



NIMS UNIVERSITY

SYLLABUS

OF

BACHELOR OF SCIENCE (MICROBIOLOGY) – BSCMB

VERSION 1.1

DIRECTORATE OF DISTANCE EDUCATION

Shobha Nagar, Jaipur-Delhi Highway (NH-11C), Jaipur- 303121
Rajasthan, India

BACHELOR OF SCIENCE (MICROBIOLOGY) – BSCMB

Eligibility	:	10+2 with PCB
Programme Duration	:	3 Years
Programme Objectives	:	<p>Our Bachelor of Science programme is a versatile degree that provides students with the optimal balance between a defined sequence of study and flexible course option. Our unique programme will give you an understanding of the basis of immune recognition and vaccine design – infectious diseases and methods of control – microbial biotechnology, and – parasitology. You will also develop an understanding of the importance of microbiology in environmental, agricultural and industrial setting. Microbiology is a discipline of enormous importance and research in this discipline has been revolutionized by new and exciting technologies such as proteomics, genomics, bioinformatics and genetic engineering.</p>
Job Prospects	:	<p>Our B.Sc. in Microbiology degree is one of the most versatile degrees you can obtain because of the fundamental nature of the discipline, and also because it can be combined with so many other sciences, leading to powerful and sought-after skills. After the completion of our programme, you will find a challenging career in medical, public health and environmental microbiology. Exciting career possibilities exist as research work is strongly gaining importance in laboratories in universities, biotechnology companies and agricultural, medical and veterinary institutes.</p> <p>Common job profiles of students after completing B.Sc. in Biochemistry include: Research Microbiologists, Industrial Microbiologists, Clinical Microbiologists, Environment Microbiologists.</p>

YEAR I

Course Code	Course Title	Theory/ Practical	Continues Assessment (Internals)	Credits
CHM14101	Introduction to Chemistry	70	30	3
GNT14101	Elements of Genetics	70	30	3
MBL14101	Introductory Microbiology	70	30	3
CMB14101	Introductory Cell Biology & Molecular Biology	70	30	3
MTH14101	Mathematics	70	30	4
IMM14101	Basic of Immunology	70	30	4
BTB14101	Biotransformation and Biocatalyst	70	30	4
ENG14101	English	70	30	4
CHM14101P	Introduction to Chemistry	35	15	1
MBL14101P	Introductory Microbiology	35	15	1
GNT14101P	Elements of Genetics	35	15	1
CMB14101	Introductory Cell Biology & Molecular Biology	35	15	1
			Total	32

YEAR II

Course Code	Course Title	Theory/ Practical	Continues Assessment (Internals)	Credits
FMT14201	Fermentation Technology	70	30	4
IMP14201	Introduction to Microbial Physiology	70	30	3
IMG14201	Introduction to Microbial Genetics	70	30	3
FDM14201	Basics of Food and Dairy Microbiology	70	30	2
BOI14201	Fundamentals of Bioinformatics	70	30	3
RTB14201	Introduction & Recent Techniques in Biotechnology	70	30	3
EAM14201	Environmental and Agriculture Microbiology	70	30	2
MMP14201	Introduction to Medical Parasitological and Mycology	70	30	3
BVM14201	Basics of Medical Bacteriology and Virology	70	30	2
IMP14201P	Introduction to Microbial Physiology	35	15	1

IMG14201P	Introduction to Microbial Genetics	35	15	1
FDM14201P	Basics of Food and Dairy Microbiology	35	15	1
BOI14201P	Fundamentals of Bioinformatics	35	15	1
RTB14201P	Introduction and Recent Techniques in Biotechnology	35	15	1
EAM14201P	Environmental and Agricultural Microbiology	35	15	1
BVM14201P	Basics of Medical Bacteriology and Virology	35	15	1
			Total	32

YEAR III

Course Code	Course Title	Theory/ Practical	Continues Assessment (Internals)	Credits
CLB14301	Clinical Microbiology	70	30	3
BTM14301	Basic Techniques in Microbiology	70	30	3
BUB14301	Bioresource Utilization and Bioremediation	70	30	3
VIR14301	Introduction to Virology	70	30	3
BOX14301	Biostatistics	70	30	4
MPR14301	Introduction to Mycology and Protista	70	30	3
PTM14301	Pharmaceutical Microbiology	70	30	3
EIE14301	Elements of Industrial Entrepreneurship	70	30	4
CLB14301P	Clinical Microbiology	35	15	1
BTM14301P	Basic Techniques in Microbiology	35	15	1
BUB14301P	Bioresource Utilization and Bioremediation	35	15	1
VIR14301P	Introduction to Virology	35	15	1
MPR14301P	Introduction to Mycology and Protista	35	15	1
PTM14301P	Pharmaceutical Microbiology	35	15	1
			Total	32

DETAILED SYLLABUS

INSTRUCTIONAL METHOD: Personal contact programmes, Lectures (virtual and in-person), Assignments, Labs and Discussions, Learning projects, Industrial Training Programmes and Dissertation.

YEAR I

INTRODUCTION TO CHEMISTRY – CHM14101

UNIT	CONTENTS
1	Chemical bond: Type of bonding, general characteristics, hybridization involves s, p, d and f orbital, dipole moment Hydrogen bond: theories of hydrogen bonding, valance bond theory, weak inter and intra molecule force of attraction, Molecular orbital theory, VESPER theory.
2	Alkanes: nomenclature, mechanism of the free radical, halogenations, activation energy. Alkenes: chemical reactivity, stability of carbonium ions, Markownikoff's rule Free radical mechanism, Stability of free radicals, ions. Dienes: methods for preparation of conjugated dienes, Electrophilic reaction mechanism & nucleophilic reaction mechanism.
3	Stereochemistry of organic compounds: different types of stereoisomerism, geometrical isomerism, optical isomerism, optical activity, R & S configuration, asymmetry synthesis. Carbohydrate: classification, reaction, constitution of glucose and fructose, mutarotation, anomers, epimerization, conversion of glucose into fructose and vice versa.
4	Thermodynamics: laws of thermodynamics, thermodynamic systems, molar heat capacity, relation Δ between H and E. Joule Thompson effect, Carnot cycle, entropy, Gibb's Helmholtz equation, Gibb's free energy.
5	Chemical equilibrium: law of mass action, Chatelier principle distribution law, hydrolyses, oswald dilution law, pH value, Henderson Hasselbalch equation, Electrode: Standard electrode potential, chemical cells.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- University General Chemistry by C.N. R. Roo.
- Principles of Physical Chemistry, 4th Edition by S.N. Marrow and C.F. proton.
- Essential of Physical Chemistry by B.S. Bahel and G.D. Tuli.
- Concise Inorganic Chemistry by J.D Lee 5th Edition

ELEMENTS OF GENETICS – GNT14101

UNIT	CONTENTS
1	Mendelism brief history of genetics and mendel's work, mendelian laws, their significance and current status. Chromosomal theory of inheritance Genetics interaction: supplementary gene, complementary gene. Duplicate genes, epistasis, inhibitory and polymorphic genes.
2	DNA as genetic material, DNA and RNA structure and type Nucleic acid, Sugar phosphodiester, Nucleosome structure, euchromatin, heterochromatin, satellite DNA, telomeres, centromere, polytene chromosome and lampbrush chromosome, Genetic code, triplet codon, characteristics of triplet cordon.

