorophyll
13. Describe the various reactions in electron transport chain?
14. Explain the concept of bioluminescence and its advantages
15. Describe the varied methods of photosynthesis in bacteria

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CORE 4 – LAB: MICROBIAL PHYSIOLOGY

Contact Hours per week: 3 **Credits: 2**
Contact Hours per semester: 45 **Subject Code: U22MBCP21**

Course Outcomes:

COs	CO Statement
CO1	To understand the identification of bacteria by various biochemical tests
CO2	Provide an idea on cultivation of microbes in selective media
CO3	To understand the cultivation of bacteria using differential media
CO4	**Evaluate the importance of the growth curve**
CO5	To understand the growth kinetics of microorganisms

1. Differential medium preparation - Eosin Methylene Blue Agar and MacConkey Agar
2. Selective medium preparation – Mannitol Salt Agar
3. Biochemical tests
   - IMViC
   - Carbohydrate fermentation test
   - Catalase test
   - Oxidase test
   - Hydrolysis of Starch
   - Hydrolysis of Casein
4. Bacterial growth curve analysis using *E. coli* by turbidity method.
5. Industrial Visit and Report

References

1. Cappuccino, J.G. and Sherman, N. 2002. Microbiology: A laboratory manual (7th Edition), Addison Wesley, New York.
2. Gunasekaran, P. 1996. Microbiology: A laboratory manual. New Age International Publishers, New Delhi.
3. Kannan, N. 2002.Laboratory Manual in General Microbiology, Panima Publishers, New Delhi.

Semester II – Part III – Allied subject II – General Chemistry –II for Biological science

Hours per week: 4 **Credits: 3** **Subject Code: U22CHAY21** / U3CHA2Y

(For those who joined from 2022 onwards)

Course Outcome:

Co1: Understand various chromatography technique

Co2: Know about proteins and Vitamins

Co3: Understand the importance of significant numbers and various methods for expressing

Co4: Concentration of the solution.

Co5: Comprehend the method of estimation carbon, hydrogen, sulphur and halogens.

Co6: Ability to draw the structure and explain the applications of dyes**.**

Unit I: Chromatography **12 Hours**

Basic principles of common types of chromatography — Paper chromatography — thin layer chromatography — column chromatography — Ion exchange chromatography. Applications of each technique.

Unit II: Protein, Nucleic acids, Hormones and vitamins **12 Hours**

Definition — classification of proteins — colour reaction of proteins — Nucleic acids — nucleoside — nucleotides and general structure of DNA. Hormones — classification — structure of some sex hormones — oestrone and testosterone. Vitamins — classification of vitamins — sources and deficiencies of Vitamins A, B1, C, D, E and K (structural elucidation not required).

Unit III: Basic chemical calculation **12 Hours**

Significant numbers — SI Units— calculation of formula weight–understanding Avogadro number — mole concept — mole fraction of the solvent and solute — conversion of grams into moles and moles into grams — stoichiometric equations.

Methods of expressing concentration of the solution: normality, molarity and molality — calculations based on principle of volumetric analysis.

Unit IV: Detection and estimation of elements **12 hours**

Detection of nitrogen, halogens and sulphur (Lassaigne's test) — estimation of carbon and hydrogen (Liebig's method), sulphur and halogens (Carius method) — Determination of empirical and molecular formula — structural formula.

Unit V: Dyes **12 Hours**

Dyes - colour and constitutions — chromophore - auxochrome theory - classification of dyes by structure and methods of applications - preparation of methyl red, Bismarck brown, Malachite green, Indigo and Congo red.

Text Books

Unit – I

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

Unit – II

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Unit – III

1. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand &Sons, 2008.

Unit – IV

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

Unit – V

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011
2. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Reference Books

Unit - I

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

Unit - II

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

Unit - III

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, textbook of organic Chemistry, Vikas house PVT Ltd, New Delhi, 1998.

Unit - IV

1. B.S.Bah1 and Arun Bah1, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Unit - V

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.

e-Resourses

1. https://microbenotes.com/chromatography-principle-types-and-applications/

2. https://youtu.be/8m7CeObsTIk
3. https://youtu.be/AUMJwjLXh1M
4. https://simple.m.wikipedia.org/wiki/Vitamin
5. https://en.m.wikipedia.org/wiki/Significant_figures
6. https://chemistryonline.guru/normality-molarity-molality-3/
7. https://youtu.be/aH-Cjyn8V_Y
8. https://www.adichemistry.com/organic/basics/analysis/lassaignes/lassaignes- test.html
9. https://youtu.be/MhBEj32wZqE
10. https://www.britannica.com/technology/dye

Part III – Allied Chemistry Lab I – LAB: Volumetric Analysis Hours per week: 2
Subject Code: U22CHAYP21 / U2CHA2YP **Credits: 2**
(For those who joined from 2022 onwards)
(Exam to be conducted at the end of even Semester)

Course Outcome:

Upon completion of this lab, the students will be able

CO1: Understand the apparatus used in volumetric analysis

CO2: The precautions to using equipment

CO3: Acquire the knowledge about the standard solutions

CO4: Prepare standard solutions

CO5: Acquire the knowledge about strength of the solutions

(Exam to be conducted at the end of even Semester)

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of standard solution.

(a) Acidimetry and alkalimetry

Standard solutions

1. Titration between a strong acid and strong base.
2. Titration between a strong acid and weak base.
3. Titration between a weak acid and strong base.

(b) Permanganometry

1. Titrations between potassium permanganate and oxalic acid, ferrous sulphate and ferrous ammonium sulphate.

(c) Iodometry

1. Titrations between sodium thiosulphate with potassium permanganate and potassium dichromate (demonstration only)

SBE 2 - BIOCHEMISTRY

Contact Hours per week: 2 **Credit: 2**
Contact Hours per Semester: 30 **Subject code: U22MBS21**

Course Outcome:

COs	CO Statement
CO1	To enable the students to acquire a specialized knowledge and understanding the bonding between biomolecules.
CO2	To give the basic knowledge about the metabolism of biomolecules and their participation in our daily life.
CO3	To enable the students to become familiar with enzyme properties and function.
CO4	To enable the students to understand the role of cell membrane and its role
CO5	To give knowledge to the student about basics of sugars and proteins in human body

Unit I **6 Hours**

Chemical Bonds - Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction); pH & biological buffers.

Unit II **6 Hours**

Biological energy transducers - Structure and functions of ATP, electron transport chain and oxidative phosphorylation, photosynthesis-light and dark reaction; Bioenergetics - Glycolysis, Gluconeogenesis, Pentose phosphate pathway, TCA cycle, coupled reaction & group transfer.

Unit III **6 Hours**

Carbohydrates - classification and functions. Amino acids - Properties and types. Protein structure - primary, secondary, tertiary and quaternary; Protein folding.

Unit IV **6 Hours**

Lipid bilayer, electrical properties of membranes, membrane proteins (intrinsic, extrinsic, lipid-linked proteins), transport mechanisms (mediated and non-mediated), ion channels and pumps.

Unit V **6 Hours**

Enzyme nomenclature and classification. Catalytic power and specificity of enzymes. General properties of enzymes - pH, temperature. Purification of enzymes. Clinical and industrial applications of enzymes. Abzymes, Ribozyme and Isozymes.

Text Books

Unit I

1. Jain J.L., Sunjay Jain and Nithin Jain., 2014. Fundamentals of Biochemistry, 7/e. S. Chand & Company (P) Ltd., New Delhi.
2. Renuka Harekrishnan, 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

Unit II

1. Renuka Harekrishnan, 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.
2. Robert K. Murray., Daryl K. Granner., Peter A. Mayes. and Victor W. Rodwell, 2003. Harper's Illustrated Biochemistry, 26/e, Lange Medical Books/McGraw-Hill, New Delhi.

Unit III

1. Renuka harekrishnan. 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.
2. Anusha Baskar and Vidya, V.G. 2009. Enzyme Technology. M.J. Publications, New Delhi.

Unit IV

1. Renuka harekrishnan. 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

Unit V

1. Renuka harekrishnan. 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

Reference Books

1. Nelson D. and Cox M., 2005. Lehninger Principles of Biochemistry ,4/e, Freeman W.H. and Company, New Delhi.
2. Donald Voet., Judith G. Voet. and Charlotte, Pratt W., 1999. John Wiley & Sons, Inc., New York.
3. Stryer. 1998. Biochemistry. W.H. freeman and Company. NewYork. 4. Zubey, G. L., 1996. Biochemistry, 4/e, Wm. C. Brown publishers.

e- Resources

1. URL of the resource 1 – Protein folding - https://www.youtube.com/watch?v=1peFJ_-N7V8
2. URL of the resource 2 – Types of chemical bonds - https://www.youtube.com/watch?v=QXT4OVM4vXI
3. URL of the resource 3 – Biomolecules - https://www.youtube.com/watch?v=YO244P1e9QM

Question Bank

1. List out major types of amino acids
2. Define isozymes
3. Where mRNA synthesis occur
4. Explain function of ATP
5. Classify protein based on their structure
6. Summarize the free energy concept Question words

Course Name: BACHELOR OF SCIENCE

Discipline : MICROBIOLOGY

Choice Based Credit System

(For those who join in June 2018 and after)

Course Scheme:

