



**SARVAJANIK
UNIVERSITY**

INCLUSIVE | INTEGRATED | INNOVATIVE

creating an enlightened society...

Faculty of Science

**SHREE RAMKRISHNA INSTITUTE OF COMPUTER EDUCATION
AND APPLIED SCIENCES, SURAT**

B.Sc. Microbiology

Syllabus

(Effective from 2021)

M.T.B College Campus, B/h P.T.Science College, Opp. Chowpati,
Athwalines, Surat-395001 Gujarat, India

Contact: 7228018498, 728018499. Email: info@srki.ac.in

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A. About B.Sc. Microbiology Programme

The Department of Microbiology of SRKI at Sarvajani University runs a **full time three-year program of six semesters**, leading to award of Bachelor of Science (B.Sc.) degree in Microbiology. The curriculum is designed to train the students in basic and advanced areas of Microbiology, keeping in mind the latest advances in the field. Particular emphasis is laid on the practical aspects of the field. Students are taught how to plan experiments, perform them carefully, analyze the data accurately, and present the results both, qualitatively and quantitatively. The students are offered basic and advanced level courses in Microbial Diversity, Microbial Physiology, Virology, Immunology, Enzymology, Environmental Microbiology, Molecular biology, Recombinant DNA technology, Industrial Microbiology, Food Microbiology etc. During the programme students were also exposing to industrial and relevant field visit.

B. Programme Objective

- The objective of the B.Sc. Microbiology is to equip the students to gain fundamental knowledge and analytical skills at an advanced level in the field of microbiology.
- The program emphasizes to apply knowledge acquired about prokaryotic and eukaryotic cellular processes, interaction of microorganisms among themselves, with physical and chemical agents and higher order organisms in environment and biological systems to various conditions.
- The laboratory training in addition to theory is included so that the students will acquire the skills to qualify for the positions in industry, clinical laboratory or for further education in a Master program.

C. Eligibility

- The candidate must have passed 10+2 or an equivalent examination with Biology as one of the subjects. **OR** Vocational course in Home Science **OR** Diploma in Pharmacy. **OR** The candidate who has passed equivalent exam from other subjects or boards need to avail eligibility certificate for this programme from the Board of Equivalence (BoE) of the Sarvajani University.

E. Evaluation Scheme

B.Sc. Microbiology				
Evaluation	Criteria	Theory	Practical	
			Sem – I & II	Sem – III to VI
Internal	Continuous & Comprehensive Evaluation (CCE)	40	30	40
	Attendance	10	10	10
	Assignment	20	--	
	Internal Practical Test and Viva - Voce	--	30	50
External	External Evaluation	30	30	50
Total		100	100	150

F. Syllabus

Name of faculty: Science	Department: Microbiology
Program: B.Sc. Microbiology Sem 6	Type: DSC-11
Subject: Microbial Technology	
Credit: 04 + 02	Total learning hours: 60
Course description: The major objective of this course is to acquaint students with the various aspects of industrial microbiology, different types of fermentation processes, fermenters designs and operations. Students will become familiar with mass scale culturing of microorganisms for industrial production of various biomolecules and /metabolites of industrial interest and different recovery methods in detail.	
Student learning outcome: <ul style="list-style-type: none"> • Student will understand the development and importance of industrial microbiology and will be conversant with different types of fermentation processes. • Student will learn about the design, operation and uses of different types of fermenters of laboratory, pilot and industrial scale. • Student will gain insight into the techniques of isolation, screening, preservation and maintenance of industrially important microbial strains and different types of media used in fermentation processes. • Student will have gained in-depth knowledge of the principles of microbial production and recovery of industrial products at large scale. 	

Unit-1: History and The Development of Fermentation Process (Duration: 06 Hrs)

- 1.1 Historical developments in fermentation technology
- 1.2 Primary & Secondary metabolites
- 1.3 Screening
- 1.4 Strain Development
- 1.5 Fermentation Processes

Unit-2: Design of Fermenter (Duration: 08 Hrs)

- 2.1 Basic function of fermenter
- 2.2 Body construction
- 2.3 Fermenter system
- 2.4 Scale up

Unit-3: Fermentation Media (Duration: 08 Hrs)

- 3.1 Characteristics of ideal production medium

- 3.2 Media Formulation
- 3.3 Carbon Sources
- 3.4 Nitrogen Sources
- 3.5 Other ingredients
- 3.6 Animal & Plant cell culture media

Unit-4: Industrial Sterilization

(Duration: 07 Hrs)

- 4.1 Principles of sterilization
- 4.2 Sterilization of equipments
- 4.3 Sterilization of production media
- 4.4 Sterilization of air