3	Chromosomal mutation: classification of chromosomal mutations translocation, inversion, deletion and duplication, variation in chromosome numbers, haploidy, diploidy, aneuploidy, euploidy and polysomy. Linkage and crossing over. Heredity defects: klinefilter syndrome, down's syndrome, Application of polyploidy.
4	Mitosis : phases and process of mitosis, structure and function of spindle apparatus, anaphasic movement Meosis, phase and process of Meiosis, synapses and synaptonemal complex, formation and fate of chiasmata and significance of crossing over. Interphase nucleus and cell cycle: S, G1, G 2 and M phase.
5	Microbial genetics: Recombination in bacteria, Molecular mechanism of recombination. Transformation, Transduction (generalized and specialized), Conjugation, Cytoplasmic inheritance.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Genetics: Ahluwalia, K. B. Wiley Eastern Ltd. New Delhi.
- B. Genetics: Altenbery, Oxford and IBH, New Delhi.
- C. Genetics: Gupta P. K.
- D. Principle of Genetics: Gardner E.J. Wiley Eastern Ltd. New Delhi.

INTRODUCTORY MICROBIOLOGY –MBL14101

UNIT	CONTENTS
1	Evolution of earth and life. Definition, history and scope of microbiology. Defferent groups of microbes and their taxonomical classification.
2	Bacterial cell: morphological types. Archeabacteria, eubaeterial and eucaryotes. Bacterial cell wall, its synthesis and functions. Appendages of bacterial cell and their role. Inclusions of bacterial cells. Endospore, and Reserved food materials. Viruses and their structure. Fungi and their types.
3	Cultivation of microbes. Growth and growth curve of bacteria. Nutrition of microorganism different nutritional types of bacteria. Selective cultural methods and enrichment culture. Factors affecting microbial growth. Sterilization methods.
4	Busics of microbial metabolism. Different pathways of glucose break down. TCA cycle and electron transport chains. Fermentation, anaerobic respiration and bacterial photosynthesis. Biosynthesis of building blocks. Uptake solutes/nutrients into cell.
5	Microbial genetics mutations, DNA repair. Transfer of genetic characters and recombination. Transfor- mation, conjugation and transduction. Plasmids. Restriction and DNA modification, regulation of metabolism.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Brock TD, Madigan MT,(1993) Biology of microorganisms. Prentice Hall Int. Inc.
- B. Ananthanarayanan R. and C. K. Jayaram Paniker (1997) Text of Microbiology, Orient Longman.
- C. Prescott Harley Klein:(1996) Microbiology III ed. ECB Pub.
- D. Tauro,P. Kapoor,K.K.and Yadav,K.S. (1996) Introduction to Microbiology. New Age International Pub. New Delhi.

INTRODUCTORY CELL BIOLOGY & MOLECULAR BIOLOGY –
CMB14101

UNIT	CONTENTS
1	Cell as a basic unit of living organism- Development of cell theory. Eukaryotic and prokaryotic cells, cell division and cell cycle, anomalies in cell division, ultra structure of the cytoplasm, cytoskeleton microtubules, microtubular organelles, microfilaments The (endo membrane system), nuclear envelope, endoplasmic reticulum and golgi complex. Membrane organelles, mitochondria, chloroplast, lysozyme, peroxisomes. Molecular organization of cell membrane, passive and active transport, $\text{Na}^+\text{-K}^+$ pump, Ca^{2+} –ATPase pumps, lysosomal and vacular membrane. ATP dependent protein pumps, co-transport into prokaryotic cells, endocytosis and exocytosis, entry of viruses and toxins in to cells
2	Cell-cell interaction, receptors and models of extra-cellular signaling: cytosolic, nuclear and membrane bound receptors, autocrine, paracrine and endocrine model of action. Muscles and nerve cells, cell senescence and death, cell differentiation. Signal transduction: signal amplification and different models, cyclic AMP, role of inositol phosphatase messenger. Biosynthesis of inositol phosphatase messenger, cyclic GMP and glycoproteins in signal transduction. Calcium model of signal amplification, phosphorylation of protein kinases.
3	. Cell culture: Techniques of culturing of prokaryotic and eukaryotic cells, cell lines and cell line generation. Maintenance of cell culture, characterization of cell, immunochemistry, morphological analysis techniques in cell culture, primary cultures, contamination, differentiation and three dimensional culture.
4	DNA and inheritance. Genetic and biochemical experiments to prove nucleic acid as a genetic material. Prokaryotes and Eukaryotes. Organization of genes. Coding and non-coding sequences. Unique, moderately repetitive and highly repetitive DNA sequence. Stellite DNA DNA replication in prokaryotes. Semi conservative mode of replication. Replication eye, forks, okazaki fragments and RNA primers. Different enzymes involved in DNA replication.
5	Replication in E-coli. Initiaiton, elongation and termination of replication. Fidelity of replication. Circular DNA. DNA polymerases. Inhibition of DNA replication , DNA repair of damages caused by different agents. Mutation and its types such as spontaneous, induced and point mutations. Chromosomes aberrations. Vectors and DNA recombinant technology. Restriction and endonucleases. Plasmid, cosmid cloning vectors. Molecular cloning and application of recombinant DNA technology.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Prescott Harley Klein:(1996) III ed. ECB Pub.
- B. Tauro,P. Kapoor,K.K.and Yadav,K.S. (1996. New Age International Pub. New Delhi.

MATHEMATICS – MTH14101

UNIT	CONTENTS
1	Set number system (in brief), complex numbers, addition, subtraction, multiplication, division, De-mover's theorem, finding roots of a polynomial equation.
2	Function – definition domain and range of a function, types of function, graphs of standard function $-X, X^2, X^3, /X/, \text{loy a X EX}$.