Semester	Part	Subject	Hour	Credit	Int.+Ext.= Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject code	Revised / New / No Change / Interchanged & Percentage of revision
III	Part I	Tamil / Hindi	6	3	25+75=100		✔					✔					U3PT3/ U1PH3	Revised/60%
	Part II	English	6	3	25+75=100				✔	✓		✓					U3PE3	Revised/90%
	Core 5	Immunology	4	4	25+75=100			✔		✓						✓	U1MBC31	No Change
	Core 6 Lab	LAB: Major Practical III	2	1	40+60=100			✔		✓				✓			U2MBC3P	Revised / 10%
	Allied 5	General Chemistry - III	4	4	25+75=100		✔			✓					✓	✓	U2CHA3Y	No Change
	Allied 6 Lab	LAB: Organic Qualitative Analysis	2	--	--		✔			✓					✓	✓	--	
	Allied 7	Biology – Plant Science	4	4	25+75=100		✔			✓						✓	U2MBA3	No Change
	Allied 8 Lab	Biology	2	-	--		✔			✓						✓	--	
IV	Part I	Tamil / Hindi	6	3	25+75=100		✔					✔					U2PT4/ U1PH4	Revised/60%
	Part II	English	6	3	25+75=100				✔	✓		✓					U3PE4	Revised/65%
	Core 7	Microbial Biochemistry	4	4	25+75=100			✔		✓				✓		✓	U3MBC4	Revised / 10%
	Core 8 Lab	LAB: Major Practical IV	2	1	40+60=100			✔		✓							U2MBC4P	No Change
	Allied 9	General Chemistry - IV	4	4	25+75=100		✔			✓				✓		✓	U2CHA4Y	No Change
	Allied 10 Lab	LAB: Organic Qualitative Analysis	2	2	40+60=100		✔			✓				✓		✓	U2CHA4YP	No Change
	Allied 11	Biology – Animal Science	4	4	25+75=100		✔			✓						✓	U3MBA4	Revised / 1%
	Allied 12 Lab	LAB: Biology	2	2	40+60=100		✔			✓						✓	U2MBA4P	No Change

Self-Learning Course

Semester	Subject	Credit	Ext =Tot	Subject Code
IV	Human Rights	5	100 = 100	U1CSL41

Year	Part	Subject	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education – Sports / YRC/RRC	1	100=100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ U1RR4

Core-5 - Immunology

Contact Hours per week: 4 **Credits: 4**
Contact Hours per semester: 60 **Subject Code: U1MBC31**

Objectives:

1. To appreciate the components of the human immune response that work together to protect the host.
2. To understand the concept of immune based as either a deficiency of components or excess diseases activity as hypersensitivity.
3. To perform and interpret the common laboratory techniques in the immunology laboratory.

Unit-I **(12 Hours)**

History of immunology. Types of immunity: innate immunity and adaptive immunity. Cells and organs of the immune system. Immune response: Humoral and Cell mediated immunity.

Unit- II **(12 Hours)**

Antigens: classes of antigens and their characteristics – Haptens – Structure, classification and characteristics of antibody. Complement system: classical and alternative pathways.

Unit- III **(12 Hours)**

General organization of MHC. Classes of HLA and H-2 complex. Antigen processing and presentation: cytosolic and endocytic pathways.

Unit -IV **(12 Hours)**

Hypersensitivity and its types. Autoimmune diseases – Organ specific (Grave's disease) and systemic (Rheumatoid arthritis). Immune tolerance. Transplantation – Types of graft rejection.

Unit -V **(12 Hours)**

Immunotechniques– Agglutination reactions, Precipitation reactions, Radioimmunoassay, ELISA and Western blotting.

Text books

Unit I

1. Madhavee latha, 2012, A text book of Immunology, 1/e, Chand publications, New Delhi.
2. Janis kuby *et.al*., 2003, Immunology, 5/e, W.H. Freeman and company, NewYork.

Unit II

1. Poul, 1990, Fundamental of Immunology, 2/e, Ravar Press, New York.
2. Janis kuby *et.al*., 2003, Immunology, 5/e, W.H. Freeman and company, NewYork.

Unit III

1. Roitt, 2012, Essentials Immunology, 12/e, Blackwell scientific publications. New Jersey.
2. Janis kuby *et.al*., 2003, Immunology, 5/e, W.H. Freeman and company, NewYork

Unit IV

1. Poul, 1990, Fundamental of Immunology II Ed. Ravar Press, New York.
2. Janis kuby *et.al*., 2003, Immunology, 5/e, W.H. Freeman and company, NewYork.

Unit V

1. Roitt, 2012, Essentials Immunology, 12/e, Blackwell scientific publications. New Jersey.

Reference

1. Roitt, 2012, Essentials Immunology, 12/e, Blackwell scientific publications. New Jersey.
2. Janis kuby *et.al*., 2003, Immunology, 5/e, W.H. Freeman and company, NewYork**.**
3. Talwar and Gupta, 1992, A Hand Book of practical Immunology (Volume I & II), Vikas publishing House Pvt. Ltd., New Delhi.
4. Donald M. Weir and John Steward, 1993, Immunology, 7/e, ELBS, London.
5. Bellanti, 1985, Immunology, 3/e, Saunders W.B. Co Ltd, Philadelphia.

Core-6 –LAB: MAJOR PRACTICAL III

Contact Hours per week: 2 **Credits: 1**
Contact Hours per semester: 30 **Subject Code: U2MBC3P**

1. Separation of serum and plasma from blood sample.
2. Blood cell count: RBC count and WBC count.
3. Differential count of leukocytes.
4. Blood typing: ABO and Rh factor.
5. Agglutination test: Widal slide test.
6. Precipitation: Ouchterlony-double immunodiffusion (Ag-Ab pattern)
7. RPR (Rapid plasma reagin) test.
8. RA (Rheumatoid arthritis) test.
9. Pregnancy test.
10. Industrial visit and reporting

Part III – Allied Paper III – General Chemistry-III

Hours per week: 4 **Credits: 4** **Subject Code: U2CHA3Y**

Objectives:

- To gain basic knowledge of photochemistry and nuclear chemistry.
- To understand the concept data analysis.
- To acquire basic knowledge in water quality parameters.
- To study the versatility of insecticides

Unit – I Photochemistry **(12 Hours)**

Introduction to photochemistry – Difference between thermal and photochemical reactions – Laws of photochemistry (Grotthus – Draper & Stark-Einstein) Quantum yield – Photosynthesis, Photophysical process (Fluorescence & Phosphorescence) – Photosensitization – Definition and examples for chemiluminescence and Bioluminescence –

Unit-II Nuclear chemistry **(12 Hours)**

Composition of the nucleus – Nuclear forces – mass defect – binding energy – Nuclear stability – Law of radioactive disintegration: Soddy's group displacement law. Nuclear fission – nuclear fusion – Principle of atom bomb and hydrogen bomb. Applications of radioactive isotopes in medicinal, agriculture, industry and Carbon dating.

Unit-III Error analysis (12 Hours)

Evaluation of analytical data: Idea of significant figures – its importance. Accuracy – methods of expressing accuracy. Error analysis – types of errors – minimizing errors. Precision – methods of expressing precision: Mean, Median, Mean deviation, Standard deviation and Confidence limit. Method of least squares.

Unit-IV Water quality parameters and their determination (12 Hours)

Physical, chemical and biological standards – significance of the contaminants over the quality and their determinations - Electrical conductivity - turbidity - pH, total solids, TDS - alkalinity - hardness - chlorides – Dissolved oxygen (DO) – Biochemical oxygen demand (BOD)- Chemical oxygen demand (COD) – Total organic carbon (TOC) - nitrate – sulphate, fluoride.

Unit-V Insecticides (12 Hours)

Introduction - Classification of insecticides - Inorganic insecticides- Organic insecticides: Natural (Nicotine, Pyrethrum & Rotenone) and synthetic Insecticides (*o*-dichlorobenzene, DDT, DDD, DDE & BHC) – Common insecticides (Baygon & Mesurol) – Insect attractants and repellents.

Reference Books

Unit-I

1. K.K.Rohatgi Mukherjee, Fundamentals of Photochemistry, New Age International private limited, 2000.
2. N.J. Turro, Modern Molecular Photochemistry, Benjamin Cummings, 1965.

Unit-II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
3. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

Unit-III

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.

Unit-IV

1. A.K.De, Environmental Chemistry (seventh edition), New age International Publishers New Delhi 2010,.
2. M.M.Uppal, A Text Book of Engineering Chemistry, Khanna Publishers, New Delhi 1988.

Unit-V

1. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Text Book of Organic Chemistry, 2nd revised edition.
2. P.L.Soni and H.M.Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.

Allied-7 - Biology – Plant science

Contact Hours per week: 4 **Credits: 4**
Contact Hours per semester: 60 **Subject Code: U2MBA3**

Objectives:

1) To develop basic knowledge of plants.
2) To guide students towards natural medicines for the treatment of some diseases.
3) To improve the interest towards the environment& plant cultivation.

Unit-I **(12 Hours)**

Basics system of classification (Artificial, natural and phylogenetic) Brief study of Linnaeus system, Bentham and Hooker and Engler and Prantleclassification. Nomenclature-Binomial system- role of Botanical survey of India.

Unit-II **(12 Hours)**

General features and classification up to class level for algae (Fritch), fungi (Alexopolas& Mims). Algae: structure and reproduction of *Sargassum.* Fungi: structureand reproduction of *Yeast* – Economic importance of algae and fungi.

