Course Name: Bachelor of Science
Discipline : Microbiology
CHOICE BASED CREDIT SYSTEM
(For those who joined in June 2023 and after)

II year B.Sc. MICROBIOLOGY

SEMESTER I

Course	Course Code	Course Title	Hours	Credit	Marks			Focus on Employability/ Entrepreneurship/ Skill Development
					I	E	Total	
Language	U23PT11	Tamil	6	3	25	75	100	
English	U23PE11	English	4	3	25	75	100	
CC-1	U23MBC11	Fundamentals of Microbiology and Microbial Diversity	5	4	25	75	100	Employability
CC-2	U23MBCP11	Practical I - Fundamentals of Microbiology and Microbial Diversity	5	4	25	75	100	Skill Development
Elective-1	U23MBE11	Basic and Clinical Biochemistry	4	3	25	75	100	Employability
SEC-1 (NME)	U23MBN11	Social and Preventive Medicine	2	2	25	75	100	Skill Development
FC	U23MBF11	Introduction to Microbiology	2	2	25	75	100	Skill Development
AECC	U23UAEC11	Communication Skills for Employment – I	2	2	25	75	100	Skill Development
Total			30	23				

SEMESTER II

Course	CourseTitle	Hours	Credit	Marks			Course Code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised/ New/ No Change/ Interchanged. (If revised %of change)
				I	E	Total			
Part I	Tamil	6	3	25	75	100	U23PT21	Employability	100% New
Part II	English	6	3	25	75	100	U23PE21	Employability/ Skill Development	New
Core 3	Microbial Physiology and metabolism	5	4	25	75	100	U23MBC21	Employability	Revised 10%
Core 4 Lab	Lab: Microbial Physiology and metabolism	5	4	40	60	100	U23MBCP21	Skill Development	Revised 10%
Elective 2	Bioinstrumentation	4	4	25	75	100	U23MBE21	Skill Development	New
Elective 3 Lab	Lab: Bioinstrumentation & Basic and clinical Biochemistry	2	2	40	60	100	U23MBEP21	Skill Development	New
NME 2	Essentials of applied microbiology	2	2	25	75	100	U23MBN21	Skill Development	No change
	Total	30	22						

III- SEMESTER

Semester	Part	Subject Name	Hours	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**	6	3	25+75=100												**U24PT31**	**Interchanged from II semester**
	Part II	**English**	6	3	25+75=100												**U24PE31**	**New**
	Core 5	**Immunology**	4	3	25+75=100			✔								✔	**U24MBC31**	**Revised 10%**
	Core 6 Lab	**LAB**: Immunology	2	2	40+60=100		✔							✔			U22MBCP31	No change
	Allied 1	**General Chemistry – I**	4	3	25+75=100												**U24CHAY31**	**New (Sem Change)**
	Allied 2 Lab	**LAB** Volumetric analysis	2	--	-												--	--
	Allied 3	Plant Science	4	4	25+75=100		✔									✔	**U24MBA31**	**Mark Change**
	Allied 4 Lab	**LAB:** Plant & Animal Science	2	--	-		✔							✔			--	--
	SLC	**Value education**	-	3	25+75=100			✔								✔	**U24VE31**	**New**
	Total		**30**	**21**														
IV	Part I	**Tamil**	6	3	25+75=100												**U24PT41**	**Interchanged from III semester**
	Part II	**English**	6	3	25+75=100												**U24PE41**	**New**
	Core 7	Microbial Genetics and Molecular Biology	4	3	25+75=100			✔								✔	**U24MBC41**	**Credit change**
	Core 8 Lab	**LAB:** Microbial Genetics and Molecular biology	2	2	40+60=100			✔						✔			U22MBCP41	No change
	Allied 5	**General Chemistry – II**	4	3	25+75=100												**U24CHAY41**	**New (Sem Change)**
	Allied 6 Lab	**LAB: Volumetric analysis**	2	2	40+60=100												**U24CHAYP41**	**New (Sem Change)**
	Allied 7	Animal Science	4	4	25+75=100		✔									✔	**U24MBA41**	**Credit change**
	Allied 8 Lab	**LAB: Plant & Animal Science**	2	2	40+60=100		✔							✔			**U24MBAP41**	**Title Change**
	SLC	**Environmental Science**	-	2	25+75=100			✔								✔	**U24ES41**	**New**
	Total		**30**	**24**														