3	Limit, differentiation (in brief), maxima and minima (upto 2 variables) rules of partial differentiation. Higher order partial differentiation.
4	Integration (in brief) differential equations – definition, order and degree of differential equation, homogenous and non-homogenous differential equations, exact differential equation (including integrating factor) linear differential equation. Application to growth and decay law of cooling.
5	Matrices – definition, types of matrices, addition, multiplication of matrices, inverse of a matrix, systems of linear equations, row echelon form, rank of a matrix, homogeneous and non-homogenous system $AX=B$, consistency, Gaussian elimination method.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Mallick, S.C, and Arora, mathematical Analyses.
- B. Jung olive maths- self study guide Cambridge lower prices edition.
- C. E.D. Rainville and P.E. Bedient (1989), Elementary differential equation. McMillan, New York.

BASIC OF IMMUNOLOGY – IMM14101

UNIT	CONTENTS
1	Humoral and cellular component of the immune system: innate immunity, skin and mucosal surface, physiological barrier, phagocytic barrier, inflammation, adaptive immunity, immune dysfunction and its consequences, allergy and asthma. Cell and organs of immune system spleen, thymus, lymph node, lymphoid cell stem cell, B-lymphocytes and T-lymphocyte natural killer cells, mononuclear phagocytes, granulocytes cells.
2	Antigen antibody interaction antigen, structure, properties, type, epitops, Heptane. Antibody structure and functions. Immunoglobulin structure, types and function.
3	Antigen-Antibody interaction, precipitation reaction agglutination, RIA, ELISA. Western blotting, major histocompatibility complex, general structure and function of MHC. Antigen processing and presentation immune fluorescence.
4	Immune effectors mechanism, cytokinin (properties, receptors, antagonists, secretion) the complement system (function, components, deficiencies) cell mediated effectors. Response cytotoxic T cells, natural killer cell, antibody dependent cell mediated cytotoxicity, inflammation, hypersensitive reaction.
5	Immunology in health of disease, immune response to infectious disease, viral, bacterial, protozoan vaccine. AIDS and other immune deficiencies, cancer, organ specific, autoimmune disease, systemic autoimmune disease.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Essential immunology Roitts, Black Well Sc. Pub. Oxford
- B. Kuby. J. Immunology W.H. Freeman and Co. N.Y.
- C. Clinical Immunology Prakash Sen Gupta. Oxford 2003

BIOTRANSFORMATION AND BIOCATALYST– BTB14101

UNIT	CONTENTS
1	Basic organic reaction mechanism. Common prejudices against enzymes. Advantages and disadvantages of biocatalyst.
2	Isolated enzyme versus whole cell systems. Mechanistic aspects and enzymes sources. Biocatalyst application.
3	Hydrolytic reaction, regioselective hydrolysis. Reduction reaction. Bakers yeast- reduction oxidation reaction , enatio selection, oxidation.
4	Hydroxylation of steroids at inactivated carbon centers. Enzyme of organic solvents reaction engineering for enzyme.
5	Catalyzed biotransformation. Catalytic antibodies. Biocatalyst from extreme thermophilic bacteria.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. A text Book of Enzymology by palmer
- B. A References Book of Biochemistry by Harper.

ENGLISH – ENG14101

UNIT	CONTENTS
1	Phonetics and Vocabulary, Transcription of Phonetics Symbols, Words stress, Synonyms and Antonyms, Word Formation- Prefix, Suffix Grammar and usage : Transformation of sentences: Direct and Indirect Narration, Active and Passive Voice, Interchange of Degrees of Comparison, Modals.
2	Comprehension, Sequences of Tenses, Elements of a Clause, Compositional Skills CVs and Job Applications , Paragraph Writing.
3	Letters- Formal and Informal Technical letter writing: Purpose of writing, space/layout, economy of words, use of verb/ passive voice, type face (.italics, bold, underline) and use of indentation.
4	Report writing: Preparation, report structure (purpose of report, scope, shape, presentation of report, introduction of report, style of report and index of report). Public communication: meetings, planning and discussion, planning procedure, timing, degree of formality, behavior, repetitive, interviews (complexity of situation, preparation of thinking, preparation of setting, opening of the interview, style of interview).

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Sasikumar, V., Dutta And Rajeevan, A Course in Listening and Speaking-I Foundation Books. 2005.
- B. Sawhney, Panja and Verma eds. English at the Workplace, Macmillan 2003.
- C. Singh , R.P. Professional Communication. OUP. 2004
- D. Judith Leigh. CVs and Job Applications OUP. 2004.

INTRODUCTION TO CHEMISTRY – CHM14101P

UNIT	CONTENTS
1	Identification of reducing and non reducing sugar
2	Identification of given organic compounds.
3	Identification of acids and bases with the help of pH meter.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Principles of Physical Chemistry, 4th Edition by S.N. Marrow and C.F. proton.
- B. Essential of Physical Chemistry by B.S. Bahel and G.D. Tuli.
- C. Concise Inorganic Chemistry by J.D Lee 5th Edition

ELEMENTS OF GENETICS– GNT14101P

UNIT	CONTENTS
1	Isolation of DNA from plant cell.
2	Study of chromosomes.
3	Study of different stages of mitosis.
4	Isolation of RNA from plant cell.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Genetics: Altenbery, Oxford and IBH, New Delhi.
- B. Genetics: Gupta P. K.
- C. Principle of Genetics: Gardner E.J. Wiley Eastern Ltd. New Delhi.

INTRODUCTORY MICROBIOLOGY –MBL14101P

UNIT	CONTENTS
1	Isolation of bacteria from different available sources.
2	Gram staining, negative staining.
3	Endospore staining.
4	Identification of fungi and their structure under microscope.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Ananthanarayanan R. and C. K. Jayaram Paniker (1997) Text of Microbiology, Orient Longman.
- B. Prescott Harley Klein:(1996) Microbiology III ed. ECB Pub.
- C. Tauro,P. Kapoor,K.K.and Yadav,K.S. (1996) Introduction to Microbiology. New Age International Pub. New Delhi.

INTRODUCTORY CELL BIOLOGY & MOLECULAR BIOLOGY– CMB14101P

UNIT	CONTENTS
1	Study of cells under microscope.
2	Isolation of DNA from animal sources.
3	Media preparation for cell culture.
4	Cell culture techniques.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Prescott Harley Klein:(1996) III ed. ECB Pub.
- B. Tauro,P. Kapoor,K.K.and Yadav,K.S. (1996. New Age International Pub. New Delhi.

YEAR II

FERMENTATION TECHNOLOGY – FMT14201

UNIT	CONTENTS
1	Introduction to fermentation technology. Fermenters, components and types. Media for industrial fermentation, air and media sterilization, Isolation, preservation and maintenance of industrial microorganisms.
2	Type of fermentation processes: analysis of batch, fed batch and continuous bioreactors. Measurement and control of bioprocess parameter.
3	Downstream processing: introduction, removal of microbial cells and solid matter. Foam separation, precipitation, filtration, centrifugation, cell disruption, liquid extraction, chromatography, drying and crystallization.
4	Industrial production of chemicals utilizing wastes. Alcohols (ethanol), acids (citric, acetic and gluconic), antibiotics (penicillin, streptomycin, tetracycline). Single cell protein.
5	Introduction to food technology, principles of food processing. Elementary idea of canning and packing sterilization, pasteurization of food product. Food preservation.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Principles of Fermentation Techniques. Stanbury,P.F., Whittaker,A. and Hall, S.J. Elsevier, Pub.
- B. A Text Book of Biotechnology R. C. Dubey. S. Chand Pub. New Delhi.