Unit-III **(12 Hours)**

General characters of Bryophytes and Pteridophytes. Bryophytes: structure andreproduction of *Riccia, Funaria*. Pteridophytes: structure and reproduction of *Selaginella.*

Unit-IV **(12 Hours)**

General characters of Gymnosperms. Gymnosperms: structure and reproduction of *Pinus* Economic importance of gymnosperms. Angiosperm: Vegetative and Floral features ofmonocot (*Allium cepa*) and dicot (*Tribulusterrestris*).

Unit-V **(12 Hours)**

General features of lichens, Type study-*Usnea*. Economic importance of lichens. Medicinal importance of plants (Tulsi, Turmeric, Ginger and Pepper).

Text books

Unit-I

1) Subhash Chandra datta. 1970 A hand book of systematic botany-Asia publishers.
2) HIrenra Chandra gangulee. College botany-New central book agency.

Unit-II

1) B.P.Pandey, 2009. The algae- S.Chand& company.
2) B.R.Vasishta, 1986. Algae - S.Chand& company.
3) B.P.Pandey, 2015. A text book of botany-Fungi- S.Chand& company.
4) S.Gupta, 2006. Text book of fungi-Oxford & IBH publishing pvt ltd.

Unit-III

1) V.Venkateswarlu, 1983 – Bryophyta - Educational publishers.
2) Kogakusha, 1955 -Cryptogamic botany-Vol-I. Bryophytes &Pteridophytes.
3) P.C.Vasishta, 1986-Vascular cryptogams: Pteridophytes- S.Chand& company

Unit-IV

1) HIrenra Chandra gangulee, 1965. College botany- New central book agency.
2) P.C.Vasishta, 1997.Taxonomy of angiosperms - S.Chand& company
3) V.Venkateswarlu, 1974.Angiosperms- S.Chand& company.

Unit-V

1) V.Verma, 2009.A text book of economic botany- Emkay publications.
2) AibertF.Hill, 1952. Economic botany - Tata McGraw Hill. Publishing company Ltd.

References:

1. A.C.Dutta, 1952.Botany for degree students, Oxford university press.
2. G.M.Smith, 1964.Cryptogamic botany, vol. I& II, Tata McGraw Hill.
3. Narayasamy et al –Viswanathan, 2000.Outlines of botany- (Printers & Publishers ltd).
4. W.T.Tailor and R.J.Wehe, 2008. General biology, East west press pvt ltd.

Semester - IV

Core-7 - MICROBIAL BIOCHEMISTRY

Contact Hours per week: 4 **Contact Hours per semester: 60**
Credits: 4 **Subject Code: U3MBC4**

Objectives:

- To enable the students to acquire a specialized knowledge and understanding the structure and functions of biomolecules.
- To give the basic knowledge about the metabolism of biomolecules and their participation in our daily life.
- To enable the students to become familiar with enzyme kinetics and inhibition.

Unit-I **(12 Hours)**

pH: acid and bases; pH scale and Measurement. Buffers: Physiological importance (Phosphate and Bicarbonate buffer system). Bioenergetics: Laws of thermodynamics and free energy concept.

Unit-II **(12 Hours)**

Carbohydrates and their metabolism: classification, biological significance and structure of glucose, lactose and starch. Glycolysis, Citric acid cycle, Entner-Doudoroff pathway, Hexose monophosphate pathway and Gluconeogenesis.

Unit-III **(12 Hours)**

Protein: Structure (primary, secondary, tertiary and quaternary), classification and properties. Properties of aminoacids. Enzymes: nomenclature and classification. Enzyme kinetics- Michaelis-Menton equation. Vitamins – Classification and its role.

Unit-IV **(12 Hours)**

Lipids: classification, properties and biological roles of lipids: Triglycerides, Phospholipids and steroids. Oxidation of fatty acids (beta oxidation).

Unit-V **(12 Hours)**

Nucleic acid: structure, types, nucleosides, nucleotides, DNA and RNA (rRNA, tRNA, mRNA) - Comparison between DNA and RNA.

Text books

Unit I

1. Jain J.L., Sunjay Jain and Nithin Jain., 2014. Fundamentals of Biochemistry, 7/e. S. Chand & Company (P) Ltd., New Delhi.
2. Renuka Harekrishnan, 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

Unit II

1. Renuka Harekrishnan, 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.
2. Robert K. Murray., Daryl K. Granner., Peter A. Mayes. and Victor W. Rodwell, 2003. Harper's Illustrated Biochemistry, 26/e, Lange Medical Books/McGraw-Hill, New Delhi.

Unit III

1. Renuka harekrishnan. 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

2. Anusha Baskar and Vidya, V.G. 2009. Enzyme Technology. M.J. Publications, New Delhi.

Unit IV

1. Renuka harekrishnan. 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

Unit V

1. Renuka harekrishnan. 2000. An introduction to Biomolecules and enzymes. Indraji pathippagam.

Reference books

1. Nelson D. and Cox M., 2005. Lehninger Principles of Biochemistry ,4/e, Freeman W.H. and Company, New Delhi.
2. Donald Voet., Judith G. Voet. and Charlotte, Pratt W., 1999. John Wiley & Sons, Inc., New York.
3. Stryer. 1998. Biochemistry. W.H. freeman and Company. NewYork.
4. Zubey, G. L., 1996. Biochemistry, 4/e, Wm. C. Brown publishers.

Core-8 – LAB: Major Practical IV

Contact Hours per week: 2 **Credits: 1**
Contact Hours per semester: 30 **Subject Code: U2MBC4P**

1. Determination of pKa value of acetic acid.
2. Determination of pH and preparation of phosphate and bicarbonate buffers.
3. Verification of Beer-Lamberts law using $CuSO_4$.
4. Estimation of carbohydrates by Anthrone method.
5. Estimation of proteins by Lowry's method.
6. Estimation of DNA by diphenylamine method.
7. Estimation of RNA by orcinol method.
8. Separation of amino acids by paper chromatography.
9. Separation of amino acids by thin layer chromatography.

Part III – Allied Paper IV – General Chemistry-IV

Hours per week: 4 **Credits:4** **Subject Code: U2CHA4Y**

Objectives:

- To study the mode of action of drugs.
- To learn some chemicals day to day life utility.
- To acquire basic idea about the alkaloids and Terpenoids.
- To gain knowledge about the soil chemistry.
- To study the role of catalyst in chemical reactions.

Unit-I Drugs **(12 Hours)**

Chemotherapy –Anaesthetics – General anaesthetics and local anasethetics (definition and example only). Sulpha drugs (Sulphonamides) - Synthesis and applications of sulpha drugs (sulphanilamide, sulphapyridine - sulphathiazole and sulphadiazine) – Mode of action of sulpha drugs. Antibiotics: Penicillin –Streptomycin- Chloramphenicol (Chloromycetin) – Structure and mode of action of these drugs (synthesis not required).

Unit-II Chemistry of some useful compounds **(12 Hours)**

Preparation and uses of CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2, Bleaching powder, Phenyl, Talcum powder, Shampoo, Shave lotion, Soaps and Detergents.

Unit-III Alkaloids & Terpenoids (12 Hours)

Alkaloids: Definition, sources, classification, structure (structural elucidation not required) and biological activities of coniine, piperine, quinine and morphine.

Terpenoids: Classification – Isoprene rule - Structure of geraniol, citral, menthol and limonene (Structural elucidation not required)

Unit-IV Soil chemistry (12 Hours)

Introduction – Modern system of soil classification – Properties of soils (soil texture) - Soil water – Types of soil water, soil temperature – Soil colloids (Silicate Clay, Oxide Clay and Humus)- Soil minerals (Primary and secondary minerals, Feldspar, Mica, Silica, Carbonates and Phosphates)- Soil pH, acidity and alkalinity- Effect of pH on plants.

Unit-V Adsorption & Catalysis (12 Hours)

Adsorption

Definition of various terms (adsorption, absorption, adsorbent, adsorbate, sorption & desorption) – Difference between adsorption and absorption – Factors influencing adsorption of gases on solids – Physical and chemical adsorption – Adsorption isotherm - Langmuir & Freundlich adsorption isotherm (derivation not required) – Application of adsorption.

Catalysis

Definition – Characteristics of catalyst – Promoters and poisons – Enzyme catalysis – Acid- base catalysis and Autocatalysis – Applications of catalysis.

Unit-I

1. B.S.Bahl and Arun Bahl, A Text Book of Organic Chemistry, S.Chand & Company Ltd, Ram Nagar, New Delhi,16th edition, 2002.
2. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Text Book of Organic Chemistry, 3rd revised edition, 2006.
3. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.

Unit-II

3. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
4. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
5. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.
6. P.K.Chattopadhyay, Modern Technology of Soaps, Detergents and Toiletries, 2nd edition, 2005.
7. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 6th edition, 1994.

Unit-III

4. B.S.Bahl and Arun Bahl, A text book of Organic Chemistry, S.Chand & Company Ltd, Ram Nagar, New Delhi,16th edition, 2002.
5. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Text Book of Organic Chemistry, 3rd revised edition, 2006.
6. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.

Unit-IV

1. Jaya shree Ghosh, Fundamental Concept of Applied Chemistry S.Chand & Company LTD, 2008.

Unit-V

1. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S.Chand & Co., 2004.
2. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.