***For III Year UG Microbiology, compulsory Internship/Industrial training should be carried out for 60 hours during IV semester vacation. 2 extra credits will be awarded on completion of the internship with report.**

Year	Part	Subject	Cr	Internal=Total	Code
I & II	Part V	NSS/NCC/Physical Education – Sports/ YRC/RRC	3	100=100	U22NS4 / U22NC4 / U22PS4 / U22YR4 / U22RR4

V- SEMESTER

Part	Course Code	Course Title	Hours	Credit	Marks			Focus on Employability/ Entrepreneurship/ Skill Development
					I	E	Total	
Core 9		Medical Microbiology	5	3	25	75	100	Employability
Core 10		Environmental and Agricultural Microbiology	4	3	25	75	100	Employability
Core 11		Research Methodology and Bioinformatics	4	3	25	75	100	Skill Development
Core 12		Lab: Medical, Environmental and Agricultural Microbiology	6	4	40	60	100	Employability
Allied 9		General Chemistry-III	4	4	25	75	100	Skill Development
Allied 10		Lab: Organic qualitative analysis	2	-	40	60	100	Skill Development
Allied 11		Introduction to Pharmacognosy	4	4	--	--	---	Skill Development
Allied 12 Lab		Lab: Pharmacognosy and Pharmacology	2	-	40	60	100	Skill Development
SBE		Employability Skills	1	1	25	75	100	Employability
Total			30	22				

VI- SEMESTER

Part	Course Code	Subject	Hour	Credit	Marks			Focus on Employability/ Entrepreneurship/ Skill Development
					I	E	T	
Core 13		Recombinant DNA (rDNA) Technology	4	4	25	75	100	Employability
Core 14		Food & Industrial Microbiology	4	3	25	75	100	Employability
Core16 Lab		LAB: Recombinant DNA (rDNA) Technology, Food and Industrial Microbiology	6	4	40	60	100	Employability
Allied 13		General chemistry IV	4	4	25	75	100	Skill Development
Allied 14		Lab: Organic qualitative analysis	2	2	40	60	100	Skill Development
Allied 15		Basic concept of Pharmacology	4	4	25	75	100	Skill Development
Allied16		LAB: Pharmacognosy and Pharmacology	2	2	40	60	100	Skill Development
SBE		Project	4	2	40	60	100	Skill Development
		Total	30	25				

SEMESTER III
CORE 5 – IMMUNOLOGY

Contact Hours per semester: 60 **Credits: 3**

Contact Hours per week : 4 **Subject Code: U24MBC31**

Course Outcomes

Cos	CO Statement
CO1	Details the organization of the immune system
CO2	Describe the types of Antigen and Immunoglobulin
CO3	Study the various types of interactions among the immune cells
CO4	Details the types of complement system and hypersensitivity
CO5	Choose the appropriate Immunotechnique for diagnosis

UNIT I **12 Hours**

History of immunology- Haematopoiesis and its regulation- Types of immunity- Innate and adaptive immunity- Types of immune cells- Primary lymphoid organs- Thymus - Bone marrow - Secondary lymphoid organs -Spleen - lymph nodes.

UNIT II **12 Hours**

Antigen and its types (Exogenous and Endogenous) - Antigenicity and Immunogenicity- Factors affecting Immunogenicity- Haptens- Adjuvants- B and T cell epitopes - Structure of antibody and its types.

UNIT III **12 Hours**

Antigen antibody interactions (Agglutination and precipitation reactions) - Major Histocompatibility Complex (MHC) - Class I MHC molecules (Cytosolic pathway), Class II MHC molecules (Endocytic Pathway) - Clinical Significance of Antigen processing and presentation.