INTRODUCTION TO MICROBIAL PHYSIOLOGY – IMP14201

UNIT	CONTENTS
1	Definition and scope of microbial physiology, macro molecular synthesis and processing: DNA, RNA and protein synthesis in brief.
2	Central pathways of carbohydrate metabolism: EM pathway, ED pathway, phosphoketolase pathway pentose phosphate pathway, TCA cycle, Glyoxylate cycle. Energy production: substrate level phosphorylation, oxidative phosphorylation, photo phosphorylation. Anaerobic respiration and energetics of chemolithotrophy. Fermentation: alcoholic fermentation.
3	Metabolite transport: facilitated diffusion (Passive Diffusion) Active transport system and group trans location, bacterial growth and growth kinetics. Continuous and synchronized growth.
4	Phototrophy. Chemotrophy. Mixotrophy. Protein degradation. Lipid and fat metabolism. Polysaccharide metabolism.
5	Biosynthetic pathways: biosynthesis of low molecular weight building blocks, glycogenesis. Nitrogen fixation. Bacterial photosynthesis. Regulation of metabolism.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Gottschalk, K, G. (1986) Bacterial Metabolism 2nd edition Springer Verlag. New York.
- B. Nicholls, D.G. and Ferguson, S. J. Bioenergetics , San Diego, Accad, Press.
- C. Lehninger, (2005) Principles of Biochemistry 4th Edition, W.H. Freeman, New York.

INTRODUCTION TO MICROBIAL GENETICS – IMG14201

UNIT	CONTENTS
1	Definition, scope and history. Genetic elements in prokaryotic and eukaryotic cells. Inheritance of characters in prokaryotic and eukaryotic cells. Bacterial and fungal genomics.
2	Molecular concept of microbial genetics and central dogma. Gene expression at molecular level. Genotype and phenotypic gene expression. Genetic code, transcription and translation. Regulation of gene expression. Lac operon, fine structure analysis model, Mutations and their types and expression, mutagens and their effects transposons. DNA repair and reversion.
3	Extra chromosomal elements: episomes and plasmids in microbes. Types of plasmids and characters controlled by plasmids, Mechanism of plasmid replication.
4	Bacterial transformations, mechanism of DNA uptake and transformation transduction, conjugation, sex factor and Hfr mechanism of chromosomal transfer. Genetic mapping. Genetic recombination.
5	Genetics of bacteria phages: T4 Lamda. Lytic and Lysogenic phages. DNA replication and phage production. PCR techniques in gene amplification. Restriction and DNA modification. Construction of a recombinant DNA molecule. Hybrid DNA clones.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Bain bridge, B.W. 1980
- B. Genetics of Microbes Glasgow: Blacked and sons.
- C. Birge, E.A. 1981 Bacterial and Bacteria phage Genetic: An introduction. Heidelberg Springer.
- D. Freifelder, D. 1987 Microbial Genetics. Boston Jones & Bartlett publ.

BASICS OF FOOD AND DAIRY MICROBIOLOGY –FDM14201

UNIT	CONTENTS
1	Food and its constituents quality factors of in food. Deterioration of food, food microorganism molds, yeasts and bacteria and their importance. Food spoilage and microbes in relation to food spoilage. Extrinsic and intrinsic factor influencing microbial group in foods.
2	Food sanitation in manufacturing and retail trade. Food preservation: heat preservation and processing. Cold preservation and processing. Food dehydration and concentration. Irradiation, microwave processing. Canning of food.
3	Fermented food: bread, cheese, vinegar, Fermented vegetables fermented food and their quality. Microbial foods: Single Cell Protein and other foods like mushroom. Fermented beverages, genetically modified microbial foods.
4	Composition and constituents of milk and milk derivatives their microorganism . Sources of contamination of milk and its spoilage. Fermented milk and of other dairy products (cheese, yogurt, curd, whey, icream, butter and ghee.)
5	Food in relation to diseases: food poisoning, Food born diseases. Food safety microbiological considerations.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Diliello, L.R. 1982 methods in food and dairy microbiology AVI Westport, CT.
- B. Varnam, A.H. 1994. Milk and milk products: technology, chemistry and microbiology Chapman & Hall, land on, New York.
- C. Wood Brain, J.B. 1985 microbiology of fermented foods. Chapman & hall, London, NV.
- D. Anon 1998 Food Biotechnology: present and future.

FUNDAMENTALS OF BIOINFORMATICS –BOI14201

UNIT	CONTENTS
1	Introduction to database flat file data base, relational database, object oriented databases.
2	Sequence analysis and phylogeny: internet sequence on the net sequence of DNA, RNA and protein. Determination of protein structure, gene and protein expression data, protein interaction data. File formats, sequence databases, genome and organism specific database. Retrieval, SRS. Similarity reaches, amino acid substitution matrices. FASTA, BLASTA various types of BLAST.
3	Multiple sequence alignment, protein families, protein domain families, building free evolution of macro muscular sequences- genome annotation.
4	C-language: introduction, operators, expressions, variables, input, output statements, control statement, function, arrays, pointers, structures, unions, file handling and case studies. Introduction to PERL, variables, strings and numbers, lists analysis, hashes conditional tops, pattern matching and application.
5	Introduction to structural database – models of protein structure – structure, function and relationship structural alignment – classification of 3D structure. CATH and Scop-concepts in protein prediction. Micro array data and analysis: tools and rescores, proteomics data qualifies, bioinformatics in drug discovery.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Bioinformatics, 1998. Baxeranis
- B. Bioinformatics 2000, higgins & taylor.
- C. Nucleic acids research. 2001. Jan. genome. Database issue.
- D. Introduction to bioinformatics – attired

