College of Computer, Science & Information Technology - Junagadh

AFFILIATED TO BHAKTA KAVI NARSINH MEHTA UNIVERSITY

न हि ज्ञानेन सदृशं पवित्रमिह विद्यते

CCSIT

✦ Syllabus (NEP-2020) ✦

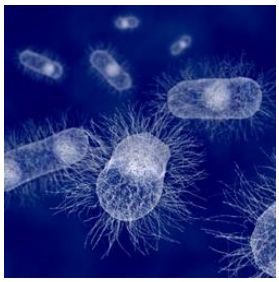
Bachelor of Science (Honours)

[MICROBIOLOGY]

[Semester – I & II]

Academic Year : 2024 – 25

(Effective from June – 2023)



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Credit Structure

Semester - 1									
Sr. No.	Course Group (Major/Minor/MDC /SEC/AEC/VAC)	Paper No.	Course Paper Title	Credit	Ext. Marks (Theory)	Int. Marks (Theory)	Ext. Marks (Pract.)	Int. Marks (Pract.)	Total Marks
1	Major-1	MAJMBT101	Basics of Microbiology (Theory)	03	50	25	--	--	75
2	Major-1	MAJMBP101	Basics of Microbiology (Practical)	01	--	--	--	25	25
3	Major-2	MAJMBT102	Principles of Microbiology (Theory)	03	50	25	--	--	75
4	Major-2	MAJMBP102	Principles of Microbiology (Practical)	01	--	--	--	25	25
5	Minor	MINCHEM111	Introductory Chemistry (Theory)	03	50	25	--	--	75
6	Minor	MINCHEM111(P)	Introductory Chemistry (Practical)	01	--	--	--	25	25
7	MDC/IDC	IDCBTT101	Introduction to Biotechnology (Theory)	03	50	25	--	--	75
8	MDC/IDC	IDCBTP101	Introduction to Biotechnology (Practical)	01	--	--	--	25	25
9	SEC	SECMB101	Laboratory Skills and Safety	02	--	--	25	25	50
10	AEC	AEC101	English Language-1	02	25	25	--	--	50
11	VAC	PHISE101	Indian Knowledge System-1	02	25	25	--	--	50
Total Credits				22	Total Marks				550

Semester - 2									
Sr. No.	Course Group (Major/Minor/MDC /SEC/AEC/VAC)	Paper No.	Course Paper Title	Credit	Ext. Marks (Theory)	Int. Marks (Theory)	Ext. Marks (Pract.)	Int. Marks (Pract.)	Total Marks
1	Major-3	MAJMBT201	Microbial Physiology-1 (Theory)	03	50	25	--	--	75
2	Major-3	MAJMBP201	Microbial Physiology-1 (Practical)	01	--	--	--	25	25
3	Major-4	MAJMBT202	Microbial Physiology-2 (Theory)	03	50	25	--	--	75
4	Major-4	MAJMBP202	Microbial Physiology-2 (Practical)	01	--	--	--	25	25
5	Minor	MINCHEM121	Foundation in Chemistry (Theory)	03	50	25	--	--	75
6	Minor	MINCHEM121(P)	Foundation in Chemistry (Practical)	01	--	--	--	25	25
7	MDC/IDC	IDCBTT201	Fundamental of Biochemistry (Theory)	03	50	25	--	--	75
8	MDC/IDC	IDCBTP201	Fundamental of Biochemistry (Practical)	01	--	--	--	25	25
9	SEC	SECMB201	Microbial Quality Control in Food & Pharmaceutical Industries	02	--	--	25	25	50
10	AEC	AEC201	English Language - 2	02	25	25	--	--	50
11	VAC	PHISE201	Environmental Science	02	25	25	--	--	50
Total Credits				22	Total Marks				550

Syllabus of B.Sc.(Honours) Semester – I

MAJOR – 1 : MAJMBT101 : BASICS OF MICROBIOLOGY (THEORY)

UNIT-1 : SCOPE AND HISTORY OF MICROBIOLOGY **(No. of Lectures - 15)**

- Microbiology as a field of Biology
- The Place of Microorganisms in the living world
- Introduction to Groups of Microorganisms
- Distribution of Microorganisms in Nature
- Applied areas of Microbiology
- Spontaneous generation versus Biogenesis
- Germ Theory of disease
- Eminent scientists of Microbiology:
- Antony von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Martinus W. Beijerinck, Sergei N. Winogradsky, Paul Ehrlich, and Edward Jenner.

UNIT-2 : CLASSIFICATION OF MICROORGANISMS **(No. of Lectures - 15)**

- Physiochemical and biological characteristics of microorganisms (including viruses); Baltimore classification.
- Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility.
- General characteristics of Cellular microorganisms, wall-less forms – MLO (mycoplasma and spheroplasts) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance.

UNIT-3 : CHARACTERISTICS AND IMPORTANCE OF ORGANISMS **(No. of Lectures - 15)**

- General concept of phytoplanktons and zooplanktons.
- General characteristics, structure, mode of reproduction and economic importance of actinomycetes with special reference to its application in medicine and industry.
- General characteristics, occurrence, structure, reproduction and importance of protozoa.

