

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

Dairy Microbiology (11101301)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<p><b>Unit-1:</b></p> <p><b>Milk:</b></p> <p>Definition, Composition and Types of Milk (skimmed, toned and homogenized) Concept of clean milk (as per National Dairy development Board (NDDB) norms) <b>Microbial analysis of milk:</b></p> <p>Microflora of raw milk, Dye reduction test (using methylene blue and resazurin), Total bacterial count, Brucella ring test and tests for mastitis, Somatic cell count</p>	%	11
2	<p><b>Unit-2:</b></p> <p><b>Spoilage of milk:</b></p> <p>Succession of microorganisms in milk leading to spoilage, Color and flavor defects, Sweet curdling, Stormy fermentation, Ropiness</p> <p><b>Pasteurization of milk:</b></p> <p>Methods of Pasteurization, LTH, HTST, UHT, Phosphatase test for determination of efficiency of Pasteurization</p>	%	11
3	<p><b>Unit-3:</b></p> <p><b>Naturally occurring preservative systems in milk</b></p> <p>LP system, Immunoglobulins, Lysozyme, Lactoferrin, etc. Preservation of milk and milk products by physical (irradiation) and chemical agents; Food grade Biopreservatives (GRAS), Bacteriocins of lactic acid bacteria; Nisin and other antimicrobials produced by Lactic Acid Bacteria (LAB). Application of bacteriocins as food grade biopreservatives in enhancing shelf life of foods; pesticides and aflatoxins in milk</p>	%	12

4	<p><b>Unit-4:</b></p> <p><b>Lactic Acid Bacteria (LAB) as starters :</b></p> <p>Types of starter cultures and their classification; Concepts of starter growth and metabolism of lactose and citrate; Production of taste and aroma compounds by starters in fermented milks and milk products; Changes caused by starters in milk during growth; LAB as probiotics in development of health foods; Bioactive peptides and their role as nutraceuticals in dairy foods.</p> <p>Preparation of yoghurt, koumiss, kefir, cultured buttermilk and whey based</p> <p>Preparation of byproducts from dairy effluents by microbial fermentation, Disposal of dairy effluents after microbial treatment; BOD and COD analysis in dairy effluents; Microbiological quality of air and water used in Dairy Plants.</p>	%	11
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**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Dairy Bacteriology  
De.S
2. Outlines of Dairy Technology  
Sukumar De
3. Milk and milk products  
Ecles C.H & Macy combes
4. Food Microbiology  
Frazier, W.C. and Westhoff, D.C.

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

Virology (11101302)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<p><b>Unit-1:</b></p> <p><b>Introduction:</b></p> <p>History and principles of virology, virus taxonomy, virus nomenclature, role of ICTV, Virus structures and morphology, Introduction to replication strategies (ssDNA, dsDNA, +sense RNA, -Sense RNA, dsRNA), Integration of viruses in host.</p>	%	5
2	<p><b>Unit-2:</b></p> <p><b>Virological methods:</b></p> <p>Cultivation and purification of viruses, <i>In vivo</i>, <i>In vitro</i> and <i>In ovo</i> systems for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation methods</p> <p>Diagnostic methods - Immnuodiagnosis, haemagglutination and haemagglutination inhibition tests, Complent fixation, neutralization, Western blot, RIPA, flow cytometry and imunohistochemistry.</p> <p>Nucleic acid based diagnosis - Nucleic acid hybridization, polymerase chain reaction, microarray and nucleotide sequencing.</p> <p>Microscopic techniques - Fluorescence, confocal and electron microscopic techniques principles and applications.</p>	%	7