UNIT IV **12 Hours**

Complement systems- Components and Pathways (Classical and Alternative) – Hypersensitivity - Types of Hypersensitivity (I, II, III, IV), Immune dysfunction: Autoimmunity and its disorder (Rheumatoid Arthritis) - Immunodeficiency and its disorder (Acquired Immuno deficiency syndrome-AIDS).

UNIT V **12 Hours**

Enzyme linked Immunosorbent Assay (ELISA) - Radio Immuno Assay (RIA) - Western blotting - Monoclonal Antibody Production (Hybridoma technology) - Vaccines and their properties- Types (Live, Attenuated and Heat killed vaccines) – Immunization schedule.

Text Book:

1. Kuby, J. 2003. Immunology. W.H. Freeman Co., New York.

Reference Books:

1. Roitt, J.M. and Brostaff, J.J. 2004. Immunology (7th edition). C.V. Mosby Publisher, St.Louis, USA.
2. Coleman, R.M., Lambard, M. F. and Siccard. 1992, Fundamental of Immunology (2nd Edition). Tata McGraw Hill Publishing Co., Ltd., New Delhi.
3. Poul, W.E. 1990. Fundamental of Immunology (2nd Edition). Ravar Press, New York
4. Eli Benjamini and Sidney Leskowitz 1994. Immunology- A short course (2nd Edition). Wiley-Liss, USA

e-Resources:

1. http://www.youtube.com/embed/ZoRFcv9WYjs
2. http://www.youtube.com/embed/oqru2Ce8WkI
3. https://www.youtube.com/watch?v=vR1CEAGVMpE
4. https://nptel.ac.in/content/storage2/courses/102103038/download/module3.pdf
5. https://nptel.ac.in/content/storage2/courses/102103038/download/module5.pdf
6. https://nptel.ac.in/courses/104/108/104108055/
   https://nptel.ac.in/content/storage2/courses/102103038/download/module6.pdf
7. https://nptel.ac.in/content/storage2/courses/102103038/download/module2.pdf
8. https://nptel.ac.in/content/storage2/courses/102103047/PDF/mod5.pdf

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LAB – IMMUNOLOGY

Contact Hours per semester: 30 **Credits: 2**
Contact Hours per week : 2 **Subject Code: U22MBCP31**

Course Outcomes:

Cos	CO Statement
CO1	Learn the various agglutination reactions
CO2	Identify blood groups and types

CO3	Analyze the components of human blood by performing methods of bleeding/ clotting
CO4	Diagnose diseases with Rapid plasma Reagin test and Rheumatoid Arthritis test.
CO5	Competently perform serological diagnostic tests such as RBC,WBC and DC

Experiments:

1. Agglutination test for
    i. ABO blood grouping and Rh typing.
    ii. Widal slide test
    iii. Rapid plasma Reagin (RPR) test and
    iv. Rheumatoid Arthritis (RA) test.
    v. VDRL test
2. Oucheterlony double diffusion test (ODD).
3. Rocket immunoelectrophoresis.
4. Pregnancy tests.
5. Blood cell count: RBC count WBC count and DC count.
6. Examination of bleeding/clotting time
7. Industrial visit- Vaccination Centers and any Health care Research Institute

References Books:

1. Richard Coico, Geoffrey Sunshine, Eli Benjamini. Immunology – A Short Course. Wiley-Liss, New York. 5 th ed., 2003.
2. Janis Kuby, Immunology, II edition. W. H. Freeman and Company, New York. 1993.
3. Peter J. Delves, Ivan M. Roitt, Encyclopedia of Immunology; Academic Press. 2nd Ed., 1998

SEMESTER III

Part III — **Allied** Subject — **GENERAL CHEMISTRY-I for Biological Science**

Hours per week: 4 Subject Code: **U24CHAY31** Credits: 3

(For those who joined from June 2024 onwards)

Course Outcomes:

CO1: To study fundamental ideas on organic chemistry.
CO2: To know the basic properties of hydrogen, hydrides & oxides
CO3: To search out an idea on colloids.
CO4: To learn some important petroleum processes and fertilizers
CO5: To acquire a knowledge on polymers.