Unit-5: Product Recovery

(Duration: 08 Hrs)

- 5.1 Stages of upstream & downstream processing
- 5.2 Broth conditioning
- 5.3 Sedimentation
- 5.4 Centrifugation
- 5.5 Filtration
- 5.6 Cell disruption
- 5.7 Product recovery
- 5.8 Distillation
- 5.9 Finishing steps

Unit-6: Microbial Fermentation of organic feed stocks

(Duration: 07 Hrs)

- 6.1 Ethanol Fermentation
- 6.2 Acetone- Butanol Fermentation
- 6.3 Glycerol

Unit-7: Microbial Fermentation of organic and amino acids

(Duration: 08 Hrs)

- 7.1 Citric acid
- 7.2 Acetic acid
- 7.3 Commercial use of amino acids
- 7.4 L-Glutamic acid

Unit-8: Microbial Fermentation of enzymes, vitamins & antibiotics. (Duration: 08 Hrs)

- 8.1 Amylases
- 8.2 Riboflavin
- 8.3 β – Lactam antibiotics
- 8.4

Reference Books:

- Creuger W., (2005). Biotechnology: A textbook of industrial microbiology, 3rd Ed., Panima, New Delhi. (ISBN: 9789385998638).
- Patel, A.H., (2012). Industrial Microbiology, 2nd Ed. Macmillan, India. (ISBN: 9789385750250).
- Stanbury, P.F., (2006). Principles of Fermentation Technology, 2 Ed., Elsevier Science Ltd. (ISBN: 9780750645010).
- Syed Sajeed Ali, (2016). Fermentation and Industrial Microbiology. (ISBN: 9788192756929).
- Waites, M.J., et al., (2001). Industrial Microbiology, 1ST Ed., Blackwell publishing. (ISBN: 0632053070).

Further Reading:

- Okafor N., (2007). Modern Industrial Microbiology and Biotechnology, Science publishers. (ISBN: 9781138036147).
- Sivakumaar P.K., Joe M.M. and Suresh K., (2010), An introduction to industrial microbiology, 1st Ed., S.Chand publication. (ISBN: 9788121935197).

List of Practical

- 1) Screening of antimicrobial metabolite producing microorganisms:
(i) Crowded plate method (ii) Wilkin's method
- 2) Sterility testing by direct inoculation method.
- 3) Bioassay of penicillin
- 4) Fermentative production of amylase by submerged fermentation and its estimation
- 5) Separation of amino acids by paper chromatography

Name of faculty: Sciences.	Department: Microbiology
Program: B.Sc. Microbiology Sem 6	Type: DSC-12
Subject: Health and Epidemiology	
Credit: 04 + 02	Total learning hours: 60
Course description: <p>The paper contains the topics related to human health. It includes the understanding for microbial diseases. The subject includes the diseases caused by bacteria, viruses, fungi and protists. Another major learning is Introduction to Epidemiology and hospital acquired infections. It also consist the control and Prevention of Hospital-Associated Infections.</p>	
Student learning outcome: <ul style="list-style-type: none"> • To make them aware about the microbial diseases and its Pathogenicity • They will learn about the various diseases caused by bacteria, viruses, fungi and protists. • Students will learn about the various Hospital-Associated Infections and get a overview of the Epidemiology. 	

Unit 1: Microbial Diseases and Pathogenicity.
(Duration:07Hrs)

- 1.1 Pathogenicity and infectious disease.
- 1.2 Virulence.
- 1.3 Exposure and transmission.

Unit 2: Human Diseases Caused by Viruses and Proins.
(Duration:10Hrs)

- 2.1 Airborne diseases: Influenza, smallpox and SARS
- 2.2 Arthropod-borne diseases.
- 2.3 Direct contact diseases: AIDS, Common Cold and Viral Hepatitides
- 2.4 Food-borne and waterborne diseases: Gastroenteritis and Poliomyelitis
- Zoonotic diseases: Rabies
- 2.5 Prion diseases.

Unit 3: Human Diseases Caused by Bacteria.
(Duration:12Hrs)

- 3.1 Airborne diseases: Diphtheria, Mycoplasmal Pneumonia and Mycobacterium

Infections

3.2 Arthropod borne diseases: Plague and RMSF

3.3 Direct contact diseases: STD and Staphylococcal Diseases

3.4 Food borne and waterborne diseases: Botulism, Cholera and *Escherichia coli*

Gastroenteritis

3.5 Zoonotic diseases: Anthrax and Q fever

3.6 Opportunistic diseases: Streptococcal Pneumonia

Unit 4: Human Diseases Caused by Fungi and Protists- I.