UNIT-4 : MICROBIAL NUTRITION **(No. of Lectures - 15)**

- Nutritional requirements of bacteria
- Nutritional types of bacteria
- Bacteriological media and their types
- Physical conditions required for growth
- Gaseous requirements and oxygen toxicity
- Selective methods
- Cultural characteristics

REFERENCE BOOKS:

1. Prescott L.M., Microbiology 7th Edition, The McGraw−Hill Companies,
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Modi, H.A. Elementary Microbiology - Vol –I & II, Akta Prakashan, Nadiyad.
4. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
6. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
7. Stanier, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5 Edition. MacMillan Press Ltd., London.
8. Frobisher M., Hinsdill, Crabtree and Goodherat Fundamentals of Microbiology, Edition. W.B Saunders Co. USA.
9. Mani, A., Selwaraj, A.M., Narayanan L.M., and Arumngam, N., Microbiology, Saras Publication, Delhi

REFERENCE WEBSITES:

1. https://onlinecourses.swayam2.ac.in/cec23_bt14/preview

MAJOR – 1 : MAJMBP101 : BASICS OF MICROBIOLOGY (PRACTICAL)

Practical	Title of the Unit and the Topics	No. of Lectures
1	Microbiology Good Laboratory Practices and Bio-safety.	30
2	Principles, working, and uses of the following laboratory instruments: (a) Microscope|, (b) Incubator, (c) pH meter, (d) Refrigerator, (e) Colorimeter (f) Colony counter	
3	Principles, working, and uses of the following sterilizers: (a) Autoclave, (b)Hot air oven, (c) Steam sterilizer, (d) Inspissator, (e) Bacteriological filters.	
4	Preparation of glassware for sterilization and disposal of laboratory media and cultures.	
5	Sterilization of heat sensitive material by membrane filtration.	
6	Preparation of Stains and Staining Reagents.	
7	Study of Permanent Slides of Bacteria, Fungi, Algae, and Protozoa.	
8	Study of bacterial motility by hanging drop method.	
9	Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.	

REFERENCE BOOKS:

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. John P. Harley, Lansing M. Prescott-Laboratory Exercises in Microbiology-McGraw-Hill. (2001)
4. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
5. Konika Sharma, Manual of Microbiology – Tools and Techniques, Ane books, Delhi

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MAJOR – 2 : MAJMBT102 : PRINCIPLES OF MICROBIOLOGY (THEORY)

UNIT-1 : PROKARYOTIC CELL: STRUCTURE AND FUNCTION (No. of Lectures - 15)

- Size, Shape and Arrangement of Bacteria
- Bacterial Structures – External to Cell Wall: Capsule, Flagella, Pili, Prostheca, Sheath & Stalk
- The cell wall of Bacteria – Structure and chemical composition of Gram negative and Gram positive Bacterial cell wall
- Bacterial Structures – Internal to Cell Wall: Cell Membrane, Protoplast, Spheroplast, Membranous intrusions and intracellular membrane system, Cytoplasm, Cytoplasmic inclusions and Vacuoles, Nuclear Material
- Bacterial Spores and Cyst – Types of spores, Structure, and formation of Endospores (Sporogenesis).

UNIT-2 : MICROSCOPY AND SPECIMEN PREPARATION (No. of Lectures - 15)

- Bright field Microscopy – Principle, Construction and Working
- Dark field Microscopy – Principle, Construction and Working
- Fluorescent Microscopy – Principle, Construction and Working
- Phase Contrast Microscopy – Principle, Construction and Working
- Electron Microscopy – Types, working and Limitations.
- Introduction to Confocal Microscopy
- Introduction to Stains, Mordents, Decolourizers and Fixatives
- Preparations for Light Microscope Examinations

UNIT-3 : STAINING AND CULTURE TECHNIQUES IN MIROBIOLOGY (No. of Lectures - 15)

- Methods of studying microorganism,
- Staining techniques: simple staining, Gram staining, negative staining, and acid-fast staining.
- Sterilization techniques (physical & chemical sterilization).
- Culture media & conditions for microbial growth.
- Pure culture isolation: Streaking, serial dilution, and plating methods; Cultivation, maintenance and preservation of pure cultures.

UNIT-4 : MICROBIAL GROWTH **(No. of Lectures - 15)**

- Reproduction of Bacteria: Modes of cell division and new cell formation
- Growth of Bacteria: Generation time, Growth rate
- Bacterial Growth Curve
- Synchronous growth and Continuous culture of Bacteria

REFERENCE BOOKS:

1. Prescott L.M., Microbiology 7th Edition, The McGraw−Hill Companies,
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Modi, H.A. Elementary Microbiology - Vol –I & II, Akta Prakashan, Nadiyad.
4. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
6. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
7. Stanier, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5 Edition. MacMillan Press Ltd., London.
8. Frobisher M., Hinsdill, Crabtree and Goodherat Fundamentals of Microbiology, Edition. W.B Saunders Co. USA.
9. Mani, A., Selwaraj, A.M., Narayanan L.M., and Arumngam, N., Microbiology, Saras Publication, Delhi

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MAJOR – 2 : MAJMBP102 : PRINCIPLES OF MICROBIOLOGY (PRACTICAL)

Practical	Title of the Unit and the Topics	No. of Lectures
1	Demonstration and handling of microscope.	30
2	Monochrome Staining : (a) Negative Staining (b) Positive Staining	
3	Differential Staining: Gram's Staining	
4	Special staining of bacteria: (a) Capsule staining – Hiss's method, (b) Cell wall staining – Webb's method (c) Spore staining – Schaeffer's method, (d) Metachromatic granule staining – Albert's method, (e) Spirochete staining – Harrie's method	
5	Isolation of bacteria by streak plate/pour plate and spread plate technique	
6	Study of liquid/solidified culture media	
7	Isolation of pure cultures of bacteria by streaking method.	
8	Preservation of bacterial cultures by various techniques.	
9	Growth curve of Bacteria by colorimetric method and determination of Generation time and the growth rate of *E.coli* by colorimetric method.	