Part III – LAB: Organic Qualitative Analysis

Hours per week: 2 **Credits: 2** **Subject Code: U2CHA4YP**

Objective:

- To gain fundamental knowledge about organic analysis

Organic analysis

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of solid derivative / colour reaction – acids, phenols, aldehydes, ketones, esters, nitro compounds, primary amines, amides, anilides, aliphatic diamide and monosaccharides.

ALLIED 11 - BIOLOGY – ANIMAL SCIENCE

Contact Hours per week: 4 **Credits: 4**
Contact Hours per semester: 60 **Subject Code: U3MBA4**

Objectives:

- To develop basic knowledge about the types of animals.
- To create awareness about the various systems in our body & their significance.
- To improve the notion of mechanism behind the physiological activities.
- Enlighten students about the human Hormones & reproduction.

Unit-I **(12 Hours)**

Classification of Invertebrates (up to class level) - General characteristics - Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca and Echinodermata.

Unit-II **(12 Hours)**

Classification of Chordates (up to class level) - General characteristics - Pisces, Amphibia, Reptilia, Aves and Mammalia. Digestive, respiratory, excretory and reproductive system of cockroach

Unit-III **(12 Hours)**

Digestive, respiratory, excretory and reproductive system of Frog and Pigeon.

Unit-IV **(12 Hours)**

Digestive system and respiratory system in human. Circulatory system: composition of blood and organization of circulatory system in human.

Unit-V **(12 Hours)**

Excretory system -Reproductive system in human (brief account) – types and role of Endocrine hormones – Menstrual cycle.

Text books:

Unit-I

1. E.L. Jordan and P.S. Verma (1995) Invertebrate Zoology, S. Chand & Co. New Delhi.
2. E.L. Jordan and P.S. Verma (1995) Chordate Zoology, S. Chand & Co. New Delhi.

Unit-II

1. E.Babsky *et. al.*, 1970.Human physiology - MIR Publishers.
2. K.A. Goyal, 2004. Animal physiology - Rastogi Publications.

Unit-III

1. J. Lee, 1965. Animal hormones - Hutchinson & co (publishers) Ltd.
2. Sambasivan et al, 2008.Animal physiology - S. Chand & Co.

Unit-IV

1. P.G.Puranik, R.S.Thakur, 1972. Invertebrate Zoology - S.Chand& co.
2. E.L.Jordan and P.S.Verma, 1995. Invertebrate Zoology, S.Chandra& co. NewDelhi.
3. E.L.Jordan and P.S.Verma, 1995 Chordate Zoology, S.Chand& co.

Unit-V

1. P.G.Puranik, R.S.Thakur, 1972. Invertebrate Zoology- S.Chand& co.
2. E.L.Jordan and P.S.Verma (1995) Invertebrate Zoology, S.Chand& co. New Delhi.

References:

1. E.L. Jordan and P.S.Verma (1995) Invertebrate Zoology, S. Chand & Co. New Delhi.
2. E.L. Jordan and P.S.Verma (1995) Chordate Zoology, S. Chand & Co. New Delhi.
3. K.A. Goyal, 2013. - Animal physiology - Rastogi Publications.
4. W.T. Tailor and R.J.Wehe, 2009. General Biology, Eastwest Press Pvt. Ltd.
5. A.J. Grove, 1969 - Animal biology - University tutorial Press Ltd.

LAB: Biology

Contact Hours per week: 2 **Credits: 2**
Contact Hours per semester: 30 **Subject Code: U2MBA4P**

Plant Science

1. Vegetative structure and reproductive structure in *Sargassum, Yeast, Funaria, Selaginella*and Pinus (section cutting of *Sargassum, Selaginella*and Pinus needle.
2. Disscection and study of any monocot flower.
3. Disscection and study of any dicot flower.

Animal Physiology

1. Morphology of one representative for each phylum- (spotters only)-*Amoeba, Hydra, Planaria, Taenia, Ascaris,* Earthworm, Prawn, Pila, Star fish, Shark, Mugil, Bufo, Calotes, Pigeon, Rat.
2. Cockroach - External, digestive, reproductive system.
3. Frog - External, digestive, reproductive system.
4. Determination of haemoglobin.
5. Estimation of urine sugar (Benedict method).
6. Blood cells of man - Slide only

Program Name: Bachelor of Science
Discipline : Microbiology
(Who those joined in the year after June 2018)

Semester	Part	Subject	Hour	Credit	Int+Ext= Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised/ New/ No Change/ Interchanged If Revised % of Change
V	Core 9	Microbial Genetics and Molecular Biology	4	4	25+75=100	✔		✔		✓						✓	U2MBC51	No Change
	Core 10	Environmental and Agricultural Microbiology	4	4	25+75=100			✔								✓	U2MBC52	No Change
	Core 11	Medical Microbiology	4	4	25+75=100			✔		✓						✓	U2MBC53	No Change
	Core12 Lab	Major Practical V LAB: Environmental, Agricultural and Medical Microbiology	6	3	40+60=100			✔								✓	U3MBC5P	Revised 25%
	Allied13	Introduction to Pharmacognosy	4	4	25+75=100		✔			✓						✓	U3MBA51	New
	Allied14 Lab	Pharmacognosy and Pharmacology	2	---	--		✔			✓						✓	---	New
	SBE 3	Mushroom Technology	2	2	25+75=100				✔	✓						✓	U2MBS51	No Change
	SBE 4	Employability Skills	2	2	25+75=100			✔		✓							U1PS51	No Change
	NME 1	Introduction to Microbiology	2	2	25+75=100			✔		✓						✓	U3MBN51	No Change
	Core 13	Recombinant DNA (rDNA) Technology	4	4	25+75=100			✔		✓						✓	U3MBC61	Revised 5%
	Core 14	Food and Industrial Microbiology	4	4	25+75=100			✔		✓						✓	U3MBC62	Revised 20%
	Core 15	Research Methodology and Bioinformatics	4	4	25+75=100			✔		✓						✓	U3MBC63	New & Revised 90%

VI	Core16 Lab	Major Practical VI LAB: Recombinant DNA Technology, Food and Industrial Microbiology	6	4	40+60=100			✔		✓						✓	U3MBC6P	Revised 20%
	Allied 15	Basic concept of Pharmacology	4	4	25+75=100		✔			✓						✓	U3MBA61	New
	Allied16 Lab	LAB: Pharmacognosy and Pharmacology	2	2	40+60=100		✔			✓						✓	U3MBA6P	New
	SBE 5	Project	4	4	40+60=100		✔									✓	U1MB6PR	New
	NME 2	Applied Microbiology	2	2	25+75=100			✔								✓	U4MBN61	New

Self-Learning Course:

Subject	Credit	Ext =Tot	Subject Code
Food Quality Analysis	5	100 = 100	U1MBSL51

MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Hours per week -4 **Credit : 4**

Hours per Semester-60 **Subject code : U2MBC51**

Course outcomes:

Students, after successful completion of the course, will be able to

CO1: Understand the basic concepts of microbial genetics and gene expression which are essential for the biology and evolution of microorganisms.

CO2 : Improve the knowledge on genetics of microbes and basic concepts of operons.

CO3 : Know about the mutations that occur in microbial genome and their repair mechanisms.

Unit I **(12 hours)**

Nucleic acids as hereditary material: DNA as genetic material (Griffith and Hershey – Chase experiment). Structure of nucleic acid: DNA double helix (Watson and Crick's model of DNA) – Different forms of DNA – B DNA, A DNA and Z DNA. Types of RNA – rRNA, mRNA and tRNA (Clover leaf model). Genetic recombination in Bacteria: Transformation, Conjugation and Transduction.

Unit II **(12 hours)**

Mutation types: Spontaneous mutation-evidence for spontaneous mutation, Point mutation (Replica Plating).Transition and Transversion. Induced mutation: Chemical mutagens and Physical mutagens. Point mutation, Suppressor mutation, Frameshift mutation. DNA repair mechanism: Photoreactivation, Excision repair and Recombination repair.

Unit III **(12 hours)**

DNA Replication: Types of DNA replication – Theta model, Rolling circle model. DNA replication is semiconservative (Meselson and Stahl experiment). Enzymes involved in bacterial DNA replication: DNA Polymerase, Topoisomerase. Mechanism of DNA replication in prokaryotes (in *E.coli*).

Unit IV **(12 hours)**

Transcription: organization of transcriptional units – RNA polymerase and mechanism of transcription in prokaryotes. Translation: Genetic code, Wobble hypothesis and the mechanism of translation.

Unit V **(12 hours)**

Gene regulation and expression: Operon concept – Structure of prokaryotic operon – *lac* operon, *trp* operon and *ara* operon

Text Books:

1. Freifelder, D., Malacinski, G.M., 1987, Essentials of Molecular Biology, John and Bartlett Publishers, London.
2. Prescott, Harley & Klein, 2008, Microbiology, 6/e, The McGraw Hill Companies, US.
3. Freifelder, D., Malacinski, G.M., 1987, Essentials of Molecular Biology.
4. Prescott, Harley & Klein, 2008, Microbiology, 6/e, The McGraw Hill Companies, US.
5. Arumugam, N, 2015, Cell and Molecular Biology, Saras Publication, Nagercoil.
6. Nelson, D. and Cox, M., 2005, Lehninger Principles of Biochemistry, 4/e, W.H. Freeman and Company, New Delhi.
7. Turner, P., McLennan, A., Bates, A. and White, M., 2005, Molecular Biology, 3/e, Taylor and Francis Group, New York.
8. Arumugam, N., 2015, Cell and Molecular Biology, Saras Publication, Nagercoil.