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

PLANT SCIENCE

Contact Hours per semester: 60 **Credits: 4**

Contact Hours per week : 4 **Subject Code: U24MBA31**

Course Outcomes:

Cos	CO Statement
CO1	Understand the importance of herbarium and Botanical Survey of India.
CO2	Get interest in admiring the variations in the vegetative and floral morphology of Angiosperms.
CO3	Understand the floral arrangement to identify the plant species.
CO4	Understand the salient features and the economic importance of Algae, Bryophytes, Pteridophytes and Gymnosperms
CO5	Provide knowledge about the structure and reproduction in Algae, Bryophytes, Pteridophytes and Gymnosperms.

Unit-I **(12 Hours)**

Basics system of classification (Artificial, natural and phylogenetic). Brief study of Linnaeus system, Bentham and Hooker, Engler and Prantle classification - Herbarium techniques, Botanical Survey of India (BSI); Botanical nomenclature – ICBN: Principles and rules.

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: structure and reproduction of *Yeast* – Economic importance of algae and fungi.

Unit-III **(12 Hours)**

General characters of Bryophytes and Pteridophytes. Bryophytes: structure and reproduction of *Riccia.* 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 of monocot (*Allium cepa*) and dicot (*Tribulus terrestris*).

Unit-V **(12 Hours)**

General features of lichens, Economic importance of lichens. Medicinal importance of plants - Tulsi, Turmeric, Ginger, Pepper, Aloe and Garlic.

Text books:

1. Subhash Chandra datta. 1970. A hand book of systematic botany-Asia publishers.
2. Michael G.Simpson (2019) Plant Systematics (third edition),Academic Press
3. Pandey, S.N and Misra, S.P (2008) Taxonomy of Angiosperms. Ane books India, New Delhi.

Reference Books:

1. Fritsch, F.E, - The Structure and Reproduction of the Algae Vol.1 & II Vikas Publication, New Delhi,1956.
2. B.P.Pandey, 2015. A text book of botany-Fungi- S.Chand& company.
3. Kogakusha, 1955 -Cryptogamic botany-Vol-I. Bryophytes &Pteridophytes.
4. V.Venkateswarlu, 1983 – Bryophyta - Educational publishers.
5. Parihar N.S., An Introduction to Bryophytes Vol.1, Central book Depot, Allahabad, 1985.
6. V.Verma, 2009.A text book of economic botany- Emkay publications.
7. AibertF.Hill, 1952. Economic botany - Tata McGraw Hill. Publishing company Ltd.

e- Resources:

1. https://www.brainkart.com/article/Types-of-classification---Taxonomy_32972/
2. https://www.botanylibrary.com/plant-taxonomy-2/herbarium-meaning-and-techniques-plant-taxonomy-botany/13231
3. https://www.vedantu.com/biology/herbarium
4. http://jagiroadcollegelive.co.in/attendence/classnotes/files/1587290512.pdf
5. https://www.studyandscore.com/studymaterial-detail/international-code-of-botanical-nomenclature-icbn-history-principles-and-aim