REFERENCE BOOKS:

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. John P. Harley, Lansing M. Prescott-Laboratory Exercises in Microbiology-McGraw-Hill. (2001)
4. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
5. Konika Sharma, Manual of Microbiology – Tools and Techniques, Ane books, Delhi

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MINOR : MINCHEM111 : INTRODUCTORY CHEMISTRY (THEORY)

UNIT-1

Chapter-1 : Atomic structure and Periodic properties **[7 hours]**

- Introduction to evaluation of atomic theory
- Basic concept of Wave particle duality of electron, De-Broglie's equation, Heisenberg's uncertainty principle
- Example based on de-Broglie's equation, Heisenberg's uncertainty principle,
- Difference between Orbit & Orbital, Quantum numbers,
- Aufbau rule, Pauli's Principle, and Hund's rule for electronic configuration, stability of half-filled and completely filled orbitals.
- Study of modern periodic table, electronic configuration in periodic table, Periodicity in atomic properties and its causes, Magic number

Chapter-2 : Chemical bonding **[8 hours]**

- Basics of Ionic bond, Covalent bond, Co-ordinate covalent bond and H-bond
- Valence bond theory and its limitations
- Concept of hybridization: sp (C_2H_2, $BeCl_2$), sp^2 (BF_3, C_2H_4), sp^3 (CH_4), sp^3d (PCl_5) & sp^3d^2 (SF_6)
- Sidgwick Powell rule and VSEPR theory,
- Calculation of total electron pairs, loan pairs, bond pairs in CH4, NH3, H2O
- Basic concept of MO theory
- Bonding and anti-bonding molecular orbital, gerade and ungerade molecular orbital, σ - molecular orbital and σ*- molecular orbital, π- molecular orbital and π*- molecular orbital,
- Energy level diagrams of B_2, C_2, N_2, O_2 with calculation of bond order and magnetic moment,
- Comparison of MO theory and VB theory,

UNIT-2

Chapter-3 : Basic Organic Chemistry **[7 hours]**

- IUPAC Nomenclature of organic compounds (Acyclic, cyclic) (minimum 30 examples should be done)
- Electronic displacements in organic molecules: (1) Inductive effect, (2) Electromeric effect, (3) Mesomeric effect and (4) Hyperconjugation.
- Homolytic and heterolytic fission, curly arrow rules
- Reaction Intermediates: (1) Carbocation, (2) Carbanion, (3) Free radical
- Types of organic reagents: Nucleophiles and Electrophiles
- Types of organic reactions: (1) Substitution, (2) Addition, (3) Elimination (4) Rearrangement.

Chapter-4 : Aliphatic Hydrocarbons-I and alkyl halides **[4 hours]**

- Alkanes: Formation of alkanes by Wurtz reaction, Wurtz-Fittig reaction.
- Free radical substitutions reactions
- Preparation of alkyl halides
- Only Introduction of two types (SN^1 & SN^2) of mechanism and difference between SN^1 & SN^2.

Chapter-5 : Introduction to Stereochemistry **[4 hours]**

- Homomers and Isomers, Concept of isomerism. Constitutional isomers, Chirality and Stereoisomers
- Modern classification of stereoisomers based on superimposability and energy criterion (Configurational enantiomers, Configurational diastereomers, Conformational enantiomers, Conformational diastereomers), Difference between enantiomers and
- diastereomers

UNIT-3

Chapter-6 : Modes of Concentration **[3 hours]**

- Primary and secondary standards for preparation of solutions and their Characteristics
- Preparation of Standard Solutions
- Equivalent weight of acid and base, Equivalent weight of acid salt, Equivalent weight of an ion.
- Molarity, Normality, Molality, %w/v, %v/v & ppm.

Chapter-7 : Adsorption **[3 hours]**

- Introduction
- Mechanism of Adsorption
- Types of Adsorptions (physical and chemical)
- Characteristics and factors affecting on adsorption
- Adsorption isotherm and Freundlich equation with limitations.
- Applications of adsorption.

Chapter-8 : Catalysis **[3 hours]**

- Introduction
- Types of catalysis (homogeneous and heterogeneous)
- Characteristics of catalysis,
- Definitions with examples: Auto-catalysis, Negative catalysis (Inhibitor), Promoters and
- Catalytic poisoning

Chapter-9 : The Colloidal State **[6 hours]**

- Introduction
- Classification of Colloids based on (1) Physical state of dispersed phase & Dispersion medium (2) Nature of interaction between dispersed phase & Dispersion medium.
- Preparation of colloidal solutions; (1) Chemical methods, (2) Peptization
- Purification of colloidal solutions; (1) Dialysis, (2) Electro-dialysis, (3) Ultrafiltration
- General properties of colloidal systems
  - Tyndall effect
  - Brownian movement
- Protection of colloids
- Importance and applications of colloids

MINOR : MINCHEM111(P) : INTRODUCTORY CHEMISTRY (PRACTICAL)

1. Organic qualitative analysis **[20 Marks]**

Identification of simple Aromatic Hydrocarbons or Compounds containing a functional group using preliminary characteristics and some Physical and Chemical tests.
[Minimum 8 compounds covering all the chemical nature must be given]

Examples:

Carboxylic acids	:	Aliphatic acids like oxalic and succinic acid,
Aromatic acids	:	Benzoic acid, cinnamic acid and pthalic acid
Phenols	:	Phenol, α-naphthol, β-naphthol
Bases	:	Aniline

Neutral : Acetone, Ethyl methyl ketone, Ethyl acetate, naphthalene, anthracene, nitrobenzene, urea, thiourea, chloroform, acetanilide, benzanilide, carbon tetra chloride, chloroform, chlorobenzene, bromobenzene.

2. Volumetric Analysis-Acid Base Titration **[15 Marks]**

1) To prepare a solution by dissolving 'x' g $NaHCO_3$ / Na_2CO_3 in 100 ml solution and determine its concentration in terms of normality and molarity using 0.1 N HCl solution.
2) To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N Na_2CO_3 solution.
3) To determine the normality, molarity and g/lit of each component in a given mixture of $NaHCO_3$ and Na_2CO_3 using 0.1N HCl solution.