Reference Books:

1. David Freifelder, 1987, Essential of Molecular Biology, Narosa publishing House, New Delhi.
2. Benjamin Lewin, 2007, GENE IX, Oxford University Press, US.
3. Watson, Baker, Bell, Gann, Levine, Losick., 2004, Molecular biology of the gene, 7/e, Pearson publications, India.
4. Kumarasan, V., 2001, Biotechnology, Saras Publication, Nagercoil, Tamil Nadu.
5. Click B.R. and Paeric Jack.J., 2008, Molecular Biotechnology, ASM Press, London.
6. Rastogi, S.C., 2006, Cell and Molecular Biology, New Age International Publishers, New Delhi.
7. Freifelder,D. 1990, Microbial Genetics. Narosa Publishing House , New Delhi.

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Hours per week -4 **Credit : 4**
Hours per Semester-60 **Subject code : U2MBC52**

Course outcomes:

Students, after successful completion of the course, will be able to

CO1: Understand the distribution and interactions of microbial population in soil and its role in biogeochemical cycles.
CO2: Evaluate the application of microbes in wastewater management.
CO3: Learn the beneficial application of microbes in agriculture.

Unit I **(12 hours)**

Distribution of microorganisms in soil – Factors influencing the soil microflora – Role of microorganisms in soil fertility – Interactions among microorganisms: mutualisms, commensalism, competition, amensalism, parasitism and predation – Positive interactions between microbes and plants: rhizosphere, phyllosphere and mycorrhizae.

Unit II **(12 hours)**

Biogeochemical cycles: Carbon cycle – Nitrogen cycle – Nitrogen fixation: symbiotic, asymbiotic and associative symbiotic relationships – Phosphorous cycle – Sulfur cycle.

Unit III **(12 hours)**

Microbes in waste treatment: Solid waste management: Saccharification, gasification and composting – Liquid wastes – Sewage treatment (Primary, secondary and tertiary treatments)

Microbial assessment of water – Most Probable Number (MPN) technique, membrane filtration – Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) – Biodegradation of xenobiotics (Chlorinated pesticide 2,4-D)

Unit IV **(12 hours)**

Microbes for sustainable agriculture - Rhizobium, Azotobacter and Blue-green algae – Mass production, field applications and significance of biofertilizers – Biopesticides – Bacterial: *Bacillus thuringiensis*, Viral: Nuclear polyhedrosis virus and Fungal: Trichoderma – Mode of action.

Unit V **(12 hours)**

Study of microbes as plant pathogens – Bacterial pathogens: Xanthomonas, Mycoplasma – Fungal pathogens: Cercospora, Fusarium – Viral pathogen: Tobacco Mosaic Virus, Cucumber Mosaic Virus.

Text books:

1. Subbarao, 1995, Soil microorganisms and plant growth, 4/e, Oxford and IBH, New York.
2. Ronald M. Atlas and Richard Bartha, 1997, Microbial Ecology, 4/e, Benjamin Cummings Publishing Company.
3. Ronald M. Atlas and Richard Bartha, 1997, Microbial Ecology, 4/e, Benjamin-Cummings Publishing Company.
4. Subbarao, 1995, Soil Microorganisms and Plant Growth, 4/e, Oxford and IBH, New York.
5. Mehrotra and Ashok Agarwal, 2005, Plant Pathology, 2/e, Tata McGraw-Hill Publishing Co. Ltd., Delhi.

References Books:

1. Michael T. Madigan *et. al*., 1997, Brocks's Biology of Microorganisms, 8/e, Prentice
2. Hall Internation Inc.
3. Ronald M. Atlas and Richard Bartha, 1997, Microbial Ecology, 4/e, Benjamin-Cummings Publishing Company.
4. Dubey and Maheshwari, 1999, A text book of Microbiology, 1/e, Chand publications, New Delhi.
5. Mehrotra and Ashok Agarwal, 2005, Plant Pathology, 2/e, Tata McGraw-Hill publishing Company Ltd., Delhi.
6. Subbarao, 1995, Soil Microorganisms and Plant Growth, 4/e, Oxford and IBH, New York.
7.

MEDICAL MICROBIOLOGY

Contact hours per week: 4 **Credit : 4**
Contact hours per semester: 60 **Subject code : U2MBC53**

Course outcomes:

Students, after successful completion of the course, will be able to

CO1: Understand the mechanisms of pathogenesis and epidemiology of microbes.
CO2: Identify the causes and symptoms of various microbial infections.
CO3: Learn the therapeutic and preventive methods for microbial diseases.

Unit I **(12 hours)**

Characteristics of infectious diseases: Normal microbial population of human body: Skin, mouth, upper respiratory tract, intestinal tract, uro-genital tract and eye. Nosocomial infections – Transmission of pathogens: Air borne, Water borne, contact transmission and vector borne transmission.

Unit II **(12 hours)**

Mechanisms of pathogenesis: Entry of the microbes into the host: Mucus membranes, skin, parenteral route and adherence. Damage to host cells: Direct damage and toxins (exotoxins and endotoxins).

Unit III **(12 hours)**

General characteristics, pathogenesis, diagnosis, treatment and preventive measures of *E. coli, Staphylococcus aureus, Streptococcus pyogenes, Mycobacterium tuberculosis, Treponema pallidum* and *Salmonella typhi* infections.

Unit IV **(12 hours)**

Pathogenesis, diagnosis, treatment and preventive measures of HIV, Hepatitis B, Influenza virus and Polio infections. Pathogenesis, lab diagnosis, treatment and preventive measures of candidiasis.

Unit V **(12 hours)**

General characteristics, life cycle, diagnosis, treatment and preventive measures of *Entamoeba histolytica* and *Plasmodium falciparum* infections. Antimicrobial agents (inhibition of cell wall synthesis, inhibition of protein synthesis, damage to the plasma membrane and antimetabolites – sulfa drugs) and resistance mechanisms of bacteria to antimicrobial agents.

Textbooks:

1. Prescott, Harley and Klein, 2008, Microbiology, 6/e, McGraw-Hill.
2. Ananthanarayan and Paniker, 2013, Textbook of Microbiology, 9/e, University Press.
3. Tortora *et al*., 1982, Microbiology: An Introduction, 3/e, The Benjamin/Cummings Publishing Company, Inc, New York.
4. Ananthanarayan and Paniker, 2013, Textbook of Microbiology, 9/e, University Press.

5. Patric R. Murray, Ken S. Rosenthal, George S. Kobayashi and Michael A. Pfaller, 1998, Medical Microbiology, 3/e, Mosby, London.
6. Ananthanarayan and Paniker, 2013, Textbook of Microbiology, 9/e, University Press.

References:

1. Patric R. Murray, Ken S. Rosenthal, George S. Kobayashi and Michael A. Pfaller, 1998, Medical Microbiology, 3/e, Mosby, London.
2. Ananthanarayan and Paniker, 2013, Textbook of Microbiology, 9/e, University Press.
3. Prescott, Harley and Klein, 2008, Microbiology, 6/e, McGraw-Hill.
4. Jawetz, Melnic and Adelberg, 2004, Medical Microbiology, 22/e, McGraw-Hill.
5. Tortora *et al*., 1982, Microbiology: An Introduction, 3/e, The Benjamin/Cummings Publishing Company, Inc, New York.

MAJOR PRACTICAL V

LAB: ENVIRONMENTAL, AGRICULTURAL AND MEDICAL MICROBIOLOGY

Contact Hours per week: 6 **Credits : 3**
Contact Hours per Semester: 90 **Subject Code : U3MBC5P**

Course Outcomes:
Students, after successful completion of the course, will be able to

CO1: Get a platform that involves working knowledge of scientific research and academics, health clinics and industries.
CO2: know about microorganisms including their environmental, agricultural and medical microbiology
CO3: Learn about laboratory isolation and identification of microorganisms that will help them to understand the application of microbes in pharmaceutical industry, food and dairy microbiology and clinical microbiology.
CO4: Demonstrate an understanding and competency in laboratory safety and specialized microbiological laboratory skills including observation, creative and analytical thinking and data interpretation.

List of Experiments:

1. Isolation, identification and Enumeration of microorganisms from Urine, stool sputum, pus and throat samples.
2. Isolation and identification of fungi and bacteria from clinical specimens
3. Maintainence of cultures.
4. Isolation, Identification and Enumeration of microorganisms from soil.
5. Enumeration of microorganisms from water.
6. Microbiological analysis of water by Most Probable Number (MPN) technique.
7. Isolation of *Rhizobium sp* from root nodules.
8. Staining and observation of Mycorrhizae from infected roots.
9. Demonstration / observation of microalgae and diatoms.
10. Visit any industry and submit the report.

References:

1. Dubey, R.C. and O.K. Maheshwari, 2005, Practical Microbiology, 1/e, S. Chand & Co. Ltd., New Delhi.

2. Aneja, K.R. 2003, Experiments in Microbiology, Plant Pathology and Biotechnology, 4/e, New Age International, New Delhi.

3. Cappuccino and Sherman, 2007, Microbiology: A Laboratory Manual, 7/e, Pearson Education, New Delhi.

INTRODUCTION TO PHARMACOGNOSY

Contact Hours per semester: 60 **Credits : 4**
Contact hours per week: 4 **Subject code: U3MBA51**

Course outcomes:
Students, after successful completion of the course, will be able to
CO1: Develop the knowledge about drugs and their functions.
CO2: Improve the knowledge Conservation of medicinal plants.
CO3: Know about the functions various systems of medicine.