INTRODUCTION & RECENT TECHNIQUES IN BIOTECHNOLOGY

RTB14201

UNIT	CONTENTS
1	Biotechnology: definition, history and scope. Emergence of modern biotechnology. Global input and current excitement of biotechnology (on environment, health care, agriculture.) Cell and plant tissue culture technique and its application. Principle and application of genetic recombinant technology. Strain improvement Gene therapy methods.
2	Fermentation technology. Fermentors, production of Ethanol, enzyme production from microbes. Enzymes immobilization techniques. Biotechnological product: single cell protein (alga, yeast, mushroom). Biofertilizer (BGA, VAM) biopesticides (Bacillus thuringiensis) pharmaceuticals (antigen, interferon, vaccines, insulin).
3	Genetic and physical mapping techniques: genetic markers. RFLP, micro and mini satellite, STS, RAPD, AFLP, SNPS. Chromosome walking and jumping. DNA sequencing techniques – maxam – Gilbert method, sanger's dideoxy chain termination method (enzymatic DNA sequencing, automated DNA sequencing method) human genome project.
4	Polymerase chain reaction (PCR) techniques and its application. Genomic library, cDNA library. DNA microarray. Transfer of recombinant DNA into bacterial cells. Southern hybridization, Northern hybridization, western hybridization. DNA finger printing and its application Gene silencing: si RNA technology, micro RNA and application of gene silencing. Antisense RNA technology and its application.
5	Introduction to nano particles. Application of nanotechnology. Stem cell and their potential. Cloning of Dolly hybridoma technology and its application.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Biotechnology, satyanarayan
- B. Plant biotechnology – J hammond P. Mc garvey and V. Yasibov

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY – **EAM14201**

UNIT	CONTENTS
1	Definition of environment and its components. Aerobiology. Assessment of air quality. Air borne microbes and their transmission. Diseases caused by air borne microbes.
2	Water as an environment – fresh water habitat marine habitat. Zonation of water ecosystem upwelling, eutrophication. Aquatic environment (temperature, hydrostatic pressure, light salinity turbidity, pH), Aquatic microorganism. Phytoplankton, zooplanktons, benthic microbes. Biogeochemical transformation.
3	Sewage and sludge: definitions, chemical characteristics and its microbiology. Waste water treatments and their efficiency. Municipal solid waste, their characteristics and treatment (composting land filling and biogas production) hazardous waste and heavy metal pollution and bioremediation. Metagenomics and its role in bioremediation.
4	Definition of soil, its components and characteristics. Soil microflora. Rhizospheric and phyllospheric microorganisms. Microbial interactions soil. Soil borne plant, animal and human pathogens. Rumen microorganisms and their role.

5	Biogeochemical cycles of nitrogen, phosphorus, sulfur and carbon and plant nutrient release. Microbial oxidation reduction of plant nutrient elements in soil nitrogen fixation, its types and microbes biofertilizers and biopesticides.
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LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Droop, M.R. and Jannasch, H.W. 1977 Advances in Aquatic Microbiology. Accad. press, N Y.
- B. Mitchell, R. 1978 Water Pollution Microbiology Wiley, New York.
- C. Paul, E A 2002 Soil Microbiology and Biochemistry . Accad. press, N Y.
- D. Atlas, R.M and Bertha, R. 1987 Microbial Ecology Fundamentals and Application (2nd Ed) Reading, M.A. Addison Wesley.

INTRODUCTION TO MEDICAL PARASITOLOGICAL AND MYCOLOGY – MMP14201

UNIT	CONTENTS
1	Introduction to the subject, definitions and scope. Disease causing fungi, their morphology and classification. Dermatophytes and agents of superficial mycoses trichophyton, edidermophyton and microsporum. Yeasts of medical importance, <i>Candida</i> , <i>Cryptococcus</i> . Mycotoxins. Antifungal agents, testing methods and quality control.
2	Dimorphic fungi of systemic mycoses. Histoplasma, Coccidioids: Sporothrix, Blastomyces and opportunistic fungi. Fungi causing mycetozoa. Recent method in diagnostic mycology. Immunity to fungal infection.
3	Medical parasitology and its importance. Protozoal diseases and causal agents. Leishmania, Trypanosoma, Giardia, Trichomonas, Balantidium, Amoebiasis, Entamoeba, Cryptosporidiosis, Cryptosporidium, Cyclospora.
4	Platyhelminthes – Taenia, Fasciola, Paragonimus, Schistosoma. Nematohelminthes – Ascaris, Ankylostoma, Enterobius, Trichinella, Trichurus. Wuchereria, Ranunculus. Examination of faeces and blood for parasites. Cultivation of protozoan parasites.
5	Strategies in diagnosis of fungal and parasitic diseases. Collection of specimen and its processing. Nucleic acid based diagnostic techniques. Some selective tests of fungal and protozoal human pathogens.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Reading 1
- B. Reading 2.....

BASICS OF MEDICAL BACTERIOLOGY AND VIROLOGY –
BVM14201

UNIT	CONTENTS
1	Historical aspects of medical bacteriology. Classification of important bacteria. Collection and transport of specimens, Isolation of bacteria from clinical specimens. Selective media for isolation of different medically important bacteria. Antibiotic sensitivity test and its principles.
2	Bacterial diseases, their causal organisms and clinical features: Diphtheria. Tuberculosis Pneumonia, plague, Gas Gangrene, Leprosy, Botulism Gastroenteritis, Salmonellosis, Shigellosis, Anthrax etc.
3	Aerobic pathogenic actinomycetes. Anaerobic gram positive, non spore forming bacilli and cocci. Anaerobic gram negative pathogenic bacilli and cocci. Mycoplasma Rickettsia, spirochetes, Treponema, Leptospira and Berrettia.
4	Introduction to viruses. Viruses as human disease causing agents, their characteristics and classification. Viruses of chicken pox, influenza, measles, mumps viral pneumonia, rubella, small pox, equine encephalitis, AIDS, common cold. Herpes, polio virus, hepatitis and prion diseases.
5	Antimicrobial therapy. Methods of drug susceptibility testing. Antibiotic assay in body fluids, vaccines and schedules, passive prophylactic measures, nutritional and environmental health measures. Health education.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Mackie and McCartney 1996 Medical Microbiology, Churchill Livingstone
- B. Shannon, D.C. and Wright, P.S.G. 1982 Microbiology in Clinical Practices
- C. Baron, E.J., Peterson, L. R. and Tenover, S.M. 1990 Bailey and Scotts

INTRODUCTION TO MICROBIAL PHYSIOLOGY – IMP14201P

UNIT	CONTENTS
1	Production of alcohol by yeast.
2	Bacterial growth kinetics.
3	Isolation of N ₂ fixing bacteria
4	Study of chromatography techniques.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Gottschalk, K. G. (1986) Bacterial Metabolism 2nd edition Springer Verlag, New York.
- B. Nicholls, D.G. and Ferguson, S. J. Bioenergetics, San Diego, Academic Press.
- C. Lehninger, (2005) Principles of Biochemistry 4th Edition, W.H. Freeman, New York.