Continuous Internal Assessment **[15 Marks]**

MDC/IDC : IDCBTT101 : INTRODUCTION TO BIOTECHNOLOGY (THEORY)

UNIT-1 : Introduction and scope of Biotechnology **No. of Hrs: 10**

1.1 Historical perspective and Definitions of Biotechnology
1.2 Current Status of Biotechnology and Future of Biotechnology in Developing World.
1.3 Recombinant DNA Technology
1.4 Applications of Biotechnology- Agriculture, Medicine & Environment

UNIT-2 : Basic concept and understanding of cell **No. of Hrs: 10**

2.1 Concept of Life, Origin and Evolution of Cell and Cell Theory
2.2 Cell Structure (organization of plant and animal cell, chemical composition of cell, comparison of plant, animal and prokaryotic cell)
2.3 Diversity of Cell Size and Shape
2.4 Ultrastructure and Function of Prokaryotic cell and Virus

UNIT-3 : Structure and function of cell organelles **No. of Hrs: 13**

3.1 Cell Wall and Plasma Membrane
3.2 Mitochondria and Chloroplast
3.3 Endoplasmic Reticulum and Golgi Bodies
3.4 Lysosomes, Glyoxisomes and Peroxisomes
3.5 Ribosomes

UNIT-4 : Nucleus, cell cycle and cell division **No. of Hrs: 12**

4.1 Nucleus
4.2 Structure and Ultrastructure of chromosomes
4.3 Overview of cell cycle
4.4 Mitosis and Meiosis
4.5 Regulation of cell cycle

REFERENCE BOOKS:

1. Alberts. Molecular Biology of cell. Garland Pub.
2. Verma, Cell biology, Genetics, Molecular Biology, Evolution & Ecology. 2006
3. Lodish, Cell & Molecular Biology, W. H. Freeman. 5th Edn.
4. C. B. Powar, Cell Biology, Himalaya Press.
5. Nelson & Cox, Lehninger Principle Biochemistry, Freeman Pub.
6. Geoffrey Cooper, The Cell Molecular Approach, ASM Pub.
7. De Robertis, Cell Biology
8. Biotechnology, B. D. Singh
9. Biotechnology & Genomics, P. K. Gupta, Rastogi Pub.
10. Biotechnology, U. Satyanarayan
11. Cell & Molecular Biology, P. K. Gupta, Rastogi Pub.
12. Albert, Essential Cell Biology, Garl and Science.
13. Glick, Molecular Biotechnology, ASM Publication.
14. Becker & Hardin, The world of the Cell, Pearson Pub.
15. Desiker, Cell & Development Biology, Dominant Pub.
16. Explore Life, Postlethwait J. H., & Hopson J. H., Thomson book Pub.
17. Essential Biology (3rd Edition), Campbell, Reece & Simon,
18. Biotechnology Fundamental & application, S. S. Purohit, Agrobios
19. Introduction to Biotechnology, Brown Campbell priest, Panima Pub. Cell Biology, Sadava, Panima Pub.

MDC/IDC : IDCBTP101 : INTRODUCTION TO BIOTECHNOLOGY (PRACTICAL)

List of Experiments **No. of Hrs. - 30**

Exp. 1 Introduction to LAB and lab environment
Exp. 2 Preparation of solution
Exp. 3 Monochrome staining
Exp. 4 Negative Staining
Exp. 5 Calibration of stage and ocular micrometer and measurement of given biological samples
Exp. 6 Cytology and histology of various organs (Permanent slides or fresh preparation)
Exp. 7 Preparation of slides showing different stages of cell division – Mitosis and meiosis
Exp. 8 Human Karyotyping
Exp. 9 Isolation of chloroplast and microscopic observation
Exp.10 Observation of bacterial motility by performing hanging drop method.

REFERENCE BOOKS:

1. Practical manuals of Biotechnology, S. Chand
2. Basic Biotechnology, Prave Fanst, Sitting & Sukatsch, Panima Pub.
3. Becker. 1996. Biotechnology: A laboratory course.
4. Karp, Cell & Molecular Biology: concepts & Experiments. 4th Edition.
5. Analyzing Chromosome, B. Czepulkowski, BIOS Scientific Publishers Ltd

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SEC : SECMB101 : MUSHROOM CULTIVATION

COURSE CONTENTS		
Units	**Unit Description**	**No. of Lectures**
Unit-1	**Introduction of Mushroom** Introduction: Morphology, Classification and identification of edible & non-edible/poisonous mushroom. Nutritional and Medicinal value of mushroom, Scope of mushroom cultivation.	

Unit-2	**Structure and Life cycle of Mushroom** Structure & Life cycle: Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajor caju) and paddy straw mushroom (Volvariellavolvcea). Breeding and genetic improvement of mushroom strains.	
Unit-3	**Cultivation Conditions** Principles & Requisites: Sterilization and disinfections of substrates, Pasteurization of different substrates, Isolation, growth media, Spawns production and their maintenance.	
Unit-4	**Techniques of Cultivation** Techniques of Cultivation: Structure and construction of mushroom House, layout of Traditional and Greenhouse method. Multiplication of spawn, Composting, bed and polythene bag preparation, spawning - casing – cropping. Pest management: chemical control Harvest and Post-harvest technology; freezing, dry freezing, drying, canning and entrepreneurship.	

PRACTICAL COURSE:

1. Introduction to Mushrooms
2. Collection & Identification of Mushrooms
3. Cultivation techniques of button Mushrooms
4. Cultivation Technology Oyster Mushrooms
5. Cultivation Technology of Paddy Straw Mushroom
6. Cultivation Technology of Milky Mushroom
7. Post-Harvest Technology- Preservation of Mushrooms

REFERENCE BOOKS:

1. Handbook on Mushrooms by Bahl N.
2. Benjamin Hirst Mushrooms: A Beginners Guide to Home Cultivation Paperback (20150)
3. V. N. Pathak .Mushroom Production and Processing Technology IST Edition Hardcover – 2011.
4. Eiri Staff Hand Book of Mushroom Cultivation, Processing and Packaging Paperback – Import, 2007

ONLINE RESOURCES:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=596

AEC : AEC101 : ENGLISH LANGUAGE-1

Table of Contents

Prescribed Text: *Confluence* by K.N.Shoba published by Cambridge University Press, New Delhi