6. https://www.plantscience4u.com/2014/04/fritsch-classification-of-algae.html
7. https://www.botanylibrary.com/algae/classification-of-algae-botany/14539
8. https://byjus.com/biology/kingdom-fungi/
9. https://qsstudy.com/the-structure-and-habitat-of-sargassum/
10. https://www.biologydiscussion.com/fungi/yeast-habitat-nutrition-and-reproduction-ascomycotina/23986
11. https://www.plantscience4u.com/2014/01/economic-importance-of-algae.html
12. https://www.toppr.com/ask/content/concept/general-characteristics-of-bryophytes-202045/
13. https://byjus.com/biology/gymnosperms/
14. https://byjus.com/biology/lichens/
15. https://byjus.com/neet/important-notes-of-biology-for-neet-plant-taxonomy/
16. https://www.vedantu.com/question-answer/basis-of-classification-of-algae-class-11-biology-cbse-5fc47a8d287b0f7a38255ae1
17. https://byjus.com/biology/kingdom-fungi/
18. https://www.biologydiscussion.com/essay/essay-on-gymnosperms-plants/21816
19. https://nmu.ac.in/Portals/0/Question%20Bank/F.%20Y.%20B.%20Sc.(Botany)%20Question%20Bank.pdf

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SEMESTER IV
MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Contact Hours per semester: 60 **Credits : 3**
Contact Hours per week : 4 **Subject Code: U24MBC41**

Course Outcomes:

Cos	CO Statement
CO1	Describes the Nucleic acids (DNA & RNA) in detail, with respect to both their structure and types.
CO2	Understand the mechanisms of central Dogma (replication, transcription and translation)
CO3	Learn the bacterial transposable elements and its types
CO4	Emphases on gene regulation in prokaryotes and presents the operon concept.
CO5	Provide the molecular features of Genetic recombination.

Unit I (12 hours)

Nucleic acids: Structure of DNA (Watson and Crick's model of DNA) – Different forms of DNA – B DNA, A DNA and Z DNA - Nucleic acids as hereditary material: DNA as genetic material (Griffith and Hershey – Chase experiment). Types of RNA – rRNA, mRNA and tRNA (Clover leaf model). Gene transfer mechanisms – Bacterial transformation, Conjugation, Transduction.

Unit II **(12 hours)**

Central Dogma – DNA Replication – Semi conservative Replication of DNA & Rolling circle, Enzymes involved in DNA Replication. Transcription: organization of transcriptional units, mechanism of transcription in prokaryotes, Post transcriptional modification of mRNA: capping, polyadenylation and splicing.

Unit III **(12 hours)**

Translation – Genetic code, Wobble hypothesis and the mechanism of translation. Transposable elements – Types of Bacterial Transposons – Composite transposons & Tn3 transposons; Transposition.

Unit IV **(12 hours)**

Mutation - Spontaneous mutation, Point mutation, Transition and Transversion. Induced mutation: Chemical mutagens and Physical mutagens. DNA Repair Mechanisms – Photoreactivation, Excision Repair, Recombination Repair.

Unit V **(12 hours)**

Gene expression and gene Regulation in Prokaryotes – lac operon, ara operon, trp operon.

Text Books:

1. David Freifelder, "Molecular Biology", Jones and Bartlett Publisher, 2/2004.

References Books:

1. Verma, P.S., Agarwal, V. K., "Genetics", S Chand and Company limited, 9/2019.
2. Maloy, S.R., Freifelder, D. and Cronan, J.E., "Microbial Genetics", Jones and Barlett Publishers, US, 2001.
3. Darnell, J., Lodish, H., and Baltimore, D., "Molecular Cell Biology", Scientific American Books, New York, 1990.
4. Freifelder, D. and Malacinski, G.M. "Essentials of Molecular Biology", John and Bartlett Publishers, London, 1987.
5. Desmound S.T. Nicholl, "An introduction to Genetic Engineering (Second Edition) by (Studies in Biology Series)", Cambridge University Press, Cambridge, 2002.
6. Brown, T.A., "Gene Cloning", Bios Scientific publishers, Oxford University Press, United Kingdom. 1999.

e- Resources:

1. https://www.biochemistry.org/wp-content/uploads/2019/04/BASC02_full.pdf
2. https://www.vanderbilt.edu/AnS/Chemistry/Rizzo/Chem220b/Ch28.pdf