(Duration:10Hrs)

4.1 Airborne diseases: Blastomycosis and Histoplasmosis

4.2 Arthropod-borne diseases: Malaria and Leishmaniasis

4.3 Direct contact diseases.

Unit 5: Human Diseases Caused by Fungi and Protists- II.

(Duration:04Hrs)

5.1 Food borne and waterborne diseases: Amebiasis and Giardiasis

5.2 Opportunistic diseases.

Unit 6: Introduction to Epidemiology.

(Duration:05Hrs)

6.1 Epidemiological methods.

6.2 Measuring infectious disease frequency.

6.3 Patterns of infectious disease in a population.

6.4 Emerging and reemerging infectious disease and pathogens.

6.5 Health-care-associated infections.

Unit 7 : Epidemiology of Hospital-Associated Infections.

(Duration:06Hrs)

7.1 Factors affecting development of hospital-associated infections (HAI).

7.2 Common hospital-associated infections.

7.3 Microbiology of hospital-associated infections.

7.4 Sources of infection.

Unit 8: Control and Prevention of Hospital-Associated Infections.

(Duration:06Hrs)

8.1 Role of microbiology in surveillance and control.

8.2 Breaking the chain of infection

8.3 Prevention and Control of Epidemics.

8.4 Appropriate use of antibiotics

Reference Books:

- Patwardhan N. and Patwardhan S. (2018). Hospital-Associated Infections: Epidemiology, Prevention and Control. (ISBN : 9789352700189).
- Wiley J. and Sherwood L. (2014). Prescott, Harley and Klein's Microbiology, 9th Ed., McGraw-Hill Science/Engineering/Math. (ISBN 9780073402406).

Further Reading:

- Greenwood. D. and Black R.C. (2012). Medical Microbiology, 6th Ed., Churchill Livingstone. (ISBN: 9780702040894).
- Tortora G.J., and Funke B.R. (2016), Microbiology an Introduction, 12th Ed., Benjamin Cummings. (ISBN: 9781292099149).

List of Practical

1. Bacteriological investigation of diagnostic problems related to blood.
2. Bacteriological investigation of diagnostic problems related to urine.
3. Bacteriological investigation of diagnostic problems related to stool.
4. Bacteriological investigation of diagnostic problems related to purulent exudates, wound, abscess.
5. Determination of MIC for given antibiotic against test organism.
6. Study of permanent slides of arthropod vectors. (Aedes and Anopheles mosquitoes, Rat flea, Mite)
7. Estimation of haemoglobin by Sahli's method
8. Total count of WBC & RBC
9. Differential count of leucocyte

Course Code	
Course Title	Essential skills of Computers
Credit	4
Teaching per Week	4 Hrs
Minimum weeks per Semester	12
Last Review / Revision	-
Purpose of Course	This course is enhance the fundamentals of computer, office automation , database management and internet facility
Course Objective	Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet. Provide hands-on use of Office applications Word, Excel and PowerPoint. Introduce the database concept with SQL in Access
Pr-requisite	--
Course Out come	Students will be able to <ul style="list-style-type: none"> • Understand concepts of computer component • Manage the documents, presentation and gain practical exposure on spreadsheet using office tool. • Create and manage database using database tool. • Use SQL statements to store, modify and retrieve data from tables • gain skills & knowledge to browse and get updated worldwide information

Course Content

Unit 1:Introduction of Computers

(Duration: 06 Hrs)

- 1.1 Evolution of computers ,Classification of Computers and components of computer
- 1.2. Fundamentals of Computers
 - 1.2.1.Software
 - 1.2.2. Hardware
 - 1.2.3 Data and User
- 1.3Essential Computer Hardware
 - 1.3.1 Processing device
 - 1.3.2 Memory device-RAM & ROM
 - 1.3.3 Input and Output devices
 - 1.3.4 Storage device-Optical & Magnetic
- 1.4. Operating System

Unit 2: Operate the Computer System

(Duration: 04 Hrs)

- 2.1. Start Menu

- 2.1.1. Programs Documents Setting
- 2.1.2. Taskbar toolbar
- 2.1.3. Find and replace utility
- 2.1.4. Help menu
- 2.1.5. Shut Down, Restart
- 2.2. Manage Computer
 - 2.2.1. Files & Folders
 - 2.2.2. Configuring Printers
 - 2.2.3. Installing Programs
 - 2.2.4. Display setting

Unit 3: Document Writer

(Duration: 10 Hrs)