INTRODUCTION TO MICROBIAL GENETICS – IMG14201P

UNIT	CONTENTS
1	Isolation of Plasmid DNA.
2	Amplification of DNA.
3	Study of PCR.
4	Assay of viruses.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Genetics of Microbes Glasgow: Blacked and sons.
- B. Birge, E.A. 1981 Bacterial and Bacteria phage Genetic: An introduction. Heidelberg Springer.
- C. Freifelder, D. 1987 Microbial Genetics. Boston Jones & Bartlett publ.

BASICS OF FOOD AND DAIRY MICROBIOLOGY – FDM14201P

UNIT	CONTENTS
1	Isolation of microbes from different available food sources.
2	Study of food microbes.
3	MBR test of milk
4	Food preservation techniques.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Varnam, A.H. 1994. Milk and milk products: technology, chemistry and microbiology Chapman & Hall, land on, New York.
- B. Wood Brain, J.B. 1985 microbiology of fermented foods. Chapman & hall, London, NV.
- C. Anon 1998 Food Biotechnology: present and future.

FUNDAMENTALS OF BIOINFORMATICS – BOI14201P

UNIT	CONTENTS
1	Computer Application - Characteristic of Computers. Input, output, storage units CPU, Computer System.
2	Determination of protein structure with the help of protein database.
3	Study of BLASTA, FASTA.
4	Sequence alignment of Protein & DNA.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Bioinformatics 2000, higgins & taylor.
- B. Nucleic acids research. 2001. Jan. genome. Database issue.
- C. Introduction to bioinformatics – attired

INTRODUCTION & RECENT TECHNIQUES IN BIOTECHNOLOGY
RTB14201P

UNIT	CONTENTS
1	Demonstration of PCR.
2	Electrophoresis and blotting techniques.
3	DNA sequencing techniques.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Biotechnology, satyanarayan
- B. Plant biotechnology – J hammond P. Mc garvey and V. Yasibov

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY –
EAM14201P

UNIT	CONTENTS
1	Isolation of microbes from air, sewage water.
2	Determination of BOD & COD.
3	Determine the quality of given water sample.
4	Isolation of rhizospheric bacteria.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Mitchell, R. 1978 Water Pollution Microbiology Wiley, New York.
- B. Paul, E A 2002 Soil Microbiology and Biochemistry . Accad. press, N Y.
- C. Atlas, R.M and bertha, R. 1987 Microbial Ecology Fundamentals and Application (2nd Ed)
Reading, M.A. Addison Wesley.

BASICS OF MEDICAL BACTERIOLOGY AND VIROLOGY –
BVM14201P

UNIT	CONTENTS
1	Isolation of medically important bacteria.
2	Antibiotic sensitivity test.
3	Staining of aerobic and anaerobic bacteria.
4	Acid fast staining of mycobacteria.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Mackie and McCartney 1996 Medical Microbiology, Churchill living stone
- B. Shannon, D.C. and Wright, P.S.G. 1982 Microbiology in Clinical Practices
- C. Baron, E.J., Peterson, L. R. and Tenover, S.M. 1990 Bailey and Scotts

YEAR III

CLINICAL MICROBIOLOGY – CLB14301

UNIT	CONTENTS
1	General rules and regulations of microbiological laboratory safety and quality. General concepts for specimen collection and handling. Specimen processing. Host-Microbe interaction, entry, invasion and dissemination and outcome.
2	Diagnosis of infection: Serological methods Agglutination assay, Immunoelectrophoresis, immuno diffusion assay, complement fixation assay and enzyme linked immunosorbent assay etc. Antimicrobial agents and resistance against them.
3	Catalase positive gram-positive cocci: Staphylococcus, Streptococcus Enterococcus, Catalase positive gram positive bacilli: <i>Bacillus</i> , <i>Corynebacteria</i> , <i>Listeria</i> . Catalase negative –gram positive bacilli Lactobacillus, Erysipalothrix. Gram negative bacilli and coccobacilli Enterobacteria (oxidase negative) and Pseudomonas and Burkholderia (oxidase positive). Haemophilus, Vibrato and Bordetella.
4	Catalase negative gram positive anaerobic bacilli: Clostridium and Actinomyces. Epidemiology and pathogenesis of Mycobacterium. Obligate intracellular and non cultivable bacterial pathogens: Chlamydia Rickettsia, Mycoplasma and Ureaplasma.
5	Laboratory methods for diagnosis of parasitic fungal and viral infections. Current and emerging technologies in the laboratory diagnosis of infectious diseases.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Forbes, B.A., Sahm, D.F. and Weissfeld A.S. 2002 Bailey and Scott's Diagnostic Microbiology (11th edition) St. Louis Missouri.
- B. Koneman, E.W. Allen, S.D., Janda, W.M., Schreckenberger, P.C. and Winn, W.C. 1992 Diagnostic Microbiology (4th edition), J.B. Lippincott. Company.
- C. Mahon, C.R. and Manusells, Jr. 1995 Text Book of Diagnostic Microbiology. W.B. Saunders company, Philadelphia

BASIC TECHNIQUES IN MICROBIOLOGY – BTM14301

UNIT	CONTENTS
1	Growth media: types including selective and non selective media. Preparation of media. Sterilization: principles and methods – most heat, dry heat, filtration, irradiation, chemical methods and disinfection. Sterilization of working tables and cloths.
2	Cultivation and purification of microbial cultures. Different methods of cultivation - broth culture plate culture and slant cultures. Purification of microbial culture by streaking, spread plate, simple streaking and coordinative streaking. Cultural characteristics of microorganisms. Enumeration of microbial population.
3	Biochemical test and identification of microbial culture. Methods of determination of microbial growth. Microbial enzyme assay. MBR test nitrate reductase test. Decarboxylase test, phenylalanine deaminase test. Enzyme induction.
4	Microbiological analysis of food products. Standard qualitative test of water. Quantitative analysis of water. Isolation of antibiotic producing microbes from soil. Determination antimicrobial activity of any isolate. Bacterial conjugation. Isolation of antibiotic resistant

	mutants. Identification of human pathogen. Microbiological analysis of urine and blood specimens.
5	Cultivation and enumeration of bacteriophages. Cultivation of fungi and their morphology. Identification of unknown bacteria and fungi. Serological techniques.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Cappuccino, J.G. and Sherman, N. 2002 Microbiology Laboratory Manual Pearson education (Singapore). Indian branch New Delhi.
- B. Dubey, R.C. and Maheshwari, D.K. 2006 Practical Microbiology. S. Chand & Company Ltd. New Delhi.