3. http://gdcganderbal.edu.in/Files/a8029a93-30ad-4933-a19a-59136f648471/Link/Transcription_Prokaryotes_2012-c_c610b1f3-17b2-48e8-b488-30de80f05ee7.pdf
4. http://www.bx.psu.edu/~ross/workmg/Struc_Nucleic_Acids_Chpt2.pdf
5. https://chem.ucr.edu/sites/g/files/rcwecm2681/files/2019-10/Chapter23.pdf
6. https://sites.engineering.ucsb.edu/~shell/che170/DNA-notes.pdf
7. https://www.pearson.com/content/dam/one-dot-com/one-dot-com/us/en/higher-ed/en/products-services/sanders-2e-info/pdf/ch8.pdf
8. https://www.cs.cmu.edu/~wcohen/GuideToBiology-pictures-color-release1.5.pdf
9. https://facultystaff.richmond.edu/~lrunyenj/bio554/lectnotes/chapter13.pdf
10. https://docs.ufpr.br/~microgeral/arquivos/pdf/pdf/Transposons.pdf
11. https://www.shcollege.ac.in/wp-content/uploads/NAAC_Documents_IV_Cycle/Criterion-II/2.3.2/ppt/Dr_Gibykuriakose_Transposibleelements.pdf
12. http://www.mantorlab.unimi.it/mantorlab/sito/Teaching_files/Lezione%2012%20-The%20Operon%20model.pdf

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CORE 9 - LAB: MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Contact Hours per semester: 30 **Credits : 2**
Contact Hours per week : 2 **Subject Code: U22MBCP41**

Course Outcomes:

Cos	CO Statement
CO1	Applying the skills gained through the molecular and microbial genetics through various techniques.
CO2	To understand about the method of gene transfer in bacteria through Transformation technique.
CO3	To gain the technical skills involved in extraction, manipulation of biomolecules and identification of gene and its expressions.
CO4	To conduct the antibiotic resistant by replica & gradient plate methods.
CO5	To understand the isolation of genomic & plasmid DNA from bacteria

Experiments

1. Replica plating technique
2. Isolation of antibiotic resistant *E. coli* by gradient plate method
3. Bacterial survival against UV irradiation
4. Transformation in bacterial cell.
5. Isolation of genomic DNA from bacteria.
6. Isolation of Plasmid DNA from bacteria.

7. RNA isolation from yeast
8. Restriction Digestion of Plasmid DNA – Single and Double digestion
9. DNA Ligation
10. Industrial visit and Submission of Report - Pasteur Institute, Coonoor

References Books:

1. Jeffrey H. Miller, "A short course in bacterial genetics**:** A laboratory manual and handbook for *Escherichia coli* and related bacteria", 1/1999.
2. Gunasekaran, P., "Microbiology: A laboratory manual" New Age international publishers, New Delhi, 1996.
3. Maloy, S.R., Freifelder, D. and Cronan, J.E., "Microbial Genetics", Jones and Barlett Publishers, United States, 2001.
4. Frederick M. Ausubel., "Current protocols in molecular biology", John Willey and Sons Publications, USA, 1987.

SEMESTER IV

Part III — Allied subject II — GENERAL CHEMISTRY —II for Biological science

Hours per week: 4 **Credits: 3** **Subject Code: U24CHAY41**

Course Outcome:

CO1: To study the separation of chemicals by chromatography techniques.
CO2: To know the classification of proteins, structure and function of nucleic acids and Hormones, and the basics of vitamins
CO3: To learn the basics of chemical calculation
CO4: To acquire a knowledge on detection and estimation of elements
CO5: To gain adequate knowledge on 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-Resoursces:

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: U24CHAYP41 Credits: 2

Course Outcome:
CO1: To acquire the basic principles of volumetric titration,
CO2: To understand the basic knowledge on standard solution, molar and the indicator
CO3: To get the knowledge on the titration between acidimetry and alkalimetry
CO4: To develop the basic knowledge on permanganometry
CO5: To know the fundamental knowledge on iodometry.