3	<p><b>Unit-3:</b></p> <p><b>Plant Virology:</b></p> <p>Transmission of plant viruses: Vectors, seed, pollen, other</p> <p>Diseases and epidemiology of selected viral groups - Begomoviruses, Tospoviruses, Potyviruses, Comoviruses</p> <p>Plant molecular virology - Plant viruses as gene vectors, viral gene expression</p> <p>Control of viral diseases - Resistance genes, cross protection, seed treatments, cultural, transgenic, VIGS</p>	%	8
4	<p><b>Unit-4:</b></p> <p><b>Animal Virology:</b></p> <p>Diseases of farm animals - Foot and Mouth Disease, Bovine Ephemeral fever, Rift Valley Fever, Swine influenza, Japanese Encephalitis</p> <p>Diseases of human - AIDS, Influenza, Human papillomavirus</p> <p>Virus and cancer - The Development and causes of cancer, tumour viruses, oncogenes, prevention and treatment.</p>	%	8
5	<p><b>Unit-5:</b></p> <p><b>Emerging virus and challenges:</b></p> <p>Mechanism of host cell damage- Host cell 'shut off', apoptosis, necrosis, alteration of signaling pathways. Viruses and the future: Promises and problems. Emerging diseases, sources and causes of emergent virus diseases. Prospectus using medical technology to eliminate specific viral and other infectious diseases, viruses as therapeutic agents, viruses for gene delivery, viruses to destroy other viruses. Importance of studying modern virology.</p>	%	9
6	<p><b>Unit-6:</b></p> <p><b>Viral Vaccines:</b></p> <p>Conventional vaccines killed and attenuated, modern vaccines - recombinant proteins, subunits, DNA vaccines, peptides, immunomodulators (cytokines), vaccine delivery and adjuvants, Antivirals - Interferons, designing and screening for antivirals, mechanisms of action, Antisense RNA,</p>	%	8

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Fields Virology Vol 1 and 2  
B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman, and S.E.
2. Basic Virology  
Edward K. Wagner, Martinez J. Hewlett, David C. Bloom and David Camerini
3. 3. Virology: Principles and Applications  
John Carter and Venetia Saunders
4. 4. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses  
S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello and A. M. Skalka

5. Basic Virology  
Edward K Wanger
6. Matthew's Plant virology  
Roger Hull
7. 7. Fundamentals of molecular virology  
Acheson and Nicholas H

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

Environmental Microbiology (11101303)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Unit-1:</b> <b>Soil microorganism:</b> Symbiotic association, association with vascular plants, phyllosphere, Rhizobium, Rhizoplane associative nitrogen fixation, Fungal and Bacterial, Endopytes - Mycorrhizae, Azorhizobium, Actinorhizae. Introduction to Biofertilizers, bacterial, cyanobacterial and azolla biofertilizers. Biopesticides - Bacterial, Viral and Fungal	%	11
2	<b>Unit-2:</b> <b>Nitrogen fixation:</b> Asymbiotic and symbiotic, nodule formation. Genetics and biochemistry of nitrogen fixation. Nif genes. Transfer of nif genes. Soil microbes releasing plant growth substance	%	11
3	<b>Unit-3:</b> Aquatic Microbiology - Ecosystems - Fresh water (ponds, lakes, streams - marine - estuaries, mangroves deep sea). Water zonation - eutrophication - food chain, potability of water - microbial assessment of water quality - water purification - Brief account of water borne diseases and preventive measures	%	12
4	<b>Unit-4:</b> Waste Treatment: Types of wastes - characterization of solid and liquid wastes. Waste treatment and useful byproducts, solid - saccharification - gasification - composting - liquid waste treatment - aerobic, anaerobic methods.	%	11

\*Continuous Evaluation:

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Introduction to Environmental Biotechnology  
A.K.Chatterji
2. Environmental Biotechnology (Industrial Pollution Management)  
B. N. Jogdand
3. Environmental Biotechnology  
S. K. Agarwal
4. 4. Environmental Biotechnology: Basic concepts and applications  
Indu Shekar Thakur

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

Microbial Metabolism (11101304)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Unit-1:</b> <b>Basic concepts of metabolism:</b> Nutritional types of microorganisms, uptake of nutrient in to the cell, Transport of nutrients by active and passive ways. aerobic, facultative anaerobic and strict anaerobic microbes	%	8
2	<b>Unit-2:</b> <b>Microbial growth:</b> Growth curve measurement of microbial growth, measurement of cell number, measurement of cell mass, factors affecting growth.	%	10
3	<b>Unit-3:</b> <b>Basic concepts of metabolism:</b> Mechanism of ATP formation, Substrate phosphorylation, Electron transport, phosphorylation, photophosphorylation, energy production during oxidation of organic substrate, amino acid and assimilatory pathway, bacterial enzymes, coenzymes, isoenzymes - structure, classification and properties.	%	13
4	<b>Unit-4:</b> <b>Bacterial Photosynthesis:</b> Habitat and examples of photosynthetic bacteria, Oxygenic and Anoxygenic mechanisms, Photosynthetic apparatus, Cyclic and non-cyclic photophosphorylation, Calvin cycle	%	13

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.