**BIORESOURCE UTILIZATION AND BIOREMEDIATION –
BUB14301**

UNIT	CONTENTS
1	Concept of Bioresource utilization and bioremediation and there scope and importance. Bioresource and biomass and availability. Mechanism of bioresource utilization.
2	Introduction to bioresource utilization , process of bioresource utilization. Composting biogas production, jute and flax retting, coir production curing tea and coffee. Biological nitrogen fixation and bacterial photosynthesis.
3	Microbes and biocatalyst : Hydroxylation of steroids , production of polyether, stains, enzyme inhibitors, immunosuppressant's, ultero contractants , antitumor agents, biosurfactants, biopolymers, biopesticides and biotertilizers.
4	Bioremediation: Definition and importance. Biodegrading of pollutants (Pesticides, polychloro ethylene biphenyls). Biotreatability assay of pollutants. Biodegradation technology and factors affecting technology. Phyto remediation.
5	Bioremediation of wastes, oil spills, spoilt mines etc. Bio sorptions. Bio augumentation by native flora as well as commercial inoculants. Genetic improvement of bioremediation microbial inoculants.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Aexander , M. 1994 Biodegradation and Bioremediation. Academic press, san Diego.
- B. Metting , F.B. Jr. 1993 (ED.) Microbial Ecology : Application in Agriculture and Environment Management, Deckkera.
- C. Ganthier, M.J. 1992 (ED.) Gene transfers and Environment. Springer – verlagy Barlin.
- D. Levin, M.A., Seidler, R.J. and Rognl, M(1992) (ED.) Microbial Ecology : Principles, Methods and Application.

INTRODUCTION TO VIROLOGY – VIR14301

UNIT	CONTENTS
1	General characteristics of viruses. Biological status of viruses. Reproduction of viruses. Isolation & cultivation of viruses, purification of viruses and assay. Importance of viruses. Viruses of bacteria, viruses of animals.
2	Viruses: - Microbial agents of diseases. Viruses containing different kinds of genetic material with examples. Viral pathogens of insects.
3	Plant viruses: Classification and nomenclature : Effect of viruses on plants. Histology , Physiology and Cytology of plants affected with viruses. Common viral diseases of plants (rice, cotton, tomato and sugar- cane). Life cycle specific types of plant viruses like. Tobacco Mosaic Virus (TMV), Cauliflower Mosaic Virus and Potato Virus X : Transmission of plant viruses with vector and without vectors.
4	Bacterial viruses: Bacteriophage, structural organization, life cycle, one step growth curve, transcription, DNA replication, eclipse phase, phage production, burst size. Lytic and lysogenic cycles. Bacteriophage typing.
5	Application of viruses in bacterial genetics. Brief detail on M13, M4, T3,T4 and lambda phages. Viruses of cyanobacteria, algae and fungi. Common human viral diseases and details of their causative agents (small pox, AIDS, Hepatitis B, Influenza and polio).

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Text Book of Microbiology by- Pelczar
- B. Biotechnology by – U. Satyanarayana
- C. Microbiology – Prescott.

BIOSTATICS – BOX14301

UNIT	CONTENTS
1	Introduction to Statistics with scope in biosciences. Statistical data: Various types (raw data, grouped) representation of data using frequency distribution diagram (simple/ multiple/ subdivided bar diagram, pie diagram), Graphs (Histogram, polygon, curve). Population, sample and sampling methods (SRS, stratified sampling).
2	Description statistics (a) measures of central tendency . Mean (definition and simple problems). Median, quadrile (definition, graphical calculation). Mode (definition graphical calculation). Situations where one is preferred over the others. (b) measures of dispersion : variance (definition, simple problems). Standard deviation coefficient of variance skewness (definition, types of skewness and graphical presentation). (d) kurtosis (definition and types, graphical presentation).
3	Probability (a) definition and its limitation, axiomatic approach. Independence and conditional problem. Standard probability, distribution (b) binomial (definition and additive property and simple examples) (c) Poisson (definition, additive property and simple examples) (d) Normal (definition , linear property and simple examples). Central limit theorem.
4	Inferential statistics (a) hypothesis, definition, types, (one tailed two tailed).(b) Sampling distribution and errors. (c) Types of errors (type I, II). Testing of hypothesis (two tailed only). (a) for mean (one population) Mean (2 population dependent and independent) (b) for variance (one population), variance (two populations), (c) Chi-square test for fitting distribution.

5	Anova (one way). Anova. (two ways) followed by test (pair wise). Correlation (definition types of correlation with simple biological problems). Scatter diagram covariance, multiple correlations (definition). Partial correlation (definition & formula).
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LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Annadurai, B.A. text book of biostatistics New age 2007 international (p) ltd, New Delhi.

INTRODUCTION TO MYCOLOGY AND PROTISTA – MPR14301

UNIT	CONTENTS
1	Definition and scope of mycology significance of fungi to mankind. General characteristics of fungi and classification.
2	Characteristics of different phyla : Chytridiomycota , Zygomycota Ascomycota, Basidiomycota.
3	Importance of fungi : Plant pathogen (Puccinia, Ustilago, Phytophthora, Fusarium, Claviceps), Human pathogens (Aspergillus , Candida). Industrially important fungi(yeast, fungi producing organic acids, vitamins and enzymes, antibiotics etc.). Fungi as biotransformer and bioremediator, Mushroom fungi and their importance. Mycorrhizae. Biocontrol agents. Endophytic fungi and their role. Fungi associates with insects.
4	Protists definition characteristics and distribution. Different types of protists and their nutrition and reproduction. Different groups ; Excavata, Amoebozoa, Chromalveolata, Archaeplastida, Rhizoria.
5	Importance of protists : Grazers, endosymbionts, commensals and parasites. Phototrophic and saprotrophic protists . Industrial and other uses of protists. Human and plant diseases caused by protists.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Alexopoulos, C.J. Mims, C.N. and Blackwell. M. 2002. Introductory Mycology (4th Edition). Wiley- India.
- B. Rayner, A.D.M., Prazier, C.M. and Moore, D. 1987 (eds). Evolutionary Biology of Fungi Cambridge Uni. Press. London.
- C. Carlile, M.j. and Gooday, G.W. 2001 The Fungi (2nd ed.) Acad. Press. New York.
- D. Griffin, D.H. 1996 Fungal Physiology (2nd ed.) Wiley- Liss, New York.

PHARMACEUTICAL MICROBIOLOGY – PTM14301

UNIT	CONTENTS
1	Definitions of Pharmacy, pharmacology and pharmaceuticals. Different groups of microbes (Bacteria, fungi, protozoa, algae and viruses). Microbial growth and bacterial growth kinetics. Microbial nutrition, Cultivation and control of microbial growth. Microbial genetics.