Unit No.	Syllabus Contents
1	**Prose** • Ethics: Humanities Vs Sciences by S.Radhakrishnan (Chpt..1.1) • Learning: Wings of Fire (Extract) by A.P.J.Abdul Kalam (Chpt. 1.2) **Short Stories** • Attitude: Witches' Loaves by O.Henry (Chpt.3.1) • Fantasy: The Country of the Blind by H.G.Wells (Chpt. 3.2)
2	**Grammar:** • Tenses (Chpt.1.1) • Coordinating Conjunctions: for, and, nor, but, or, yet, and so. (Chpt. 1.2) **Writing:** • Developing a creative paragraph. (Chpt. 3.2)

Suggested Reading:

1. Business Communication by Urmila Rai and S.M. Rai. Himalaya Publishing House
2. Effective Technical Communication by M Ashraf Rizvi. Tata Mc Graw hill
3. Spoken English: A Foundation Course by Kamlesh Sadanand and Susheela Punitha (Part I and Part II)
4. Intermediate English Grammar: Reference and Practice for South Asian Students by Raymond Murphy. Cambridge University Press
5. Malgudi Days by R.K. Narayan. Indian Thought Publications
6. The Best of Ruskin Bond published by Penguin Books
7. The Collect Short Stories of Khushwant Singh published by Ravi Dayal Publisher
8. W. Somerset Maugham The Complete Short Stories Vol-I published by Heinemann : London

VAC : PHISE101 : INDIAN KNOWLEDGE SYSTEM-1

Objectives:

1) Students will enable to understand the strong foundation of Indian culture, philosophy, and spirituality.
2) Students' consciousness regarding nationalism will be stronger.
3) Students will understand the role of the Indian Knowledge system in national consciousness and national development.
4) Students will be able to understand the contemporary importance and need of an Indian rich Knowledge System.

Units	Content	Teaching Hours.

Unit-1	**Introduction to IKS**
	• **Introduction to IKS & Its importance**
	  • Introduction & importance of IKS
	  • Various IKS Systems
	• **Shashtra – Foundational Literature of Bharatvarsha**
	  • What is Shashtra?
	  • Importance of Shashtra
	  • Classification of Shashtra – Vaidic & Avaidic (With examples of imp. Literature)
	• **Base of IKS proliferation**
	  • Bharatiya Education System and its philosophy
	  • History of BSE From Ancient to modern
	  • Domains of Educations : Gurukul, Pathshala, Vidhyalay, Vishvavidhyalay
		15

Unit-2	**Contribution of IKS to the world**
	• **Mathematics & Astronomy**
	  • Number System
	  • Algebra & Arithmetic
	  • Geometry
	  • Trigonometry
	  • Planetary System
	  • Speed of Light
	  • Eclipse
	• **Life Sciences**
	  • Physics
	  • Chemistry
	  • Botany
	• **Metal Technology**
	  • Mining Techniques
	  • Types of Metals
	  • Equipments and techniques of Metal Smelting
		15

Syllabus of B.Sc.(Honors) Semester – II

MAJOR – 1 : MAJMBT201 : MICROBIAL PHYSIOLOGY (THEORY)

Unit-1 : Introduction to Biomolecules **No. of Lectures – 12**

- Classification, Structures and Biological function of Carbohydrates
- Classification, Structures and Biological function of Lipids
- Classification, Structures and Biological function of Proteins
- Classification, Structures and Biological function of Nucleic acids

Unit-2 : Enzymes **No. of Lectures – 12**

- Characteristics of Enzymes, Chemical & Physical Properties of Enzymes
- Classification and Nomenclature of Enzymes
- Enzyme activity: Nature & Mechanism of enzyme activity, Inhibition of enzymes
- Mechanism and Regulation of Enzymes Activity and Synthesis
- Differences between Prokaryotic & Eukaryotic Enzyme Regulation

Unit-3 : Microbial Control-I **No. of Lectures – 12**

- Fundamentals of Microbial Control: Principle and Types, Definition of Sterilization, Disinfectant, Antiseptic, Sanitizer, Germicide, Bactericide and Bacteriostasis
- Characteristics, Evaluation and Selection of Ideal antimicrobial Agent Bacteriological media and their types

Unit-4 : Microbial Control-II **No. of Lectures - 10**

- Physical Agents of Microbial Control:
- High Temperature, Low temperature, Desiccation, Osmotic Pressure, Radiation, Ultraviolet lights, X-rays, Gamma rays, Cathode rays, surface tension and interfacial tension, filtration.
- Chemical Agents of Microbial Control:
- Phenol and phenolic compound, Alcohol, Halogen, Heavy metals and their compounds, Dyes, Detergents, Quaternary ammonium compounds, Aldehydes, Gaseous sterilization.
- Phenol Coefficient Method for the evaluation of chemical antimicrobial agents.

Reference Books:

1. Atlas. R.M., Microbiology, 2nd Edition. Wm. C. Brown Publishers
2. Satyanarayana. U., Biochemistry, Books and allied Pvt. Ltd.
3. Prescott L.M., Microbiology 7th Edition, The McGraw−Hill Companies,
4. Mathew, Van Holde & Ahern, Biochemistry,3 rd Edition. Pearson Education (Singapore) Pte. Ltd. India

a. Branch, New Delhi

5. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co.

b. Ltd. New Delhi.

6. Powar and Daginawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
7. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
8. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi

MAJOR – 1 : MAJMBP201 : MICROBIAL PHYSIOLOGY (PRACTICAL)

Practical	Title of the Unit and the Topics	No. of Lectures
1	Qualitative analysis of Amino acids and Proteins	30
2	Qualitative analysis of Carbohydrates.	
3	Colorimetric estimation of Protein by Folin and Lowry's method.	
4	Titrimetric estimation of reducing Sugars by Cole's method.	
5	Colorimetric estimation of reducing sugar by DNSA method.	
6	Assay of Alpha – Amylase by iodometric method.	
7	Effect of Chemicals on growth of bacteria.	
8	Effect of Antibiotics on growth of bacteria: Agar ditch method and Agar cup Method	
9	Effect of physical Agents on growth of bacteria.	
10	Enumeration of bacterial number by viable count technique.	