**Reference Books:**

1. Fundamentals and principles of Bacteriology  
Sale, A.J
2. A Text book of Microbiology  
Dubey, R.C. and Maheswari, D.K
3. General Microbiology  
Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R.
4. Photosynthesis  
Dall D.O. and Rao, K.K.

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

LAB-1 (Dairy Microbiology and Virology) (11101305)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
-	-	3	2	-	30	-	-	20	50

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Dairy Microbiology:</b> Isolation and identification of lactic acid bacteria.	%	
2	<b>Dairy Microbiology:</b> Qualitative tests for milk: Phosphatase test; MBRT test; Test for mastitis.	%	
3	<b>Dairy Microbiology:</b> Quantitative tests for milk: Milk fat estimation; Standard Plate Count, Somatic cell count.	%	
4	<b>Dairy Microbiology:</b> Isolation and identification of <i>Xanthomonas citri</i> from infected sample	%	
5	<b>Virology:</b> Plant viruses: study of symptoms.	%	
6	<b>Virology:</b> Amplification of plant virus by rolling circle amplification	%	
7	<b>Virology:</b> Cloning of viruses in plant binary vector and <i>Agrobacterium</i> mediated transformation	%	
8	<b>Virology:</b> Study of disease development patterns on virus inoculated plants and symptoms load score.	%	

9	<b>Virology:</b> Quantification of virus copy numbers by RT - PCR	%	
10	<b>Virology:</b> Haemagglutination test	%	
11	<b>virology:</b> Hemagglutination inhibition assay	%	

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# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

LAB-2 (Environmental and Industrial Microbiology) (11101306)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
-	-	3	2	-	30	-	-	20	50

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Environmental Microbiology and Industrial Biotechnology:</b> Determination of COD.	%	
2	<b>Environmental Microbiology and Industrial Biotechnology:</b> Testing of chlorine demand of water .	%	
3	<b>Environmental Microbiology and Industrial Biotechnology:</b> Microbiological quality assurance of any of the commercially available foods.	%	
4	<b>Environmental Microbiology and Industrial Biotechnology:</b> Bioassay of penicillin/vitamin B12.	%	
5	<b>Environmental Microbiology and Industrial Biotechnology:</b> Determination of fecal coliforms by MPN technique/MF technique	%	
6	<b>Environmental Microbiology and Industrial Biotechnology:</b> Isolation of azotobacter and rhizobium.	%	
7	<b>Environmental Microbiology and Industrial Biotechnology:</b> Sterility testing of injectibles.	%	
8	<b>Environmental Microbiology and Industrial Biotechnology:</b> Assay of amylase	%	

9	<b>Environmental Microbiology and Industrial Biotechnology:</b> Chloroplast Isolation.	%	
10	<b>Environmental Microbiology and Industrial Biotechnology:</b> Chlorophyll estimation.	%	
11	<b>Environmental Microbiology and Industrial Biotechnology:</b> Isolation and estimation of secondary metabolites from sugar beet.	%	

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It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

Industrial Biotechnology (11102301)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<p><b>Unit-1:</b></p> <p><b>Basic Principles of Industrial Biotechnology:</b></p> <p>Important commercial products produced by microorganisms and GMOs and their applications,</p> <p>Screening and selection of micro-organisms: A)Primary Screening- Definition and techniques, Crowded Plate, Auxanography, Enrichment, Indicator dye, B)Secondary Screening- Definition and features Stock cultures: A)Aims of preservation of cultures B)Definition of working and primary stock cultures C)Techniques of preservation -Serial subculture -Sterile soil, water, silica gel -Sterile mineral oil -Lyophilisation -Storage in liquid Nitrogen</p>	%	13
2	<p><b>Unit-2:</b></p> <p><b>Microbes in industry:</b></p> <p>Foods from microorganism (vinegar and cheese). production of citric acid, amylases, proteases, vitamin B12, beer, wine, biogas, methane, hydrogen</p>	%	10
3	<p><b>Unit-3:</b></p> <p><b>Fermentation Equipment and its use:</b></p> <p>a) Definition of Fermentor/Bioreactors b) Structure of Ideal Fermentor c) Definition and uses of Impellers and their types, Spargers and their types, Baffles, Headspace, d) Controls and Sensors (temperature, pH, antifoam, dissolved oxygen and carbon dioxide sensor) e) Types of reactors (Definition, description, diagram and uses) Stirred Tank reactors, Bubble columns, Airlift Bioreactors (internal and external loop), Fluidised bed, Packed Bed column, Photobioreactors, Tray bioreactors.</p>	%	11