2	Infection and factors influencing infection. Host microbe relationship. Host defense mechanisms and mechanism of immunity. Vaccines, preparation standardization and storage. Vaccines for different diseases like diphtheria gas gangrene, tetanus, cholera, plague T.B. polio, measles, small pox, typhoid, whooping cough. Anti-diphtheria serum, ant rabies serum antivenom serum.
3	Common diseases : Pneumonia, Gonorrhoea, Cerebrospinal – Meningitis, Diphtheria, Typhoid Fever, Bacillary and Amoebic Dysentery, Cholera, Plague, Influenza, Pertussis , Whooping Cough, Gas Gangrene, Tetanus, Tuberculosis, Leprosy, Syphilis, Rickettsia, Rabies, Poliomyelitis, Dengue, Small Pox, Chicken Pox, Malaria, Mumps, their causal organisms mode of transmission and control. Fungal diseases their causative agents.
4	Bacteriostatic, bactericidal, fungicidal drugs : sulfonamides, antibiotics and antifungal drugs, their mechanism of action and side effects. Commonly used antiviral drugs (NRTIs, NNRTIs, NtRTs,PIs & fusion inhibitors). Antibiotic sensitivity (MIC & MBC).
5	Fermentation : types of fermenters and their working. Production of antibiotics (penicillin, tetracyclins, streptomycin, griseofulvin), vitamins (riboflavin & biotin) and whole cell drugs (sporoline etc) and ergotamine. Microbiological transformations (oxidation, hydrolysis, reduction, esterification and isomerization). Microbiological assay of drugs and vitamins.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Howland, R.D. and Mycek, M.J. 2006, Pharmacology (3rd edition). Lippin Cott Williams & Wilkins.
- B. Barar, F.S.K. 2007 Essentials of Pharmaceutical (4th edition) S. Chand & Company Ltd., New Delhi.
- C. Jain, N.K. 2005, Pharmaceutical Microbiology. Vallabh Prakashan, Delhi.
- D. Kori, S.S. and Halki, M.A. 2000 Pharmaceutical Biotechnology. Vallabh prakashan, Delhi.

ELEMENTS OF INDUSTRIAL ENTREPRENEURSHIP – EIE14301

UNIT	CONTENTS
1	Principles of management – Meaning and importance, Evaluation of management of thoughts: Function of management : Planning – meaning and importance, steps in process of organizing, types of organization structures, informal organization.
2	Directing – communication process, barriers to effect communication mediation- theories of motivation, leadership styles. Controlling control techniques. Personal management : manpower planning, sources of recruitment, relation and training of staff, job evaluation, merit rating, performance appraisal. Administration and system of wage payment, incentive, trade and industrial relations.
3	Purchase and store management: Concept of quotation, tenders and comparative statement, inspection and quality control inventory, carrying cost and fixed cost of inventor. BEP analyses, store management, function of store keeper. Methods of inventory LIFO, FIFO. Marketing management: concept of selling, marketing.
4	Export and import management : concept of international trade, duties and antidumping duty cost involved in exporting product, pricing of export product. Govt. assistance- promotion, export houses. Export promotion council and patent right.
5	Management laws: concept of contract act, offer, types of contracts, void contract. Concept of guaranty and warranty. Introduction of MRTP and FERA. Work duty, work management, time and motion duty, chart, flow diagram, sio chart, therbligs. Quality management: TQM, quality management, ISO system.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. George, Jr. C.S. Management for Business and Industry.
- B. Kootz and Donnel, Principles of Management.
- C. Shukla, M.C. Business Organization and Management.

CLINICAL MICROBIOLOGY – CLB14301P

UNIT	CONTENTS
1	Staining of bacteria.
2	ELISA test.
3	Catalase test.
4	Agglutination test.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Forbes, B.A., sahm, D.F. and Weissfeld A.S. 2002 Bailey and Scotto’s Diagnostic Microbiology (11th edition) st. Louis Missouri.
- B. Koneman, E.W. Allen, S.D., Janda, W.M., Schreckenberger, P.C. and Winn, ire, W.C. 1992 Diagnostic Microbiology (4th edition), J.B. Lippincott. Company.
- C. Mahon, C.R. and Manusells, Jr. 1995 Text Book of Diagnostic Microbiology. W.B. Saunders company, Philadelphia

BASIC TECHNIQUES IN MICROBIOLOGY – BTM14301P

UNIT	CONTENTS
1	Media preparation and sterilization techniques.
2	Cultivation of bacteria.
3	Growth curve of bacteria.
4	Microbiological analysis of urine and blood samples.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Cappuccino, J.G. and Sherman, N. 2002 Microbiology Laboratory Manual Pearson education (Singapore). Indian branch New Delhi.
- B. Dubey, R.C. and Maheshwari, D.K. 2006 Practical Microbiology. S. Chand & Company Ltd. New Delhi.

**BIORESOURCE UTILIZATION AND BIOREMEDIATION –
BUB14301P**

UNIT	CONTENTS
1	Isolation of nitrogen fixing bacteria and their cultivation.
2	Study of enzyme kinetics.
3	Study of Nitrogen fixation.
4	Bioremediation of wastes.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Metting , F.B. Jr. 1993 (ED.) Microbial Ecology : Application in Agriculture and Environment Management, Deckkera.
- B. Ganthier, M.J. 1992 (ED.) Gene transfers and Environment. Springer – verlagy Barlin.
- C. Levin, M.A., Seidler, R.J. and Rognl, M(1992) (ED.) Microbial Ecology : Principles, Methods and Application.

INTRODUCTION TO VIROLOGY – VIR14301P

UNIT	CONTENTS
1	Isolation and cultivation of viruses from diseased plant.
2	Purification of viruses and their assay.
3	Isolation of bacteriophages.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Text Book of Microbiology by- Pelczar
- B. Biotechnology by – U. Satyanarayana
- C. Microbiology – Prescott.

INTRODUCTION TO MYCOLOGY AND PROTISTA – MPR14301P

UNIT	CONTENTS
1	Identification and characterization of fungi.
2	Production of organic acid with the help of fungi.
3	Study of paramecium and amoeba.
4	Study of disease causing protozoans.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Rayner, A.D.M., prazier, C.M. and Moore, D.1987 (eds). Evolutionary Biology of Fungi
Cambridge Uni. Press. London.
- B. Carlile, M.j. and Gooday, G.W. 2001 The Fungi (2nd ed.) Acad. Press. New York.
- C. Griffin, D.H. 1996 Fungal Physiology (2nd ed.) Wiley- Liss, New York.

PHARMACEUTICAL MICROBIOLOGY – PTM14301P

UNIT	CONTENTS
1	Identification and characterization of algae.
2	Widal test.
3	Ames test.
4	Production of antibiotics.

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:

- A. Barar, F.S.K. 2007 Essentials of Pharmaceutical (4th edition) S. Chand & Company Ltd., New
Delhi.
- B. Jain, N.K. 2005, Pharmaceutical Microbiology. Vallabh Prakashan, Delhi.
- C. Kori, S.S. and Halki, M.A. 2000 Pharmaceutical Biotechnology. Vallabh prakashan, Delhi.