- 3.1. Components of Word Writer
 - 3.1.1. Creating Document Typing Text
 - 3.1.2. Saving and Closing Opening an Existing
 - 3.1.3. Password Protection
 - 3.1.4. Printing & Previewing Documents
 - 3.1.5. Switch between Multiple Documents
 - 3.1.6. Save to PDF
- 3.2. Familiar Formatting Tools
 - 3.2.1. Working with Text boxes & frame
 - 3.2.2. Working with Pictures & Objects
 - 3.2.3. Inserting Place Comments
 - 3.2.4. Working with Tables
 - 3.2.5. Spell Check utility
 - 3.2.6. Use of hyperlink
- 3.3. Other features
 - 3.3.1. document templates
 - 3.3.2. Insert and edit images
 - 3.3.3. Add custom charts and manage charts
 - 3.3.4. Add and manage table
 - 3.3.5. View multiple documents
 - 3.3.6. Mail merge

Unit 4: WPS Presentation**(Duration : 10 Hrs)**

- 4.1.Introduction of presentation , toolbar and files
- 4.2.Familiar Formatting Tools
 - 4.2.1. WordArt text effects,
 - 4.2.2. built-in slide styles
 - 4.2.3. Use of templates.
- 4.3. Advanced Animation
 - 4.3.1. Multimedia: using audio and video -Audio and video formats -Inserting audio and video objects
 - 4.3.2. Animations -Set and customize animation effects -Set text animations -Animate the elements of a chart
- 4.4.Extended Desktop
 - 4.4.1. Organizing and publishing a presentation
 - 4.4.2. Custom slide shows -Managing transitions
 - 4.4.3. Graphic objects formatting -Editing of graphic objects , Visual communication: using graphics and images .
 - 4.4.4. Insert Shapes, SmartArts, Charts and Diagrams
 - 4.4.5. Other tools: equations
- 4.5.Use of Hypertext links
 - 4.5.1. Action buttons
 - 4.5.2. Import slides from other presentations
 - 4.5.3. Export slides as graphics object

Unit 5: WPS Spreadsheet**(Duration: 10 Hrs)**

- 5.1. Introduction to workbook ,worksheet and manage worksheet
- 5.2. Introduction to toolbars, add and view toolbar
- 5.3. Formulas toolbar
- 5.4. Built in functions, types of functions
- 5.5. Table Formatting , Pivot Tables
- 5.6. Insert Built-in Charts & customize charts
- 5.7. View Multiple Documents

Unit 6:Database Management System

(Duration: 04 Hrs)

- 6.1.Database system applications.
- 6.2.Purpose of Database system.
- 6.3.View of Data-Data abstraction, Instance and schema, Data model.
- 6.4.Database language-DDL, DML
- 6.5.Database Architecture-Two tier Architecture, Three tier Architecture.

Unit 7: Practical approach for Database

(Duration :10 Hrs)

- 7.1. Introduction to tables, data types and field properties
- 7.2. Create a table and add fields ,Guidelines for naming fields, controls, and objects
- 7.3. Set the field size , Combine fields using the Calculated data type
- 7.4. Add or change a table's primary key
- 7.5. Create and use an index to improve performance
- 7.6. SQL Queries: CREATE, INSERT, UPDATE, DELETE and SELECT with WHERE clause, ORDER BY etc.

Unit 8: Awareness of Internet

(Duration:06 Hrs)

- 8.1. Introduction of Internet and browser
- 8.2.Surfing Internet
- 8.3.Using of Search engine browser
- 8.4.Mail Utility

Refrence Books:

1. Fundamentals of Computers” by Rajaraman V and Adabala N.
2. “FUNDAMENTALS OF COMPUTERS” by E Balagurusamy
3. WPS Office - Free Office Suite for Word,PDF,Excel ,WPS SOFTWARE PTE. LTD.[Available on google play store]
4. MS Office in a Nutshell -Publisher: VikasPublishing House
5. Wps office 2016 writer eBook , by Lalit Mali, Kindle Edition
6. The Internet Book by Douglas E. Comer
7. Advanced Microsoft Access: Learn Techniques of Ms Access for Database Management Systems by Blerton Abazi

List of Practicals

1. Type a document related to “Basic of computer” and do formatting of it
2. Create a biodata of your own with academic and job experience
3. Create a word document which make an invitation card and send it to at least 5 different person using mail-merge.
4. Create a different subject pages and use of index with hyperlink and references on that pages.
5. Use of spreadsheet which use of utility of fill, format and use of built-in functions
6. Use of spreadsheet which manage the employee attendance and make calculation based on using user-defined formula
7. Make a various chart with any specify table
8. Create presentation with given topic and use WPS presentation
9. Create presentation with image and video link
10. Create a database which create a table of personal details. Use insert and update query of SQL: CREATE, INSERT, UPDATE, DELETE
11. Write a queries use of SELECT with WHERE clause, ORDER BY
12. Write a create index of any table data with using of SELECT query