Reference Books:
1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. John P. Harley, Lansing M. Prescott-Laboratory Exercises in Microbiology-McGraw-Hill. (2001)
4. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
5. Konika Sharma, Manual of Microbiology – Tools and Techniques, Ane books, Delhi
6. David T. Plummer. An Introduction to Practical Biochemistry.

MAJOR – 2 : MAJMBT202 : MICROBIAL PHYSIOLOGY-II (THEORY)

Unit-1 : Chemistry for the Microbiologist **No. of Lectures – 12**

- Chemicals, Elements and structure of Atoms
- Molecules and Chemical bonds
- Chemical reactions
- Water and pH
- The essence of biochemistry for microbiologist

Unit-2 : Microbial Response **No. of Lectures – 12**

- Microbial growth in response to nutrition and energy Autotroph/Phototroph, heterotrophy,
- Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph,
- Photolithoautotroph, Photoorganoheterotroph

Unit-3 : Transport Systems **No. of Lectures – 12**

- Passive and facilitated diffusion.
- Primary active transport, concept of uniport, sodium potassium pump and proton pump.
- Secondary active transport, symport and antiport Group translocation Iron uptake.

Unit-4 : Antibiotics and their Mode of Action **No. of Lectures – 10**

- Chemotherapeutic agents and Chemotherapy
- Characteristics of ideal chemotherapeutic agent
- Antibiotics and their mode of action:
- Inhibition of cell wall synthesis, Damage to cytoplasmic membrane, Inhibition of nucleic acid and protein synthesis, Inhibition of specific enzyme system.
- Antifungal, antiviral and antitumor chemotherapeutic agents
- Microbiological assay of antibiotics
- Nonmedical uses of antibiotics

MAJOR – 2 : MAJMBP202 : PRINCIPLES OF MICROBIOLOGY (PRACTICAL)

Practical	Title of the Unit and the Topics	No. of Lectures
1	Effect of pH on growth of bacteria.	30
2	Effect of salt on growth of bacteria.	
3	Effect of Antibiotics on growth of bacteria: Agar ditch method and Agar cup Method	
4	Effect of carbon and nitrogen sources on growth of bacteria	
5	Enumeration of bacterial number by viable count technique.	

Reference Books:
1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. John P. Harley, Lansing M. Prescott-Laboratory Exercises in Microbiology-McGraw-Hill. (2001)
4. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
5. Konika Sharma, Manual of Microbiology – Tools and Techniques, Ane books, Delhi
6. David T. Plummer. An Introduction to Practical Biochemistry.

MINOR : MINCHEM121 : FOUNDATION IN CHEMISTRY (THEORY)

Unit – 1 :

Chapter-1 Chemistry of s-block elements [07 Hours]

- General introduction
- Electronic configuration, Atomic and ionic radii, Ionization potential
- Physical properties
- Special characteristics such as metallic character, Flame coloration.
- Inert pair effect, relative stability of different oxidation state.
- Diagonal relationship of (1) lithium with magnesium (2) beryllium with aluminum.
- Preparation, Physical properties and uses of Na2CO3, NaHCO3, NaOH.

Chapter-2 Chemistry of p block elements [04 hours]

- Introduction of Oxides
- Properties of oxides, Classification of oxides based on their chemical behavior and based on their oxygen content.
- Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses; Borax, Boric acid, Borohydrides (diborane) and Aluminum halide.

Chapter-3 Basic Principles of Qualitative Analysis [04 Hours]

- Introduction
- Preparation of Original Solution (OS)
- Concept of classification of cations (IP and Ksp) and role of Group reagents
- Explanation with chemical equations for the following
  A. Dry test for positive radicals
     1) Charcoal test, (2) Cobalt nitrate test & (3) Flame test.
  B. Dry test for negative radicals (including use of various reagent papers)

UNIT – 2 :

Chapter-4 Aliphatic Hydrocarbons-II [07 Hours]

- Hydrocarbons containing Carbon-Carbon π bonds
- Formation of alkene by Elimination reactions, dehydration of alcohol, dehydrohalogenation of alkyl halide, dehalogenation of vicinal and germinal dihalides,
- Introduction to mechanism of elimination reactions: E1, E2.
- Types of eliminations products (Saytzeff and Hofmann)
- Types of addition products *(Markownikov/ Anti Markownikov).*
- Reactions of alkynes: Acidity, electrophilic addition reactions like halogenation, hydrohalogenation and hydration. Nucleophilic addition reaction with hydrogen cyanide and alcohol.

Chapter-5 Alicyclic compounds [04 Hours]

- Introduction and classification of ring systems (Based on number of rings, size, number of carbon atom common between the two rings).
- IUPAC nomenclature of cycloalkanes (including simple spiro compounds, fused ring and bridged ring systems-bicyclic only)
- Method of preparation of small ring cycloalkanes: Intra-molecular Wurtz' reaction, Diels-Alder reaction.
- Chemical Properties of Cycloalkanes: Substitution Reactions, Addition Reactions,
- Baeyer's Strain Theory and its limitations (puckering).

Chapter-6 Aromatic Hydrocarbons [04 Hours]

- Aromaticity: Criteria for aromatic, non-aromatic and antiaromatic compounds, applications of Huckel's rule to simple annulene, cyclic carbocation/anion.
- Electrophilic aromatic substitution reactions of benzene with general mechanisms.
- Theory of effect of substituents on reactivity and orientation (with resonating structures for activating and deactivating groups).