4	<b>Unit-4:</b> <b>Detection and assay of fermentation products:</b> A). Physical or chemical assay. i). Titration and gravimetric assay. ii). Turbidity analysis and cell determination. iii). Spectrophotometric assay. iv). Chromatographic partition assay. B). Biological assay- Definition benefits and drawbacks. i) Diffusion assay. ii) Turbidometric and growth assay. iii) End point assay. iv) Metabolic response assay. v) Enzymatic assay	%	11
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**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Medical Microbiology  
D.D. Bernard, R. Dulbecco, H.N. Eisen and H.S. Ginsbery
2. Industrial Microbiology  
M.K.J. Waites et. al
3. Instant Notes in Microbiology  
Nicklin et. al
4. Microbiology : An introduction  
G.J. Tortora et. al
5. Principles of Fermentation Technology  
Stanbury and Whittakar
6. Industrial Biotechnology  
Cruger and Cruger
7. Microbiology  
Pelczar and E.C.S. (Jr.) Chan

# PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 5th Sem B.Sc. PROGRAMME

Omics Technologies (11102305)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
Lect	Tut	Lab		External		Internal			
				T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<p><b>Unit-1:</b></p> <p><b>Genomics:</b></p> <p>Genome sequencing projects Microbes, plants and animals, Accessing and retrieving genome project information from web, Identification and classification using molecular markers-16S rRNA typing/sequencing, EST's and SNP's. Comparative-genomics Introduction, comparative genomics of plants, cereal and legume Evolutionary Genomics Introduction to genome evolution, Acquisition of new genes, Evolution of non-coding regions, Molecular phylogenetics and applications, Evolution of multigene families in the genome</p> <p>Introduction and applications of Structural Genomics, Functional Genomics, Metagenomics and Pharmacogenomics.</p>	%	11
2	<p><b>Unit-2:</b></p> <p><b>Singenomics and Next Generation Sequencing:</b></p> <p>Designing and producing microarrays, types of microarrays, cDNA microarray technology, oligonucleotide arrays, Sample preparation, labeling, hybridization, generation of microarray data. Next generation sequencing technologies</p> <p>Introduction to Next Generation Sequencing (NGS) technologies, Principles of NGS by Roche/454, Illumina, Life Technologies, Pacific Biosciences, Ion Torrent technologies, Applications of NGS to disease diagnosis and personalized medicine. Protein micro arrays Types of protein arrays, Protein microarray fabrication, Experimental analysis of proteins arrays. Data acquisition and processing, Applications of protein microarray types.</p>	%	11



3	<b>Unit-3:</b> <b>Epigenetics and Epigenomics:</b> Introduction and their impact on cellular homeostasis, Epigenomics in Cancer and Neuroregenerative diseases Epigenomics in plants.	%	8
4	<b>Unit-4:</b> <b>Protein analysis</b> (includes measurement of concentration, amino-acid composition, N-terminal sequencing), 2-D electrophoresis of proteins, Gel based and Gel free proteomics, Microscale solution isoelectric focusing, Peptide mass fingerprinting, LC/MS-MS for identification of proteins and modified proteins, MALDI-TOF, SAGE and Differential display proteomics, Protein-protein interactions. Proteomics of chloroplast, nucleus, mitochondria. Proteomics in Seed germination, allergy and Cancer	%	8
5	<b>Unit-5:</b> <b>Other -Omics technologies:</b> Introduction and applications (with special reference to diseases) of Transcriptomics, Lipidomics, Metabollomics, Degradomics, Nutritionomics, Toxicomics, Interactomics, Connectomics	%	7

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. DNA Microarrays - A Practical Approach  
Schena M
2. DNA Microarrays  
Rinaldis E. D. and Lahm A.
3. Mass Spectrometry – Principles and Applications  
Hoffman E. D. and Stroobant V
4. Data mining for Genomics and Proteomics  
Darius M. Dziuda
5. Introduction to Proteomics : Tools for new Biology  
Daniel C. Liebler
6. Proteomics  
Timothy Palzkill
7. Research papers and reviews of concerned topics