Unit I **(12 hours)**

Pharmacognosy-Introduction and History; Scope and development of Pharmacognosy; Sources of Drugs – Medicinal plants, marine sources and Tissue culture. Structural Classification of medicinal plants.

Unit II **(12 hours)**

Cultivation and Collection of drugs of natural origin; Factors influencing cultivation of medicinal plants; Conservation of medicinal plants; Applications of plant hormones: Auxin, Gibberlin, Cytokynin and Abcissic acid.

Unit III **(12 hours)**

Introduction and properties of primary metabolites: Carbohydrates- Beta-Glucose, Agar; Enzymes - Gelatinase, caseinase; Lipids- castor oil, bees wax. Introduction to secondary metabolites: Test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Essential oil and Resins.

Unit IV **(12 hours)**

Plant tissue culture: Historical development of plant tissue culture; Types of cultures; Nutritional requirements; growth and their maintenance. Applications of plant tissue culture in pharmacognosy.

Unit V **(12 hours)**

Applications of Pharmacognosy in various systems of traditional medicine: Allopathy; Ayurveda; Unani; Siddha; Homeopathy and Chinese systems of medicine.

Text Books:

1. Biren shah, 2013. Text book of Pharmacognocy and Phytochemistry, 2nd edition, Elsevier india.
2. Evans, W.C. 2009. Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London,
3. Tyler, V.E., Brady, L.R. and Robbers, J.E., 1988. Pharmacognosy, 9th. edition, Lea and Febiger, Philadelphia,
4. Text Book of Pharmacognosy by T.E. Wallis, Published by Elsevier Inc.
5. Mohammad Ali., 2011. Pharmacognosy: Pharmacognosy and Phytochemistry, Volume 1, Published by CBS Publishers & Distributors Pvt. Ltd.
6. Kokate, C.K., Purohit, Gokhlae, 2007. Text book of Pharmacognosy, 37th edition, Nirali Prakashan, New Delhi.

References:

1. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, NewDelhi.
2. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, NewDelhi, 2007
3. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
4. Anatomy of Crude Drugs byM.A. Iyengar.
5. Cultivation of Medicinal and aromatic crops by A..A.Farooqui and B.S. Sreeramu.
6. Pharmacognosy & Pharmacobiotechnology by Ashutosh kar
7. Advances in Harticulture Volume.II Medicinal and Aromatic Plants by K.L. Chada & Rajendra Gupta.
8. Herbal Medicine expanded commission E Monographs. Blumenthal/ Goldberg/Brinckmam.
9. "Indian Medicinal Plants" Volumes by Kirtikar K.R. and Basu B.D.
10. Goodman and Gilman's Pharmacological Basis of Therapeutics.

MUSHROOM TECHNOLOGY

Contact Hours per week: 2 **Credits : 2**
Contact Hours per semester: 30 **Subject Code : U2MBS51**

Course outcomes:
Students, after successful completion of the course, will be able to
CO1: Understand the basic biology and life cycle of mushrooms.
CO2: Know the methodology of mushroom cultivation.
CO3: Know the commercial, therapeutic and nutritive value of mushrooms.

Unit I **(6 Hours)**

Mushroom technology – History and Scope – Morphology and classification – Edibility and poisonous properties – Formation and development of vegetative basidiocarp – Structure of basidiocarp.

Unit II **(6 Hours)**

Salient features of mushrooms – Morphology, Structure and Life cycles of Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajorcaju*), Paddy straw mushroom (*Volvariella volvcea*) and Button mushroom (*Agaricus bisporus*).

Unit III **(6 Hours)**

Mushrooms farm structure, design and layout – Isolation and culture of spores – Media preparation – Inoculation – Production of mother spawn – Multiplication of spawn – Principle and techniques of composting – Method of paddy straw mushroom cultivation – Casing – Cropping – Harvesting – Marketing.

Unit IV **(6 Hours)**

Nutritional value of mushrooms – Mushroom food products: organic mushroom – Mushroom nutraceuticals: *Ganoderma lucidium*, *Cordyceps sinensis* – Mushroom recipes: Sauteed mushroom, Stuffed mushroom and Grilled mushroom.

Unit V **(6 Hours)**

Therapeutic and Health benefits of mushrooms: Antimicrobial, anticancer metabolites from mushroom – Economic importance of mushrooms – Mushroom cultivation status in Tamilnadu.

Text Books:

1. V.N Pathak, Nagendra Yadav and Maneesha Gaur 2010, Mushroom production and processing Technology Published by Agrobios, India
2. Nita Bahl, 2002. Handbook of mushroom 4th edn. Vijay Primalani for Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Suman B. C. and Sharma V. P, 2014, Mushroom Cultivation in India, Daya Publishing House, New Delhi.
4. Hand Book of Mushroom Cultivation, 1999. TNAU Publications.
5. Dubey and Maheshwari. 2006. A Text Book of Microbiology. Chand Publications.
6. Chang T.S. and Hayes W.A., 1978. The Biology and Cultivation of Edible Mushrooms. Academic Press, New York.
7. Suman, B.C and Sharma V.P.2014, Daya Publishing House, New Delhi.
8. Ignacimuthu, S. 1997. Disease and Pests of Mushroom, Applied Plant Biotechnology, Oxford & IPH Publishing Co. Pvt. Ltd., New Delhi.
9. Dubey and Maheshwari. 2006. A Text Book of Microbiology. Chand Publications, New Delhi.
10. Tripathi, D. P., 2005, Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
11. Alice, D., Muthusamy and Yesuraja, M, 1999, Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.

References:

1. V.N. Pathak, Nagendra Yadav and Maneesha Gaur 2010, Mushroom Production and Processing Technology Published by Agrobios, India
2. Suman B. C. and Sharma V. P, 2014, Mushroom Cultivation in India, Daya Publishing House, New Delhi.
3. Dubey and Maheshwari. 2006. A Text Book of Microbiology. Chand Publications. New Delhi.
4. ICAR publications, Cultivation of Edible Mushroom.

SBE- EMPLOYABILITY SKILLS

Contact Hours per week: 2 **Subject Code: U1PS51**
Contact Hours per Semester: 30 **Credits: 2**

To enrich the Employability Skills by imparting Reasoning skills, Aptitude skills and General Knowledge.

Unit I : **(6 – Hours)**
Quantitative Aptitude – Averages, Percentage, Profit & Loss, Ratio & Proportion, Time & Work, Time & Distance, Clock.

Unit II : **(6-hours)**
Quantitative Aptitude –Problems on Ages, Boat & Stream, Simple Interest, Compound Interest, Area, Partnerships.

Unit III: Reasoning **(6-hours)**
Verbal Reasoning - Analogy, Classification, Series, Coding & Decoding, Blood Relations, Direction Sense Test.

Unit IV: Reasoning **(6-hours)**
Verbal Reasoning - Number Test, Ranking & Time sequence Test, Alphabet Test, Logical Venn Diagrams.

Unit V: **(6-hours)**
General Knowledge: Abbreviations, Acronyms, Famous Personalities, Important Days, Capital Cities, Currencies, Books and Authors, Inventions.

Reference Books:

1. Verbal & Non Verbal Reasoning - R.S.Aggarwal
2. Quantitative Aptitude - R.S.Aggarwal
3. Subjective & Objective Quantitative Aptitude - R.S.Aggarwal
4. Malayala Manorama Year Book, 2014

NME - INTRODUCTION TO MICROBIOLOGY

Contact Hours per week: 2 **Credit: 2**
Contact Hours per Semester: 30 **Subject code: U3MBN51**

Course outcomes:
Students, after successful completion of the course, will be able to
CO1: Develop the basic awareness of microbiology
CO2: Understand the basic properties and importance of microorganisms

Unit I **(6 hours)**
Introduction to microbiology, concepts of microorganism –Theory of spontaneous generation, biogenesis and Germ theory of disease - History of microbiology: Leeuwenhoek, Louis Pasteur and Robert Koch.

Unit II **(6 hours)**
Bacteria: major features of bacteria – ultra structure of bacteria (*E. coli*) – shapes of bacteria (coccus, bacillus, vibrio and spirillum – introduction only) – Economic importance of bacteria - beneficial role of bacteria.

Unit III **(6 hours)**
Algae: definition and general features of algae – economic importance of algae – common algae: *Volvox* and *Spirulina.*

Unit IV **(6 hours)**
Fungi: Introduction and distinguishing characteristics – structure (yeast) – Economic importance of fungi.

Unit V **(6 hours)**
Protozoa: introduction and structure of *Plasmodium* – Virus: introduction and general characteristics of virus – Transmission and treatment of HIV.

Text books

1. Dubey, R.C. and Maheswari, D.K. 2010. A Text Book of Microbiology. S Chand publications, NewDelhi.
2. Mani , A., Selvaraj , A.M., Narayanan , L.M. and Arumugam, N. 2014. Microbiology – General and Applied . Saras Publication, Nagercoil, Tamil Nadu.

References

1. Prescott, Harley and Klein.2006.Microbiology 6/e. The McGraw-Hill companies.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R.1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
3. Kumaresan, V. 2015. Biotechnology. Saras Publication, Nagercoil, Tamil Nadu.
4. Tauro, P., Kapoor, K.K. and Yadav, K.S.1989. An Introduction to Microbiology. Willey Publications. New Delhi.