UNIT – 3 : Chapter-7 Ionic Equilibrium [07 Hours]

- Types of electrolytes, degree of dissociation and factors affecting degree of dissociation,
- Ionic product of water, dissociation constants of weak acids and bases,
- Common ion effect and calculation of concentrations of OH^- ions ($NH_4Cl + NH_4OH$) and H^+ ions (H_2S+HCl),
- Solubility and solubility products of sparingly soluble salts,
- Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis)
- Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases,

Chapter-8 Solid State **[08 Hours]**

- Introduction,
- Crystalline and Amorphous solid,
- Forms of Crystalline Solids (Molecular, Ionic, Metallic and Network solid)
- Crystal Lattice & it's Characteristics
- Primitive & Centered Cubic unit cells (SCP, BCC FCC, ECC)
- Calculation of No of atoms per unit cell
- Crystal systems & Bravais lattices,
- Close pack Structures (1D, 2D & 3D)
- Octahedral & Tetrahedral Voids & it's position
- Schottky and Frenkel defects.
- Laws of crystallography: (1) Law of Symmetry, (2) Law of constancy of interfacial angles.
- Density of unit cell,
- Numerical based on Formula of compounds and Density.

MINOR : MINCHEM121(P) : FOUNDATION IN CHEMISTRY (PRACTICAL)

2 Hours per Week **[25 Marks]**

Performance **[15 Marks]**

1. **Qualitative analysis of inorganic salts**
   (Minimum 12 salts-containing two radicals)
   Inorganic salts containing anion (chloride, bromide iodide, nitrate, nitrite, sulphate, sulphite, sulphide, carbonate, phosphate (soluble & insoluble), oxide, chromate, and dichromate).

2. **Inorganic volumetric analysis**
   (Standard solution should be given)
   1) Quantitative estimation of Cu^{2+} in a given $CuCl_2.2H_2O$ solution using 0.01M EDTA solution.
   2) Quantitative estimation of Ni^{2+} in a given $NiSO_4.7H_2O$ solution using 0.01M EDTA solution.
   3) Quantitative estimation of Zn^{2+} in a given $ZnCl_2$ solution using 0.01M EDTA solution.
   4) Determination of total Ca^{+2}/Mg^{+2} of water by EDTA.
   5) Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution.
   6) Determination of alkali in antacid using 0.1M HCl solution.
   7) Quantitative estimation of Fe^{2+} by dichromate method (Internal indicator method).

Viva **[10 Marks]**

MDC/IDC : IDCBTT201 : FUNDAMENTAL OF BIOCHEMISTRY (THEORY)

UNIT-1 :- Chemistry of Life **No. of Hrs: 10**

1.1 Chemicals, Elements and structure of Atoms
1.2 Molecules and Chemical Bonds:
1.3 Chemical reactions
1.4 The Properties of Water
1.5 pH and Buffer

UNIT-2 :- Enzymes - I **No. of Hrs: 12**

2.1 Introduction and Characteristics of Enzymes, Biocatalyst and Chemical Catalyst, Coenzymes, Cofactors, Isoenzyme and Allosteric Enzyme
2.2 Chemical and Physical Properties of Enzymes.
2.3 Classification and Nomenclature of Enzymes.
2.4 Catalytic Mechanism (Proximity and Orientation effects, Acid base Catalysis, Covalent, Catalysis and Metal ion catalysis and Transition state analog)

UNIT-3 :- Enzymes - II **No. of Hrs: 13**

3.1 Enzyme Kinetics (derivation of Michaelis–Menten constant, linear transformation of the equation)
3.2 Enzyme Inhibition: Mechanism and Types (Irreversible and Reversible)
3.3 Mechanism of Enzyme Regulation: Covalent and Allosteric Regulation
3.4 Differences between Prokaryotic & Eukaryotic Enzyme Regulation

UNIT-4 :- Molecular Transportation and Signaling **No. of Hrs: 10**

4.1 Composition and architecture of membrane
4.2 Passive and facilitated diffusion.
4.3 Primary active transport, concept of uniport, sodium potassium pump and proton pump.
4.4 Secondary active transport, symport and antiport Group translocation Iron uptake.

Reference Books :-

1. Plumner. An introduction to practical Biochemistry, 3rd Edition
2. J. Jayraman. Lab Manual in Biochemistry.
3. Cohn and Stumph. Outline of Biochemistry. Wiley eastern.
4. Seidman and Moore. 2000. Basic laboratory methods for biotechnology. Lovgman
5. Switzer and Garrity. Experimental Biochemistry WH Freeman. 2nd Edition

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MDC/IDC : IDCBTP201 : FUNDAMENTAL OF BIOCHEMISTRY (PRACTICAL)

List of Practical **No. of Hrs. – 30**

Sr. No.	Practical
1	Measurement of pH
2	Making of Buffer
3	Assay of enzyme - Amylases by KI-I2 method
4	Assay of enzyme – phosphatase
5	Assay of enzyme – invertase by GOD POD method.
6	Effect of Substrate concentration (Determination of Km and Vmax)
7	Effect of pH and temperature on enzyme activity
8	Effect of Enzyme inhibitors on enzyme activity

Reference Books :-

1. Plumner. An introduction to practical Biochemistry, 3rd Edition
2. J. Jayraman. Lab Manual in Biochemistry.
3. Cohn and Stumph. Outline of Biochemistry. Wiley eastern.
4. Seidman and Moore. 2000. Basic laboratory methods for biotechnology. Lovgman
5. Switzer and Garrity. Experimental Biochemistry WH Freeman. 2nd Edition

SEC : SECMBT201 : MICROBIAL QUALITY CONTROL IN FOOD & PHARMACEUTICAL INDUSTRIES

Unit-1 : Microbiology Laboratory and Practice **No. of Lectures - 8**

- Microbiological Laboratory and Safe Practices:
- Good laboratory practices-Good laboratory practices, Good microbiological practices.
- Biosafety cabinets: Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3. Discarding biohazardous waste.