(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
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)

ALLIED 7 – ANIMAL SCIENCE

Contact Hours per semester: 60 **Credits : 4**
Contact Hours per week : 4 **Subject Code: U24MBA41**

Course Outcomes:

Cos	CO Statement
CO1	Develop basic knowledge about the types of animals.
CO2	Students acquire the knowledge of various organs in the animals.
CO3	Understand the basis of chordates and their evolutionary importance.
CO4	Gain knowledge about the reproductive and respiratory mechanisms and their regulations.
CO5	Create awareness about the various systems in our body.

Unit-I **(12 Hours)**

Classification of Invertebrates - General characteristics - Paramecium, Olynthus, Obelia, Pork tape worm, Earthworm, Giant tiger prawn, Apple snail, and Star fish.

Unit-II **(12 Hours)**

Classification of Chordates - General characteristics - Shark, Frog, Calotes, Pigeon and Rabbit. Digestive, respiratory, excretory and reproductive system of cockroach

Unit-III **(12 Hours)**

Digestive, respiratory and reproductive system of Frog and Pigeon.

Unit-IV **(12 Hours)**

Digestive, respiratory, Excretory, Reproductive system in human.

Unit-V **(12 Hours)**

Circulatory system: composition of blood and organization of Endocrine in human – Menstrual cycle.

Text books:

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. E.Babsky *et. al.*, 1970.Human physiology - MIR Publishers.

References:

1. K.A. Goyal, 2013. - Animal physiology - Rastogi Publications.
2. W.T. Tailor and R.J.Wehe, 2009. General Biology, Eastwest Press Pvt. Ltd.
3. A.J. Grove, 1969 - Animal biology - University tutorial Press Ltd.

e- Resources:

1. https://nmu.ac.in/Portals/0/Question%20Bank/F.%20Y.%20B.%20Sc.(Zoology)%20Question%20Bank.pdf
2. https://byjus.com/questions/explain-the-male-reproductive-system-of-cockroach/
3. https://byjus.com/question-answer/what-does-the-reproductive-system-of-a-frog-do-how-

is-this-similar-to-the-human-reproductive-system/
4. https://byjus.com/biology/human-respiratory-system/
5. https://humanbiology.pressbooks.tru.ca/chapter/chapter-16-answers/
6. https://nmu.ac.in/Portals/0/Question%20Bank/F.%20Y.%20B.%20Sc.(Zoology)%20Question%20Bank.pdf
7. https://byjus.com/questions/explain-the-male-reproductive-system-of-cockroach/
8. https://byjus.com/question-answer/what-does-the-reproductive-system-of-a-frog-do-how-is-this-similar-to-the-human-reproductive-system/
9. https://byjus.com/biology/human-respiratory-system/
10. https://humanbiology.pressbooks.tru.ca/chapter/chapter-16-answers/

ALLIED LAB 11 - Plant & Animal Science

Contact Hours per semester: 30 **Credits : 2**
Contact Hours per week : 2 **Subject Code: U24MBAP41**

Course Outcomes:

Cos	CO Statement
CO1	Gain proficiency in handling basic instruments and laboratory techniques.
CO2	Understand the floral variations among plant species.
CO3	Understand the physiology of fish respiration and human blood cells.
CO4	To know the various adaptations in the animals.
CO5	Acquires the knowledge of evolutionary importance of animals.
CO6	Analyses the quality of the biomolecules.

Plant Science

1. The study of any one Monocot and Dicot plant. (Draw labelled diagrams of the floral parts including longitudinal sections of the flower, construct the floral diagram and give the floral formula). Section cutting of *Pinus* needle.
2. Preparation of Herbarium (10 different plant species).
3. Undergo field study to acquaint with the flora of Hills.

Animal Science

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. Diagrammatic representation
    i. Cockroach - External, digestive, reproductive system.
    ii. Frog - External, digestive, reproductive system.
3. Determination of haemoglobin (Sahli's method).
4. Estimation of urine sugar (Benedict method).
5. Observation of human Blood cells using permanent Slide.