RECOMBINANT DNA (rDNA) TECHNOLOGY

Hours per week : 4 **Credit : 4**
Hours per Semester : 60 **Subject code : U3MBC61**

Course outcomes:
Students, after successful completion of the course, will be able to
CO1: Gain knowledge about the various techniques used for gene transfer.
CO2: Understand the various enzymes and vectors involved in recombinant DNA technology.
CO3: Plan and undertake research in molecular biology in the laboratory.

Unit I **(12 hours)**
Enzymes: Restriction endonucleases (Type I, II and III) – DNA polymerase – Terminal nucleotidyl transferase – Alkaline phosphatase – Polynucleotide kinase – DNA ligase – Methyl transferases.

Unit II **(12 hours)**
Vectors (Plasmid vectors): pBR322 and pUC19 – Shuttle vectors – Bacteriophages vectors: M13 vector and lambda vector – Cosmids – Phagemids.

Unit III **(12 hours)**
Extraction and purification and estimation of nucleic acids – Gel electrophoresis – DNA sequencing: Maxam – Gilbert (Chemical) and Sanger – Nicholson (dideoxy/enzymatic) sequencing method.

Unit IV **(12 hours)**
Construction of Genomic library and cDNA library – Principle and applications in analysis of recombinants: Selection and screening of recombinants (Colony hybridization, Insertional inactivation and Blue and white colony selection) – Blotting techniques (Northern, Southern and Western) – Polymerase chain reaction (PCR).

Unit V **(12 hours)**
Applications of r-DNA technology: Medicine (Production of Insulin) – Recombinant vaccines – Gene therapy (Ex vivo and In vivo) – Transgenic animals (sheep) – Transgenic plant (Insect resistance). Biosafety of rDNA technology – Intellectual property rights (IPR) – Patenting of rDNA technology products.

Text books:

1. Brown .T.A, 2006, Gene Cloning and DNA Analysis– An Introduction, 5/e, Wiley-Blackwell, UK.

2. Dubey. R.C, 2013, A Textbook of Biotechnology, 5/e, S. Chand & Co. Ltd., New Delhi.

3. Primrose S. B. and Twyman R. M., 2006, Principles of Gene Manipulation and Genomics, 3/e, Blackwell Publishing Company, Oxford, UK.

4. Brown T. A. and Gene Cloning, 2006, DNA Analysis: An Introduction, 5/e, Wiley-Blackwell, UK.

5. Glick B.R. and Pasternak J. J., 2003, Molecular Biotechnology, 3/e, ASM press, Washington.

Reference Books:

1. Kumaresan, V., 2003, Biotechnology, 3/e, Saras Publication, Nagercoil, Tamil Nadu.
2. Joseph Sambrook and David William Russell, 2001, Molecular cloning, 3/e, CSHL Press, New York.
3. Brown .T.A, 2006, Gene Cloning and DNA Analysis – An Introduction, 5/e, Wiley-Blackwell, UK.
4. Dubey R.C., 2013, A Textbook of Biotechnology, 5/e, S. Chand & Co. Ltd, New Delhi.
5. Primrose S. B and Twyman R. M., 2006, Principles of Gene Manipulation and Genomics, 3/e Blackwell Publishing Company, Oxford, UK.
6. Glick B.R. and Pasternak J.J., 2003, Molecular Biotechnology, 3/e, ASM press, Washington.

FOOD AND INDUSTRIAL MICROBIOLOGY

Contact Hours per Semester: 60 **Credits : 4**
Contact Hours per week: 4 **Subject Code : U3MBC62**

Course outcomes:

Students, after successful completion of the course, will be able to
CO1: Develop knowledge about the role of microorganisms in food substances and detection of spoilage causing microorganisms.
CO2: Understand the basic ideas about the fermentation technology.
CO3: Know the various types of microbial production of industrial products.

Unit I **(10 hours)**

History of Food Microbiology, Food as a substrate for microorganisms, Factors affecting growth of Microorganisms: Intrinsic and extrinsic factors.

Unit II **(12 hours)**

Preservation of Food: High, Low Temperature, Radiation and Chemical preservatives. Food spoilage of Cereals, Meat, Milk and Milk products. Health – Promoting microorganisms – Probiotic bacteria.

Unit III **(12 hours)**

Microbial spoilage of foods & food borne diseases, food poisoning, food infection and intoxication. Examples: *E. coli* O157:H7, *Salmonella*, *Campylobacter jejuni*, *Bacillus cereus, Shigella sp., Clostridium sp., Staphylococcus sp. Aspergillus niger,* Norwalk like viruses, *Hepatitis A.*

Unit IV **(13 hours)**

Fermentor: Basic design and its function – Fermentor types: Air lift, Continuous Stirred Tank Reactor (CSTR), Tower and Packed bed fermentor. Fermentation types: Submerged and Solid state fermentation– Bioreactor operations – Batch, fed batch and continuous process: Media for industrial fermentation. Inoculum development, Strain improvement by rDNA technology.

Unit V **(13 hours)**

Industrially important of microbial products, Production of Penicillin, Streptomycin. Enzyme- amylase, protease and amino acid – Glutamic acid, ascorbic acids alcoholic beverage - wine production, Single Cell Protein (SCP) production and immobilization techniques. Biofuel, Biohydrogen and Methane production.

Text Books:

1. Frazier, W. C. and Westhoff, D.C., 1989, Food Microbiology, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Adams, M.R. and Moss, M.O., 2000, Food Microbiology, New Age International (P) Ltd., New Dehli.
3. Moshrafuddin Ahamed and Basumatary, S.K., 2008, Applied Microbiology, MJP Publishers, Chennai.
4. Patel, A.H., 2000, Industrial Microbiology, 1/e, Macmillan Publishers India.
5. Kalaichelvan, P.T. and Arulpandi., 2007, Bioprocess Technology, MJP Publishers, chennai.
6. Jebakumar Solomon, 2009, Foundations in Bioprocess Technology – Theory and Practice. Ratna Printers, TamilNadu.

Reference Books:

1. Peppler, H. J., 1979, Microbial Technology, Volumes I & II –. Academic Press, New York.

2. Stanbury, P. F. and Whitaker, A., 1984, Principles of Fermentation Technology – Pergamon Press.

3. Casida, L. E., 2007, Industrial Microbiology –Jr. John Wiley and Sons.

4. Patel, A. H. 2000, Industrial Microbiology, 1/e, Macmillan Publishers India.

RESEARCH METHODOLOGY AND BIOINFORMATICS

Contact Hours per week: 4 **Credit : 4**
Contact Hours per Semester: 60 **Subject Code: U3MBC63**
Course outcomes:
Students, after successful completion of the course, will be able to
CO1: Understand the principles of research and various research methods and their applications, principles of thesis writing.
CO2: Understand the basic Biostatistics and guidelines for writing a manuscript for a journal.
CO3: Acquire knowledge in basic concept in bioinformatics.
CO4: Understand the various types of databases and uses and applications of biological databases.

Unit I **(10 hours)**
Introduction to Research –Literature Collection: review of Literature – Literature citation: citation sequence system – Journal Abbreviations – Research report: components – Plagiarism tools- iThenticate, Turnitin.

Unit II **(14 hours)**

Research report: tabulation –Figures: Numbering – Caption – Preparation of statistical diagram, Photographs, Microphotographs – Formatting and Typing: Spacing – Fonts – Format of thesis.

Unit III **(12 hours)**

Concepts in Statistics: Primary data and secondary data reports– Diagrammatic representation of Graphs and Diagram: Bar diagram, Pie diagram, Histogram. Experimental designs: Introduction – Observation – Hypothesis and Null-hypothesis – Experimental error – Replication – Controls.

Unit IV **(12 hours)**

Introduction to bioinformatics: Databases: Introduction - characteristics – types. Nucleotide databases: DNA Data Bank of Japan (DDBJ), National Center for Biotechnology Information (NCBI) – Protein Databases: Protein Data Bank (PDB), PRINTS.

Unit V **(12 hours)**

Searching and Sequencing analysis, Local Alignment (BLAST and FASTA) - Multiple sequence alignment: - Clustal W and Clustal X, Significance of MSA - Analysis of phylogeny and evolutionary trees. Phylogenetic software - Phylip.

Text Books

1. Research Methodology for Biological Sciences, N.Gurumani, (2006), MJP Publishers, Chennai.
2. Rastogi, S.C.*et al*., 2003, Bioinformatics- Concepts, Skills, and Applications. CBS Publishing.
3. S. Ignacimuthu, S.J., 1995, Basic Bioinformatics, Narosa Publishing House, New Delhi.

References

1. Leach, A. R., 2001, Molecular Modeling: Principles and Applications, Prentice Hall.
2. Gibas, C. and Jambeck. P, 2001, Developing Bioinformatics Computer Skills, Oreilly & Associates Inc.
3. Baxevanis, A. D. and B. F. Francis Ouellette, 2001, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley-IEEE.
4. N. Gautham, 2006, Bioinformatics: Databases and algorithms, Narosa publishing house, Chennai.
5. P. Shanmughavel., 2005, Principles of Bioinformatics, Pointer publishers, Jaipur.
6. Sharma, Munjal and Shankar, 2008, A text Book of Bioinformatics, Rastogi Publication, Meerut.