Unit-2 : Standard Microbial Methods-1 **No. of Lectures – 8**

- Determining Microbes in Food / Pharmaceutical Samples:
- Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts.
- Biochemical methods: Limulus lysate test for endotoxin, sterility testing for pharmaceutical products.
- Enrichment culture technique, Detection of specific microorganisms - on
- Salmonella Shigella Agar, Mannitol salt agar, EMB agar, McConkey Agar.

Unit-3 : Standard Microbial Methods-2 **No. of Lectures – 7**

- Ascertaining microbial quality of milk by MBRT, Rapid detection
- methods of microbiological quality of milk at milk collection centers
- (COB, 10 min Resazurin assay).

Unit-4 : Food Safety and Microbial Standards **No. Of Lectures – 7**

- Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations.
- Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.

Reference Books

1. Quality Control in the Food Industry V1, S Herschdoerfer, ISBN: 9780323152068,: Academic Press, 1967
2. Prescott L.M., Microbiology 7th Edition, The McGraw−Hill Companies
3. Principles of Sensory Evaluation of Food- 1965 MA Amerine, RM , Pangborn and EB Roessler, Elsevier.
4. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
5. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.

AEC : AEC201 : ENGLISH LANGUAGE – 2

Table of Contents

Prescribed Text: Confluence by K.N.Shoba published by Cambridge University Press, New Delhi.

Unit No.	Syllabus Contents
1	**(A) Short Stories:** • Humour: The Boy Who Broke the Bank by Ruskin Bond (Chpt.3.3) • Social Justice: The Squirrel by Ambai (Chpt.3.4) **(B) Non Fiction;** • Artificial Intelligence: AI and Literature: The Muse in the Machine by John Thornhill (Chpt.4.1) • Social Media: Facebook is Making Us Miserable by Daniel Gulati (Chpt.4.2)
2	**(A)Grammar:** • Direct and Indirect Speech (Chpt.3.3) **(B)Writing:** • Filling Forms (Chpt. 3.4) • Informal Letters (Chpt. 3.4)

Suggested Reading:

1. Intermediate English Grammar: Reference and Practice for South Asian Students by Raymond Murphy. Cambridge University Press
2. Business Communication by Urmila Rai and S.M. Rai. Himalaya Publishing House
3. Effective Technical Communication by M Ashraf Rizvi. Tata Mc Graw hill
4. Spoken English: A Foundation Course by Kamlesh Sadanand and Susheela Punitha (Part I and Part II)

Paper Style:

Ques. No.	Particulars	Marks
Q.1	**(A) Answer the following Questions (2/4)** (From Unit-1(A)) **(B) Short Questions/MCQs (One liner) (5/6)** (From Unit-1(B))	**05** **05**
Q.2	**(A) Fill the form appropriately.** (From Unit-2(B)) **(B) Write a Letter. (1/2)** (From Unit-2(B))	**05** **05**
Q.3	**(A) Do as Directed. (3/5)** (From Unit-2(A)) **(B) MCQs. (2/3)** (From Unit-1(A & B))	**03** **02**
Total Marks		**25**

VAC : ENVIRONMENTAL SCIENCE

Units	Content	Teaching Hours.
Unit-1	પર્યાવરણના વૈશ્વિક પ્રશ્નો • તેજાબી વર્ષા (એસિડ રેઇન) – અસર, સમીકરણો • ગ્રીન હાઉસ ઇફેક્ટ, અસરો, ગ્રીન હાઉસ વાયુઓ, પ્રકારો • ઓઝોનના સ્તરમાં ક્ષતિ, અસરો	**50%**
Unit-2	કુદરતી આફતો અને તેના પ્રકાર ભૂકંપ/ધરતીકંપ • વ્યાખ્યા, ધરતીકંપ, એપીસેન્ટર, હાઇપો સેન્ટર, આફ્ટરશોક • ધરતીકંપના પ્રકારો – ટેકટોનિક / નોન ટેકટોનિક • સિસ્મોગ્રાફ • ધરતીકંપ દરમ્યાન બચાવ/રાહતના સૂચનો • ધરતીકંપ આવે ત્યારે શું કરવું અને શું ના કરવું.	**50%**

Suggested Reading:

1. પર્યાવરણ શાસ્ત્ર – બીપીનભાઈ જોશી
2. પર્યાવરણ અને ભૂકંપ ઈજનેરી – ડો. એમ. બી. ગોહિલ, અનિલ કે. પોપટ
3. પર્યાવરણ સાથે – રમેશ સાવલિયા
4. પર્યાવરણ – ડો. એમ. બી. ગોહિલ
5. પર્યાવરણ શિક્ષણ – પ્રો. પંકજભાઈ પરમાર
6. Ecology and Environment – P. D. Sharma, Rastogi.

Evaluation Scheme and Distribution of Marks

Paper Style (For the Subject with Credit 2)

Ques. No.	Particulars	From which Unit	Marks
1	Questions (Any Two Out of Four)	1	10
2	Questions (Any Two Out of Four)	1	10
3	Questions (Any Two Out of Four)	From each Unit	05
Total Marks			**25**

Paper Style (For the Subject with Credit 4)
(Major/Minor/MDC Paper Evaluation Scheme and Distribution of marks)

EXTERNAL ASSESSMENT BY UNIVERSITY		
Que. No.	**Particulars**	**Marks**
Q-1	Questions from Unit-1(Any Two out of Four)	10
Q-2	Questions from Unit-2(Any Two out of Four)	10
Q-3	Questions from Unit-3(Any Two out of Four)	10
Q-4	Questions from Unit-4(Any Two out of Four)	10
Q-5	Questions from Unit-5(Any Two out of Four)	10
Total Marks		**50**

College of Computer, Science & Information Technology - Junagadh

AFFILIATED TO BHAKTA KAVI NARSINH MEHTA UNIVERSITY

Courses Offered

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- D.M.L.T. – Diploma in Medical Laboratory Technology
- M.Sc.(IT) – Master of Science in Information Technology
- M.Sc.(Micro.) – Master of Science in Microbiology
- M.Sc.(Chem.) – Master of Science in Chemistry

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