Name of Faculty: Science	Department: Biotechnology
Program: B.Sc. Sem 6	Type: DSE-6
Subject: Recombinant DNA Technology	
Credit: 02	Total learning hours: 30
Course description: The objectives of this course are to provide students with the theory and practical experience of the use of Recombinant DNA technology which facilitate investigation of molecular biology and evolution-related concepts.	
Student learning outcome: <ul style="list-style-type: none"> ● Students will develop an understanding on basic idea of gene cloning, its importance, types of enzymes used as tools in gene cloning as being prime players. ● As being carriers of genes of interest, students will understand about different types of vectors and comparative advantages offered by each of them so that proper choice of vector can be done. ● Students will gain knowledge about techniques to insert prepared clones into different organisms and identification of recombinants. ● The unit focuses on and thus provides knowledge of different techniques to, first, identify and then further validation of recombinants. ● At the end of the course, the students will have sufficient scientific understanding of the subject and have good knowledge of application of Recombinant DNA techniques in Life Sciences Research. 	

Unit-1: Introduction & scope

(Duration: 04 Hrs)

- 1.1 Introduction to Recombinant DNA Technology and its Scope
- 1.2 Milestones in Genetic Engineering: Isolation of Gene
- 1.3 Concept and Basic Steps of Gene Cloning
- 1.4 Application of Recombinant DNA Technology

Unit-2: Enzymes in Recombinant DNA Technology

(Duration: 04 Hrs)

- 2.1 Nucleases and Restriction Endonucleases
- 2.2 DNA Polymerases and Terminal Transferase
- 2.3 Reverse Transcriptase, Kinase and Phosphatase
- 2.4 DNA Ligases (T4 DNA ligase & *E.coli* DNA ligase)

Unit-3 Cloning vector

(Duration: 06 Hrs)

- 3.1 Plasmids
- 3.2 Cosmids

- 3.3 Phages- Lambda and M13
- 3.4 Artificial Chromosomes (BAC &YAC)
- 3.5 Shuttle Vectors and Expression Vectors
- 3.6 Plant Vectors (Agrobacterium and virus based)

UNIT-4 Gene Cloning and Screening

(Duration: 04 Hrs)

- 4.1 Cutting and Joining Vector and Insert DNA
- 4.2 Transformation of Recombinant DNA in Host
- 4.3 Insertion of Phage DNA
- 4.4 Introduction of DNA to Non-Bacterial Cells
- 4.5 Methods for Screening of Transformants

Unit-5 Gene Cloning and Expression

(Duration: 03 Hrs)

- 5.1 Factors Affecting Expression of Cloned DNA
- 5.2 Synthesis of cDNA,
- 5.3 Construction of cDNA Library and Genomic DNA Library (including applications.

Unit-6 Techniques in RDT

(Duration: 03 Hrs)

- 6.1 Southern, Northern and Western blotting
- 6.2 Polymerase Chain Reaction: Working Mechanism and Application, Variants of PCR
- 6.3 Site Directed Mutagenesis.

Unit-7 Application of RDT

(Duration: 03 Hrs)

- 7.1 Transgenic Technology: Types Approaches & Application (Plant & Animals).
- 7.2 Gene therapy: Principles, Strategies and Ethics of Human Gene Therapy.
- 7.3 Application of DNA Technology in Forensics and Parental Disputes.

Unit-8 DNA Sequencing Methodologies

(Duration: 03 Hrs)

- 8.1 Sanger's Di-deoxy Chain Termination Method
- 8.2 Capillary Based Gel Electrophoresis (Automated Sequencing)
- 8.3 Overview: Next Generation Sequencing

References Books:

- Brown TA. Gene cloning and DNA analysis: an introduction. John Wiley & Sons; 2016 Jan 19. ISBN 978-1-4051-8173-0
- Recombinant DNA 2nd Edition. Watson, James D. and Gilman, M. (2001) W.H Freeman and Company, New York. SBN 10: 0716722828
- Molecular Biotechnology: Principles Application of Recombinant DNA 2nd Edition. Glick, B.R. and Pasternak, J. J. (1998) ASM press Washington DC. 978-1-55581-498-4
- Principles of Gene Manipulation by S.B. Primrose, RM Twyman and RW Old (6thEdition) 1-4051-3544-1