MAJOR PRACTICAL VI

LAB: Recombinant DNA Technology, Food and Industrial Microbiology

Contact Hours per week: 6 **Credit : 4**
Contact Hours per Semester: 90 **Subject Code : U3MBC6P**
Course Outcomes:

Students, after successful completion of the course, will be able to

CO1: Provide theoretical as well as research-oriented training on food and industrial microbiology.

CO2: Provide public awareness regarding the merits and demerits of using microbes and microbial products in the fields of Recombinant DNA Technology, Food and Industrial production.
CO3: Apply scientific knowledge and high quality research in the field of rDNA Technology, Food and Industrial Microbiology.
CO4: Perform quality research focusing on Microbiology and other interdisciplinary fields.

List of Experiments:

1. Isolation of Plasmid DNA from bacteria and separation by Agarose gel electrophoresis.
2. Isolation of Chromosomal DNA from bacteria and separation by Agarose gel electrophoresis
3. Methylene blue reductase test – Milk Sample
4. Enumeration of bacteria in milk by standard plate count.
5. Enumeration of microorganisms from spoiled fruits (Orange/Apple) and spoiled vegetables(Tomato/potato)
6. Immobilization of yeast cells by sodium alginate.
7. Production of extracellular amylase enzyme by Submerged fermentation
8. Industrial visit and submit a report.

References:

1. J.G. Cappuccino and N. Sherman, 2014, Microbiology: A laboratory manual, 11/e, Pearson publications United States.
2. P. Gunasekaran, 1996, Microbiology: A laboratory manual, New Age international publishers, New Delhi.
3. N. Kannan, 2002, Laboratory manual in General Microbiology, Panima publishers, New Delhi.
4. Sundaraj, T. and S. Aswathy, 2002, Microbiology Laboratory Manual 1/e, Chennai.
5. Dubey, R.C. and O.K. Maheshwari, 2005, Practical Microbiology, 1/e, S. Chand and Co.Ltd., New Delhi.
6. Short protocols in Molecular Biology II edition, John Wiley & Sons by Fredrick M. Anusbel, Harvard Medical School.

BASICS CONCEPTS OF PHARMACOLOGY

Contact hours per week: 4 **Credits : 4**
Contact hours per semester: 60 **Subject Code : U3MBA61**

Course outcomes:

Students, after successful completion of the course, will be able to
CO1: Develop the knowledge of pharmacology.
CO2: Understand the anatomy and microbial infections of human.
CO3: Create the awareness about the adverse effects of drugs.

Unit I **(12 hours)**

Drugs- Introduction, Route of administration, Concept of Pharmacokinetics, Pharmaco-dynamics and Adverse drug reactions. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials.

Unit II **(12 hours)**

Measurement of Drug levels in different body fluids and significance. Drugs acting on digestive system- Antacids and drugs used in peptic ulcer, purgatives, and laxatives, Antidiarrohoeals, Emetics, Anti-emetics and Analgesics.

Unit III **(12 hours)**

Anti-Protozoan Drugs (Plasmodium falciparum & Entamoeba histolytica). Anti-Fungal Drugs (Aspergillus niger & Candida albicans). Anti-Bacterial Drugs (Salmonella typhi & Mycobacterium tuberculosis). Anti-Cancer Drugs. Anti-Viral drugs (HIV, Hepatitis B virus).

Unit IV **(12 hours)**

Antibiotics- Penicillin, Tetracyclines, Streptomycin, Sulphonamides. Antitubercular agents, Anti-leprotic drugs. Disinfectants and antiseptics.

Unit V **(12 hours)**

Drugs affecting the Gastro Intestinal System, Respiratory System, Cardiovascular System, Central nervous system, Urine and renal functions. Excretion of drugs in stool and bile.

Text books:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J. 8th Edition 2015. Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J. 2012. Basic and clinical pharmacology, Tata McGrawHill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics, 2006. Page 81 of 161
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A.K., Bradley R.W. 2009. Applied Therapeutics, The Clinical use of Drugs, 9th edition, The Point Lippincott Williams &Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. 2014. Lippincott's Illustrated Reviews-Pharmacology, 6th edition, Wolters Kluwer(India) Pvt.Ltd - New Delhi.

References:

1. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers MedicalPublishers (P) Ltd, New Delhi.
2. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
3. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
4. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company,Kolkata.
5. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan.

ALLIED LAB: PHARMACOGNOSY AND PHARMACOLOGY

Contact hours per week: 2 **Credits : 2**
Contact hours per semester: 30 **Subject Code: U3MBA6P**
Course Outcomes:
Students, after successful completion of the course, will be able to

1. Learn and get experiences about herbs and their sciences

2. Define principle procedure of general formulations of drugs.
3. Recognize route of drug administration and classification of Pharmaceutical dosage form.

List of experiments:

1. Cross anatomical studies (T.S. of stem) of *Azadiracta indica* L.
2. Morphological characteristics of plant families- *Tridax procumbens* L., *Catharanthus roseus* (L.) G.Don
3. Maintenance of laboratory animals as per CPCSEA guidelines (record work only).
4. Blood collection, serum and plasma separation
5. Study of different routes of drugs administration in mice/rats (record work only)
6. Preliminary Phytochemical Screening of *Phyllanthus niruri* L.
7. Preliminary Phytochemical Screening of *Vitex negundo* L.
8. Preliminary Phytochemical Screening of *Pedalium murex* L.
9. Preliminary Phytochemical Screening of *Tribulus terrestris* L.
10. Preliminary Phytochemical Screening of *Moringa oleifera* Lam.

Recommended Books:

1. Bikash Medhi and Ajay Prakash, 2010. Practical Manual of Experimental and Clinical Pharmacology, jaypee brothers medical publishers (p) ltd.
2. Biswas.C and Johri, B.M.I999, The Gymnosperms. Narosa publishing house, New Delhi.
3. Harborne, J. B. practical manual of Phytochemical Methods (A Guide to Modern Techniques of Plant Analysis), Third Edition 1998. Published by chapman & Hall, an imprint of Thomson Science, 2-6 Boundary Row, London SE1 8HN, UK.

PROJECT WORK

Contact Hours per week: 4 **Credit : 4**
Contact Hours per Semester: 30 **Subject Code: U1MB6PR**

The aim of project work (lab work) is to inculcate students to learn adequate knowledge on research methodology in the subject and prepare them for pursuing research in experimental or computational areas of the subject. Student's allotment is done by lot system. The project work study is to be undertaken under the guidance of a Teacher of the Department. The guiding teacher will make continuous internal assessment of the Project Work. No teacher shall be permitted to guide more than eight students in a semester for Project Work under his/her supervision. The project work will be evaluated by the external examiner.

- Project will be done by the final year students in the sixth semester under the guidance of respective guides.
- For projects internal marks (max 40) will be awarded by the respective guide and external marks (max 60) will be awarded in the external examinations.
- Minimum number of pages for B.Sc. Project thesis shall be 30.

NME - APPLIED MICROBIOLOGY

Contact Hours per week: 2 **Credit: 2**
Contact Hours per Semester: 30 **Subject code: U4MBN61**

Course outcomes:
Students, after successful completion of the course, will be able to
CO1: Understand the basic ideas about beneficial role of microorganisms.
CO2: Learn the application of microbes in various field.
CO3: Develop the knowledge about the role of microorganisms on the food and dairy industry.

Unit I **(6 hours)**
Introduction to applied microbiology – microbes in agricultural improvement – role of microbes in food, medicine and industry.

Unit II **(6 hours)**
Agricultural microbiology: Biofertilizers – organism used as biofertilizer. Role of biofertilizer - Applications of Biofertilizer – *Rhizobium* (Symbiosis), Vermicompost.

Unit III **(6 hours)**
Food microbiology: microorganisms of food – common food items – purpose of microbial examination in foods – methods of food preservation: pickling, salting, canning and refrigeration (introduction only).

Unit IV **(6 hours)**
Dairy microbiology: composition of milk – role of microorganisms in milk – Dairy products: curd, yogurt and cheese.

Unit V **(6 hours)**
Medical microbiology: Normal microflora of Human body(skin infection) – Disease caused by microbes (interaction only)– Bacterial diseases – Cholera and Typhoid(causes, diagnosis, treatment and prevention).

Text books

1. Mani , A., Selvaraj , A.M., Narayanan , L.M. and Arumugam, N. 2014. Microbiology – General and Applied . Saras Publication, Nagercoil, Tamil Nadu.
2. Kumaresan, V. 2015. Biotechnology. Saras Publication, Nagercoil, Tamil Nadu.
3. Dubey, R.C. and Maheswari, D.K. 2010. A Text Book of Microbiology. S Chand publications, NewDelhi.
4. Ananthanarayanan, R. and Jayaram Panicker, C.K. 2005. Text book of Microbiology, orient Long man, London.

References

1. Swaminathan, M. 1990. Food and Nutrition, Bappco. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
2. Kannaiyan, S. 2002. Biotechnology of biofertilizers, Narosa publishing house, New Delhi.
3. Subba Rao, N.S. 2002. Soil microorganisms and plant growth. 4th edition. Oxford and IBH publishing co Pvt. Ltd, New Delhi.
4. Adams, M.R. and Moss, M.O. 2006.Food microbiology, New Age international (P)

Ltd., New Delhi.

5. Greenwood, D. Richard C.B. Salk, John, F. and Peutherer. 2003. Medical Microbiology(5th Edition). Churchill Livingstone, USA.